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Man-Made Disasters in Korea: Case Histories and Improvement Plans

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Abstract- The infrastructure in Korea was built after the significant growth in the economy after 1960. Today, this aged infrastructure has been inappropriately maintained and managed without awareness of man-made disasters. Even though the Korean government established complementary laws and regulations to prevent man-made disasters, these disasters have occurred in various locations and have been presented as social problems, they have also resulted in large social and economic losses. This paper examines both historical reviews and damage assessments and provides improvement to plans for typical man-made disasters including fire, collapse, explosion, traffic accidents, and environmental pollution. The problems caused by man-made disasters showed that disaster responses were not properly carried out because of the lack of prevention systems or appropriate equipment and facilities and there were no regular safety inspections or appropriate maintenance or repairs of the infrastructure. It is found that the laws related to man-made disasters are very broad, and they overlap across different government organizations. This paper proposes improvement plans to prevent or minimize damages against man-made disasters.

Index Terms- Disasters, Man-made disasters, Damage, Republic of Korea

I. INTRODUCTION

As the technology for human life has developed, the damage by traditional natural disasters such as droughts and floods has been reduced; in contrast, however, man-made disaster catastrophic events resulting from human decisions including both sudden and long term disasters and unexpected risks of damage to intelligent infrastructure have increased. Sudden man-made disasters include structural, building, and mine collapses that occur independently with no outside force. Long-term man-made disasters resulting from both human error and natural forces tend to refer to national and international conflicts. Man-made disasters such as nuclear disasters, oil spills, and terrorist attacks have caused major losses of human lives and livelihoods and can be defined in different ways according to researchers and by the law.

In Korea, man-made disasters are defined by the Federal act on the Disaster and Safety Management and comprise large-scale accident defined by the presidential decree, including fire, collapse, explosion, traffic accidents, and environmental pollution. Large-scale accidents such as the fires in Sealand, a restaurant, and subways in Hwaseong, Incheon, and Daegoo city, respectively; the collapse of the Sinhegyu and Seongsoo Grand Bridge, the Sampoong Grocery Store, and the Wawoo

Apartments; a gas explosion in the Ahyun-dong, in Daegoo subways, and in Bucheon as well as traffic accidents related to a derailed train in Gupo; the crash landing of an Asiana Airplanes flight, the sinking of a Family Ship in the West Sea; phenol leaking into the Nakdong River resulted from not having prepared disaster systems. These disasters were being administrated by several government organizations (National Disaster Management Institute, 2007) [1].

India experienced 480 man-made disasters during the period of 1990–2009. Man-made disasters constituted 62.2% of the total (Purohit & Suthar, 2012) [2]. These disasters seriously disrupt a society's economy, agriculture and health-care sectors, typically producing long-lasting effects that perpetuate underdevelopment (Harding, 2007) [3]. One example regarding a society's health-care sector is the effects of using asbestos for industrial and domestic applications (David & Russell, 2013) [4].

How to assess the damages caused by man-made disasters has been an important issue. A rigorous damage assessment methodology for building owners and managers to assess the vulnerability of their facilities and these improved damage assessment skills provide reasonable remediation for reducing the loss of life and property during a disaster. A spatial analysis of their impacts on people and physical assets has been developed (Kemp, 2007) [5]. There are several methods for addressing disasters through response and recovery systems. Improving mobile computing support for disaster response and recovery facilitates better assessment of the damage caused to buildings and expedites safe, efficient, and effective disaster response (Aziz et al., 1997) [6].

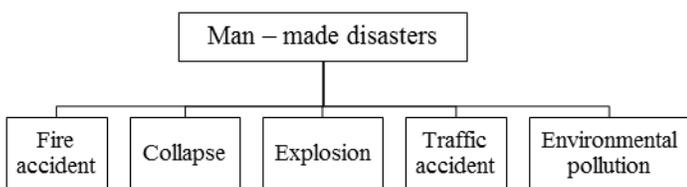
The design of reliable and scalable communication and information management systems is necessary for coordinated responses. Strategic disaster planning using geo-coding and information distribution make it much easier to visualize loss, analyze requirements, plan the efficient distribution of resources, and provide necessary infrastructure for a coordinated response to disaster (Banipal, 2006) [7]. Data interoperability, data integration and data sharing between different emergency management agencies can be utilized by integrating geographic information system (GIS) and simulation models combined with suitable databases and expert systems (Vijayaraghavan et al., 2012) [8].

Partnership frameworks should be established to implement the sequential phases of prevention, preparedness, response, and recovery for disaster management (Kim, 1993) [9]. Communities' being aware of their surroundings, available resources, and help, and listening to their concerns are important during emergencies. More community participation will lead to stronger and more resilient cities. However, there are two common barriers to learning from disasters: information

difficulties and blame and organizational politics (Nirupama & Maula, 2013; Pidgeon & O’Leary, 2000) [10-11].

In the United States, the Federal Emergency Management System (FEMA) and the Department of Homeland Security have been well established to control natural and man-made disasters (Lee, 2005) [12]. In Korea, the industrialized and urbanized areas were developed following the economic growth from the 1960s. Large-scale, underground, and high-rise structures were built in areas all around the country in a very short period of time with no strategic safety plans. The National Emergency Management Agency (NEMA) [13], one of government institutions in Korea, was established in 2003 and initiated a database obtained from the historical damage data on previous natural and man-made disasters. In this study, typical damages and accidents caused by the increased numbers of man-made disasters in Korea as listed in Table 1 were investigated, and improvement plans to prevent or minimize damages are suggested.

Table 1: Man-made disasters in Korea



II. CAUSES OF MAN-MADE DISASTERS

Fire Accident

Fire accidents including Sealand in Hwaseong, the subway in Daekoo, and Hof and Restaurant in Incheon resulted in life and property losses. The Sealand fires in June 1994 were caused when the fires to kill the mosquitoes came in contacted with combustible materials. This fire resulted in twenty-three deaths with six injured, and property losses of roughly \$65,000. After this accident, periodic safety checks were conducted in Korea, especially for child care centers and kindergartens, and education policies were developed to increase expertise in the field of safety inspections.

Subway fire accidents in Daekoo in February 2003 resulted in the loss of 192 lives, injuries to 148 people, and property damages of \$40 million. The criminal in this accident, a fifty-year old man, ignited a plastic bottle filled with oil, and the twelve-passenger train was burned to its frame. On the day after the accident, Daekoo was proclaimed a special disaster area. After the accident, the safety issues concerning heat insulating material for the interiors of subway trains, fire shutters, and train seats; an education program for the crew and passengers; a risk management manual; and the subway response system were examined to establish safety policies.

The fire accident at the restaurant located on the fourth floor of a building in Incheon on October 30, 1999, resulted in 57 deaths and 80 injuries. Most of the victims were high school students. The lessons learned from this accident were that fire insurance and safety management for building facilities are

important social issues. Figure 1 shows number of disasters, fatalities, injuries, and property loss induced by fire accident for recent seventeen years.

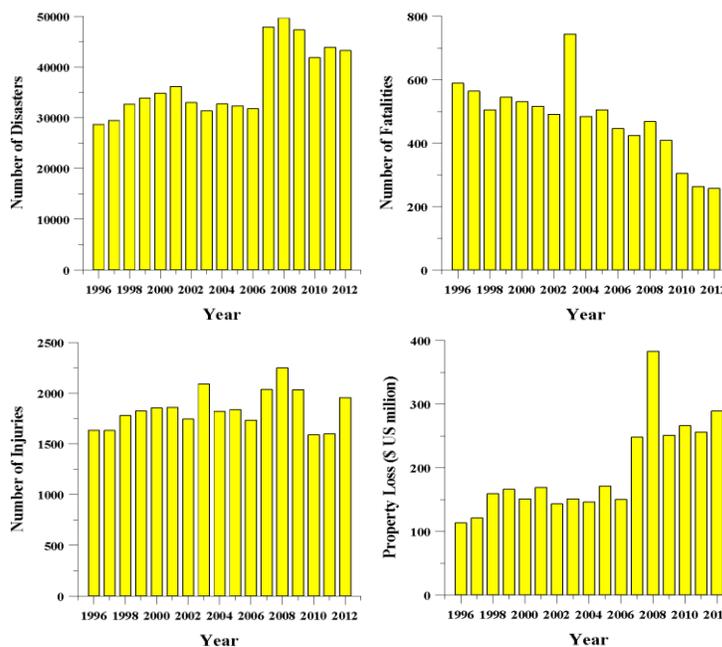


Figure 1. Number of disasters, fatalities, injuries, and property loss induced by fire accident during 1996-2012

Collapse

Collapses of infrastructure including buildings, pedestrian overpasses, bridges, and dams were caused by inappropriate design and construction, low-level technology, aging, inappropriate maintenance and management, ground softening, insufficient periodic safety checks, fires, a gas explosion, and overload. Typical cases were the collapses of the Sinhengju and Seongsoo Grand Bridge, the Sampoong Grocery Store, and the Wawoo Apartments.

The Sinhengju Grand Bridge collapsed owing to inappropriate design, construction, and supervision on July 31, 1992. The bridge was designed with incorrect spans of piers between two towers and constructed with incorrect connections between the cable-stayed bridge and the continuous bridge. The collapse was also induced by the inappropriate number and location of piers between the two towers (Khan & Rahman, 2007) [14]. The collapse occurred at the almost completed stage of construction. This accident provided lessons on how the bridge needed to be very carefully designed and constructed with allowable safety levels.

The collapse of the Seongsoo Grand Bridge resulted in the losses of 32 lives and injuries to 17 on October 21, 1994. It was caused by the collapse of a truss at the upper level located in the middle of the piers. There were also substantially high social and economic losses such as traffic congestion and property damages of \$600 million. After this accident, a diagnostic assessment of the bridges was conducted, especially for those over the Han River; Dangsang railway bridge was replaced, and the Hannam, Yanghwa, and Jamsil grand bridges were reinforced.

The collapse of the Sampoong grocery store was caused by the multiple reasons such as inappropriate design, construction,

supervision, and maintenance, and it resulted in 502 deaths and injuries to 938 people on June 29, 1995. This accident directly brought to light issues that resulted in establishing an emergency management law in Korea. This was the first place to be declared a special disaster area. During the accident response and recovery, an insufficient number of rescue members and equipment in addition to nonsystematic command systems were found. Hence, after this accident, the necessary prevention and recovery systems for disasters were emphasized.

The Wawoo Apartments collapsed within four months after the completion of construction on April 8, 1970. An investigation was conducted to determine the causes of the collapse. The investigation results showed that the foundation columns were not resistant to the self-weight of the apartments. An insufficient amount of rebar in the foundation constructed along the mountain slopes was the direct reason for the collapse. After this accident, the mayor of Seoul, who was responsible for this accident, resigned, and the residential problems of the urban poor led to social issues. Figure 2 shows number of disasters, fatalities, injuries, and property loss induced by collapse for recent seventeen years.

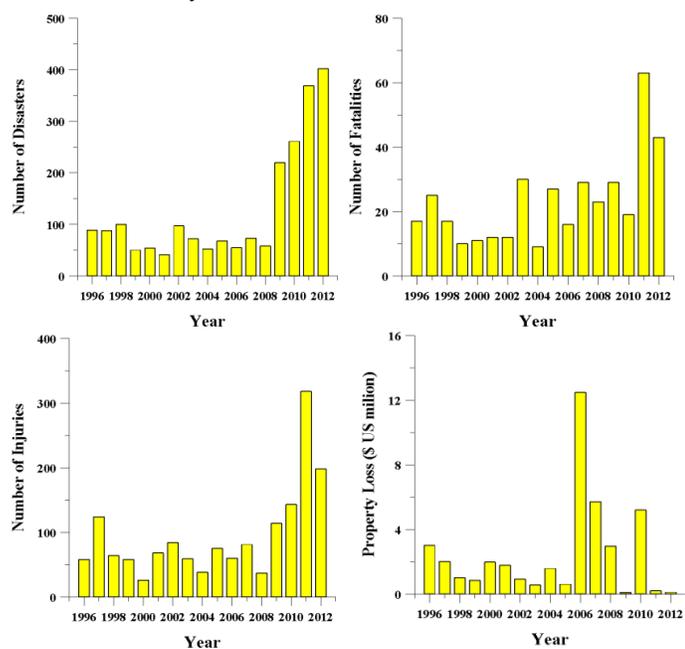


Figure 2. Number of disasters, fatalities, injuries, and property loss induced by collapse during 1996-2012

Explosion

Explosions caused by the explosion of phosphide gas, explosives, and energy resulted in life and property losses. Physical models were developed to calculate the physical effects of explosion and fire from Liquefied Petroleum Gas (LPG) accidents and also to predict the affected areas. The areas affected by LPG tank accident were estimated through the integration of a chemical explosions and fire models with a GIS database. Theoretical investigations of various methods for calculation, the physical effects of explosions, and fire events on vessels containing 120 tons of LPG were carried out with many physical models (El-Harbawi et al., 2004) [15]. Typical gas

explosions in Korea were occurred in Seoul, Daekoo, and Bucheon city.

A gas explosion on December 7, 1994, occurred at Ahyundong in Seoul following the ignition of a fire from spread gas leaking from a motor-operated valve during the inspection of the gas meter at the Korea Gas Corporation gas governor station. The accident resulted in the losses of 12 lives, injuries to 170 people, and 366 refugees from 127 residential buildings. After the accident, an immediate response was not appropriately and systematically carried out because of low-level of technology and insufficient equipment (Lee, 2002) [16].

The excavation work on roadways in Daegoo took place with the permission of the government administration office. However, the excavation damaged the gas pipelines buried at this site and resulted in a gas explosion that caused 101 deaths and injuries to 202 more on April 28, 1995. Great losses directly resulted from the passive, lackadaisical responses of the related government organizations. Subsequently, the roadways in which urban gas pipelines were buried were required by law to have special maintenance for the safety of gas pipelines.

An explosion at the LPG station in Bucheon occurred on September 11, 1998. Leaked gas ignited by unknown sources resulted in the explosion. At that time, the vent valve on the underground LPG tank was the vent valve was opened and emitted gaseous nitrogen. The accident resulted in the death of one, 96 injuries, and property damages of \$11 million. After the accident, a comprehensive management system for the LPG station with respect to safety was established, and a new contract form for a safe supply of LPG was introduced, both to fully compensate victims for damages and possible mistreatments by the poor retail businessman who managed the LPG station. Figure 3 shows number of disasters, fatalities, injuries, and property loss induced by explosion for recent seventeen years.

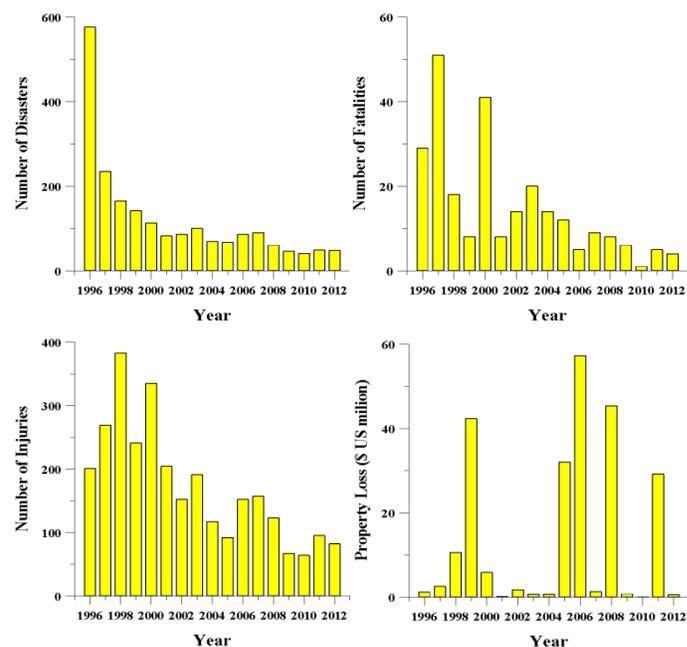


Figure 3. Number of disasters, fatalities, injuries, and property loss induced by explosion during 1996-2012

Traffic Accident

Traffic accidents by car, railway, airplane, and ships have resulted in life and property losses. Typical accidents in Korea include a derailed train at Gupo in Busan, the crash landing of Asiana airlines airplane, and the sinking of Family Ship in the West Sea.

In March 1993, as a train passed the Gupo station, it was derailed because the soft ground settlement caused by blasting loads near the railways during excavation work because the Korea Electric Power Corporation performed the construction work without permission from the National Railroad Administration. The accident resulted in the losses of 78 lives and injuries to 198 people. The lesson learned from the accident was the importance of communication between each government organization.

The crash of the Asiana Airlines flight resulted in 66 deaths and injuries to 46 in July 1993. To save gas and avoid customer complaints, a reckless emergency landing was carried out on the army runway with neither radar supports nor an instrument landing system during heavy rainfall. In general, the number of customers using airplanes has substantially increased; in contrast, the safety facilities were insufficient. After the accident, a systematic rescue system at the airport was developed.

The sinking of Family Ship in the West Sea on October 12, 1993, was caused by reckless navigation in extreme weather conditions, overloads of both passengers and baggage, and only two security members. A half-hour after the accident, the police helicopter departed and the patrol ship arrived after one hour. This accident showed the problem of an inappropriate rescue system. After the accident, strengthening the system arose as an important issue. Figure 4 shows number of disasters, fatalities, injuries, and property loss induced by traffic accident for recent seventeen years

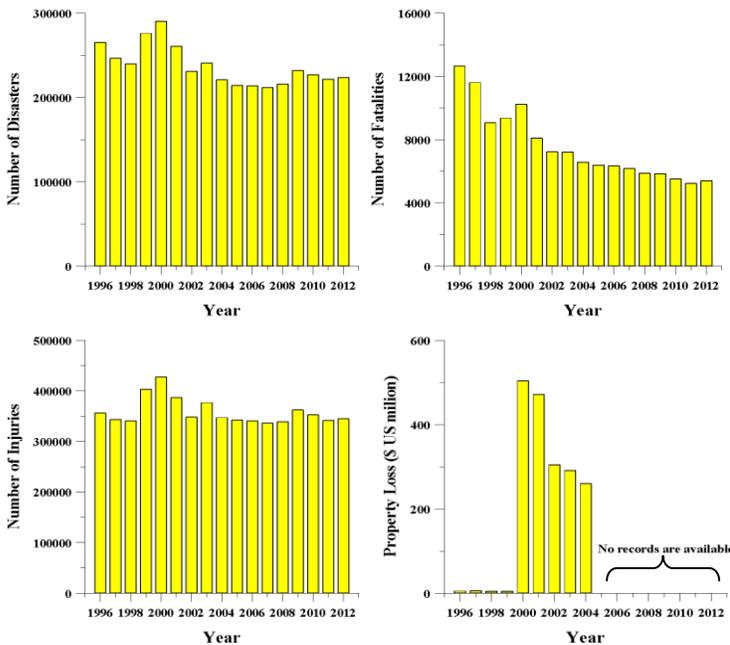


Figure 4. Number of disasters, fatalities, injuries, and property loss induced by traffic accident during 1996-2012

Environmental Pollution

Environmental pollution includes air, water, and soil pollution. Only water pollution has been a critical problem in Korea. One of the typical cases was phenol pollution in the Nakdong River, which occurred on March 14, 1991. Thirty tons of phenol leaked from a damaged phenol pipeline, infiltrated an intake station, and then contaminated the water supply for the residents of Daekoo. This was the first environmental pollution problem for which the organization committee was rebuked. Figure 5 shows number of disasters, fatalities, injuries, and property loss induced by environmental pollution for recent seventeen years

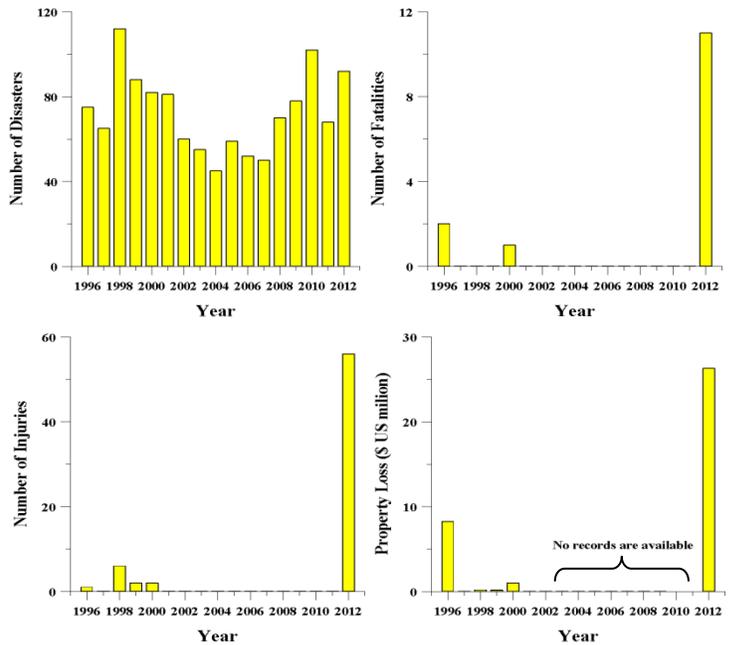


Figure 5. Number of disasters, fatalities, injuries, and property loss induced by environmental pollution during 1996-2012

III. PROPOSED IMPROVEMENTS TO PLANS FOR MAN-MADE DISASTERS

Fire Accident

If anticipated fire-damaged areas are very large or highly condensed areas of buildings have been declared fire boundary zones (National Disaster Management Institute, 2007) [1]. Fireproof design law should be upgraded and should establish new criteria reflecting the new technology and materials.

Law enforcement for the maintenance of fire protection facilities and safety management should be strengthened to improve safety inspections of firefighting equipment. Because the fire safety criteria coded by architecture and firefighting, laws were established by several different government organizations under a lack of systematic co-work systems, inefficient management resulted. The experiment revealed that the fire prediction, estimation, and management capacity in Korea is only 40% to 50% of the level of that in advanced countries, and therefore, new technologies related to these and an efficient interactive system should be developed and established by

combining similar regulations, supplementing regulations, and making new regulations if it is necessary.

Collapse

A safety management system for infrastructure is operated in three sequential steps: design, construction, and maintenance. Design laws are related to construction technology management, roadways, architecture, firefighting, electrics, and gas. In contrast, construction laws are related to construction technology management and both industrial safety health and construction standards. Laws on maintenance and management are related to the special law for the safety management of infrastructure and facilities and for disaster and safety management standards (Lee, 2005) [12]. The special law is prosecuted by the Ministry of Land, Transport, and Maritime Affairs, and safety inspections are conducted based on a precise safety diagnosis manual to investigate structural defects. The safety management standard law is prosecuted by the Ministry of Public Administration and Security. This disaster management institution manages facilities that are at risk of a disaster. Although the law is well classified, it is complicatedly connected to the overlapping duties of different government organizations. Hence, a comprehensive and united law is required, and professional institutions should be established to systematically resolve and manage problems.

Explosion

Most explosions in Korea have been caused by gas (National Emergency Management Agency, 2007) [13]. Advanced prevention systems for the risk of explosions were developed, but there were limitations because the analysis was performed for limited specific conditions and the systems were still based on simple introductory procedures and a low level of technology. The system did not satisfactorily reflect all industrial fields. However, prevention systems in advanced countries have been developed and associated with systematic and comprehensive safety policies. Because gas explosions are primarily caused by carelessness and safety insensitivity, a specialized agency should periodically inspect gas facilities and carry out safety education and publicity activities. Government officials should guide and supervise the specialized agency to maintain professionalism. Because the locations of gas pipelines buried underground are not electronically geo-coded in GIS, there is high risk during the excavation work for subway construction and roadway expansion and reinforcement, especially in urban areas. Therefore, the gas pipelines constructed in the past and also newly constructed gas pipelines should be digitized by digitizing in GIS.

Traffic Accident

Traffic policy in Korea needs to be established from good references based on prototype models of well-developed traffic safety policies around the world, and the government should enact an enforcement policy to increase driver awareness of traffic safety through education programs. This may require hiring a professional road safety officer. A database for the areas in which frequent traffic accidents occur should be compiled for traffic analysis to simulate possible traffic accidents. Traffic facilities should be improved especially for high risk accident regions.

The safety criteria established by each organization cannot be enforced by law (Park, 2005) [17]. In advance, criteria especially for railways should be established by law to supplement both signal system equipment and electricity supplies, and rapid response and recovery systems should be improved by utilizing the equipment.

There are only three professional rescue ships in Korea, in contrast, there are 190 in Japan. There are substantially small numbers of rescue ships in Korea. Hence, the government should invest funds in increasing the number of rescue ships for rapid and efficient responses to reduce life and property losses. In England, after Braer Ship accident, 10,000-HP tug boat was deployed near the oil-tanker seaway. In Korea, there are 100-ton rescue ships that are not eligible to rescue the ships. Large-scale of rescue ships that satisfy the high demand efficiency and safety should be deployed in cases of ships that run aground and in high-risk crash zones. Korea's Coast Guard is the only existing organization responsible for the marine accidents.

Environmental Pollution

Air pollutants do not automatically disappear and they harm both the human body and ecology in nature. Most air pollutions in Korea is caused by exhaust fumes generated by the greatly increased numbers of diesel engine automobiles, especially in urban areas. Based on an environment report, sulfite gas contamination is severe, especially in Seoul, at a level that exceeds two times standard recommended by the World Health Organization (WHO). Additionally, acids contained in rain generated by sulfite gas amounted to four to six times more than the 1990 average amount of acids contained in rain. To reduce air pollution mainly induced by traffic, the local government agency should establish a comprehensive strategic plan, and residents may have to actively participate in the education program.

A scientific management system associated with a water pollution remediation policy should be developed to control water quality. The pollution-loading system should be enforced by law, and the central and local government agencies should establish an information system to systematically manage water pollution. A diagnosis of environmental pollution by a professional environmental company should be conducted, and also, contracts for estate businesses should reflect any pollution investigation results because there is a possibility of secondary losses such as groundwater contamination after a certain period of time.

IV. CONCLUSION

In this study, typical losses induced by man-made disasters in Korea were described, and appropriate improvement plans were suggested. The analyzed results of typical problems caused by man-made disasters showed that disaster responses were not properly carried out because of the lack of prevention systems or appropriate equipment and facilities. There were no regular safety inspections or appropriate maintenance or repairs of the infrastructure.

In the meantime, the laws related to man-made disasters are broad, and they overlap across different government organizations. Therefore, the laws should be clearly modified to avoid the overlapping of multiple organizations and should be

scientifically supplemented. The laws of each government administration should be reexamined and, if necessary, integrated and merged in order to develop efficient co-work systems between different government organizations. When the disasters occur, each organization should be responsible for assigned work and charged with respect to its responsibility. Public activities and citizen education should be carried out in systematic ways with practical exercises.

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A performance of hybrid biosorbent 'M-Bios' of Pb(II) and Cu(II) in aqueous solutions.

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Abstract- 'M-bios' biosorbent is a hybrid of mangrove wasted bark from charcoal industry at Perak, Malaysia and green algae from Sabah to remove heavy metals. This biosorbent is subjected to FTIR and ICP-MS. 'M-Bios' contain N – H (3421.89 cm⁻¹, 3465.90 cm⁻¹), C = O (1728.72 cm⁻¹) and – OH (3531.37 cm⁻¹, 3722.01 cm⁻¹, 3768.36 cm⁻¹) functional groups (weak groups) that that easily replaced by metal ions. The adsorption performances were fitted by pseudo-kinetic, Langmuir and Freundlich study. The plots obey both adsorption isotherm models, Langmuir and Freundlich by R² values. A good agreement between experimental and theoretical q_e for contact time data suggested that adsorption reaction happen in aqueous solution was a rate determination of chemisorption process(pseudo second-order kinetic). In order to prevent precipitation as they forming hydroxide, pH 4 and 5 were used. Surface morphology shows the pore and folded surface which enhance the percent of adsorptions

Index Terms- Mangrove, Biosorbent, Biosorption, Algae, ICP-MS

I. INTRODUCTION

Water is a vital resource used to sustain changes in biodiversity and life on earth. However, some of the surface of water such as rivers is the usual place for the discharging of domestic wastes and also surface runoff of agricultural activities (Kuo Bau, 2010). Hence, the river might contain pollutants such as heavy metals, phosphates, nitrates and phenols and this problem have an adverse effect to human health, nation economy, marine life and environment in Malaysia (Salwa, 2008). Therefore, the study on biosorption was gaining intention due to the high potential and an innovative technology on the removal of heavy metal from water system.

Biosorption can be defined as the passive uptake of toxicants by inexpensive dead/inactive biological materials and the mechanisms of the pollutant uptake were differ according to the biomass type (Gupta et al., 2000; Farooq et al., 2010). In this study, an innovative idea of biosorbent namely 'M-bios' was produced, in the line with the 'go-green' concept to overcome the problem on water pollution especially heavy metals. 'M-bios' was produced from combination of mangrove and algae was then cross linked with chitosan.

The objectives of the present study are to study on the initial concentration, pH and contact time. Therefore, 'M-Bios' was

exposed in laboratory scale in order to investigate the performance effects based on isotherms and kinetics studies.

II. MATERIALS AND METHODS

1.1. Mangrove and brown algae.

Mangroves bark used in this study were collected from the charcoal factory as the waste product at Kuala Sepetang, Perak, Malaysia. Meanwhile, *P. Gymnosporea* was ordered from Sabah. These samples were washed with distilled water for several times before undergoes NaOH and NaCl treatment. These samples were incubated with NaOH at room temperature for 4 hours. After that, the treatment was proceeding with NaCl treatment for another 4hours before washed several times until the remaining colour gone. The samples were left to dry overnight.

1.2. Preparation of cross linked hybrid of mangrove-brown algae with chitosan biosorbent.

The ratio used for hybrid is 7 to 1 of mangrove bark to brown algae. 0.7 grams of mangrove bark and 0.3 grams of algae were weighed and both were mix together. The used of 7:1 ratio mangrove bark to brown algae based on our preliminary study which is the maximum uptake of metal ions. 1% v/v of acetic acid was prepared to prepare 1% w/v chitosan viscous solution. The solution was heated for about half an hour (Laus et al., 2010). 8ml of viscous chitosan was mixed together with the hybrid samples. The mixture was then stirred for 20 minutes. After that, the mixture was placed in oven at 60°C for overnight to dry.

1.3. Heavy metals quantifications.

Pb and Cu elements were chosen as they are usually found in industrial waste. The biosorption of these elements were conducted in batch equilibrium studies with control variable of mass of 'M-Bios', 1 gram and volume used was 10 ml. For study on initial concentration, standard solutions of 1, 5, 10, 30, 50 and 100 ppb were prepared. Immersed 'M-Bios' was incubated for one hour in each of standards solution prepared. For contact time study, time was varied to 15 minutes, 30 minutes, 45 minutes, 60 minutes, 2 hours, and 3 hours. Study of pH was done by varied the pH of 2, 3, 4, 5 and 6. These studies were agitated by using orbital shaker with speed of 150 rpm. The equilibrium adsorption, q_e (μg/g) for these studies was calculated by using formula below:

$$q_s = \frac{C_i - C_f}{m} \times V \quad (i)$$

Where C_i and C_f are representing initial and final concentration of aqueous solution ($\mu\text{g/L}$), respectively, V is the volume of solution used (ml) and m is mass of biosorbent used (g) (Tirtom et al., 2012; Boddu et al., 2008).

1.4. Quality control.

All studies were carried out by triplicate as control. Control flask also prepared by immersed biosorbent into Mili Q-plus and was incubated on the same condition mentioned before. Fresh standard solutions were prepared for each time before using ICP-MS.

1.5. Fourier transform-infrared spectroscopy (FTIR)

FTIR spectrum of hybrid mangrove-algae and cross-linked hybrid were recorded with PerkinElmer 2000 FTIR Spectrometer. Samples were run by using Ge plate; therefore, samples must be in powder form. The scanning wavenumber of infrared was at $4000\text{cm}^{-1} - 400\text{cm}^{-1}$ range.

III. RESULT AND DISCUSSION

1.6. FTIR analysis

Figure 1 shows the IR spectra hybrid mangrove-algae and cross linked chitosan-hybrid. Hybrid mangrove-algae showed the broad band at 3421.89 cm^{-1} and 3465.90 cm^{-1} which correspond to the N – H stretch vibration. N – H bending vibration also showed at 1555.40 cm^{-1} . These peaks indicate the presence of amine group in the compound. Peak at 1728.72 cm^{-1} assigned by the presence of C = O stretch vibration. These N – H and C = O bonds providing site for heavy metals to attached on the biosorbent in order to remove them from aqueous solution. Besides that, – OH groups seemed at region $2500\text{-}3500\text{ cm}^{-1}$ indicates – OH stretch and O- H bending vibration also show peaks at 3531.37 cm^{-1} , 3722.01 cm^{-1} and 3768.36 cm^{-1} in the spectrum. These functional groups influent the adsorption of metals on biosorbent as they are weak groups which easy to be replaced by stronger group such as metal ions. Other than the presence of O – H, N – H, and C = O bonds, there are a few more vibration stretch such as C = N, C – O and C – Cl which increased the adsorption ability. C =N, C – O and C – Cl stretch vibration are located at 2271.60 cm^{-1} , 1728.72 cm^{-1} and 688.43 cm^{-1} , respectively. Cross linked chitosan hybrid was encouraged more – OH and – NH groups on the surface of biosorbent. Therefore, the adsorption of metal ions increased as increase the number of active sites. Table 1 shows the frequencies and attribution of hybrid and cross linked biosorbent.

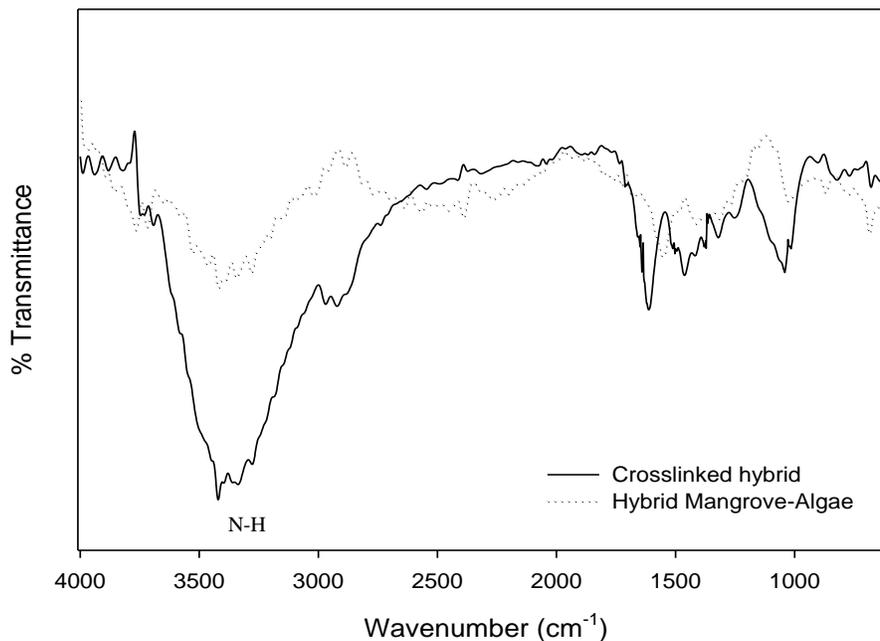


Figure 1 Spectrum of hybrid mangrove-algae and cross linked chitosan-hybrid

Table 1 Frequencies and attribution of hybrid and cross linked biosorbent.

Frequencies (cm^{-1})	Attribution
3421.89 and 3465.90	- NH stretch
1555.40	N-H bending
1728.72	C=O stretch
3531.37, 3722.01 and 3768.36	O- H bending
2271.60	C=N stretch

1728.72	C-O stretch
688.43	C-Cl stretch

1.7. The Effect of Initial Concentration

Figure 2 shows the effect of initial concentration of Pb(II) and Cu(II) biosorption onto 'M-Bios'. The effects show the increases of equilibrium adsorption for both Pb(II) and Cu(II) as the concentration was increased. The same result of adsorption increased was shown in previous study (Zhang et al., 2007; Vinod et al., 2009; Hameed et al., 2008). The increases of equilibrium adsorption for Pb(II) and Cu(II) from 1 ppb to 100 ppb as the initial concentration increase was due to the occurrence of driving force (Hameed et al., 2008). Driving force

is defined by the difference concentration between the biosorbent and the sorbet in the aqueous solution. This driving force was higher in 100 ppb aqueous solution compared to 1 ppb thus; this condition would lower the mass resistance between biosorbent and sorbet and help the adsorption process (Vijayaraghavan & Yun, 2008; Vilar et al., 2006).

Therefore, as the initial concentration is increases, the equilibrium adsorption is increases as well, as the driving force higher and lower the mass transferred between biosorbent and sorbet in the aqueous solution.

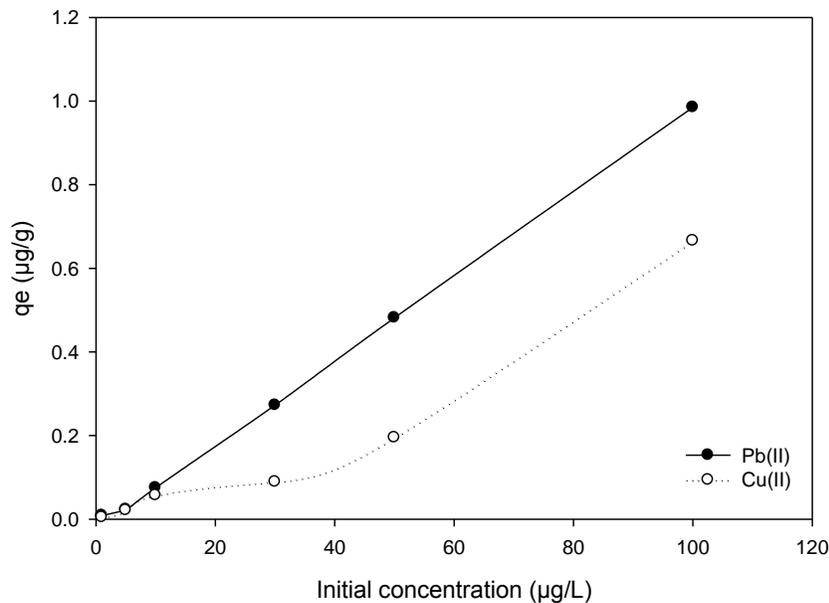


Figure 2 Effect of initial concentration of Pb(II) and Cu(II) biosorption onto 'M-Bios'

1.8. Effect of Contact Time

The effect of contact time of Pb(II) and Cu(II) biosorption onto 'M-Bios' was shown in Figure 3. The contact time was varied from 15 to 240 minutes and the equilibrium adsorptions were observed. The equilibrium adsorption was increases and the increases of contact time for both metal ions. The rapid adsorption start at the first 15 minutes and gradually reached equilibrium at 45 and 60 minutes for Pb(II) and Cu(II), respectively. The same results were shown by previous studies

(Jaikumar, 2009; W. Ngah & Hanafiah, 2008). This happen because between the biosorbent and sorbet in aqueous solution, there are strong attractive forces which make the diffusion faster in the surface of the biosorbent to obtained the equilibrium (Jaikumar, 2009). Thus, the adsorptions of Pb(II) and Cu(II) were depend on the time contact varied. As the contact increases, the adsorption might as well increases.

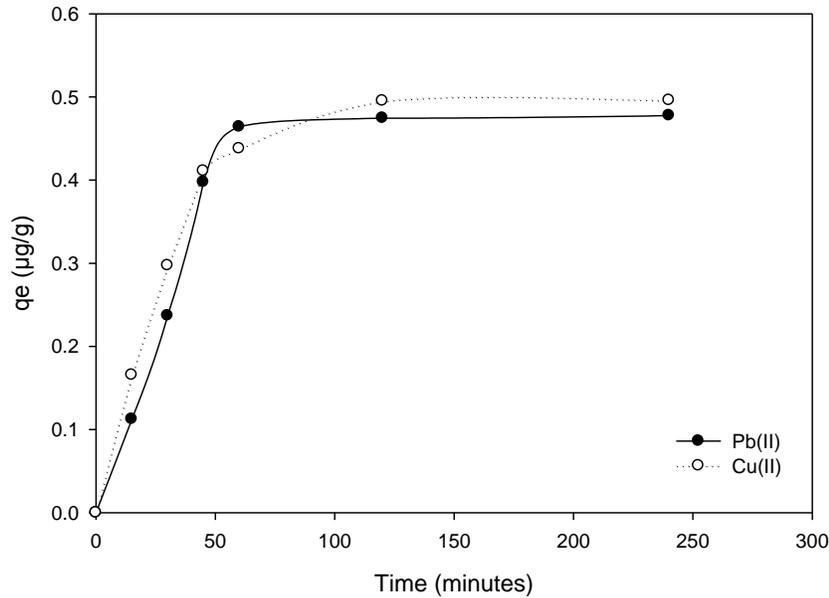


Figure 3 Effect of contact time of Pb(II) and Cu(II) biosorption onto 'M-Bios'

1.9. Effect of pH

pH is one of the most important parameter in biosorption study as it is charge the sites of biosorbent functional group and might as well influence the speciation of metal ions (Farooq et al., 2010). The effect of pH of Pb(II) and Cu(II) biosorption onto 'M-Bios' show in Figure 4. Optimum pH values obtained for Pb(II) and Cu(II) ions adsorption are at pH 4 and 5, respectively. This is due to the decreases of hydrogen ions in low pH, so less competitive with Cu(II) and Pb(II) ions to be adsorbed onto 'M-Bios'. Therefore, the negatively charged surface of biosorbent would attract more cations as electrostatic interaction occurs (Ooa et al., 2009).

However, as the pH values increase, the adsorption on 'M-Bios' decreased. This is happen because the increases of pH causing the coagulation between the metals ions and the aqueous solution, therefore, fewer ions would be attached onto the surface of biosorbent. Other than that, it is because the occurrence of electrical repulsion between biosorption and metal ions as they have the same charge (Jaikumar, 2009). The effect of pH of Pb(II) and Cu(II) biosorption onto 'M-Bios' is shows in Figure 4. Therefore, in order to have the optimum adsorption of metal ions, pH 4 and 5 were used to prevent precipitation as they forming hydroxide (Ooa et al., 2009).

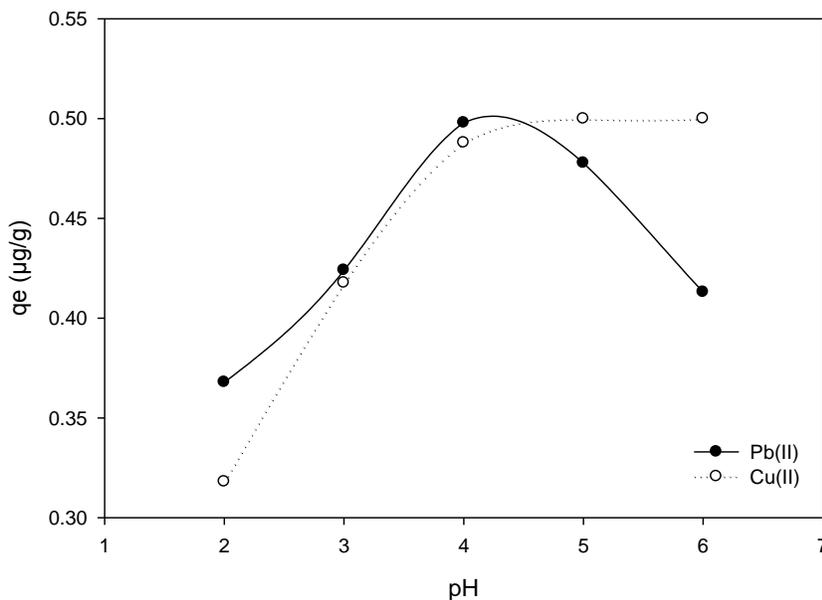


Figure 4 Effect of pH of Pb(II) and Cu(II) biosorption onto 'M-Bios'

1.10. Two parameter adsorption isotherms

These batch equilibrium data obtained for adsorption of Pb(II) and Cu(II) on ‘M-Bios’ with different initial concentrations were used to explain the adsorption phenomenon. There are two types of isotherm studies that we concern in this research; Langmuir and Freundlich isotherm.

Langmuir is defined by (Ooa et al., 2009), as adsorption by monolayer and he assumes that the adsorption sites are energetically equivalent and the adsorption happen on a homogeneous adsorbent, which mean no interaction between sorbed species. Langmuir isotherm is written on mathematical form as in equation (ii) below:

$$\frac{C_e}{q_e} = \frac{1}{Qb} + \frac{C_e}{Q} \quad (ii)$$

Straight line graphs with a slope of 1/Q were obtained by plotting graph of C_e/q_e against C_e ($\mu\text{g/L}$). C_e is an equilibrium concentration of metal ($\mu\text{g/L}$) and q_e is the amount of metal adsorbed per gram of biosorbent.

Freundlich isotherm describing the reversible adsorption and not only for single layer adsorption but it is describing the heterogeneous system (Tirtom, 2012). Freundlich assumes the surface supporting sites will be varied by the affinities of the

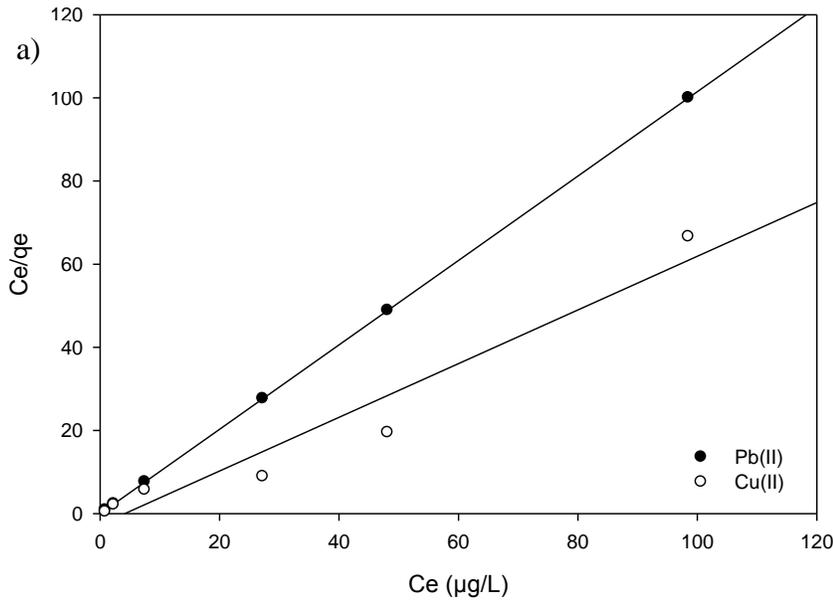
metals itself. Freundlich isotherm is written on mathematical form as in equation (iii) below (Ooa et al., 2009):

$$\log q_e = \log K_F + (1/n) \log C_e \quad (iii)$$

1/n is the slope of the straight line by plotting $\log q_e$ against $\log C_e$ and $\log K_F$ is the y-intercept. Langmuir and Freundlich plots for elements Pb(II) and Cu(II) are shown in Figure 5.

Based on the data obtained Figure 5, Langmuir and Freundlich plots for Pb(II) and Ni(II) adsorption onto ‘M-Bios’, Langmuir and Freundlich models in this research were found to be successfully described in term of linearity of coefficient, R^2 (Hamideh et al., 2011) which R^2 result for all plots are equally to value 1. From the linearized Langmuir and Freundlich isotherm adsorption plots, table 2 shows the Langmuir and Freundlich isotherm correlation coefficient for element of Pb(II) and Cu(II). Langmuir isotherm model predict the formation of single layer on the surface of biosorbent, which mean Langmuir is obeyed by the character of strong sorption onto specific active site (Iqbal & Saeed, 2007).

According to the Freundlich data obtained, R^2 for Pb(II) and Cu(II) represent a better experimental adjustment to the heterogeneous material biosorbent active sites and adsorption mechanism (Copelloa et al., 2013).



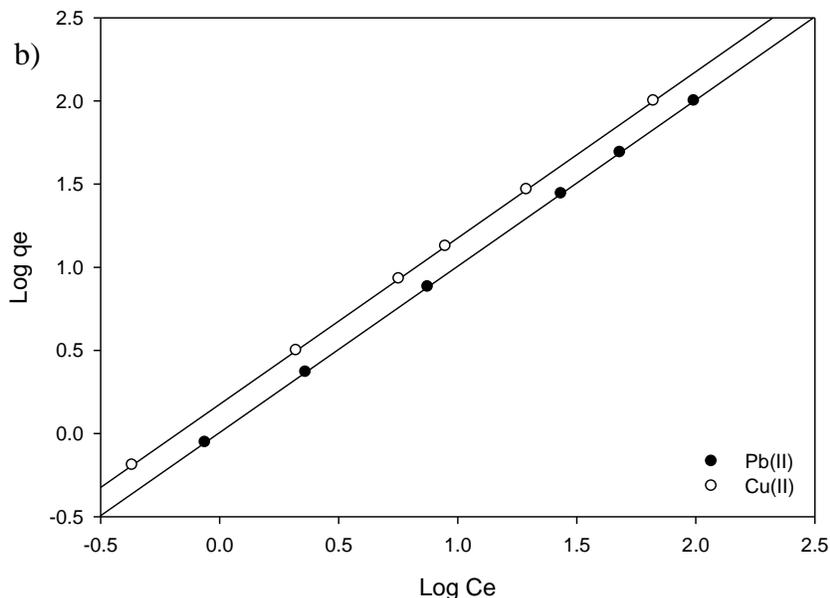


Figure 5 (a) Langmuir and (b) Freundlich isotherm of Pb(II) and Cu(II)

Table 2 Langmuir and Freundlich isotherm correlation coefficient for biosorption of Pb(II) and Ni(II).

Elements	Langmuir			Freundlich		
	$1/Q$	b	R^2	$1/n$	$Log K_F$	R^2
Pb(II)	1.0152	0	1	1	0.0066	1
Cu(II)	1.5015	0	1	1	0.1765	1

1.11. Adsorption Kinetics

Data from contact time studies then was used to analyse the adsorption kinetic models, pseudo first-order and pseudo second-order. The mechanism of the process can be obtained by kinetic constants by calculating using linearized plot of both models. These two models were analysed in linear form after been rearranged from the equations (Ooa et al., 2009). Pseudo first-order is used for reversible reaction with an equilibrium established between biosorbent and sorbet in aqueous solution (Ooa et al., 2009). Pseudo first-order equation is given as (iv);

$$\frac{dq}{dt} = K_1(q_s - q_t) \quad (iv)$$

Equation (iv) is integrated for boundary condition: $t=0-t$ and $q=0-q_e$ to have (v);

$$\log(q_s - q_t) = \log q_s - \frac{K_1 t}{2.303} \quad (v)$$

Where q_t is the concentration metal ions absorbed at time, t ($\mu\text{g/g}$) and K_1 is the first-order constant (1/min).

Pseudo second-order is based on assumption that the rate limiting factor maybe chemisorption (Ooa et al., 2009; Hamideh et al., 2011). In chemical adsorption (chemisorption), by forming the covalent bond, metal ions stick to the biosorbent surface and

have tendency to bind with the sites that minimizes their coordination number with the surface (Hamideh et al., 2011). Pseudo second-order equation is given as below (vi);

$$\frac{dq}{dt} = K_2(q_s - q)^2 \quad (vi)$$

Equation (vi) is integrated and rearranged for the same boundary condition to have (vii);

$$q_t = \frac{1}{q_s} t + \frac{1}{K_2 q_s^2} \quad (vii)$$

Where q_t is the concentration of metal ions absorbed at equilibrium and time is t , while K_2 is the second-order kinetic constant, ($\text{g}/\mu\text{g}\cdot\text{min}$).

In the adsorption of Pb(II) and Cu(II) on ‘M-Bios’, pseudo second-order kinetic model gave the higher correlation coefficient values of 0.9557 and 0.9898 for Pb(II) and Cu(II), respectively than pseudo first-order. This data also obtained by previous study (Ooa et al., 2009). A good adjustment to pseudo second-order for both metals ions indicate that chemisorption is the rate limiting step in adsorption process. This fact can be supported by comparing the experimental q_e with theoretical q_e of second-order model. Theoretical q_e of second-order model should be accordance with experimental q_e . From the data obtained, theoretical q_e had good agreement in the experimental

q_e , which suggested that adsorption reaction happen between biosorbent and sorbet in aqueous solution was a rate determination of chemisorption process. Table 3 show the pseudo first and second-order kinetic model correlation coefficient for biosorption of Pb(II) and Ni(II) (Ooa et al., 2009; Copelloa et al., 2013).

Table 3 Pseudo first and second-order kinetic model correlation coefficient for biosorption of Pb(II) and Ni(II).

Kinetic models		Pb(II)	Cu(II)
	q_e (exp.)	0.4775	0.4959
Pseudo-first order	K_l	0.0461	0.0461
	q_e (theo.)	0.7847	0.9160
	R^2	0.9315	0.9677
Pseudo-second order	K_l	0.0530	0.0794
	q_e (theo.)	0.5647	0.5549
	R^2	0.9557	0.9898

IV. CONCLUSION

In conclusion, amine, hydroxyl and carboxyl help in adsorption of Pb(II) and Cu(II) from aqueous solutions and driving force that lowers the mass transferred between biosorbent and sorbet in the aqueous solution. In initial concentration study, the linearized plots obey both adsorption isotherm models, Langmuir and Freundlich by R^2 values were 1. The adsorptions depend on the time contact varied, as the contact increases, the adsorption increase. A good agreement between experimental and theoretical q_e suggested that adsorption reaction happen was a rate determination of chemisorption process (obey pseudo second-order kinetic model). In order to prevent precipitation pH 4 and 5 were used. Surface morphology of 'M-bios' shows the pore and folded surface which enhance the percent of adsorptions. 'M-Bios' is an interesting commercial product as its low cost of preparation and largely abundance in Malaysia.

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A Randomized Controlled Trial to Compare the Effectiveness of Static Stretching Versus PNF Stretching of Hamstring Muscles Following Superficial Heat in Athletes

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Abstract- Flexibility is an essential fitness component that decrease with age and immobility can lead to change in muscle and joint function postural alignment and host of indirect impairments like muscle tightness, atrophy, fibrosis, contracture, joint analysis, postural deformity. Tight hamstring muscle may be a potential risk factor for strain injuries in sports, in which a full range of motion is needed. The stiff and short hamstring muscle tendon unit may be a risk factor for low back pain and the development of patellar tendinopathy. At present various interventions are available to increase flexibility of hamstring muscle. However, there are not many studies that have analyzed the effects of static stretching and proprioceptive neuromuscular facilitation stretching of hamstring muscles following superficial heat in athletes. The aim of the study was to find out the efficacy of effectiveness of static stretching and PNF stretching of hamstring muscles following superficial heat in athletes.

Thirty subjects were randomly assigned into 2 groups. Group A hamstring stretching was given and Group B proprioceptive neuromuscular facilitation was given. Outcome was evaluated by range of motion. Study shows after the treatment session, both the groups show a significant increase in active knee extension range of motion. It shows that both the methods of stretching were effective but the PNF group shows more improvement than static group, so the PNF stretching is more effective than static stretching.

Index Terms- Hamstrings, Flexibility, AKE, Stretching, PNF

I. INTRODUCTION

Flexibility is a key component for injury prevention and rehabilitation (Odunaiya 2005). Zachezewski has defined muscle flexibility as the ability of a muscle to lengthen, allowing one joint to move through a range of motion and a loss of muscle flexibility as decrease in the ability of muscle to deform resulting in decreased range of motion (William 2012). Tight hamstring muscle may be a potential risk factor for strain injuries in sports, in which a full range of motion is needed. The stiff and short hamstring muscle tendon unit may be a risk factor for low back pain and the development of patellar tendinopathy (Ylinen 2009). As documented in several studies, incidence rates of hamstring strains range between 7.1% and 30% with relatively high recurrence rates between 18% and 34% (Nagarwal 2010). A tight hamstring causes increased patellofemoral compressive force, which may eventually lead to patellofemoral syndrome

(Odunaiya 2005). Muscular stretching has a great importance in preventing injuries and developing skills and physical ability. Many muscular stretching methods, exist such as dynamic stretching (ballistic), static stretching and stretching by the proprioceptive neuromuscular facilitation (PNF) (Rashad 2010).

Various Proprioceptive neuromuscular facilitation stretching techniques based on Kabat's Concept are: Hold relax, contract relax and contract relax-antagonist contract etc. (Nagarwal 2009) Proprioceptive neuromuscular facilitation training has a safe and better effect on hamstring muscle's flexibility, strength and endurance (Mohammadi 2012).

Although, effect of static and PNF stretching have been well documented in sport science, there have been only a limited amount of studies evaluating the same factors for rehabilitation purposes (Daneshmandi 2011).

The present study was undertaken with the intention to compare the effectiveness of static stretching and the PNF stretching of hamstring muscles following superficial heat in athletes.

II. MATERIAL AND METHODS

This study was approved by Research and Ethical committee of University College of Physiotherapy, Faridkot. Athletes were taken from the Government Barijindra College and Baba Farid law college. Informed consent was signed by each participant. A randomized controlled trial with equal randomization (1:1 for two groups) were done with 15 patients in each group, total (n=30). The inclusion criteria age was 18 to 23, both male and female, tightness of hamstring muscle, limited hamstring extensibility as determined by active knee extension angle less than 160 degree or less than 90 degree while hip is in flexed position, subjects who were injury free in the trunk and lower extremities from last 6 months. The exclusion criteria was athlete with hamstring spasm, or tendinopathy within the last 6 month, history of back or knee joint pain, inflammatory conditions of hip or knee joint, any medical condition that could be exacerbated by therapeutic heating, any osteoarthritis or any current musculoskeletal disease, signs and symptoms of delayed onset muscle soreness, upper motor neuron disease and lower motor neuron disease, who were taking analgesics or anti-inflammatory drug.

Intervention

Athletes were divided into two groups based on randomization and inclusion and exclusion criteria. Treatment was given for 5 days per for 4 weeks duration. The follow up was at the base and 4th week.

In Group A 15 participants were selected. The moist heat packs were given over the posterior aspect of thigh for 10 minutes. During stretching program the participant were in supine position with their other extremity strapped down the

table. For each stretch, the investigator passively flexed the hip with knee fully extended, allowing no hip rotation. The lower leg was rested on the investigators right shoulders. The hamstring muscle was stretched until the subject first reported a mild stretch sensation. 3 repetition of hamstring stretching were given. This was followed by static stretching. The stretched position was held for 30 secs, followed by 10 sec rest. The stretching was given five days a week for four weeks.

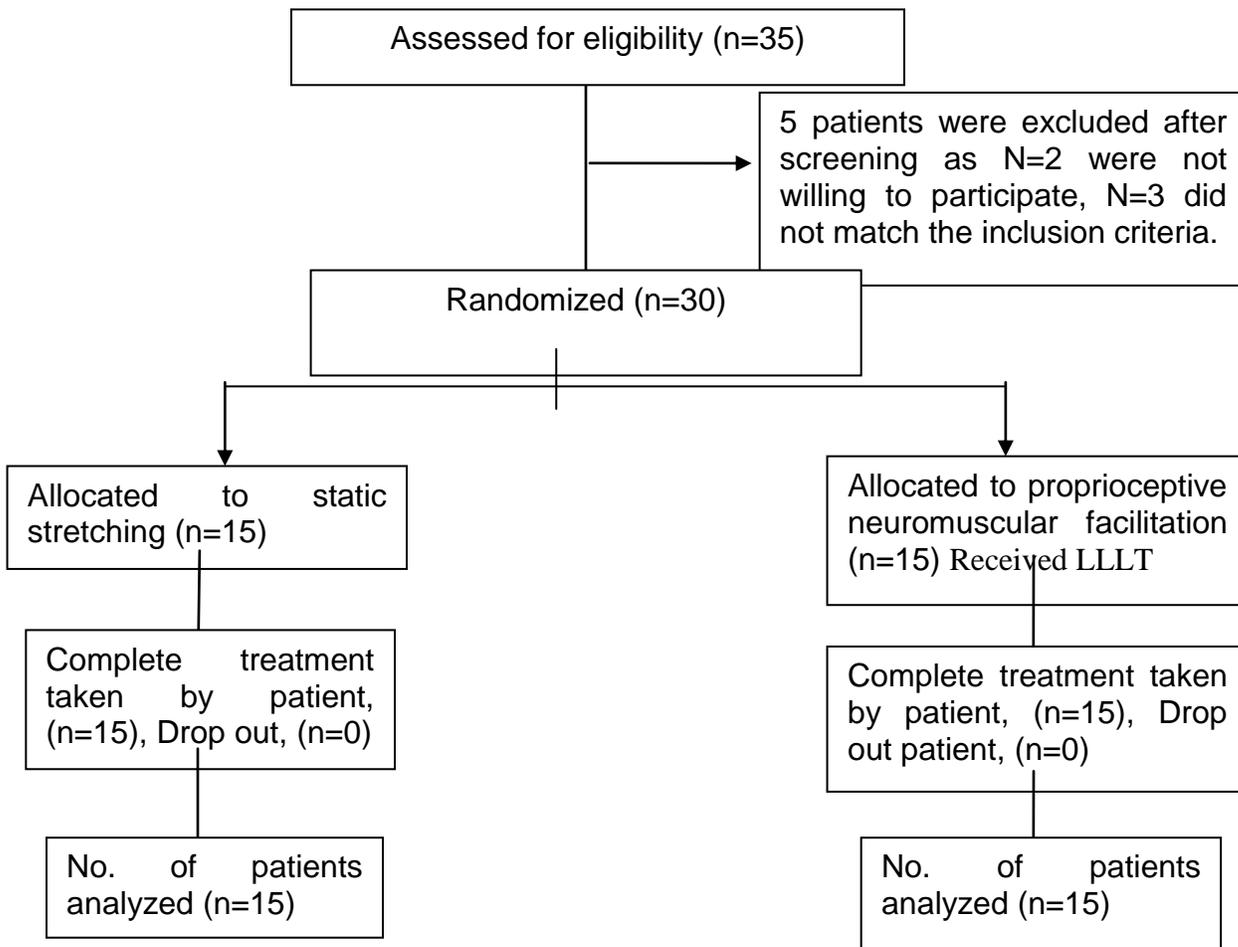


Fig 4.1 Flow Chart of treatment program

In Group B 15 athletes were included and were given PNF stretching followed by moist heat pack. During stretching program athletes were in supine lying position with knee extended and foot in neutral position. Hip was flexed until tension in hamstring muscle group was felt by the participant. The hamstring muscle was stretched until the participant first reported a mild stretch sensation and position was held for 7 secs than ask the participant to contract isometrically the hamstring muscle for 3 sec and 20 sec relaxation. This sequence was repeated for 5 times. This stretching was given five days in a week for four weeks.

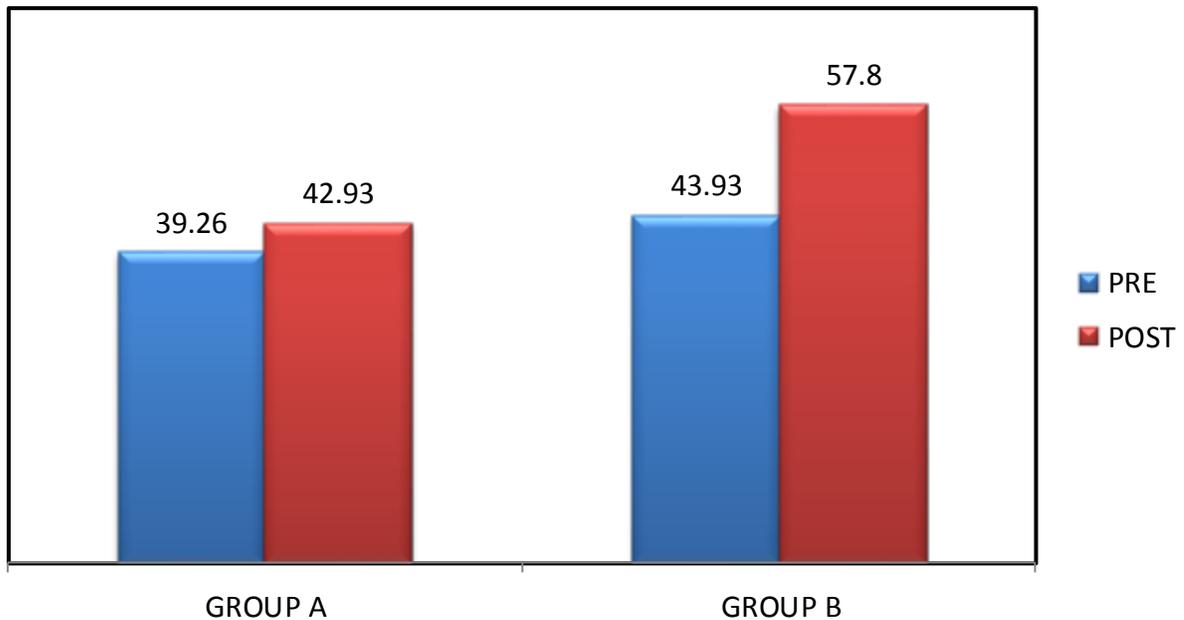
III. DATA ANALYSIS

The data obtained were analyzed using SPSS. t-test was used to determine the effectiveness of static stretching and PNF stretching following the superficial heat on the athletes. Unpaired t test was used for within group comparison of both groups. The level of statistical significance was set at a p value of 0.05.

IV. RESULTS

Unpaired t test was done within Group A and Group B to analyze the significance of age. The mean age of subjects in group A was 22.26 and that of group B was 20.40 respectively. The unpaired t test value was 2.135 ($p = 0.042$). There was no significant difference in the age group. Comparison between the ROM of both the groups has been done. There was significant difference in ROM between pre values of both the groups with mean values of 39.26 and 49.93, but in post values of ROM, there was a significant difference in the ROM between both groups ($p < 0.01$). Group B showed highly significant improvement than Group A in ROM with mean value of 4.66 (Group A) and 14.86 (Group B) after 4 weeks of treatment. Group B showed highly significant improvement than group A in ROM with mean value of 14.86 (Group B), 4.66 (Group A)

COMPARISON OF ROM BETWEEN GROUPS



V. DISCUSSION

We found significant improvement in athletes with group B than group A i.e PNF stretching is more effective than the static stretching for hamstring muscles following the superficial heat in athletes.

The static stretching showed the significant improvement in hamstring flexibility, the pre treatment mean ROM was 39.26 and after the static stretching it was 49.93. This is because the static stretching exhibits the mechanism of action that static stretching exercise causes plastic stretching which results in irreversible tissue elongation (Turner et al, 1988). A stretching activity causes a neural inhibition of muscle group being stretched. The neural inhibition reduces reflex activity which causes greater relaxation and decreased resistance to stretch (Daneshmandi Hassan et al, 2011)

The PNF stretching showed the significant improvement in hamstring flexibility, the pre treatment mean ROM was 42.93 and after the static stretching it was 57.80. A number of studies have demonstrated that ROM significantly increased after the PNF stretching exercise protocols. Handel et al (1997) found increase in active and passive ROM after 8 weeks of CRPNF stretching training. Similarly Schuback et al (2004) observed the effectiveness of self-stretch incorporating PNF components involving a therapist-applied PNF technique (Daneshmandi Hassan et al.2011).

VI. CONCLUSION

This study concluded that both static stretching and proprioceptive neuromuscular facilitation are found to be effective in increasing the range of motion and improving the flexibility. However it is concluded that proprioceptive neuromuscular facilitation is more effective than the static stretching. In addition it is statistically proved that range of motion, flexibility status were improved at two weeks with statistical significance of $p < 0.005$.

Proprioceptive neuromuscular facilitation stretching in normal athletes leads to improved flexibility and range of motion status as compared to static stretching.

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The Deliverance System for mass Housing for the Urban Poor in India, using Bamboo as an Alternative Building Material

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Abstract- For Bamboo to become a mainstream material of the building industry, as a material of substance; an up scaled value of its utility and its deliverance is where research energies have to be spent. Resolution of primary technical issues make it even more compelling to focus on why bamboo construction is not popular despite possessing qualities needed for structural members in tension. Prima Facie; more than the structural vulnerability, appearance, fire and insect attack proneness affecting durability; it is the resolution of the issue of finance, the legal status and the detailed implementation strategy, that appear to be of a greater urgency.

To hand over a dwelling unit to its owner, an extra cost amounting to 28% is incurred in urban areas. The conventional system of a “financed house” becomes financially burdensome and cannot be a solution for the poor. An appropriate Deliverance system for mass housing for the Urban Poor in India, using Bamboo as an Alternative Building Material is therefore an urgent requirement.

Index Terms: Alternative Material, Bamboo, Cost Cutting, Deliverance Mechanism, Mass Housing, Urban Poor;

I. INTRODUCTION

Bamboo has proven to be a technically sound material for construction of dwelling units for the urban poor. However its low popularity index still requires to be questioned especially among the urban poor. The technical solutions lower costs to an extent after which Housing finance Institutions take over the task of delivering them to the target group.

The poorest of the poor are unable to afford even the low cost house designed using bamboo as the key material for construction without financial assistance. At the technical level any further reduction cannot be without a compromise in the standards of safety quality, durability and adequacy in size and number of rooms or services. The concept of mass housing is with the understanding of bulk economy and the economies of scale, repetition and template development and implementation.

Similarly creative housing finance models have to be developed prescribing clearly about who does what so as to reduce overlapping of procedures and prevention of losses that may occur due to non application of economical financing methods

and deliverance of housing to the target group – in this case the Below Poverty Line households, seeking finance for funding the purchase of a house.

While the utility of engineered bamboo construction cannot be ignored for it to enter the urban housing market it shall require simple thumb rule “template” construction techniques, with an in-built quality of repetitiveness of procedures and methods.

On closer analysis of the National Policies it is clear that what gets promised is what is “Possible to be built in a small budget while keeping the technology constant” and certainly not what is “desirable” or “acceptable” in terms of size and number of rooms. A unilateral decision on compromise of standards is being made uniformly across the country, thereby reducing the area, size of rooms, and number of rooms. Any constraints in exploring possibilities about material, design, technology or creative financial options will affect affordability

II. PRE DELIVERANCE COST CUTTING SYSTEMS

A. Scale:

In order to be able to substitute the energy guzzling construction materials, at that high a scale as is required for mass housing, parallel activities involving plantation, drying, seasoning and chemical treatment have to be promoted and up scaled as separate units, as an extension of a “focused agro-based employment scheme” for small and marginal farmers. The product would thus be “especially and exclusively treated bamboo for the purpose of mass housing for the urban poor, following the customized design specifications and construction details.

“Cost reductions through the development of new materials and methods are difficult to come by. Often other costs - services, materials, land, energy, and skilled labor – rise fast enough to over shadow these savings. Clearly modern Technology by itself has not yet provided an answer, and very few realists now believe that it will”. (Angel Shlomo and Stanley Benjamin [1])

B. Templates:

The technical scope of the research, involves identifying that very specific template treatment process, which can convert

bamboo into a suitable reinforcement material in concrete for structural elements in a humble dwelling unit.

C. Incremental Housing

Another unexplored possibility is that of phasing out the construction, so that it is affordable at certain given points of time, when constructed incrementally. Frequent small expenditures, spaced out as per the need, urgency for construction, or availability of bulk money through saving or an event resulting in an income peak, has a higher probability of being affordable.

“The Aesthetic desire to produce finished product housing units and all their associated facilities including schools, markets, hospitals, recreation parks, playgrounds, movie theatres, and places of employment – gives rise to the myth of completeness. Yet the vast majority of the third world housing is built in small increments over long periods, and communities take shape slowly over time as needs are felt and money becomes available.” (Angel Shlomo and Stanley Benjamin [2])

D. Speed of Construction

To expedite the speed of construction, an intensive use of prefabricated bamboo components is recommended.

Engineered bamboo provides more options for increasing speed of construction. Assertive reactions from experts who had been interviewed indicated that whole bamboo has failed to live up to social urbane image and lacked the robustness required for flexibility in planning and designing.

The inability to go multi storied using whole bamboo would create tremendous pressure on urban land creating an artificial freeze in the land market. This would create an imbalance in the demand and supply for public projects and lead to unwarranted increase in land prices, making un-affordability not only an irreversible phenomenon but also widespread

E. Standardization of Economical Spans for Mass Application

For a modest Dwelling Unit, an economical span of 10-12 feet is considered fairly appropriate and is found to be economical even if steel reinforcement were to be used. Large spans are not possible in bamboo; hence it would prove to be ideal for a small dwelling unit. Though *Dendrocalamus Strictus* is known to grow up to a height of 40 feet, it is the tapering of the diameter of the bamboo culm, with height, that makes it difficult to get splints of uniform cross-sectional area as reinforcement, for very long lengths.

F. Technical Procedures and Precautions

What are those precautions that are needed to be observed, while converting bamboo into a suitable reinforcement material in concrete for structural elements? The outcome of the detailed technical study by Prof. Falade of Nigeria made bamboo splices ready for reinforcement if the surface was treated to create friction to form a bonding key with concrete, an equivalent of tor

steel, as against plain MS bars with hooks used in the early 80s for the same purpose, i.e. - prevent concrete to slip, on shrinking.

When comparing the equivalence of the quantity of reinforcement required for a beam or a column out of bamboo and steel respectively, it is observed that the former requires a larger proportion of cross-sectional area than the latter for a given factor of safety, load, load type, and span / height as the case may be.

At the next level of refinement of structural design, the same study concluded by recommending that the extra cross sectional area required for BRC, be compensated not by larger cross sectional area of individual bamboo splints, but a larger number of splints, each with a smaller cross-sectional area. This harnesses the full potential of the tensile property of bamboo splints. Slimmer the splint, larger is the tensile strength.

The overall cross-sectional dimensions of beam/column/slab using BRC are required to be larger than those in the case of SRC. While a remarkable saving in the quantity of steel used for the structure can be achieved, a resulting increase in the quantity of concrete is indicative of some amount of marginalization in the monetary saving. However the environmental benefits cannot be ignored.

Friction issue is resolved by wrapping a layer of bitumen around the splints and tying a thin wire around them to create an undulated rough surface. It serves a dual purpose of preparing for effective strong bonding as well as waterproofing so as to prevent the dampness from the wet concrete mix from penetrating bamboo splints and causing decay.

How to save quantity of concrete is yet another offshoot for research, and might lead to alternative materials, additives or a completely new technology. Saving of concrete in SRC is not totally unknown and structural engineering practices do already exist. To find parallel methods which can be used for BRC can be a study in itself

Most bamboo culms available for building purposes have gone through some treatment. A slight modification to the process could render it appropriate, even if it means a slight increase in the market prices of treated bamboo.

Given its limitations and potentials, how can they be best countered or harnessed, as the case may be? Having achieved this, through technical research, a methodology for a systematic dissemination of the procedure from plantation to harvesting to the final availability of bamboo as a ready material for use in construction was worked out. As and when these are made known to prospective agencies that will be involved in low cost mass housing projects for the Urban Poor, bamboo will have succeeded in its utility as a construction material for mass housing.

The agencies will be a new cadre of specially trained manpower in handling such projects. Training of all the related personnel specially deputed for the first few years in handling finance, technology, and legalities along with distribution of DUs among

the target group (in this case the Urban Population below Poverty Line) will be part of their skill sets. They will be implementers of smaller action plans either location specific or activity specific.

Training schedules and content will be designed accordingly. Unless policies are converted into programmes, programmes are converted into projects, projects are converted in small action plans, carried out by heterogeneous groups of multi-tasking professionals, who can take responsibility of hands-on delivery of housing, Bamboo technology, would forever remain a part of ambitious Policies.

III. THE LEGAL, ADMINISTRATIVE AND FINANCIAL MACHINERY FOR IMPLEMENTATION

A. Guidelines for Special Area Policies

a national level (special area) strategy has to be proposed. The objective of the analysis is for making a DU thus designed, to become a part of the mainstream housing, with a limited agenda of:

Streamlining the financial/ administrative /local level machinery so that special bye laws are framed for dwelling units using bamboo for their construction. These could extend over seismic zones which may have bamboo readily available

Special relaxations in criteria for housing finance for bamboo houses meant for the urban poor to increase access to loans cross subsidy and property insurance etc.

Training for pre-processing / treatment and customizing bamboo for its use as reinforcement

IV. CREATE AN ECONOMIC ENVIRONMENT

A. A Parallel Construction Industry

1) Structural design measures

Measures and their combinations could transform bamboo into an appropriate material for all the Key building components. It can be considered as a material that can partially replace the key building materials which add up to form a major part of the cost. A material technology that could make architectural design fairly functional, durable, safe, green, climate responsive, affordable and socially acceptable.

2) Treatment related measures

Measures need to be taken to treat bamboo technically up to such a level of fineness, that it gets qualified as a structurally safe and durable material for construction, enough to attract bankers financiers and other funding agencies, rendering it as an appropriate material for mass housing. This would also involve speed of construction, but is outside the scope of this study. A material technology that could redefine architectural design thus making room for a totally new segment and variant called parallel housing. It is only then that the technical innovations can find a market even among the Urban Poor, residing close to bamboo producing regions.

3) Measures for design of techno financial model systems

Measures need to be evolved to formulate techno – financial models which would operationally transform an architecturally designed bamboo house into an easily accessible commodity which can be treated as an asset or an investment, attracting speculation for its value appreciation.

4) Architectural design related measures

It could be visualized as a material which shall simultaneously create a parallel construction Industry, while also being commercially beneficial for the owner. This would encourage investment in a bamboo house. This phenomenon is already in existence among the urban poor, but the properties in most cases are shanties, with a very short life span, hence the values do not appreciate in consonance with the other pucca properties around the same area. Hence the commodity continues to remain at unattractive levels of commercial interest.

As such it becomes imperative to formulate a set of standards for the use of bamboo as a structural material, along with guidelines and regulatory measures, integrated into the National building Code as special specific byelaws for bamboo growing regions.

V. A STRUCTURED SUPPORT SYSTEM FOR BAMBOO REGIONS

A. Corrective Measures

The research in the area of identifying technical corrective measures is only a small part of the exercise. An equally rigorous follow-up exercise to have the systems in place and to evolve standards, codes, byelaws and charters will be required. To ensure the delivery and distribution of affordable housing, using a renewable material such as bamboo, so as to reach the target group

B. Financial Management

A parallel research on financial management evolving soft criteria for offering cheap loans, subsidies and formulating social security measures to extend over the right to modest housing and humane living environment for the poor under the provisions of Article 43 which currently focuses only on just and humane environment for work.

C. Insurance and Financial Security

Insurance facility against fire, theft, death along with medical insurance to promise financial security will have to be dovetailed to the package of benefits and privileges legitimately acquired by a citizen.

D. Acceptance of the Phenomenon of Migration

The Policies have to be thoughtfully framed in order to embrace the phenomenon of migration and accommodate the migrants willingly, instead of allowing them to stay informally on unauthorized patches of land within the city disrupting the rhythm of the city, through overloading the infrastructure which was never meant for them.

E. Incentive Package and Fast Clearance of Bamboo House Applications

Simultaneously the administration wings created especially for the owners of low cost houses out of Bamboo, with special provision for smooth and fast clearance of applications for building bamboo houses, and if possible even providing an incentive package.

F. Monitoring Controlling Networking and Training

The monitoring and control network, the training institutes to provide parallel hands-on education, and the active involvement of voluntary agencies, NGOs, grass-root level workers, and elected representatives, sanitation engineers along with self help groups, all shall have to work in coordination. Funding agencies and research labs providing innovations, and break-through in the bamboo construction field. Construction of architectural live models, for active promotions and display, to attract those who are willing to experiment with construction of bamboo houses, may have to be an integral part of the program. Capacity building measures must precede the actual construction boom for bamboo housing in order to cater to the demands of mass housing. Building components, partially replaced with bamboo shall be used to arrive at permutations and combinations, for creating a variety of architectural designs, which would also provide choices for selecting the one that would best suit the budget, and monthly instalments for the repayment of loans.

G. Redefining a Pucca House

Last but not the least is the political will and the correction in the census definition of a pucca house, for the inclusion of composite bamboo housing to make it easy for such house owners to treat it as an asset through-out its life span.

VI. SIMPLIFICATION OF TECHNOLOGY AND PROCEDURES

If bamboo technology is made convenient to handle, promoted along with standards, codes and bylaws, tied up with the legal and the financial machinery, then the entire package put together could go a long way in eliminating houselessness. Once a gateway is created for bamboo, all other alternative materials and technology would follow.

Prof. Falade, who experimented with Bamboo Reinforced Concrete, proved that it is a reinforcement which can be, designed in just the same way as Steel reinforced concrete with a few extra precautions. This and many other findings can make bamboo frog leap into the mainstream market and offer great relief to the Houseless and the very poor.

VII. COORDINATION AMONG MULTIPLE AGENCIES

While the Policies may have an ambitious and well intended package in place for minimizing houseless population and eliminating housing shortages, some of these require fine coordination among multiple agencies. Historically, multiplicity of functions and overlapping of jurisdictions have been the cause for the failure policies, schemes and programs. Limiting the

scope of this study to providing a cheaper solution for constructing a house using Bamboo Reinforced Concrete for the Key structural elements, replacing steel has proved to be technically feasible.

VIII. SEPARATE STANDARDS TO BE EVOLVED

However; some of the important housing terminology needs to be redefined, in order to have the benefits of the research to reach the urban poor living close to bamboo growing regions; Translating the design into a series of standard thumb rules will make it easy for construction, thereby eliminating the involvement of engineers, contractors and architects, further contributing to cost reduction.

IX. AWARENESS BUILDING

Awareness Manpower Training is yet another area for action for effective promotion of innovation through lab land transfer furthering the objective of employment generation and self help working environment.

X. DESIGN GUIDELINES

A. Alternative Materials to be Used Based on Merit

It has to be noted that all alternative materials unconventional materials do not result in a kutch house. In fact if the damage and destruction caused due to failure of structural design, were to be included in the cost benefit analysis, most unconventional material would qualify as being pucca in the sense of being safer if not durable.

B. Habitability is Not a Function of Durability

A Pucca house despite being durable, safe and secure can still be inhabitable by virtue of its size, climate non responsiveness, persons to room ratio.

C. Hidden Costs Add to Non-Affordability of Pucca House

A pucca house can be durable, safe secure, habitable and still be unaffordable on account of other hidden costs, including travel and other betterment, processing and user charges, taxes etc.

D. Hidden Costs Add to Non-Affordability of Kuccha House

A so called Kutch (temporary) house (using parallel technology) can also be durable, safe secure, habitable and still be unaffordable on account of its inherent capital cost, other hidden costs, including travel and other betterment, processing and user charges, taxes etc.

E. Adequacy Cannot be Sacrificed in the Name of Affordability

Affordability cannot be equated to size of the house infinitely as being inversely proportional to it, but must stop at a point when it starts to get inhabitable or inadequate. Affordability has to be delinked from minimum size and number of rooms required by a given household.

A pucca (permanent) house cannot be made affordable, unless the safety, size, and quality are partially sacrificed. Housing and Infrastructure cannot be mutually exclusive. Habitat not Housing

is what needs to be planned for. Each being valueless, without the other.

While defining affordability of dwelling units, other miscellaneous hidden costs may mean nothing at higher levels of income, but at Below Poverty Levels, these constitute a large proportion of the household income, and can tilt the balance between affordability or otherwise. Costs of all kinds, including notional, running, sunk, opportunity are more relevant in the case of the Urban Poor, than for higher incomes.

Sensitivity to loss, like a single non earning day could create far more turbulence in the life of a BPL household, than for higher income groups, hence tax holidays, subsidies, grants and waivers to be integrated with other resilient fiscal planning measures capable of absorbing non-repayment or untimely repayment offering flexibility to borrowers.

Similarly, expenditure on extra travelling, for each member of the household due to relocation (if any) could also affect affordability, in which case relocation compensation measures to be in- built in the form of subsidized travel costs using renewable BPL concession passes or travel cards.

XI. RECOMMENDATIONS FOR COST CUTTING DURING THE PROCESS OF DELIVERANCE OF HOUSING

Having understood poverty, the plight of the urban poor, the possibilities and constraints, it is clear that an approach needs to be adopted, which identifies the constants and the variables, and the limits the floor and ceiling cut offs for Below Poverty Line category.

The increase in costs during the process of handing over a DU to the urban poor cannot be the same as for those at higher income groups. The system evolved has to be devoid of expenditure to the poor. Hence clearly defined roles are required for the stakeholders involved in reaching out to the target group in question.

XII. THE ROLE OF STAKEHOLDERS IS DEFINED AS FOLLOWS

Table 1: Recommended Role of Various Agencies in Cost Reduction

Objective : Minimum EMI/ Rent for Below Poverty Line		
Who	What	How
Central Govt. Policy	5-Year plan provisions, Definitions	Annual budgets, Tax exemptions, special target group specific/ area specific exclusive policies, Cross subsidies, modify definitions
Central Government, State Government, Local body, Architect + Structural Engineers + Contractors	Development Control Rules, building Bye Laws, Schemes, Definitions	Design, Supervision, Choice of Material, Specifications Technology special byelaws for Urban Poor
Banks, HFIs.	Special cheaper Loans, Subsidies	Minimize paperwork procedural matters.
Local bodies	Through Development control rules, Master Plan Allocation & Land-use plan	Special land reservations, Relocation schemes and regularization of unauthorized settlements Issue of relevant concession cards for use of public transport,

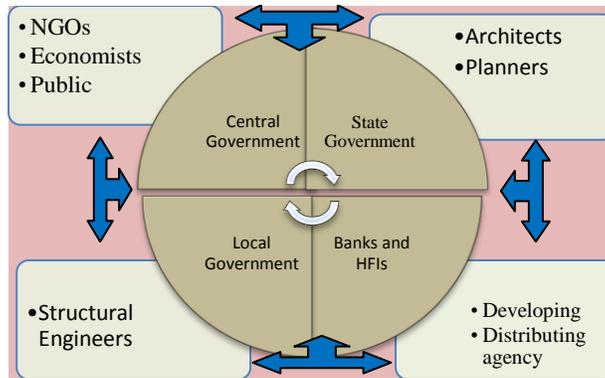


Fig 1. (a) Hierarchy of Roles

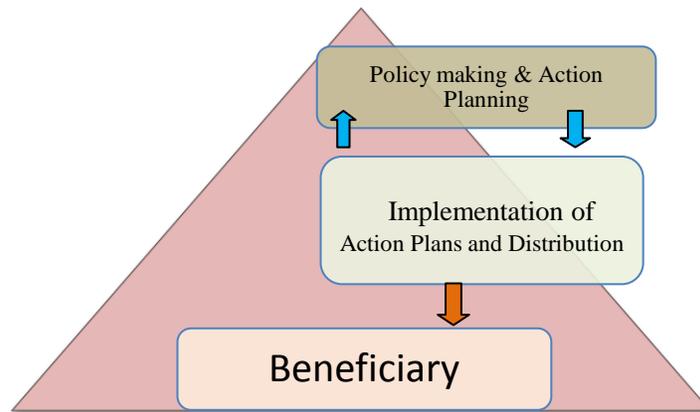


Fig 1. (b) Hierarchy of Roles

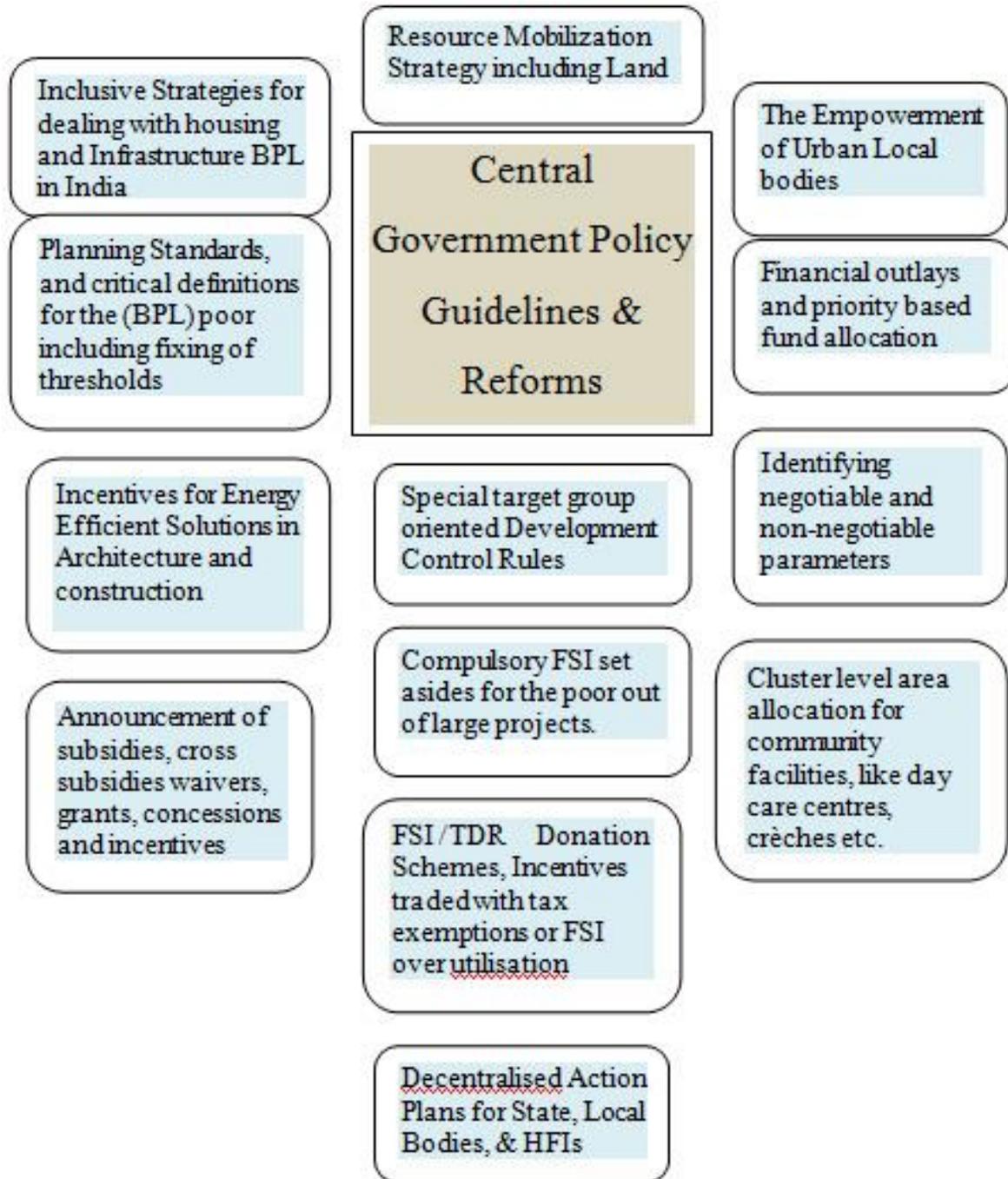


Fig 2. Role of Central Govt.

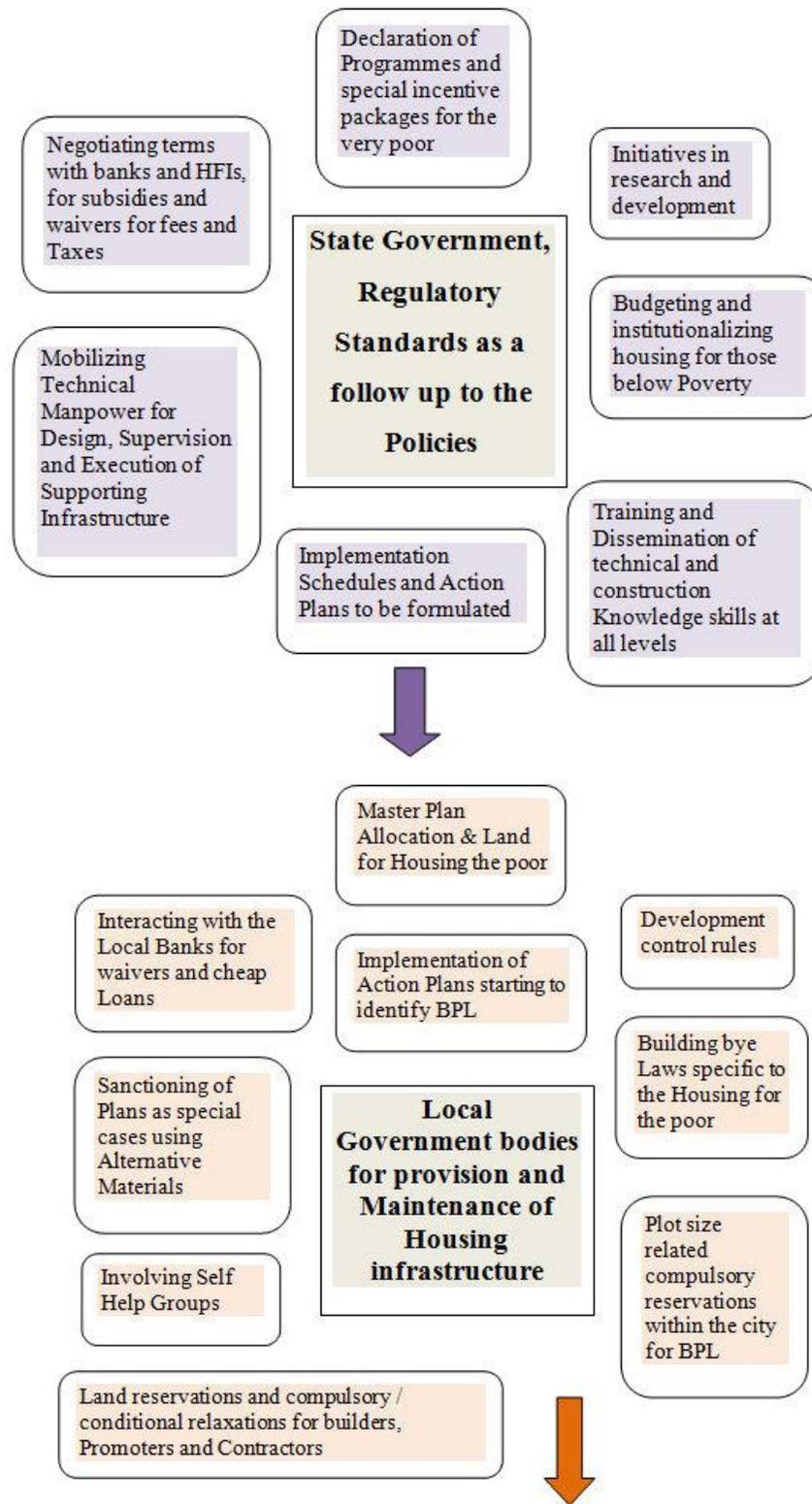


Fig 3. Role of State Govt. and Local Govt. bodies

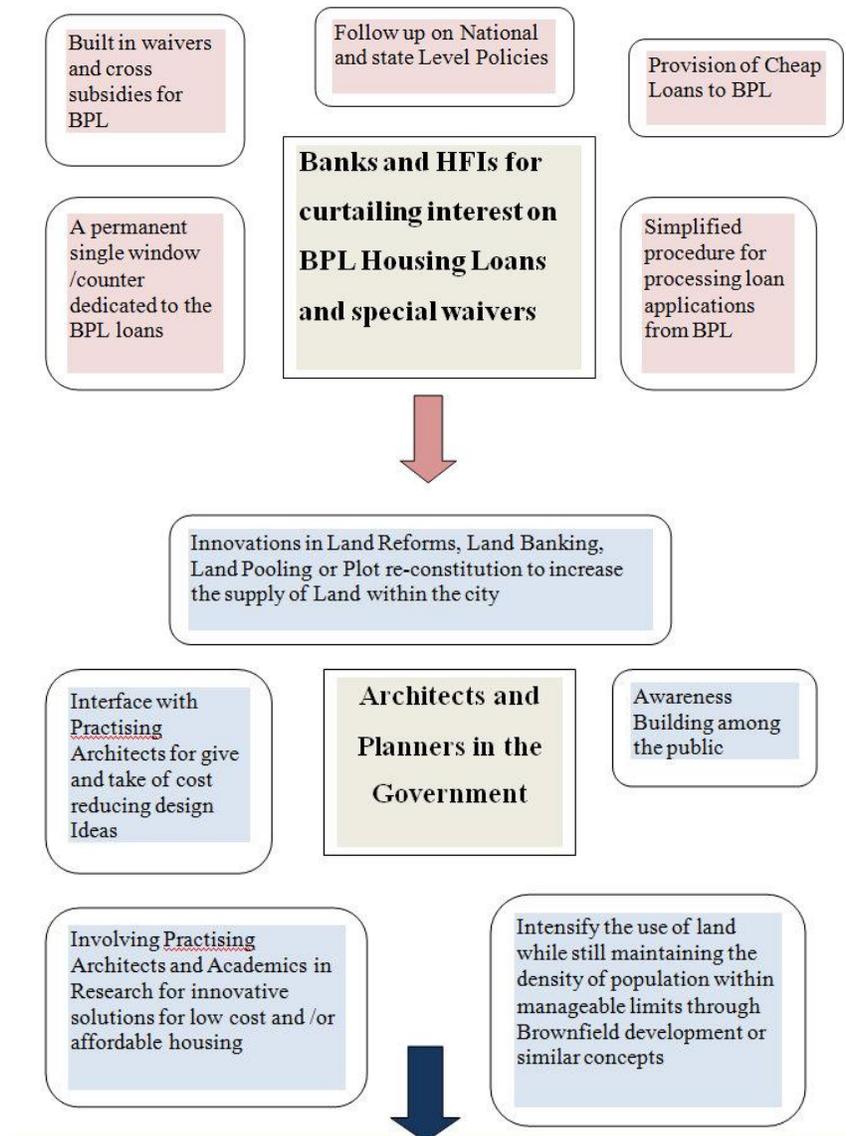


Fig 4. Role of architects and planners in Govt.

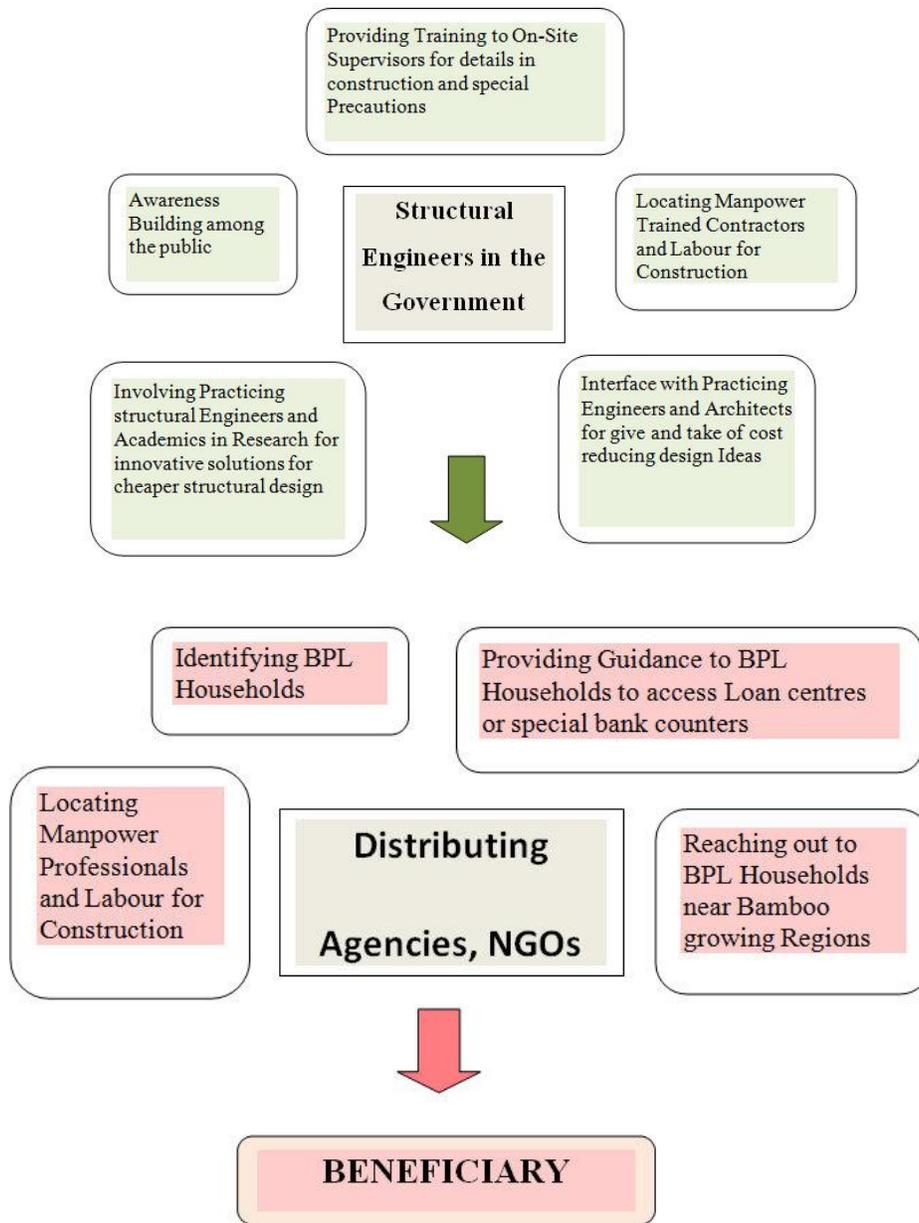


Fig 5. Role of distributing agencies , NGOs and structural engineers

XIII. CONCLUSION

A streamlined system for the handover of DUs after all design level cost cutting is over can bring respite in the affordability levels for the Urban poor. A complete role chart has been recommended for the purpose. This is with the objective of cost cutting of pilferages due to an inefficient management of housing deliverance systems which could reduce costs up to 28% as per the original research.

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Determining the relationship between the dielectric properties and the basic physical and chemical parameters of the air-dry soil

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Abstract- Measurements of the electric conductivity, σ , and relative dielectric permittivity, ϵ_r , were conducted (0.1Hz –15 MHz) on 40 air-dried soil samples that were subsequently analyzed for pH, total organic matter in soil ($\Delta M/m_1$), P_2O_5 , Fe_2O_3 and heavy metal concentrations (Pb, Cd, Cr, Ni, Cu и Zn). The pH of soil samples varied between pH 5.25 and pH 7.73 (mean pH 6.71), the $\Delta M/m_1$ varied between 1.49 % and 9.96 % (mean 4.56 %). The mean content of Fe_2O_3 was 44352.5 mg/kg, which was 114 fold higher than the mean concentration of the heavy metals (Pb, Cd, Cr, Ni, Cu и Zn). The mean content of P_2O_5 was 0.26% . We found a linear relation between σ (1 MHz) and the indicated physicochemical parameters; P_2O_5 (coefficient of correlation, $r = 0.637$), pH ($R = 0.530$), Fe_2O_3 concentration ($r = 0.450$), content of $\Delta M/m_1$ ($r = 0.545$) and heavy metal concentration ($r = 0.460$). Similar relationships and correlation coefficients were found between ϵ_r (10 kHz) and the same physicochemical parameters. As the latter represent general biogeochemical parameters, our findings suggest that dielectric spectroscopy may provide useful approach to probing soil geochemistry, iron cycling and anaerobic microbial activity. Furthermore, our results yield insights into the impact of various physicochemical parameters on the induced polarization of soils.

Index Terms- Dielectric spectroscopy, Soil, Conductivity, Relative permittivity, Total content of heavy metals (Pb, Cd, Cr, Ni, Cu и Zn), Total organic matter ($\Delta M/m_1$)

I. INTRODUCTION

The quality of soil is controlled by physical, chemical and biological components of soil and their interactions [1, 2]. The soil has physical, chemical as well as electrical properties. Colour, texture, grain size, bulk density etc., comprise the physical properties; Nutrients, organic matter, pH, etc., comprise chemical properties while, electrical properties include dielectric constant, electrical conductivity and permeability. The concept of soil health and soil quality has consistently evolved with an increase in the understanding of soils and soil quality attributes. Perveen S. et al. [3] have studied micronutrient status of soils and their relationship with various physico-chemical properties. Chhabra G. et al. [4] have shown that available manganese decreased with soil pH and available copper increased with clay

and organic carbon content. Results of physical and chemical tests provide information about the capacity of soil to supply mineral nutrients. Martin C. et al. [5] have shown that the electrical conductivity of soil water is a good indicator for absorbing the amount of nutrients available for crops.

Bell R. W. and Dell B. [6] demonstrated that the deficiency of nutrients has become major constraint to productivity, stability and sustainability of soils. The status of available micronutrients in soils and their relationship with various physico-chemical properties have been attempted by several investigators [7,8,9]. Avnimelech Y. et al. [10] estimated the organic content and bulk density of flooded mineral soils and found that the sediment bulk density was inversely related to the organic carbon concentration. The measurements of dielectric constant of soils as a function of moisture content over wide microwave frequency range were carried out in the past by many investigators [10-17]. These investigators have used soils covering different parts all over world and with different texture/structures. Almost all these investigators have concluded that the dielectric constant of soils is strongly dependent on moisture content. Further, Sami S. [19] has reported the effect of chemical and mineral composition of dust on dielectric constant. Srivastava S. K. and Mishra G. P. [13] studied the characteristics of soils of Chhatisgarh at X – band frequency and showed the dependence of dielectric constant of soils on their texture. Calla O. P. N. et al. [20] have studied the variability of dielectric constant of dry soil with its physical constituents at microwave frequencies. Dawood N. K. et al. [21] have evaluated the dielectric constant by clay mineral and soil physico-chemical properties and showed that texture and mineral content of soil had different impact on dielectric constant. Chaudhari H. C. and Shinde V. J. [22] have reported that the dielectric properties of dry soil at microwave frequency in X-band are function of its chemical constituents and physical properties. In a detailed study, Sengwa R. J. and Soni A. [23] have reported the variation of dielectric constant with density of dry minerals of soil at 10.1 GHz.

Below 50 MHz the frequency dependence of dielectric permeability ϵ and the specific conductivity σ of soils strongly depend on their water content [22,25,26] and on the soil type [27]. A strong dependence of inductive polarizability on Fe content in wet and rich in organic matter marshy soils was established[28].

The properties of dry soil along with its type have a great importance in agriculture. For microwave remote sensing applications, dielectric constant is the primary important electrical property for dry soil. Further, due to dependence of dielectric constant on the physical constituents and chemical composition of the soil, the detailed study of its variability with these soil parameters will be useful for better understanding of soil physics[2,29].

The aim of the present study was to investigate the relationship between soil dielectric properties and some basic physicochemical parameters in air-dried samples of arable soils.

II. MATERIALS AND METHODS

Reagents. The reagents are qualified "p.a". Stock standard solution (Merk, Germany) with a concentration of 1000 mg / l for the determination of Fe, Pb, Cd, Cr, Ni, Cu and Zn was applied. In all procedures double-distilled water was used.

Soil samples. The study included five major regions of the central part of South Bulgaria (Asenovgrad, Pazardzhik, Plovdiv, Stara Zagora Parvomai). Sampling was carried out in accordance with ISO 10381-1, 2002[30]; ISO 10381-2, 2002[31]; ISO 10381-3, 2002[32]. A total of 40 fixed sites with an area of 100 m² were defined. From each site 3 separate samples from depth of the plow layer 0-30 cm were taken. The average sample was prepared by mixing and homogenizing of incremental samples and stored in sealed glass containers for analysis in the laboratory.

Determination of pH and total organic matter of soil . pH determinations were accomplished by pH – meter (pH-meter Consort C932, Belgium), with a glass electrode in a suspension containing soil / water 1:5 according to ISO 10390 [33] . The moisture content and the $\Delta M/m_1$ were determined in accordance with standard tests for organic and clay soils / ASTM D2974 / . $\Delta M/m_1$ dried sediment samples were determined on the basis of weight loss on ignition .

Mineralization of the samples. The mineralization of the samples was carried out according to EPA Method 3052 procedure (1996) [34] . 1g air - dry soil to the nearest 0.001 g in PTFE vessels was weighted. HNO₃, HF, HCl and H₂O₂, were added using a microwave system Multiwave 3000 . The maximum power was 1400 W, and the maximum pressure in Teflon vessels - 40 bar .

Determination of iron and heavy metals in soils. In the determination of iron and heavy metals in the soil samples Atomno absorption spectrometer "AAnalyst 800 with graphite furnace HGA" Company "Perkin Elmer", at wavelengths: Fe - 248.3 nm, Pb - 217.0 nm, Cd - 228.8 nm, Cr -357,9 nm, Ni - 232.0 nm, Cu - 324.8 nm and Zn - 213.9 nm was used.

Determination of phosphorus in the soil. In determining the content of P in the soil samples UV / VIS DR 5000 spectrophotometer (Hach Lange, Germany), at a wavelength of P - 410 nm. (BDS ISO 11263:2002) was used[35].

Determination of the electrical properties of soils. The resistance, R (Ohm), and capacitance, C (F), of each soil sample were measured after placing the soil sample between two electrodes mounted in a conductometric cuvette. Alternating voltage of 1000 mv with frequency f (Hz) was imposed between the electrodes and the current and its phase difference to the

voltage were measured by impedansomer. Using these data the values of R and C were determined based on an appropriate electric model of the sample. The model of resistor and capacitor, connected in parallel, was the most appropriate for the poorly conductive soil samples. The R and C of soil samples were measured at large number of frequencies in the range 0.001 Hz - 5 MHz using Solartron 1260A Impedance/Gain-phase analyzer (England) interfaced to a computer.

The values of R and C depend on sample material as well as on the geometry of electrodes. Instead of R and C it is more convenient to use another variables, electric conductivity σ (mS/m) and relative permittivity ϵ_r , which describe the intrinsic electrical properties of sample material and are independent on the electrode configuration. The dimensionless ϵ_r reflects the concentration of bound charges in the sample and the propensity of these charges to be displaced under the influence of an incident electric field. σ is proportional to the concentration of free charges in the sample and to their ability to travel a certain distance without collision with the particles of sample. At low frequencies the dissipation of energy depends primarily on σ , while at high frequencies (e.g. above 1 MHz) the dissipation of energy is dominated by the dielectric losses due to bound charges.

According to (Davey et al., 1992) σ and ϵ_r were calculated from equations (1) and (2)

$$\epsilon_r = K.C/\epsilon_0 \dots\dots\dots (1)$$

$$\sigma = K/R \dots\dots\dots (2)$$

Here, $\epsilon_0 = 8.854.10^{-12}$ (F/m) is the dielectric permittivity of vacuum and K is the constant of the conductometric cuvette. In case of flat electrodes, distanced at d (m), each having the area of S (m²), the $K= d/S$. In this case the conductometric cell had a cylindrical shape with a diameter of 17 mm and volume of 4.5 ml. The wall of the cylinder and a thin rustles rod in the axis of cylinder served as electrodes. Based on equation (2) the constant, K, was calculated equal to 1.55 cm¹ for the frequencies less than 1 MHz measuring the resistance of the conductometric cuvette filled with salt solution with known conductivity.

Prior to measuring the soil samples were dried and break to pieces with approximately the same size. As a control sample containing no organic material we used fine sea sand taken from the shore of the Baltic Sea (Poland) after subjecting it to heat treatment (300°S, 15 min), washing with distilled water and drying. Distilled water with $\epsilon_r = 80$ was used as control in measuring the dielectric permittivity of soil samples.

Accuracy and precision

Soil materials used for accuracy and precision tests include three certified soil samples corresponding to two main soil types in Bulgaria:

1. Light Alluvial–deluvial Meadow Soil PS-1, SOOMET No. 0001-1999 BG, SOD No. 310a-98.
2. Light Meadow Cinnamonic Soil PS-2, SOOMET No. 0002-1999 BG, SOD No.311a-98.
3. Light Alluvial–deluvial Meadow Soil PS-3, SOOMET No. 0003-1999 BG, SOD No. 312a-98.

SPSS (Statistical Package for Social Science) program for Windows was used for statistical data processing.

III. RESULTS AND DISCUSSION

The obtained values of some of the basic physico-chemical parameters- pH, $\Delta M/m_1$, P_2O_5 , Fe_2O_3 and total heavy metals content (Pb, Cd, Cr, Ni, Cu and Zn) of the studied air-dried soil samples are presented in Table 1. The pH of the soil samples was

in the range from medium acid (pH = 5.25) to slightly basic (pH = 7.73) with a mean value of pH = 6.71. The average iron content in the dry soil samples was 44352,50 mg/kg which is 114 times higher as compared with the average value of the total mass of the other investigated heavy metals(Pb, Cd, Cr, Ni, Cu and Zn). The mean value for P_2O_5 was 0,195%, and for $\Delta M/m_1 - 4,561\%$. In the table, there were found lower values of ϵ_r at higher frequencies, which was due to frequency dispersion.

Table I: Principal physicochemical data collected for the soil probes under study

Sample	Soil type FAO	pH	ϵ_r , 10 kHz	ϵ_r , 100 kHz	σ (mS/m), 1 MHz	Fe_2O_3 , mg/kg	Total heavy metals, mg/kg	P_2O_5 , %	$\Delta M/m_1$, %
1	Fluvisols	7.30	11.30	6.90	1.05	49700	845.7	0.263	6.154
2		7.36	14.17	9.70	1.38	46800	948.2	0.258	8.692
3		7.28	10.53	7.22	0.57	29600	600.9	0.192	3.796
4		7.31	12.99	8.60	0.78	68800	1055.4	0.193	4.718
5		7.48	10.81	6.77	0.67	50900	1121.0	0.165	2.056
6		7.54	11.26	7.01	0.76	37100	802.6	0.166	2.089
7	Leptosols	6.41	11.04	8.06	0.88	38400	349.2	0.210	6.864
8		6.32	10.45	7.46	0.84	45200	404.0	0.156	7.077
9		6.11	10.15	7.34	0.77	44300	411.8	0.237	6.629
10		6.37	10.56	7.35	0.95	37000	303.4	0.187	6.390
11	Vertisols	5.55	10.36	7.40	0.92	51900	298.0	0.165	7.930
12		5.30	7.64	5.83	0.27	49600	519.5	0.147	1.546
13		5.34	9.16	6.98	0.51	53400	280.3	0.156	8.000
14	Chromic	6.11	9.75	7.18	0.75	42200	197.7	0.229	7.317
15		7.59	11.66	7.19	1.33	31500	196.9	0.192	8.964
16		6.72	10.18	6.78	0.93	47600	268.6	0.210	5.992
17		6.68	9.72	6.59	0.91	27900	213.1	0.229	6.024
18		6.61	11.04	7.12	1.10	45100	223.5	0.238	6.730
19		6.42	10.00	7.02	0.90	45400	325.4	0.256	7.467
20		6.54	9.35	6.76	0.72	53900	314.4	0.238	7.488
21		6.50	10.19	6.95	0.90	55000	388.7	0.238	8.309
22	Leptosols	5.82	4.02	3.52	0.08	19800	446.5	0.120	2.571
23		5.76	5.45	4.28	0.18	22700	149.6	0.170	2.281
24		5.25	4.12	3.52	0.10	22900	132.9	0.120	1.579
25		6.05	7.25	4.86	0.35	55900	165.7	0.165	2.040
26		6.98	8.67	5.73	0.39	58100	225.4	0.156	2.825
27		6.09	7.19	4.93	0.33	58100	385.2	0.137	2.264
28		6.79	5.26	4.14	0.19	41500	142.7	0.137	1.490
29		5.71	5.27	4.24	0.17	46300	163.9	0.165	1.694
30		6.66	5.39	4.25	0.19	39300	114.2	0.156	1.599
31		7.70	7.48	4.87	0.36	32800	181.8	0.210	1.886
32		7.68	11.30	7.12	0.69	42500	538.9	0.165	3.196
33		7.73	6.81	4.98	0.27	36400	222.3	0.192	1.795
34	Vertisols	7.41	9.37	6.12	0.57	45700	555.3	0.238	4.294
35		7.00	13.18	8.69	0.62	61500	272.5	0.229	4.901
36		7.01	14.20	9.19	0.72	62200	316.1	0.210	5.346
37		6.99	11.20	7.34	0.61	53700	341.9	0.210	4.409
38		7.58	11.21	7.34	0.54	42800	599.6	0.229	2.273
39		7.68	12.00	7.69	0.65	42400	279.9	0.229	2.896
40		7.70	12.07	7.80	0.60	38200	207.5	0.238	2.852

Max. value	7.73	14.20	9.70	1.38	68800	1121.0	0.263	8.964
Min. value	5.25	4.02	3.52	0.08	19800	114.2	0.120	1.490
Average	6.71	9.59	6.57	0.64	44352.50	387.75	0.195	4.561
Standard deviation	±0.75	±2.62	±1.52	±0.33	±11192.22	±255.24	±0.04	±2.473

The regression-correlation analysis displayed that the influence between the studied soil parameters was very slight. The obtained correlation coefficients were presented in Table 2 and they characterized with low values. Statistical significance was established only for the effect of heavy metals content on soil pH: $r = 0,366$ and determination coefficient $R^2 = 0.134$ at $p < 0.05$. The results obtained corresponded to the data from other investigations [36,37,38].

Table II: Correlation coefficients between some of the principal physicochemical parameters (pH, $\Delta M/m_1$, P_2O_5 , Fe_2O_3 , total amount of heavy metals (Pb, Cd, Cr, Ni, Cu и Zn) of air-dried soil probes

Correlation	Correlation coefficient, r	Statistical significance
Fe_2O_3 as a function of the content of $\Delta M/m_1$	0.211	$p > 0.05$
Fe_2O_3 as a function of pH	0.044	$p > 0.05$
Fe_2O_3 as a function of the content of heavy metals	0.270	$p > 0.05$
pH as a function of the content of heavy metals	0.366	$p < 0.05$
$\Delta M/m_1$ content as a function of the content of heavy metals	0.052	$p > 0.05$
pH as a function of the content of $\Delta M/m_1$	0.097	$p > 0.05$

The apparatus for measuring the dielectric parameters of the soil samples was calibrated by the use of materials with known parameters. The value for $dH_2O \epsilon_r$ was approximately 80 (10 kHz – 5 MHz) and varied sand and between 2.5 and 4.0 for the separate mineralized soils (500 Hz – 5 MHz). The value of ϵ_r increased monotonously, while that for each of the investigated soil samples when the frequency was reduced from 5 MHz to 1 Hz. These data agreed with the results of other authors [39,40,41] and emphasized the reability of the applied dielectroscopic method for the investigation of soil samples in the studied conditions. The values of ϵ_r and σ for each soil sample determined at selected current frequency are presented in Table 1.

Fig. 1 and Fig. 2 display the distribution diagrams of the couple values $EPSr(10kHz) - \Delta M/m_1, \%$, $EPSr(100kHz) - \Delta M/m_1, \%$, $EPSr(10kHz) - P_2O_5, \%$ and $EPSr(100kHz) - P_2O_5, \%$ for the studied soil samples. The plots show the presence of linear correlation between $EPSr - P_2O_5, \%$, $EPSr - \Delta M/m_1, \%$ of the soil samples. A similar linear graphical distribution was defined in the rest of the cases when a correlation between the cited basic physic-chemical parameters and $EPSr$ of the soil samples was examined. The strength of the established linear

correlations between the basic physico-chemical parameters and the dielectric properties - ϵ_r and σ of the soil samples was assessed by calculation of the corresponding correlation coefficients presented in Table 3.

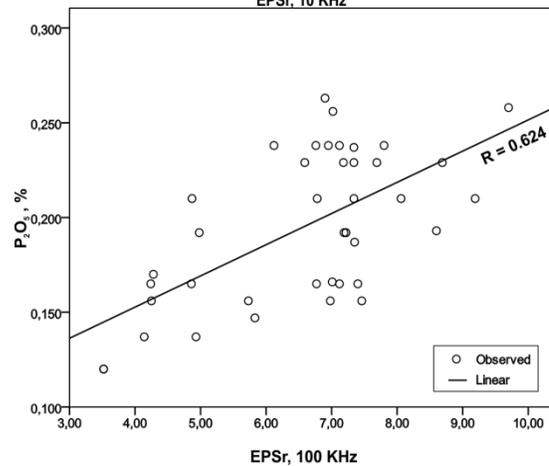
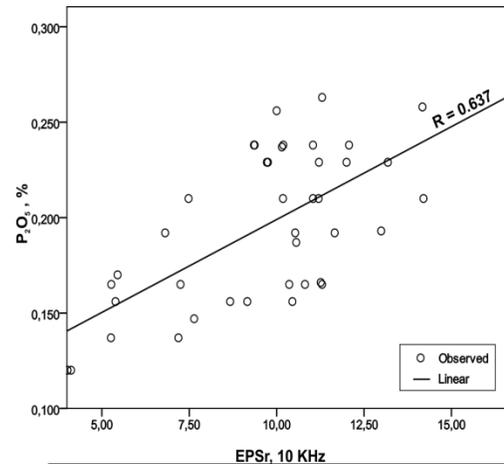


Figure 1: Statistical dependence between $EPSr$ (10kHz) and $P_2O_5, \%$; $EPSr$ (100kHz) and $P_2O_5, \%$ of air tempted soil samples

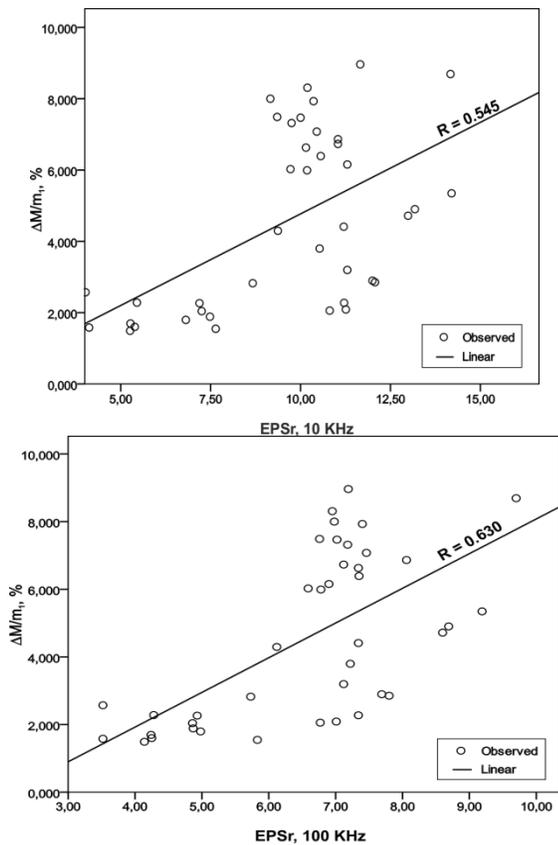


Figure 2: Statistical dependence of EPSr (10kHz) - ΔM/m₁ %, EPSr (100kHz) - ΔM/m₁ of air tempted soil samples

Table III. Correlation coefficients between the dielectric parameters ε_r (10 kHz) and σ (mS/m) and some of the principal physicochemical parameters (pH, ΔM/m₁ %, P₂O₅, Fe₂O₃, total amount of heavy metals (Pb, Cd, Cr, Ni, Cu n Zn)) of air-dried soil probes.

Correlation	Correlation coefficient, r	Statistical significance
ε _r , 10 kHz as a function of pH	0.530	p < 0.05
ε _r , 10 kHz as a function of Fe ₂ O ₃ (mg/kg)	0.451	p < 0.05
ε _r , 10 kHz as a function of the content of heavy metals (mg/kg)	0.463	p < 0.05
ΔM/m ₁ , % as a function of ε _r , 10 kHz	r = 0.545	p < 0.01
P ₂ O ₅ , % as a function of ε _r , 10 kHz	r = 0.637	p < 0.01
σ, 1 MHz as a function of pH	0.316	p < 0.05
σ, 1 MHz as a function of Fe ₂ O ₃ (mg/kg)	0.203	p > 0.05
σ, 1 MHz as a function of the content of heavy metals (mg/kg)	0.336	p < 0.05
ΔM/m ₁ , % as a function of ε _r , 100 kHz	r = 0.630	p < 0.01

P ₂ O ₅ , % as a function of ε _r , 100 kHz	r = 0.624	p < 0.01
σ, 1 MHz as a function of ε _r , 10 kHz	r = 0.794	p < 0.01
σ, 1 MHz as a function of ε _r , 100 kHz	r = 0.786	p < 0.01

The data from Table 3 displayed that the dielectric properties ε_r and σ of the dried soil samples were moderately influenced by the studied basic soil parameters – pH, Fe₂O₃ content, P₂O₅, total organic compounds and total heavy metals content. The calculated correlation coefficients (r from 0,20 to 0,64) have moderately low values. The determined correlation coefficients with regard which estimate the strength of the linear correlation between the studied basic physico-chemical parameters of the samples and the dielectric properties (ε_r and σ) characterized with statistical significance (p < 0.05) except for that regarding to the correlation between σ and Fe₂O₃ of the samples (p > 0.05). Statistically greater effect (p < 0.05) on ε_r (10 kHz), ε_r (100 kHz) and σ (1 MHz) was established for P₂O₅(r = 0.637 and 0.624, respectively), ΔM/m₁(r = 0.545 and 0.63, respectively), pH (r = 0.53, respectively), Fe content (r = 0.45, respectively) and total heavy metals content (r = 0.46, respectively). The latter results demonstrated the necessity of additional investigation on soils with higher total organic compounds content, where higher correlation coefficients are expected.

The determined correlation coefficients displayed that each of the studied basic physico-chemical parameters could be independently analyzed in the range of 20% to 40% from the variation of the proper dielectric parameter, ε_r and σ of the soil samples. In total, however, as independent between each other (Table 2), they could explain practically the entire interval of statistical variation of the dielectric properties of the soils.

According to the data from Tables 1,2 and 3, each of the studied basic soil parameters influences individually and independently on the dielectric soil properties. As stated, the latter could explain the determined moderately low correlation coefficients. More informative is the frequency dependence of σ as ε_r of the soil samples was influenced in a similar way by the strong dielectric polarization of the organic compound and the studied salts.

IV. CONCLUSIONS

The determined correlation coefficients displayed that each of the studied basic physico-chemical parameters could be independently analyzed in the range of 20% to 40% from the variation of the proper dielectric parameter, ε_r and σ of the soil samples. In total, however, as independent between each other, they could explain practically the entire interval of statistical variation of the dielectric properties of the soils.

More informative is the frequency dependence of σ as ε_r of the soil samples was influenced in a similar way by the strong dielectric polarization of the organic compound and the studied salts.

The obtained physicochemical correlations by means of the IP method with a different extend of correlation could be applied

for solving of various scientific and practical tasks to predict and control the soil characteristics.

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Gender Imbalance: Trends, Pattern and its Impact on West Bengal

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Abstract- Sex is an easily identifiable characteristic of an individual. Sex composition of a population refers to the balance between male and female in any population. It can be expressed either in the form of proportion of a particular sex in the population or as a ratio between the population of two sexes. As is obvious, the first one gives the number of males per hundred females or number of males per thousand females in the population and is the most widely used measure of sex ratio the world over. On the country the second provides the number of females per hundred males or number of females per thousand males in the population. The sex composition by age group especially the 0-6 years is vital for studying the demographic trends of child population. Though, the overall sex ratio has improved to 947 as compared to 934 in 2001, the child (0-6 years) sex ratio, i.e. the number of girl children per 1,000 male children has shown an unabated decline since 1971. It has declined from 1010 in 2001 to 950 in 2011. The decreasing child sex ratio will have a cascading effect on population over a period of time leading to diminishing sex ratio in the state. Sex ratio is an important determinant for assessing composition of population, quality of life, levels of development and level of human resources, level of participation in different economic activities of males or females of a particular region. The preview of the present study is to assess the trends, spatial pattern of overall and child sex ratio and find out the association of sex ratio and also there impact in the society of West Bengal (India).

Amartya Sen estimated that there were nearly 100 million women missing in the world around 2000 and nearly a third of them were missing in India (Sen, 2003).

The disadvantage surroundings Indian woman's capacity to survive that leads to this imbalance, are rooted in a complex web of socio-cultural factors, while gender based differentials in mortality are seen by some as the main causes of this differentials to an ethos of discrimination against women, which is manifested in their unequal access to life supporting resources such as food, nutrition and health care, especially during childhood. Widespread gender biased practices thus serve to distort the female male ratio among child populations of various ages, finally culminating in the male dominant female male ratio of our population (Marty and Jean Dreze: 1995).

In West Bengal sex ratio is define as the number of females per thousand males in a human population. The sex ratio of West Bengal has continuously increasing after the independence, 865 from 1951 census from 947 in 2011(P) census. On the other hand, the child sex ratio between the age group of 0-6 years has come down to 914 in the 2011 census from 927 in the 2001 Census. The declining child sex ratio trend is being recorded since 1991. This declining trend can now be observed in regions where, historically, the ratios had been sound. Developed states have recorded even steeper falls. Literacy and economic development have resulted in sharper change. In India, the Child Sex Ratio (CSR) is defined as the number of females per thousand males in the age group 0-6 years in a human population.

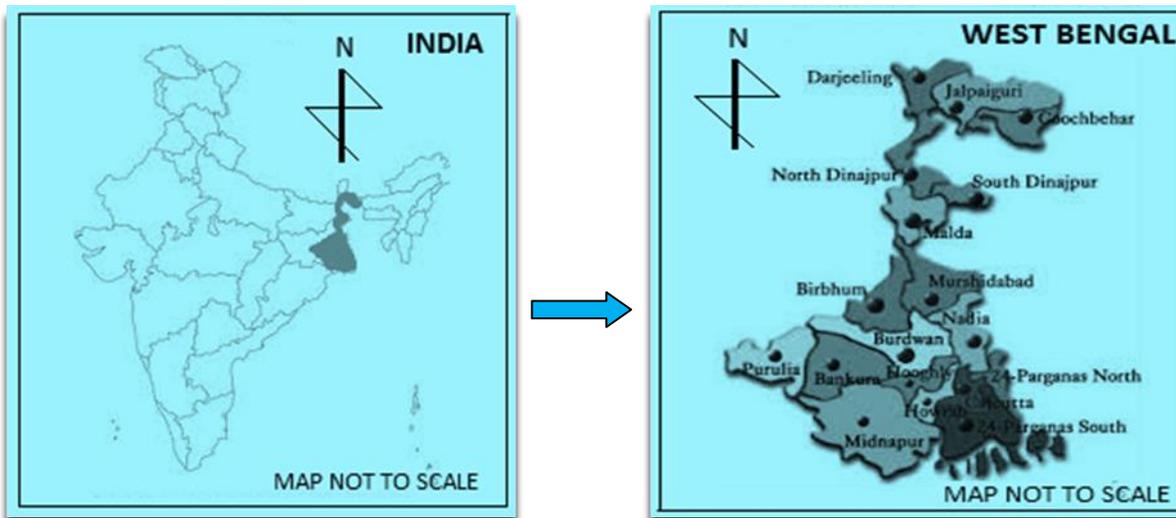
I. INTRODUCTION

Sex are the basic characteristic or biological attributes, and affect not only its demographic but also its social, economic and political structure, for the influence birth and death rates, internal and international migration, marital status, manpower, the gross national product, planning regarding educational and medical services and housing etc. as well as socio cultural and biological factors together influence the overall demographic composition of population and its sex ratio. It is an important tool for regional analysis.

The increasing deficit of women in India's population has been documented ever since the first decennial enumeration of people was conducted in the British-occupied parts of India in the late 19th century. Over the span of more than 100 years, the deficit of women has progressively increased as evident from the sex ratio of the population (Visaria, 1972; Visaria, 2002).

II. STUDY AREA

The state of West Bengal has been selected as a study area which is located between 21°25' to 26°50' north latitudes and 86°30' to 89°58' east longitudes with three international boundaries i.e., Bangladesh, Nepal and Bhutan. It occupies a geographical area of about 88,752 sq. km. (2.70 per cent of the India's total geographical area) and extending from the Himalayas in the north to the Bay of Bengal in the south. It is surrounded by Sikkim and Bhutan in the north, Assam and Bangladesh in the east, the Bay of Bengal in the south and Orissa, Jharkhand, Bihar and Nepal in the west. According to 2011 Census, its total population is 91,347,736 (7.55 per cent of India's total population), density is 1029 persons per sq. km. (in terms of population density West Bengal is on the second among the Indian states).



OBJECTIVES: The objectives of the present study are –

1. To analyze the pattern of existing general sex ratio and child sex ratio.
2. To explore the factors determining sex ratio.
3. To analyze the level of association between various socio-economic and cultural determinants and sex ratio.
4. To suggest some remedial to improve the sex ratio.

HYPOTHESIS: In line with the research objectives and from the literatures reviewed that will be used in the analysis of this work, the main hypotheses to be tested in this study are:

1. Urbanization stimulates the male selective migration that helps to reduce sex ratio of this area. That means urbanization increase sex ratio decrease.
2. Literacy reduced the faith of the son preference that means literacy and sex ratio has positive relationship.
3. Increase female IMR reduced child sex ratio, which means the inverse relationship between female IMR and CSR that means increase female IMR and decrease child sex ratio.

DATA BASE AND METHODOLOGY:

- The paper is based on secondary data sources. To fulfill the objectives data regarding literacy, urbanization and sex ratio of West Bengal is obtained from census of India (2011), statistical abstract of West Bengal and IMR of females is collect by the publication of population foundation of India, may 2008 “Infant and Child Mortality in India: Districts Level Estimates”.
- The collected data are processed to analyze the pattern of literacy rate and sex ratio in West Bengal. The districts of West Bengal are grouped into three categories i.e. high, medium and low literacy on the basis of simple statistical method. To analyze spatial pattern of sex ratio, the same technique is applied for calculation.
- Spearman’s Rank Difference method is used for analyzes the correlation between literacy and sex ratio, IMR of females and child sex ratio and also urbanization and sex ratio.

- Suitable maps and diagrams are used to illustrate the facts. Choropleath map is used to show the pattern of sex ratio, literacy urbanization and female IMR.
- SPSS software is used for, to test the signification level between the associations of variables.

III. TRENDS OF OVER ALL SEX RATIO AND CHILD SEX RATIO OF INDIA AND WEST BENGAL

Child sex ratios are recognized to be a better indicator of women’s position, because it is very unlikely that they would be vitiated by sex-selective migration trends. In a population unaffected bias against girl children (as evident for example in female infanticide and feticide), the CSR would favour girls since girls are endowed by nature. This indeed was true of west Bengal till 1971. It is a cause for grave concern that in west Bengal the sex ratio for children aged up to six years has declined from 1010 to 950 in 2011: “the imbalance that has set in at this early age group is difficult to be removed and remain to haunt the population for long time to come”(choudhuri, sukanta:1990). Ashis Bose would like to coin the acronym DIMARU, “where D stand for daughters and Maru stand for killing” and on the basis of statistical cut of level of fifty points decline in CSR between 2001 to 2011, this marker would apply to Punjab, Haryana, Himachal Pradesh, Madhya Pradesh and Gujarat (COI). The child sex ratio is a sensitive indicator that displays the status of girl children. Trends in child sex ratio will reveal the intensity of changes in it, over a period of time. Table-1 shows the trends of child sex ratio in India.

Table – 1: Child Sex Ratio (CSR) and Over-all Sex Ratio (OSR) in India

YEAR	1951	1961	1971	1981	1991	2001	2011
OSR	946	941	930	934	927	933	940
CSR	983	976	964	962	945	927	914

Source: Census of India, 1951- 2011(Provisional).

The child sex ratio has been declining faster than overall sex ratio. The decline in the child sex ratio in 2001 Census is a major cause of worry among the planners, demographers and researchers. Lower sex ratio among children is indicative of more females than males among child population which may lead to demographic imbalance over time if the trend continues in future.

YEAR	1951	1961	1971	1981	1991	2001	2011
OSR	865	878	891	911	917	934	947
CSR	----	1008	1010	981	967	960	950

Source: Census of India, 1951- 2011 (Provisional).

Table – 2: Child Sex Ratio (CSR) and Overall Sex Ratio (OSR) in West Bengal

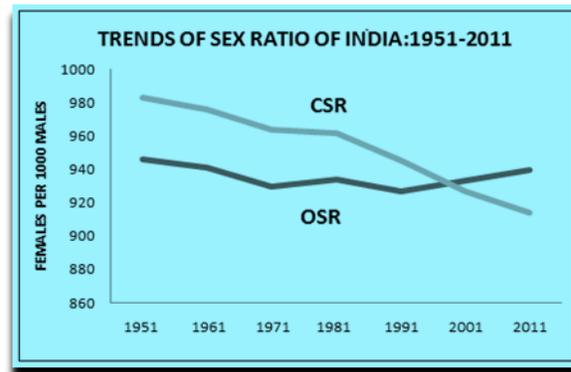
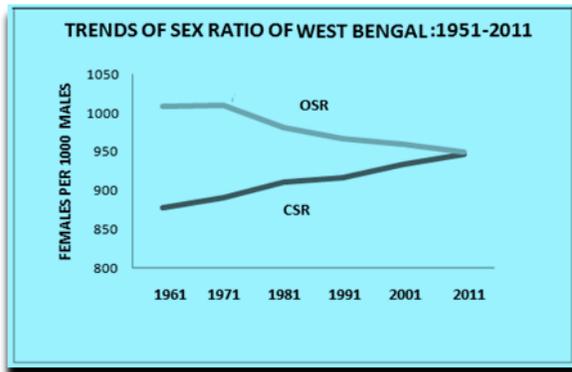


Fig: Trends of overall sex ratio and child sex ratio of India and West Bengal, 1961-2011.

Table-2 shows the trends of child sex ratio in West Bengal. In West Bengal CSR always decrease 1971 onwards and OSR always increase after Independence. The child sex ratio in West Bengal has been historically negative or in other words,

unfavorable to females since 1981. In the post independence period, the trend of child sex ratio slipped down for four consecutive decades after 1971. During 1971-2011 a steep fall of 60 points was seen in the child sex ratio in West Bengal.

Trends of Over All Sex Ratio in West Bengal(1951-2011)								Trends Of Child Sex Ratio Of West Bengal	
DISTRICT	YEAR							2001	2011(p)
	1951	1961	1971	1981	1991	2001	2011(P)		
Darjeeling	863	864	882	888	914	937	971	962	943
Jalpaiguri	825	854	887	910	927	942	954	969	949
Coachbehar	855	890	916	935	935	949	942	964	948
Uttar Dinajpur	884	888	908	931	921	938	936	965	946
Dahksin Dinajpur	884	932	941	946	944	951	954	966	948
Malda	966	965	948	949	938	948	939	964	945
Mursidabad	973	974	956	959	943	952	957	972	963
Birbhum	974	973	968	962	946	950	956	964	952
Burdwan	888	858	886	897	899	922	943	956	947
Nadia	937	948	948	946	936	946	947	972	955
North 24 Parganas	846	834	862	891	907	926	949	958	947
Hugli	883	892	896	909	917	947	958	951	946
Bankura	981	981	958	964	951	952	954	953	943
Puruliya	983	973	963	957	947	954	955	964	947
East Mednipur	955	952	945	951	944	947	936	942	938
West Mednipur	955	952	945	951	944	961	960	959	952
Howrah	810	808	838	873	881	906	935	956	964
Kolkata	593	630	662	741	799	829	899	927	930
South 24 Parganas	861	921	917	927	929	937	949	964	953

Source: Census of India, 1951-2011(P).

IV. SPATIAL PATTERN OF SEX RATIO

West Bengal as a whole has 947 number of females per thousand of males population in 2011. But the district level sex ratio is varies from district to district ranges from 899 to 971. All 19 districts are categorized into three groups as follows:

High Sex Ratio:

The districts which have the sex ratio above 947 are included into high category. High sex ratio was recorded in the districts of Birbhum, Bankura, West Mednipur, Hugly, North 24 Parganas, South 24 Parganas, Murshidabad, Dakshin Dinajpur, Jalpaiguri, Darjeeling and Puruliya.

Moderate Sex Ratio:

The districts which have sex ratio ranges from 900 to 947 are included in the moderate category. Moderate sex ratio was recorded in the districts of Burdwan, East Mednipur, Howrah, Nadia, Uttar Dinajpur, Malda and Cooch Behar.

Low Sex Ratio:

The districts which have the sex ratio below 900 are included in this group. Only Kolkata district has the lowest sex ratio in West Bengal.

Table: Spatial Pattern of Sex Ratio of West Bengal, 2011

Categories	Districts
High sex ratio (Above 947female per 1000 males.)	Birbhum, Bankura, West Mednipur, Hugly, North 24 Parganas, South 24 Parganas, Murshidabad, Dakshin Dinajpur, Jalpaiguri, Darjeeling and Puruliya.
Moderate sex ratio (900 to 947 female per 1000 males)	Burdwan, East Mednipur, Howrah, Nadia, Uttar Dinajpur, Malda and Cooch Behar.
Low sex ratio(below 900)	Kolkata

Source: Census of India, 2011(P).

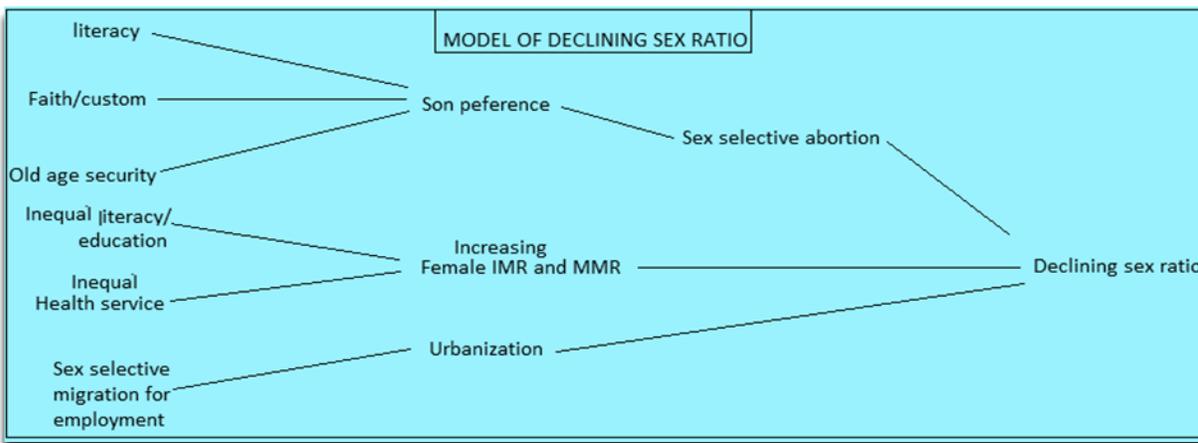
CAUSES OF LOW SEX RATIO OF WEST BENGAL:

A) DECLINING CHILD SEX RATIO OF WEST BENGAL:

The following are the reasons for declining trends of child sex ratio in West Bengal:

Analysis has drawn attention to two possible factors behind the falling CSRs that is-

1. The sex ratio at birth (SRB: Male live birth per 1000 female live births) has become biased against females due to the continuing pressure of son preference and neglected of girl child.
2. The female age specific death rates (ASDR) for the age group 0-4 years and 5-9 years have been found to be higher than corresponding male rates.
3. Indeed, in a rapidly growing country, a concerning recent trend is age sex selective abortion, resulting in an increasing skewed sex ratio at birth (UNFPA, 2009: Vitenam issues. This hints at the ongoing rampant misuse of technology in this state.



B. GENERAL CASUSES OF LOW OVERALL SEX RATIO OF WEST BENGAL:

1. High maternal mortality.

2. This is explained in apart by a sharp decline in maternal mortality between 1950-2010 but also very high rates of violent deaths (including homicides, traffic accidents, suicide) which are four times higher for men than they are for women.(Alves, Cavenaghi and Martine, 2011).

3. Sex selective migration in city especially for Kolkata and Howrah district.

With small family norms, many young couples do not for a second child happens to be a male. Higher female life expectancy is likely to initiate a new trend and tilt the scale of low sex ratio.

CO-RELATION OF LITERACY RATE AND SEX RATIO:

Literacy and education is universally recognized as a major component of human development. As such, certain minimum level of literacy seems to be essential for a population to break out the vicious of poverty. Literacy affected on various attributes of the population such as fertility, mortality, migration and also sex ratio. The knowledge of sex ratio is essential for the understanding the condition of women in society. A decline or low number of female population in the total population is strongly suggestive of the neglect of girl children, sex selective abortions and traditional attitudes of the society. Thus, the analysis of literacy and sex ratio is immense significant. According to 2011 census, the total population of West Bengal is 91,347,736, sex ratio is 947 and the literacy rate is 77.08.

SPATIAL PATTERN OF LITERACY RATE:

West Bengal as a whole has 77.08 percent literacy in 2011. But the district level literacy differs from district to district ranges from 60.13 per cent to 87.66 per cent. All 19 districts of West Bengal are divided into three categories as following:

High Literacy Rate:

The districts which have above mean plus one standard deviation are included in this category. The districts have the literacy rate above 79.92 per cent are included in high category. High literacy rate was recorded in the district of East Mednipur, Howrah, Hugly, North 24 Parganas and Kolkata due to high number of educational institutions, availability of educational facilities, high urbanization, development of transport and communication and so on.

Moderate Literacy Rate:

The districts which have literacy rate ranges from 70.95 to 79.92 per cent are included in this category. Moderate literacy was recorded in the districts of Burdwan, Bankura, West Mednipur, South 24 Parganas, Nadia, Dakshin Dinajpur, Jalpaiguri, Darjeeling and Cooch Behar district. In these districts, moderate literacy was found due to lack of educational infrastructure.

Low Literacy Rate:

The districts which have literacy rate below 70.95 per cent are included in low category. Low literacy rate was found in the districts of Birbhum, Murshidabad, Malda, Uttar Dinajpur and Puruliya. In these districts low literacy was recorded due to lack of educational institution, poverty and low student teacher ratio.

Table 4: Co-Relation between Spatial Pattern of Literacy Rate and Spatial Pattern of Sex Ratio, 2011

Districts	Literacy rate(2011)	Rank	Sex ratio(2011)	Rank	D	D2
Darjeeling	79.92	6	971	1	5	25
Jalpaiguri	73.79	13	954	8	5	25
Coach behar	74.59	11	942	14	-3	9
Uttar dinajpur	60.13	19	936	16.5	2.5	6.25
Dahksin dinajpur	73.86	12	954	8	4	16
Malda	67.71	16	939	15	1	1
Mursidabad	67.53	17	957	4	13	169
Birbhum	70.9	15	956	5	10	100
Burdwan	77.15	9	943	13	-4	16
Nadia	75.58	10	947	12	-2	4
North 24 parganas	84.95	3	949	10.5	-7.5	56.25
Hugli	82.55	5	958	3	2	4
Bankura	70.95	14	954	8	6	36
Puruliya	65.38	18	955	6	12	144
East mednipur	87.66	1	936	16.5	-15.5	240.25
West mednipur	79.05	7	960	2	5	25
Howrah	83.85	4	935	18	-14	196
Kolkata	87.14	2	899	19	-17	189

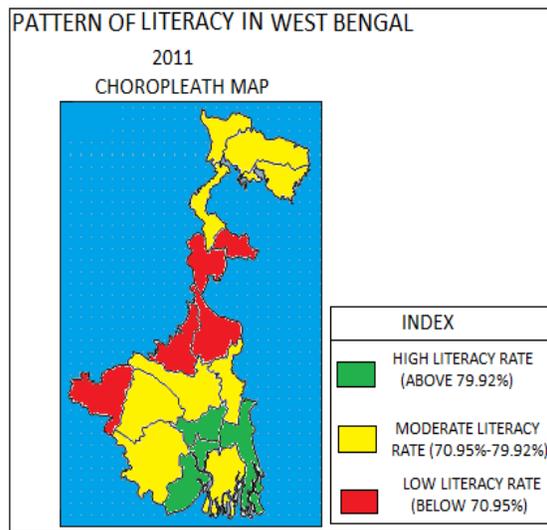
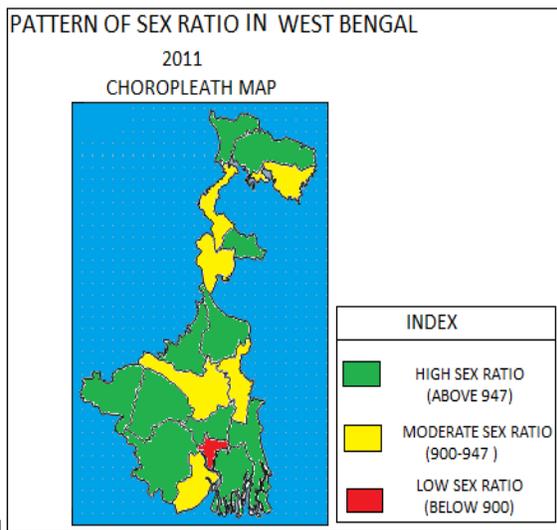
South 24 parganas	78.57	8	949	10.5	-2.5	6.25
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Source: Census of India, 2011(P).

CORRELATION BETWEEN LITERACY AND SEX RATIO:

The Spearman’s Rank Difference method is used for the calculation of the correlation of literacy and sex ratio in West Bengal. It is observed that there is rather low and negative

correlation i.e. $r = -0.27$ between the literacy and sex ratio in West Bengal.



DISCUSSION:

There are wide disparities in the literacy and sex ratio of West Bengal in 2011. The highest literacy was found in East Mednipur district and lowest in Uttar Dinajpur District. The highest sex ratio was found in Darjeeling district whereas lowest in Kolkata district of West Bengal. But the correlation between literacy and sex ratio found in low degree and negative angle i.e. $r = -0.27$ at 0.38 significance level (single tailed). It means high literacy rate, low sex ratio. It was observed higher the literacy rate lower the sex ratio i.e. Kolkata district and lower the literacy higher the sex ratio i.e. Dakshin Dinajpur district of West Bengal.

CO-RELATION BETWEEN FEMALES IMR AND CHILD SEX RATIO:

The infant mortality rates denotes that as a ratio of infant deaths (deaths of children under one year of age) registered in a calendar year to the total number of live births registered in the same year, where female IMR is one of the determinants of child sex ratio. Generally high female IMR is indicate that lower child sex ratio, because high female IMR mean that the loss of number of female child population that also help in reduce the child sex ratio. That’s why the present study tries to understand the relation between child sex ratio and female IMR of west Bengal.

Table 5:Co-Relation between Females IMR and Child Sex Ratio, 2001.

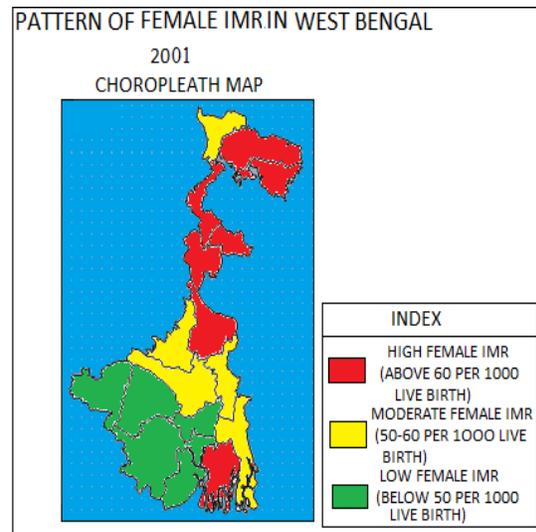
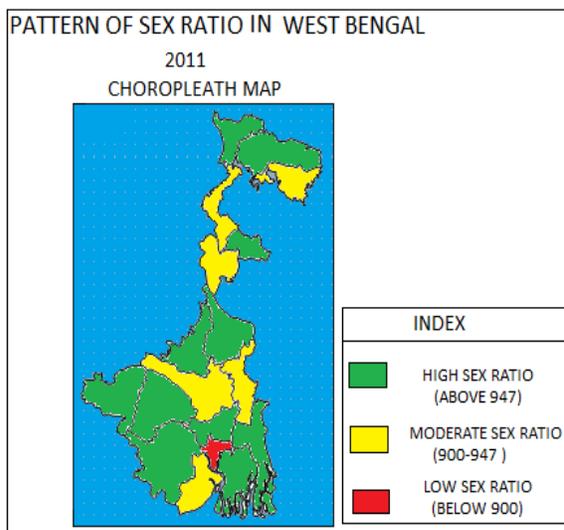
Districts	Females IMR(2001)	Rank	Child sex ratio(2001)	Rank	D	D2
Darjeeling	57	10	962	9	1	1
Jalpaiguri	65	15	969	17	-2	4
Coach behar	72	17	964	12	5	25
Uttar dinajpur	61	13	965	15	-2	4
Dahksin dinajpur	74	18	966	16	2	4
Malda	85	19	964	12	7	49
Mursidabad	64	14	972	18.5	-4.5	20.25
Birbhum	58	11.5	964	12	-0.5	0.25

Burdwan	53	7	956	5.5	1.5	2.25
Nadia	58	11.5	972	18.5	-7	49
North 24 parganas	55	8	958	7	1	1
Hugli	35	1	951	3	-2	4
Bankura	47	3	953	4	-1	1
Puruliya	49	5	964	12	-7	49
East mednipur #	49	5	942	2	3	9
West mednipur #	49	5	959	8	-3	9
Howrah	43	2	956	5.5	-3.5	12.25
Kolkata	56	9	927	1	8	64
South 24 parganas	69	16	964	12	4	16

Mednipur has a district in the survey time, so study perspective these two districts (East and West Mednipur) give same number of female IMR.

Source: census of India, 2001 and the publication of population foundation of India may 2008 "Infant and Child Mortality in India: Districts Level Estimates".

The Spearman's Rank Difference method is used for the calculation of the correlation of females IMR and child sex ratio in West Bengal. It is observed that there is rather moderate and positive correlation i.e. $r=0.44$ between the females IMR and child sex ratio in West Bengal.



DISCUSSION: There are wide disparities in the females IMR and child sex ratio of West Bengal in 2001. The highest females IMR was found in Malda district and lowest in Hugli District. The highest child sex ratio was found in Murshidabad and Nadia district whereas lowest in Kolkata district of West Bengal. But the correlation between females IMR and child sex ratio found in moderate degree and positive angle i.e. $r=0.44$ at 0.12 significance level (single tailed). It means high female's infant mortality rate, high child sex ratio. It was observed higher the females infants mortality rate higher the child sex ratio i.e. Malda and Dahksin Dinajpur district and lower the females infant mortality rate, lower child the sex ratio i.e. Hugli,

Bankura, Howrah, Kolkata district of West Bengal. This is an inverse position of general condition.

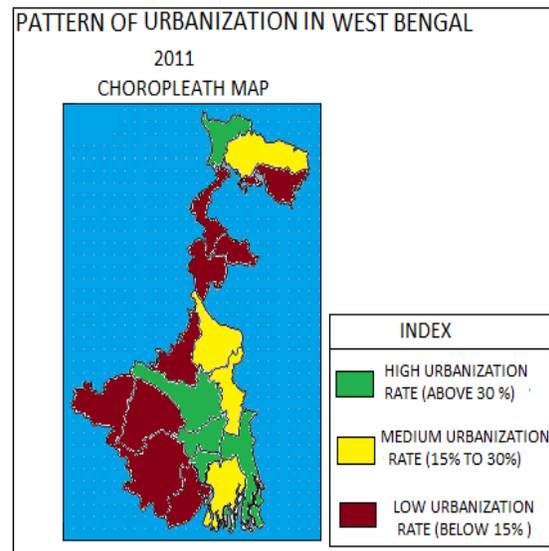
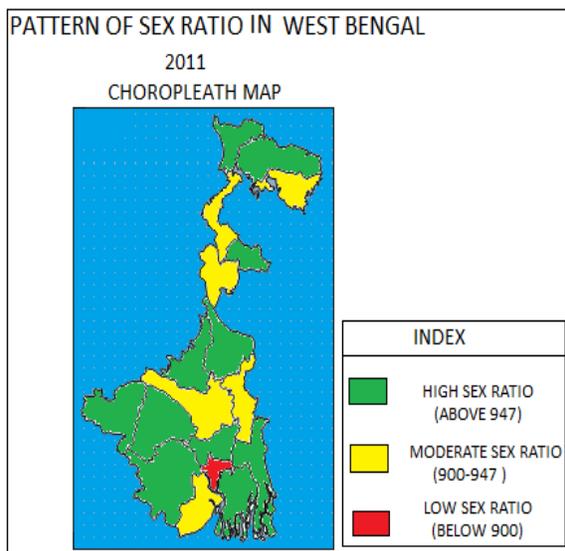
CO-RELATION OF URBANIZATION AND SEX RATIO:

The conventional wisdom is that men migrate to cities leaving their families behind in their villages, and the females follow later. While studying the relationship between urbanization and sex ratios in Indian context, it is observed that highly urbanized states-Maharashtra, Punjab and West Bengal have lower than national average urban sex ratio.

Table 6: Co-Relation between Urbanization and Pattern of Sex Ratio, 2011.

Districts	Urbanization	Rank	sex ratio	Rank	D	D2
Darjeeling	38.99	5	971	1	4	16
Jalpaiguri	27	8	954	8	0	0
Coach behar	10.25	18	942	14	4	16
Uttar dinajpur	13.8	12.5	936	16.5	-4	16
Dakshin dinajpur	14.13	11	954	8	3	9
Malda	13.8	12.5	939	15	-2.5	6.25
Mursidabad	19.78	10	957	4	6	36
Birbhum	12.8	14	956	5	9	81
Burdwan	39.87	4	943	13	-9	81
Nadia	27.81	7	947	12	-5	25
North 24 parganas	57.59	3	949	10.5	-7.5	56.25
Hugli	38.62	6	958	3	3	9
Bankura	8.36	19	954	8	11	11
Puruliya	12.75	15	955	6	9	81
East mednipur	11.65	17	936	16.5	0.5	0.25
West mednipur	12.03	16	960	2	14	196
Howrah	63.6	2	935	18	-16	256
Kolkata	100	1	899	19	-18	324
South 24 parganas	25.61	9	949	10.5	-1.5	2.25

Source: census of India, 2011(P).



The Spearman's Rank Difference method is used for the calculation of the correlation of urbanization and sex ratio of West Bengal. It is observed that there is rather moderate and negative correlation i.e. $r = -0.58$ at 0.01 significance level (single tailed) between the urbanization and sex ratio of West Bengal.

IMPACT OF DECLINING SEX RATIO IN WEST BENGAL:

1. The excess of males tends to lower the age of marriage of females (19.9 in 2006). Early marriages lead to considerable disparity in age between husband and

wives. This difference in age tends to increase widowhood.

2. Early marriage of females may also lead to increased fertility and population growth.
3. An adverse sex ratio (i.e., when the proportion of females is small) leads to the social emergence of many social and moral evils like rape, prostitution, impairing the morale of workers in near future. It also witnessed in human development report (2011) on gender inequality index that India record 129th rank which shows the significance of gender discrimination.

V. POLICY RECOMMENDATIONS

Son preference is the main culprit is known to be found in certain type of cultures, that is part lineal cultures. To sort out this son preference is most needed for to improve sex ratio and social stability against the women violence. This is solve out by the-

1. The modern state has powerful tools for in incorporating and managing it citizenry, rendering partlineages a threat rather than asset for the state. The modern state has brought in political, social and legal reforms aimed to challenge traditional social hierarchies, including the age and gender hierarchies of the kinship system.
2. Impact of media; suggest that states can accelerate the resultant decline in son preference, through media efforts to help parents perceive that daughters can now be valuable as sons and also use folk drama for this purpose. Behavior change communication programs –disseminated via mass media, community level events, interpersonal communication/ counseling, and electronic media-increases awareness and to motivate individual to action (Bongaarts, Cleland, Townsend, Bertrand, and Monica Das Gupta:2012).
3. Need incentive in education and health organization for women participation. Government needs special attention on women educational scholarship and health subsidy for women health that change the behavior of the society about women.
4. Allowing full participation of women in personal and family decisions — especially those relating to childbearing;

VI. CONCLUDING OBSERVATION

1. Kolkata and Howrah, industrial developed belt has low sex ratio due to sex selective male migration from neighbor districts due to search employment and other facilities.

2. Malda (939) and Uttar Dinajpur (936) are the frontiers districts between north south region where low moderate sex ratio is due to very high female IMR 85 and 61 respectively.
3. The child sex ratio in West Bengal has fallen 950 in 2011 from 1010 in 1971. The main culprits of declining child sex ratio are female foeticide, son preference and gender inequality which to suppress male dominant social structure. West Bengal has 49.3 abortions per 100 live births (Chhabra and Nunna, IIPS, from NFHS).
4. The missing girl in child is alarming danger symbol of gender inequality in child population and feature total population. The deficit in girl child population leads to serious demographic imbalance and difficult social consequences.

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Correlation analysis of drought, salinity and submergence tolerance in some traditional rice cultivars of Sri Lanka

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Abstract- Searching new materials for biotic and abiotic stress tolerance from diverse sources such as traditional rice gene pool is important as there is limited variability for the traits in the improved rice cultivars. Identification and introgression of favorable alleles into elite breeding lines from traditional rice cultivars to increase the biotic and abiotic stress tolerances in cultivated rice are still progressing. This will prevent genetic erosion of cultivated varieties in Sri Lanka hence many improved rice cultivars are derived from few parental lines. Identification of rice cultivars with multiple tolerances are very much needed to utilize in the regions where micro climate of the crop is changing time to time due to short term flooding in prolonged rainy seasons, unexpected drought seasons comes with delayed monsoon rain or increasing salinity in coastal belt with intrusion of tidal waves. For selecting rice cultivars with multiple tolerances and identification of mode of tolerance at different abiotic stresses, thirty three traditional rice cultivars were separately evaluated for drought salinity and submergence tolerance at seedling stage. Each experiment was carried out according to the randomized complete block design with four replicates and twenty plants were included in to each replicate. In drought tolerant screening water cut was done at four weeks after planting and five days after 80% of the plants were completely withered. Plants were watered once again for recovery before evaluation. In salinity tolerance screening, rice seedlings were grown in soil filled trays and equal volume (500 ml) of 5 dS/m saline solution was added to each and every tray at 2 weeks after planting (2 WAP), 3 WAP and 4 WAP to make the soil salinized. Plants were evaluated 10 days after the 3rd salinity treatment. In submergence tolerance screening, two week old rice seedlings were subjected to 14 day complete submergence stress and plants were evaluated after two week recovery period under de-submerged conditions. Control experiment was carried out parallel to each stress condition. Plant survival percentages were calculated after each abiotic stress treatment. Among tested 34 traditional rice cultivars 53%, 72%, and 25% of rice cultivars scored more than 50% of survival rates at drought, salinity and submergence stress respectively. Dik wee and Gonabaru scored more than 50% survival rates at each drought, salinity and submergence stress while Kahata wee, Maddaikaaruppan, Manamalaya, Mas Samba and Rath kara wee scored in-between 40%-49% survival rates at each stress condition. Pearson's correlation analysis showed 0.9256 of positive correlation in survival rates of drought and submergence stressed traditional rice cultivars. This finding proves that the mode of tolerance at drought and submergence stress is somewhat similar in these rice

cultivars while the mode of tolerance at salinity and submergence or salinity and drought are differed

Index Terms- Drought, salinity and submergence tolerance, traditional rice, seedling stage

I. INTRODUCTION

Rice is grown in varied environmental conditions where it shows different levels of reactions to abiotic stresses, depending on the environmental conditions of origin and, cultivation. Rice has been adapted to tropical, sub tropical and temperate climates (Lafitte, 2004). It is grown in uplands where very little water is required in seedling establishment stage like Chena cultivation in Sri Lanka or direct sowing in southern Russia, and in low land, waterlogged soils as usually the case in lower river estuaries of south Asia. Rice cultivars affected by flooding in these areas have developed submergence tolerance. Further it is moderately tolerant to salinity where it is grown under seepage in coastal areas and moderately tolerant to soil acidity where it has been adapted to upper catchment areas of rivers with acidic soils developed due to excess run off, but rice is sensitive to chilling and does not acclimate to freezing (Reyes et al. 2003).

Drought stress

Drought and high salinity are the most important environmental factors that cause osmotic stress and dramatically limit plant growth and crop productivity (Boyer, 1982). Drought is a major cause of yield loss in rain-fed rice, grown on over 40 million ha in Asia. (Venupeasad et al. 2007).

However, rice consumes about 90% of the freshwater resources in Asia used for agriculture (Bhuiyan, 1992). About 80% of the world's rice is grown under irrigated (55%) and rain fed lowland (25%) ecosystems. Development of rice cultivars with less water requirement indirectly protects natural water resources.

A proper understanding of the physiological mechanisms for drought stress tolerance must be needed for achieving drought tolerance in rice. Though conventional plant breeding techniques are time-consuming, it has been immensely helpful in releasing drought-tolerant varieties. However, this is not adequate to cope up with the future demand for rice, as drought seems to spread to more regions and seasons across the world. Identification of favorable alleles for introgression into rice varieties will give a chance to utilize natural gene pool for the development of drought stress tolerance in rice. Drought stress most severely

impacts yield when applied during the reproductive stage of the rice plant. In other growth stages drought stress limits yield causing poor seedling establishment and poor tiller number.

Salinity stress

Soil salinity has been identified as caused by three different reasons; natural, clearing of native vegetation, and irrigation (Manneh et al. 2007). Soil salinity constraints rice production and over 30% of the irrigated rice area in the world is affected by saline conditions due to irrational management and defective irrigation practices (Yeo and Flowers, 1984). Current guidelines (Maas and Grattan, 1999; Hanson et al. 1999) indicate that rice yields decrease 12% for every unit (dS/m) increase in above 3.0 dS/m. According to the classification of classes of soil salinity, low salinity; EC 2-4 dS/m can be caused by natural salinity and irrigation salinity. Species with low-moderate salt tolerance can be grown successfully under this salt stress. Moderate to high salt tolerant plant species are needed when the electrical conductivity falls between 4-8 dS/m. This salinity is caused by irrigation water logged. Under high-salinity condition with EC value more than 9 dS/m only halophytes can be grown in the areas like seeping. Utilization of unexploited genetic variation in sub species of rice cultivars with distinguishable level of tolerance for biotic and abiotic stresses avoids genetic engineering techniques such as gene transformation to develop stress tolerant cultivars with less chance for acquiring considerable tolerance in the case of traits, which are controlled by many genes. Introgression of Japonica rice cultivars with Indica rice cultivars to overcome the narrow gene pool is well practiced in broad areas of development of stress tolerant rice cultivars. Further Indica rice cultivars named Pokkali and Nona-Bokara are well-known salt tolerant rice cultivars with high heritability values (Gregorio and Senadhira, 1993) but it is said that salt tolerance is co-inherited with other undesirable agronomical characters (Heu and Koh, 1991).

The growth under saline condition depends on the reducing ability of sodium and chloride uptake while maintaining potassium uptake in to the plant (Koyama et al. 2001). The development of appropriate technique for management of salinity is critical for optimizing rice performance under saline or potentially saline conditions. Mass and Grattan (1999) reported that yields cannot be improved under salt-stressed conditions by increasing the seeding rate. And they found that, high field-water levels are more growth limiting than shallow water levels. Therefore, the solution for rice growers who are facing salinity problems is, irrigation management strategies that maintain low levels of salinity stress while minimizing high field water levels (Grattan et al. 1999). Various methods such as soil reclamation, excessive irrigation, and soil drainage are used to minimize soil salinity; they are always laborious and expensive. Other strategies such as varietal improvement have to be done for constant and profitable rice production.

Submergence stress

An increase in the frequency and magnitude of hydrological fluctuations is seen in modern agriculture as a result of global climate change as well as poor management of agricultural lands. Almost one-third of world's rice lands are at a low elevation and rainfed, and a large proportion of it is prone to both drought and

flash flooding. Submergence affects 15 million ha of low land rice growing areas in South and South East Asia. In Sri Lanka alone, rice lands with flash flooding exceed 25,000 - 40,000 ha. Ismail and Mackill (2009, www.knowledgebank.IRRI) suggest that there would be a different mechanism in Goda Heenati which is a submergence tolerant Sri Lankan traditional rice cultivar (www.knowledgebank.IRRI). Studies conducted in Sri Lanka (Ranawake et al. 2010 a; Ranawake et al. 2010b; Ranawake et al. 2011a, Ranawake et al. 2011b) showed that some other traditional rice cultivars have also shown different tolerance mechanisms to submergence at seedling stage indicating the need of further systematic study of tolerant levels and mechanisms of traditional rice cultivars.

Importance of genetic variability

Extent of genetic variability present in a gene pool is an important factor for genetic improvement in rice. Sri Lanka traditional rice gene pool consists of many abiotic and biotic stress tolerant traits with divers agronomical characters (Ranawake et al. 2010a; Ranawake et al. 2010b; Ranawake et al. 2011a; Ranawake et al. 2011b; Ranawake et al. 2012) The selected abiotic stress tolerant rice cultivars have the potential of direct introduction in to farmer fields (Djilianov et al. 2005) or utilization of them in the breeding programs implement to develop abiotic stress tolerance rice cultivars (Djilianov et al. 2005; Ashfaq et al. 2012). Evaluation of salinity, drought and submergence tolerance in 33 traditional rice cultivars was done at Faculty of Agriculture, University of Ruhuna, Sri Lanka with the aim of identifying stress tolerant traditional rice cultivars.

II. MATERIALS AND METHODS

Thirty three traditional rice cultivars were collected from Plant Genetic and Resource Center (PGRC) Gannoruwa, Peradeniya, Sri Lanka for the study.

Screening for level of drought tolerance

Seed dormancy was broken by keeping seeds at 50o C for 5 days. Seed surface sterilization was done by dipping seeds in 70% ethyl alcohol for 2 minutes and dipping seeds in 5% Chlorex solution for 30 minutes. Seeds were washed out thoroughly by distilled water. Dormancy broken seeds were germinated at 35o C and planted in plastic boxes (15 cm X 7.5 cm X 15 cm) filled with homogenized soil up to ¾ of the total depth according to the randomized complete block design with 20 plants per replicate and four replicates for each cultivar. Water cut was done at four weeks after planting. Five days after 80% of the plants were completely withered plants were watered once again for recovery. Ten days after watering, plants were evaluated according to survival percentage.

Screening for level of Salinity tolerance

Germinated seeds were planted in trays (45 cm X 30 cm X 5 cm) according to the randomized complete block design (RCBD) with 3 replicates and with 20 plants for each replicate. Trays were filled with homogenized soil up to 3 cm depth. Equal volume (500 ml) of 5 dS/m saline solution was added to each and every tray at 2 Weeks after planting (2 WAP), 3 WAP and 4 WAP as 1st, 2nd & 3rd salinity treatments. Electrical conductivity (EC) of soil solution was measured at each time.

Equal volume of water was added to all the trays every other day. Plant survival percentage was recorded on the 10th day after 3rd salinity treatment.

Screening for level of submergence tolerance

Experiment was carried out according to the randomized complete block design (RCBD) with 4 replicates. Each replicate contained 20 plants. Uniformly germinated seeds were planted in trays (60 cm X 90 cm) and maintained them at control growth conditions for 2 weeks. Two week old seedlings were subjected to 14 day complete submergence conditions separately and control experiment was carried out all along the experiment period. After complete submergence period plants were allowed two week period for recovery at control growth conditions. Plant survival percentage was recorded at the end of the experiment.

III. RESULTS AND DISCUSSION

Among tested traditional rice cultivars 53%, 72% and 25% of rice cultivars scored more than 50% survival rates at drought, salinity and submergence stress respectively (Table 1). In fact Sri Lankan traditional rice cultivars show exceptional levels of tolerance. For example in a study of 76 rice cultivars, nine Sri Lankan indigenous cultivars were among the top thirteen for survival under submergence for 2 weeks (Singh et al. 2010). However this is a great figure comparing that only 6% of 3156 rice cultivars tested for tolerance at the Huntra Rice experiment research station Thailand survived at 10 day submergence (Setter et al. 1997) and only 2% of 18,115 lines were submergence tolerance at 10 days at IRRI (Setter and Laureles, 1996).

Heeneti-309 was the best submergence tolerant rice cultivar with the survival rates more than 95% at the seedling submergence stress. Rathel and Matholuwa also scored more than 85% survival rates at two week submergence stress. Interestingly these three cultivars scored more than 60 % of survival rates at the drought stress. This type of rice cultivars are very much suitable for the areas where rice cultivation totally depends on the monsoon rains. Due to climate change, sometimes monsoon rain prevails more weeks than usual and sometimes it onset later than the expected duration causing drought seasons in the middle of the crop. These areas are frequently affected by floods as well as by drought.

Rice cultivar Dik Wee I scored more than 60 % survival rates at all the stress conditions. This is an exceptional rice cultivar in terms of abiotic stress tolerance.

Table 1 Survival rates of traditional rice cultivars after drought, salinity and submergence stress

Accession Number	Name	Survival rate (%)		
		Submergence	Salinity	Drought
3550	Bathkiri el	0.0 ^r	19.8 ^q	86.7 ^a
2203	Dikwee I	60.0 ^h	64.4 ^d	60.0 ^k
3543	Gonabaru	55.56 ^j	57.9 ^g	69.4 ^g
3692	Handiran	8.3 ^q	29.1 ^l	73.3 ^e
3707	Heenati	8.3 ^q	0.0 ^y	60.0 ^k
3132	Heenati-309	96.74 ^a	0.0 ^y	50.0 ^m

3641	Heen dik Wee	0.0 ^r	91.2 ^a	20.0 ^q
3644	Herath	75.0 ^e	27.7 ⁿ	53.3 ^l
3642	Kahata Samba	33.3 ⁿ	25.4 ^o	80.0 ^b
3387	Kahata wee	70.0 ^f	48.5 ^h	73.3 ^e
3713	Kalukanda	20.8 ^p	59.0 ^f	46.67 ⁿ
3162	Kiri naran	36.84 ^m	0.0 ^y	60.0 ^k
3388	Maddai karuppan	53.33 ^k	74.2 ^c	40.0 ^o
3721	Manamalaya	79.2 ^d	79.3 ^b	46.67 ⁿ
2349	Mas samba	60.0 ^h	45.1 ^j	86.7 ^a
3472	Masuran	0.0 ^r	16.1 ^t	20.0 ^q
3214	Matholuwa	86.2 ^b	14.9 ^u	75.0 ^c
3388	Maddai karuppan	53.33 ^k	74.2 ^c	40.0 ^o
3142	Molaga samba	0.0 ^r	16.1 ^t	72.2 ^f
3672	Mudaliwi	75.0 ^e	22.1 ^p	62.5 ⁱ
3663	Murunga	25.0 ^o	19.7 ^r	60.0 ^k
3639	Polayal	66.7 ^g	8.3 ^w	26.7 ^p
3592	Ranhiriyal	58.3 ⁱ	5.8 ^x	80.0 ^b
2196	Rathel	86.4 ^b	0.0 ^y	60.0 ^k
3684	Rathkara	75 ^e	48.5 ^h	66.6 ^h
3390	Rathu heenati	80.0 ^c	12.5 ^v	55.56 ^k
3473	Ratu wee	41.7 ^l	35.8 ^k	12.5 ^r
3629	Ruwan raththaran	0.0 ^r	0.0 ^y	73.3 ^e
3605	Seedevi	8.3 ^q	63.2 ^e	50.0 ^m
3725	Sivuru wee	0.0 ^r	28.2 ^m	46.67 ⁿ
3171	Sudu hetada	0.0 ^r	0.0 ^y	61.7 ^j
3160	Valihundiran	80.0 ^c	16.4 ^s	20.0 ^q
3445	Yakada wee	0.0 ^r	47.2 ⁱ	73.9 ^d

Superscript letters indicate DMRT groups. The same letters in the same row are not significantly differed.

According to the applied bio assay conditions, twenty three rice cultivars scored more than 50% survival rates at drought stress. Mas Samba and Bathkiri el were the best among all the other cultivars those scored 86.7% survival rates.

At each stress condition Dik wee and Gonabaru scored more than 50% survival rates (Table 1). The genetic constituents of this type of cultivars must be dissected to understand the alleles responsible for tolerant levels. Kahata wee, Maddaikaruppan, Manamalaya, Mas Samba and Rath kara wee scored in-between 40%-49% survival rates at each stress condition (Table 2). Out of 33 traditional rice cultivars Heeneti-309 scored the highest survival rate at both submergence (96.74%) and drought (86.67%) stresses but at salinity stress it scored only 19.81% survival rate.

Table 2 Rice cultivars scored given survival rates at each salinity, drought and submergence stress.

Survival%	Rice cultivar
> 50%	Dik Wee Gonabaru
40%-49%	Kahata Wee Maddaikaruppan Manamalaya Mas Samba Rathkara
30%-39%	Herath
20%-29%	Kahata Samba Kalu Kanda Mudali Wee

Murunga

The pair wise correlation analysis showed 0.9256 of positive correlation in survival rates of drought and submergence stressed traditional rice cultivars but the correlations between salinity and drought or submergence and salinity stress were negative (Table 3). On the other hand the highest survival percentage at salinity stress was scored by Herath (91.16%). Its survival percentage at salinity stress was only 20% while its submergence tolerance was around 75% (Table 1).

Table 3 Correlation coefficients for trait pairs

Trait pair	Correlation coefficient	P value
Submergence -drought	0.9256	0.001
Submergence- salinity	-0.0825	0.6532
Drought-salinity	-0.2663	0.406

Currently Marker Assisted Back-Crossing is being practiced to develop cultivars with tolerance to submergence (Neeraja et al. 2007). Mega varieties with SUB1A introgression have been developed and proved that SUB1A enhanced the level of submergence tolerance in introgression cultivars (Endang et al. 2009). It has been found that SUB1A mediates ABA responsiveness, thereby activating a cascade of stress responsive gene expression, thus mediating both submergence and drought tolerance through prevention of water loss from leaves and suppression of leaf elongation conserving carbohydrate reserves (Fukao et al. 2007). This result is in agreement with our bio assay data where many cultivars those submergence tolerance were drought tolerance at the seedling stage. The strong correlation ($r=0.9256$) in between submergence tolerance and drought tolerance emphasized the common features of mode of tolerance in submergence tolerance and drought tolerance.

It is worth studying traditional rice cultivars in systematic way for each tolerance to find new breeding materials and finding new abiotic stress tolerant genes within traditional rice cultivars.

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Fertilizer Response of some Sri Lankan Traditional Rice Cultivars during Vegetative Growth Phase

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Abstract- Traditional rice cultivars in Sri Lanka conserve different abiotic and biotic tolerant traits but the yield of traditional rice cultivars is not as much of improved cultivars. Abiotic stress tolerance of some traditional rice cultivars were evaluated in previous studies at Faculty of Agriculture, Mapalana, Sri Lanka and this study attempted to understand the possibility of enhancing the yield and yield components of traditional rice cultivars by altering the fertilizer dose. A field experiment was carried out from October 2011 to April 2012 at the Faculty of Agriculture, Mapalana. Traditional rice cultivars are considered to be weaker in response to fertilizer. Four different fertilizer levels namely no fertilizer, half of the recommended dose, recommended dose and twice of the recommended dose were evaluated with forty Sri Lankan traditional rice cultivars to understand the response of them on different agronomic parameters. Germinated seeds were planted in rows with 15 cm X 20 cm spacing. Twenty plants were managed for each line and three lines were maintained for one replicate of cultivar. Experiment was conducted with four replicates. Effect of fertilizer on the plant height, number of tillers/plant and number of leaves/plant were measured at three weeks after transplanting during the vegetative phase of cultivars. These parameters were significantly differed with the fertilizer doses and with the individual cultivars. Average plant height was ranged from 37.8 cm to 115.8 cm. The highest plant height was obtained by the cultivar Herath Banda (115.8 cm) at the half recommended dose while the lowest plant height was recorded by the cultivar Palasithari 601 (37.8 cm) at no fertilizer dose. Highest number of tillers per plant (7.3) and the highest number of leaves per plant (28.8) were obtained by the cultivar Dena wee at the twice recommended dose and also the lowest tiller number (1.55) and the lowest number of leaves/plant (6.2) was recorded by the cultivar Palasithari 601 at the twice recommended dose. Among tested traditional rice cultivars, cultivar Herath Banda recorded the highest plant height at all four fertilizer levels (no fertilizer (111.6 cm), half recommended dose (115.8 cm), recommended dose (103.6 cm), and twice recommended dose (105.9 cm). Dena wee recorded the highest number of tillers at no fertilizer (7.0), recommended dose (5.9) and twice recommended dose (7.3) while Herath Banda recorded the highest number of tillers (5.6) at half recommended dose. Highest number of leaves at no fertilizer dose was recorded by the cultivar Kotathavalu 1 (22.3). Cultivar Herath Banda (22.2) recorded the highest number of leaves at half of the recommended dose while cultivar Dena wee recorded the highest number of leaves/plant at recommended dose (21.1) and twice recommended dose of fertilizer (28.8). Correlation of these

parameters and other yield components with the final yield is yet to be computed.

Index Terms- Fertilizer Response, Sri Lankan Traditional rice

I. INTRODUCTION

Rice is the staple food in the diet for much of the world and it runs second to wheat in its importance as a food cereal in the human diet (FAO, 2011). About 672 Million Metric Tons of rice is grown annually in the world (FAO, 2011). Rice is the single most important crop occupying 34 percent (0.77 million ha) of the total cultivated area in Sri Lanka (Department of Agriculture, 2006). Presently paddy consumes the largest share of chemical fertilizers and it accounts for approximately 50 percent of the overall use of chemical fertilizers in Sri Lanka (Wijewardhena, 1987). There are three major nutrients namely, Nitrogen (N), Potassium (K) and Phosphorus (P) essential for paddy cultivation. Three main fertilizers Urea, Muriate of potash (MOP) and Triple super phosphate (TSP) provide the nitrogen, potassium and phosphorus respectively (Ekanayake, 2006). The fertilizer added to the soil to ensure all necessary nutrient elements are available to the crop to stimulate plant growth and yield (Thenabadu, 1980). Commercial fertilizers have to be supplied to fulfill the compensate the nutrients depleted from the soil by crop-uptake together with leaching and erosion losses (Thenabadu, 1980). Inorganic fertilizers release nutrients in readily soluble mode to soil solution and these are instantly available as plant nutrients (Siavoshi et al. 2011). Fertilizer consumption depends on rice variety, soil condition and farmer practices (Hach and Nam, 2006). Imbalanced fertilizer application, especially in wet season, creates severe diseases and lodging resulting low efficiency of nitrogen fertilizer application (Hach and Nam, 2006). Although there are four techniques available for determining fertilizer requirements namely Field experimentation, Soil tests, Plant tests and biological tests, Field experiments are considered the most dependable for establishing fertilizer recommendations (Priyangani et al. 2008) The fertilizer recommendations for rice have undergone many changes since the first fertilizer recommendation of Joachim in the 1930s (Thenabadu, 1980). It should be taken in to consideration the application of fertilizer should be varied during the different growth stages of a plant. If a heavy dressing of inorganic fertilizers is applied as a basal dressing, the high concentration of salts may sometimes damage or inhibit the seed germination (Thenabadu, 1980). Along with improved cultural management, the use of balanced fertilizer is one of the most important aspects for increased crop productivity.

Sri Lanka possesses about two thousand indigenous rice accessions (Priyangani et al. 2008), which are having various agronomic characters differing from one another and also differing from modern rice cultivars (Ranawake et al 2011b). At the onset of green revolution farmers initiated to cultivate high yielding varieties which are highly responsive to inorganic fertilizers as a replacement for traditional rice varieties (Weerahewa et al, 2010). Traditional rice cultivars are generally tall and have few tillers and produce low but stable yields even under unfavorable environments and typically they are cultivated without the application of fertilizer (Saito et al. 2005). Various field fertilizer experiments have been conducted with traditional rice cultivars to understand the expansion of yield potential in different countries by altering fertilizer application and the results revealed that the most of rice cultivars show a remarkable increase in grain yield when fertilizer application is increased (Saito et al. 2005; George et al. 2005). Some Sri Lankan traditional rice cultivars have been screened for abiotic stress tolerances such as drought, salinity and submergence (Ranawake et al 2011b ; Ranawake et al 2010a; Ranawake et al 2011a; Ranawake and Dahanayake 2012a; Ranawake et al 2012b ; Weragodawidana et al. 2012). There is a potential to introduce these cultivars directly to farmer field or use as future breeding materials. In such a process, less yield of traditional rice cultivars may pop-up as the major restriction (Saito et al. 2005; Amarasinghe et al 2013). According to Khuong (2008), fertilizer is the major factor affecting on grain yield and quality. Some of the Sri Lankan traditional rice cultivars have been evaluated for fertilizer response (Amarasinghe et al. 2013). However, there is no adequate information on response of traditional rice cultivars of Sri Lanka for fertilizer applications. Hence, the present study was carried out to understand the response of individual traditional rice cultivar on different levels of inorganic fertilizers at different growth stages. The data presented in the paper is focused on the vegetative growth phase of traditional rice cultivars.

II. MATERIALS AND METHODS

Forty traditional rice cultivars listed in the table 1 having Plant Genetic Resources Center (PGRC) Accession Numbers were germinated and planted in nursery beds. Ten day old seedlings were transplanted in the experimental field at the Faculty of Agriculture, Mapalana, Kamburupitiya, Sri Lanka in rows with 15 cm X 20 cm spacing according to the randomized complete block design. The soil is low humic clay soil with low base saturation.

Table 1
Forty Sri Lankan Traditional rice cultivars used for the experiment

PGRC Acc.No.	Local name	PGRC Acc.No.	Local name
3673	Kaluhandiran	3654	Pokuru Samba
3674	Kirikara	3655	Rata wee
3675	Kotathavalu 1	3660	Suduru
3676	Dena wee	3658	Ingrisi wee
3677	Herath Banda	3659	Kotathavalu 2
3678	Hondarawala	3653	Kalu Karayal

3679	Kottakaram	3668	Ranruwan
3681	Dandumara	3669	Rajes
3686	Karayal 1	3670	Madoluwa
3687	Dewardederi	3671	Suduru Samba
3469	Sudu wee	3688	Handiran
3477	Sudu Goda wee	3691	Gunaratna
3479	Kiri Naran	3661	Polayal
3480	Karayal 2	3664	Tissa wee
3482	Akuramboda	3665	Sudu Karayal
3486	Puwakmalata		
	Samba	3666	Podisayam
3487	Palasithari 601	3423	Giress
3489	Murungakayan 3	3427	Naudu wee
3490	Murungakayan 101		
3434	Kokuvellai		
3496	Bala Ma wee	3463	Karayal 3

Four replicates were arranged for each fertilizer level and each replicate was consisted of 3 lines. Twenty plants were included in to each line. Four different fertilizer levels were applied: no fertilizer, half of the recommended dose, recommended dose and twice of the recommended dose. The recommended fertilizer dosage for modern rice cultivars was used as the recommended dose (Basal Dressing: Urea 50 Kg/ha, TSP 62.5 Kg/ha, MOP 50 Kg/ha Top Dressing: Urea 37.5 Kg/ha). Basal dressing was applied before planting and top dressing was applied two times at 2 weeks after planting and at 8 weeks after planting. Plant heights (cm), number of tillers/per plant, number of leaves/per plant were recorded during the vegetative growth stage at 6 weeks after planting. Data were statistically analyzed by ANOVA and mean separation was done by DMRT using SAS statistical software (SAS, 2000). Yield and yield components of the population at each fertilizer level are intended to be measured after harvesting.

Considering the contribution of the plant height, number of leaves/plant and number of tillers/plant for the final yield, an arbitrary rating scale was developed for the evaluated parameters. Since the number of tillers is the major contributor to the yield, the highest 5 points were allocated for the maximum number of tillers/plant. Between number of leaves/plant and plant height, number of leaves/plant was given a higher rating 3 points, while less 2 points were allocated to the plant height. Rice cultivars with plant height more than 110 cm were not considered for scoring since they tend to be lodged. A fraction of maximum score was given for the second highest and third highest values of each parameter as given in table 2.

Table 2: Arbitrary rating scale used for the evaluation of best fertilizer level for individual rice cultivar

Plant height < 110 cm	Number of leaves	Number of tillers	
Highest score	2	3	5
Second highest	1	2	4
Third highest	0.5	1	3
Lowest	0	0	0

III. RESULTS AND DISCUSSION

Plant height: According to ANOVA plant height of individual traditional rice cultivars significantly differed with the fertilizer level where there was a significant difference among rice cultivars as well. Average plant height of the rice cultivars ranged from 37.8 cm to 115.8 cm. The highest plant height was

Table 3
Plant height of individual rice cultivar at different fertilizer applications

	Plant height (cm)			
	No F.	X ½ RD	RD	X 2 RD
<i>Kaluhandiran</i>	76.9 ^b	73.3 ^c	94.6 ^a	46.3 ^d
<i>Kirikara</i>	81.3 ^{ab}	71.6 ^c	86.6 ^a	79.3 ^b
<i>Kotathavalu 1</i>	93.1 ^c	101.3 ^b	102.5 ^a	68.8 ^d
<i>Dena wee</i>	80.7 ^c	102.9 ^a	102.6 ^a	81.7 ^b
<i>Herath Banda</i>	111.6 ^b	115.8 ^a	103.6 ^d	105.9 ^c
<i>Hondarawala</i>	59.6 ^b	56.7 ^c	73.2 ^a	50.3 ^d
<i>Kottakaram</i>	62.0 ^b	96.3 ^a	97.5 ^a	60.5 ^c
<i>Dandumara</i>	95.3 ^b	64.0 ^c	98.5 ^a	95.6 ^b
<i>Karayal 1</i>	91.5 ^b	86.6 ^c	71.3 ^d	95.2 ^a
<i>Dewaredderi</i>	92.7 ^c	94.3 ^b	91.5 ^d	97.5 ^a
<i>Sudu wee</i>	72.1 ^d	104.6 ^a	92.1 ^c	98.4 ^b
<i>Sudu Goda wee</i>	77.6 ^d	80.6 ^b	95.8 ^a	81.1 ^c
<i>Kiri Naran</i>	82.8 ^d	87.3 ^b	97.0 ^a	85.5 ^c
<i>Karayal 2</i>	93.5 ^d	103.4 ^a	101.4 ^b	99.2 ^c
<i>Akuramboda</i>	43.8 ^d	86.0 ^b	100.5 ^a	50.4 ^c
<i>Puwakmalata Samba</i>	60.3 ^b	71.6 ^a	53.5 ^c	59.5 ^b
<i>Palasithari 601</i>	100.2 ^a	99.4 ^b	87.3 ^c	37.8 ^d
<i>Murungakayan 3</i>	49.5 ^d	75.5 ^b	82.5 ^a	73.5 ^c
<i>Murungakayan 101</i>	49.3 ^d	83.9 ^a	75.6 ^b	74.4 ^c
<i>Bala Ma wee</i>	94.2 ^b	97.3 ^a	77.7 ^c	90.5 ^b
<i>Pokuru Samba</i>	97.4 ^c	98.1 ^b	101.5 ^a	96.8 ^d
<i>Rata wee</i>	80.5 ^a	75.0 ^{bc}	76.7 ^b	72.1 ^c
<i>Suduru</i>	73.5 ^b	85.3 ^a	85.6 ^a	85.5 ^a
<i>Ingrisi wee</i>	94.7 ^a	66.9 ^c	94.1 ^a	81.3 ^b
<i>Kotathavalu 2</i>	76.8 ^c	77.9 ^b	95.5 ^a	76.6 ^c
<i>Kalu Karayal</i>	84.1 ^c	87.4 ^b	96.3 ^a	96.9 ^a
<i>Ranruwan</i>	87.7 ^b	85.1 ^c	91.3 ^a	83.7 ^d
<i>Rajes</i>	89.6 ^c	98.0 ^a	84.8 ^d	90.5 ^b
<i>Madoluwa</i>	60.3 ^c	51.3 ^d	89.6 ^a	73.8 ^b
<i>Suduru Samba</i>	60.8 ^c	63.0 ^{bc}	74.5 ^a	64.6 ^b
<i>Handiran</i>	96.6 ^b	102.1 ^a	64.3 ^c	98.4 ^b
<i>Gunaratna</i>	91.6 ^b	55.9 ^d	97.4 ^a	71.9 ^c
<i>Polayal</i>	89.9 ^a	81.5 ^b	61.0 ^d	69.6 ^c
<i>Tissa wee</i>	91.9 ^c	101.0 ^a	91.7 ^c	96.9 ^b
<i>Sudu Karayal</i>	77.2 ^c	94.6 ^a	76.4 ^d	81.8 ^b
<i>Podisayam</i>	68.8 ^b	52.9 ^d	90.6 ^a	62.1 ^c
<i>Giress</i>	73.0 ^c	93.9 ^a	70.5 ^d	87.6 ^b
<i>Naudu wee</i>	81.4 ^b	71.5 ^d	86.1 ^a	78.3 ^c
<i>Kokuvellai</i>	87.9 ^c	98.0 ^a	82.7 ^d	95.1 ^b
<i>Karayal 3</i>	84.3 ^b	77.2 ^c	95.4 ^a	83.4 ^b

Means with the same letters are not differ significantly
No F No fertilizer, RD Recommended dose

recorded by the cultivar Herath Banda (115.8 cm) at the half of the recommended dose while the lowest plant height was recorded by the cultivar Palasithari 601 (37.8 cm) at no fertilizer conditions. Cultivar Suduru and cultivar Kalu karayal increased their height linearly with the increased fertilizer applications. Among tested traditional rice cultivars, cultivar Herath Banda recorded the highest average plant height (115.8 cm – 103.6 cm) at all four levels of fertilizer (Table 3). Cultivar Polayal reached its maximum potential height at no fertilizer condition. Further Herath Banda, Sudu wee, Karayal 2, Puwakmalata samba, Murungakayan 101, Bala Ma wee, Rajes, Handiran, Tissa wee, Sudu karayal, Giress and Kokuwellai cultivars recorded their highest plant height at half of the recommended dose. Similarly Kaluhandiran, Kotathavalu 1, Hondarawala, Dandumara, Kirinaran, Akuramboda, Murungakayan 3, Pokuru samba, Kotathavalu 2, Ranruwan, Madoluwa, Suduru Samba, Gunaratna, Podisayam, Naudu wee and Karayal 3 recorded their highest plant height at the recommended fertilizer level. Plant height of cultivars Kirikara, Dena wee, Kottakaram and Ingrisi Wee were unique for all the fertilizer levels. Karayal 1, Dewaredderi, and Sudu Goda Wee recorded their maximum height at twice the recommended dose of fertilizer and there was no linearity in plant heights with the fertilizer application. Cultivar Palasithari 601 and cultivar Rata wee gradually decreased their plant height with the increased fertilizer.

Number of tillers/plant: Number of tillers/plant in traditional rice cultivars significantly differed with the fertilizer applications. Average number of tillers/plant in the tested traditional rice cultivars ranged from 1.55 to 7.3 while Dena Wee recorded the highest number of 7 tillers at no fertilizer and 6, at recommended dose and at 7.3 at twice the recommended dose while Herath Banda recorded the highest number of tillers of 5.6 at half the recommended dose. The lowest tiller number of 1.55 was recorded by the cultivar Palasithari 601 at twice the recommended dose. Hondarawala, Dandumara, Akuramboda and Rata wee cultivars increased the number of tillers alongwith the increase of fertilizer. Kirikara, Sudu Goda wee, Palasithari 601 and Karayal 3 decreased the tiller numbers with increasing of fertilizer level. Kaluhandiran reached its maximum tiller number even at no fertilizer conditions. Kotathavalu 1, Herath Banda, Kottakaram, Karayal 1, Kiri naran, Karayal 2, Murungakayan 3, Bala Ma wee, Kotathavalu 2, Gunaratna, Sudu Karayal, Podisayam, Giress, Naudu wee and Kokuwellai cultivars gained their maximum number of tillers at half of the recommended dose of fertilizer while Suduru, Suduru samba and Tissa wee recorded their maximum number of tillers at recommended dose. Further elevated amount of fertilizer couldn't boost the tiller number of these cultivars (Table 4). Kalu karayal couldn't response to the fertilizer when increasing its tiller number with the added fertilizer doses at vegetative growth phase. This is contrary with Saleem et al. (Saleem et al. 2010) which indicated that the number of tillers/hill increases with the level of nitrogen fertilizer. However, Murtaza et al. (2000) and Mahmood et al. (1993) recorded that the number of tillers significantly increases with the use of nitrogen fertilizer. Further, Mannan et al. (2011) have also concluded that not only tiller number, but also number of panicles, panicle length, spikelet sterility and straw yield increased with the increase of nitrogen levels.

Table 4
Number tillers/plant of individual rice cultivar at different fertilizer applications

	Number of tillers/plant			
	No F.	X ½ RD	RD	X 2 RD
<i>Kaluhandiran</i>	3.5 ^a	2.9 ^{bc}	3.0 ^b	2.9 ^{bc}
<i>Kirikara</i>	3.3 ^a	3.1 ^b	3.1 ^b	2.8 ^c
<i>Kotathavalu 1</i>	5.1 ^b	5.5 ^a	5.0 ^b	4.5 ^c
<i>Dena wee</i>	7.0 ^a	5.3 ^c	5.9 ^b	7.3 ^a
<i>Herath Banda</i>	4.4 ^c	5.6 ^a	4.8 ^b	4.2 ^d
<i>Hondarawala</i>	3.0 ^c	3.2 ^b	3.2 ^b	4.0 ^a
<i>Kottakaram</i>	2.6 ^c	3.0 ^a	2.9 ^b	2.6 ^c
<i>Dandumara</i>	3.3 ^d	3.7 ^c	4.5 ^b	5.2 ^a
<i>Karayal 1</i>	2.8 ^d	5.5 ^a	5.3 ^b	4.4 ^c
<i>Dewardderi</i>	2.8 ^d	3.6 ^b	3.0 ^c	5.1 ^a
<i>Sudu wee</i>	3.0 ^c	5.2 ^a	3.9 ^b	5.1 ^a
<i>Sudu Goda wee</i>	3.4 ^a	3.1 ^b	3.0 ^b	2.4 ^c
<i>Kiri Naran</i>	2.6 ^d	4.3 ^a	3.8 ^b	3.5 ^c
<i>Karayal 2</i>	3.2 ^b	3.5 ^a	3.1 ^b	3.2 ^b
<i>Akuramboda</i>	3.7 ^c	4.5 ^b	4.5 ^b	4.7 ^a
<i>Puwakmalata Samba</i>	1.8 ^c	3.4 ^a	2.9 ^{ab}	2.6 ^b
<i>Palasithari 601</i>	3.4 ^a	3.5 ^a	3.6 ^a	1.6 ^b
<i>Murungakayan 3</i>	2.1 ^d	5.0 ^a	3.5 ^c	4.6 ^b
<i>Murungakayan 101</i>	2.0 ^c	4.1 ^a	3.9 ^a	2.9 ^b
<i>Bala Ma wee</i>	3.2 ^d	4.9 ^a	3.8 ^b	3.3 ^c
<i>Pokuru Samba</i>	3.5 ^c	4.0 ^{ab}	3.8 ^b	4.3 ^a
<i>Rata wee</i>	3.1 ^c	3.2 ^b	3.2 ^b	3.4 ^a
<i>Suduru</i>	3.3 ^c	4.9 ^a	3.9 ^b	4.1 ^b
<i>Ingrisi wee</i>	3.5 ^b	3.3 ^c	3.5 ^b	4.1 ^a
<i>Kotathavalu 2</i>	3.6 ^d	4.7 ^a	4.3 ^b	3.9 ^c
<i>Kalu Karayal</i>	3.7 ^a	3.7 ^a	3.7 ^a	3.8 ^a
<i>Ranruwan</i>	3.5 ^b	3.4 ^c	3.8 ^a	3.7 ^a
<i>Rajes</i>	2.9 ^d	3.4 ^b	3.1 ^c	3.6 ^a
<i>Madoluwa</i>	1.8 ^d	2.1 ^b	1.9 ^c	2.7 ^a
<i>Suduru Samba</i>	1.7 ^c	1.6 ^c	2.4 ^a	2.1 ^b
<i>Handiran</i>	3.3 ^c	4.8 ^a	3.2 ^d	3.8 ^b
<i>Gunaratna</i>	3.4 ^c	4.3 ^a	3.4 ^c	3.8 ^b
<i>Polayal</i>	4.6 ^a	3.5 ^c	4.7 ^a	4.4 ^b
<i>Tissa wee</i>	3.8 ^b	3.5 ^c	3.9 ^a	3.8 ^b
<i>Sudu Karayal</i>	2.7 ^c	3.8 ^a	3.2 ^b	3.2 ^b
<i>Podisayam</i>	2.1 ^d	4.3 ^a	2.2 ^c	3.6 ^b
<i>Giress</i>	1.7 ^d	5.1 ^a	2.3 ^c	3.6 ^b
<i>Naudu wee</i>	3.2 ^d	4.6 ^a	3.3 ^c	3.9 ^b
<i>Kokuvellai</i>	3.0 ^d	3.9 ^a	3.4 ^c	3.6 ^b
<i>Karayal 3</i>	4.6 ^a	3.2 ^{bc}	3.3 ^b	3.0 ^c

Means with the same letters are not differ significantly

No F No fertilizer, RD Recommended dose

Table 4
Number tillers/plant of individual rice cultivar at different fertilizer applications

	Number of tillers/plant			
	No F.	X ½ RD	RD	X 2 RD
<i>Kaluhandiran</i>	3.5 ^a	2.9 ^{bc}	3.0 ^b	2.9 ^{bc}
<i>Kirikara</i>	3.3 ^a	3.1 ^b	3.1 ^b	2.8 ^c
<i>Kotathavalu 1</i>	5.1 ^b	5.5 ^a	5.0 ^b	4.5 ^c
<i>Dena wee</i>	7.0 ^a	5.3 ^c	5.9 ^b	7.3 ^a
<i>Herath Banda</i>	4.4 ^c	5.6 ^a	4.8 ^b	4.2 ^d
<i>Hondarawala</i>	3.0 ^c	3.2 ^b	3.2 ^b	4.0 ^a
<i>Kottakaram</i>	2.6 ^c	3.0 ^a	2.9 ^b	2.6 ^c
<i>Dandumara</i>	3.3 ^d	3.7 ^c	4.5 ^b	5.2 ^a
<i>Karayal 1</i>	2.8 ^d	5.5 ^a	5.3 ^b	4.4 ^c
<i>Dewardderi</i>	2.8 ^d	3.6 ^b	3.0 ^c	5.1 ^a
<i>Sudu wee</i>	3.0 ^c	5.2 ^a	3.9 ^b	5.1 ^a
<i>Sudu Goda wee</i>	3.4 ^a	3.1 ^b	3.0 ^b	2.4 ^c
<i>Kiri Naran</i>	2.6 ^d	4.3 ^a	3.8 ^b	3.5 ^c
<i>Karayal 2</i>	3.2 ^b	3.5 ^a	3.1 ^b	3.2 ^b
<i>Akuramboda</i>	3.7 ^c	4.5 ^b	4.5 ^b	4.7 ^a
<i>Puwakmalata Samba</i>	1.8 ^c	3.4 ^a	2.9 ^{ab}	2.6 ^b
<i>Palasithari 601</i>	3.4 ^a	3.5 ^a	3.6 ^a	1.6 ^b
<i>Murungakayan 3</i>	2.1 ^d	5.0 ^a	3.5 ^c	4.6 ^b
<i>Murungakayan 101</i>	2.0 ^c	4.1 ^a	3.9 ^a	2.9 ^b
<i>Bala Ma wee</i>	3.2 ^d	4.9 ^a	3.8 ^b	3.3 ^c
<i>Pokuru Samba</i>	3.5 ^c	4.0 ^{ab}	3.8 ^b	4.3 ^a
<i>Rata wee</i>	3.1 ^c	3.2 ^b	3.2 ^b	3.4 ^a
<i>Suduru</i>	3.3 ^c	4.9 ^a	3.9 ^b	4.1 ^b
<i>Ingrisi wee</i>	3.5 ^b	3.3 ^c	3.5 ^b	4.1 ^a
<i>Kotathavalu 2</i>	3.6 ^d	4.7 ^a	4.3 ^b	3.9 ^c
<i>Kalu Karayal</i>	3.7 ^a	3.7 ^a	3.7 ^a	3.8 ^a
<i>Ranruwan</i>	3.5 ^b	3.4 ^c	3.8 ^a	3.7 ^a
<i>Rajes</i>	2.9 ^d	3.4 ^b	3.1 ^c	3.6 ^a
<i>Madoluwa</i>	1.8 ^d	2.1 ^b	1.9 ^c	2.7 ^a
<i>Suduru Samba</i>	1.7 ^c	1.6 ^c	2.4 ^a	2.1 ^b
<i>Handiran</i>	3.3 ^c	4.8 ^a	3.2 ^d	3.8 ^b
<i>Gunaratna</i>	3.4 ^c	4.3 ^a	3.4 ^c	3.8 ^b
<i>Polayal</i>	4.6 ^a	3.5 ^c	4.7 ^a	4.4 ^b
<i>Tissa wee</i>	3.8 ^b	3.5 ^c	3.9 ^a	3.8 ^b
<i>Sudu Karayal</i>	2.7 ^c	3.8 ^a	3.2 ^b	3.2 ^b
<i>Podisayam</i>	2.1 ^d	4.3 ^a	2.2 ^c	3.6 ^b
<i>Giress</i>	1.7 ^d	5.1 ^a	2.3 ^c	3.6 ^b
<i>Naudu wee</i>	3.2 ^d	4.6 ^a	3.3 ^c	3.9 ^b
<i>Kokuvellai</i>	3.0 ^d	3.9 ^a	3.4 ^c	3.6 ^b
<i>Karayal 3</i>	4.6 ^a	3.2 ^{bc}	3.3 ^b	3.0 ^c

Means with the same letters are not differ significantly

No F No fertilizer, RD Recommended dose

Number of leaves: Number of leaves significantly differed with the fertilizer levels and the cultivars as shown in the the ANOVA Table 5.

Table 5
Number of leaves/plant of individual rice cultivar at different fertilizer applications

	Number of leaves/plant			
	No F.	X ½ RD	RD	X 2 RD
<i>Kaluhandiran</i>	13.5 ^a	11.5 ^c	12.0 ^b	9.9 ^d
<i>Kirikara</i>	13.4 ^a	12.0 ^b	12.3 ^b	10.7 ^c
<i>Kotathavalu 1</i>	22.3 ^a	21.8 ^b	21.0 ^c	14.2 ^d
<i>Dena wee</i>	21.3 ^b	21.0 ^c	21.1 ^c	28.8 ^a
<i>Herath Banda</i>	18.4 ^b	22.2 ^a	17.8 ^c	17.5 ^c
<i>Hondarawala</i>	11.2 ^c	11.7 ^b	11.2 ^c	16.0 ^a
<i>Kottakaram</i>	8.8 ^d	12.0 ^a	11.5 ^b	10.5 ^c
<i>Dandumara</i>	13.0 ^d	13.3 ^c	17.3 ^b	20.8 ^a
<i>Karayal 1</i>	11.1 ^d	21.9 ^a	21.0 ^b	17.5 ^c
<i>Dewardderi</i>	10.8 ^c	14.3 ^b	10.9 ^c	20.5 ^a
<i>Sudu wee</i>	14.5 ^d	20.6 ^a	17.2 ^c	20.3 ^b
<i>Sudu Goda wee</i>	12.6 ^a	12.7 ^a	12.0 ^b	10.6 ^c
<i>Kiri Naran</i>	10.8	17.3 ^a	15.5 ^b	13.5 ^c
<i>Karayal 2</i>	12.6	14.2 ^a	12.8 ^c	13.2 ^b
<i>Akuramboda</i>	15.6 ^c	18.1 ^b	18.3 ^b	18.8 ^a
<i>Puwakmalata</i>				
<i>Samba</i>	7.1 ^d	13.4 ^a	11.8 ^b	10.2 ^c
<i>Palasithari 601</i>	13.3 ^c	14.0 ^b	14.5 ^a	6.2 ^d
<i>Murungakayan 3</i>	8.7 ^d	19.9 ^a	14.0 ^c	18.4 ^b
<i>Murungakayan 101</i>	8.4 ^d	16.2 ^a	15.2 ^b	11.3 ^c
<i>Bala Ma wee</i>	12.6 ^d	19.8 ^a	15.0 ^b	13.3 ^c
<i>Pokuru Samba</i>	13.7 ^d	15.8 ^b	15.0 ^c	16.9 ^a
<i>Rata wee</i>	12.3 ^c	12.8 ^b	12.8 ^b	13.8 ^a
<i>Suduru</i>	12.3 ^d	19.6 ^a	15.1 ^c	16.0 ^b
<i>Ingrisi wee</i>	14.0 ^b	13.0 ^c	14.0 ^b	16.4 ^a
<i>Kotathavalu 2</i>	14.5 ^d	18.8 ^a	17.3 ^b	15.7 ^c
<i>Kalu Karayal</i>	14.6 ^b	14.6 ^b	14.5 ^b	14.8 ^a
<i>Ranruwan</i>	14.0 ^b	13.5 ^c	15.0 ^a	14.6 ^{ab}
<i>Rajes</i>	11.7 ^d	13.8 ^b	12.5 ^c	14.5 ^a
<i>Madoluwa</i>	6.5 ^d	8.3 ^b	7.2 ^c	10.6 ^a
<i>Suduru Samba</i>	6.5 ^c	6.5 ^c	10.0 ^a	9.0 ^b
<i>Handiran</i>	13.2 ^c	19.3 ^a	10.0 ^d	15.3 ^b
<i>Gunaratna</i>	13.7 ^c	17.0 ^a	13.8 ^c	15.8 ^b
<i>Polayal</i>	18.3 ^b	14.8 ^c	18.8 ^a	18.1 ^b
<i>Tissa wee</i>	15.1 ^a	14.2 ^b	15.5 ^a	15.2 ^a
<i>Sudu Karayal</i>	10.6 ^c	15.3 ^a	12.6 ^b	12.8 ^b
<i>Podisayam</i>	8.3 ^d	17.3 ^a	8.9 ^c	14.4 ^b
<i>Giress</i>	6.8 ^d	20.5 ^a	9.2 ^c	14.3 ^b
<i>Naudu wee</i>	12.9 ^d	18.3 ^a	13.0 ^c	15.5 ^b
<i>Kokuvellai</i>	12.1 ^d	15.5 ^a	13.5 ^c	14.5 ^b
<i>Karayal 3</i>	18.5 ^a	12.9 ^c	13.1 ^b	12.0 ^d

DMRT groups are given in English letters

No F No fertilizer, RD Recommended dose

Average number of leaves ranged from 6.2 to 28.8 in the tested traditional rice cultivars. The development stage of the rice plant can be determined by the number of leaves it bears. The population used for the study included different cultivars with different days to maturity. From germination to heading, the number of leaves developed from the main culm is generally less in number for a short duration variety than a long duration variety (Datta, 1981). Highest average number of leaves (28.8) was obtained for the cultivar Dena wee in 117 days at twice the recommended dose and also the lowest average number of leaves (6.2) was recorded by the cultivar Palasithari 601 (123 days to maturity) at the twice the recommended dose (Table 3). Vegetative growth was vigorous, especially with nitrogen application and number of leaves in main stem is frequently more than 20 in modern rice cultivars according to Tanaka et al. [Tanaka, 1976]. Tanaka et al. (1976) further reported that the rice yield can be increased if the number of active leaves on plant can be increased. The cultivars Dandumara, Akuramboda, Rata wee and Kalu karayal proved this phenomenon by gradually increasing the number of leaves with the increase fertilizer but Kirikara, Kotathavalu 1 and Sudu Goda wee decreased their number of leaves with the increased fertilizer (Table 5). Herath Banda, Kottakaram, Karayal 1, Sudu wee, Kirinaran, Karayal 2, Puwakmalata Samba, Murungakayan 3, Murungakayan 101, Bala Ma wee, Suduru, Kotathavalu 2, Handiran, Gunaratna, Kokuvellai, Podisayam, Giress, Naudu wee and Sudu Karayal acquired maximum number of leaves at half of the recommended dose and Palasithari 601, Suduru samba and Polayal recorded the highest number of leaves at the recommended fertilizer dose during the vegetative phase. Intermediate plant type records the plant height between 80 cm - 120 cm and they are well adapted to both poor and favorable environments and provide medium to good grain yield (www.knowledgebank.irri.org/extension/farmersguideuplandrice). Further semi-dwarf cultivars normally reached up to 110 cm height (www.knowledgebank.irri.org/extension/index.php/ses). Roberts et al. (Roberts et al. 2013) have also concluded that the semi-dwarf cultivars produced higher yields than that of tall cultivars. Hence in this study when use arbitrary rating scale to evaluate the performances of cultivars, cultivar increases its plant height over 110 cm even at vegetative stage was considered as unfavorable in plant architecture. Plant height also a major contributor to the yield (Yadav et al. 2011) but greater plant height susceptible to lodging reduces yield, quality of production, and mechanical harvesting efficiency (Weber, 1966; Kono, 1995). It was estimated that lodging caused a loss of 26 kg ha⁻¹ in rice production in southern India (Duwayri et al. 2000). According to Ogbodo et al. (2010) and Yadav et al. (2011) number of tillers/plant directly contributes to the yield. Thus the fertilizer level which recorded the highest tiller number was considered as the best fertilizer level for increasing tiller number in arbitrary rating scale. Further Tanaka et al. (1976) stated that the rice yield is increased with the higher number of leaves on plant. In the present study the cultivars with the highest number of leaves/plant were considered as more suitable cultivars for higher yield.

Yadav et al. (2011) concluded that the harvest index, numbers of tillers per hill, panicle length, number of spikelets per panicle, plant height as the main contributors to yield. Among those parameters harvest index, number of tillers per hill, panicle length and number of spikelet per panicle are the most important characters that directly contribute to yield (Weber, 1966). Hence in the used arbitrary rating scale, number of tiller/plant was given the highest score (Table 2).

Table 6 Cumulative values of scores at different fertilizer levels

No F.	X		X 2	Best level
	RD	RD		
<i>Kaluhandiran</i>	9	1.5	10.5	4 RD
<i>Kirikara</i>	9	6	15	0.5 RD
<i>Kotathavalu 1</i>	7.5	8	15.5	0 RD
<i>Dena wee</i>	12	3	15	9 RD
<i>Herath Banda</i>	6	8	12	2 RD
<i>Hondarawala</i>	2	6.5	8.5	8 RD
<i>Kottakaram</i>	4	10	14	4 RD
<i>Dandumara</i>	1	4.5	5.5	9 2RD
<i>Karayal 1</i>	1	13	14	6 RD
<i>Dewaredderi</i>	0.5	7	7.5	10 2RD
<i>Sudu wee</i>	3	10	13	8 RD
<i>Sudu Goda wee</i>	5	7.5	12.5	2 RD
<i>Kiri Naran</i>	0	9	9	4.5 RD/2
<i>Karayal 2</i>	4	10	14	6.5 RD
<i>Akuramboda</i>	0	7	7	8.5 2RD
<i>Puwakmalata</i>				
<i>Samba</i>	1	10	11	5.5 RD
<i>Palasithari 601</i>	8	8	16	0 RD
<i>Murungakayan 3</i>	0	9	9	6.5 RD/2
<i>Murungakayan 101</i>	0	10	10	5.5 R Dor
<i>Bala Ma wee</i>	1	10	11	4.5 RD
<i>Pokuru Samba</i>	0.5	8	8.5	8 RD
<i>Rata wee</i>	2	6.5	8.5	8 RD
<i>Suduru</i>	0.5	9	9.5	7 RD
<i>Ingrisi wee</i>	6	1.5	7.5	9 2RD
<i>Kotathavalu 2</i>	0.5	9	9.5	4.5 RD
<i>Kalu Karayal</i>	5.5	8	13.5	10 RD
<i>Ranruwan</i>	7	0.5	7.5	7 RD
<i>Rajes</i>	0.2	8	8.2	9 2RD
<i>Madoluwa</i>	0.5	6	6.5	9 2RD
<i>Suduru Samba</i>	1	5	6	7 2RD

<i>Handiran</i>	5	10	15	7 RD
<i>Gunaratna</i>	5	8	13	6.5 RD
<i>Polayal</i>	9	2	11	6.5 RD
<i>Tissa wee</i>	7.5	7	14.5	8 RD
<i>Sudu Karayal</i>	1.5	10	11.5	7 RD
<i>Podisayam</i>	0.5	8	8.5	6.5 RD
<i>Giress</i>	0.5	10	10.5	7 RD
<i>Naudu wee</i>	1	8	9	6.5 RD
<i>Kokuvellai</i>	0.5	10	10.5	7 RD
<i>Karayal 3</i>	9	6	15	1 RD

According to used scoring system, among tested traditional rice cultivars majority of the rice cultivars performed well at the recommended fertilizer dose. Rice cultivar Dandumara, Dewaredderi, Akuramboda, Ingrisi wee, Rajes, Modaluwa and Suduru Samba performed well at twice the recommended fertilizer dose while Kiri Naran and Murungakayan-3 performed well at half of the recommended dose.

CONCLUSIONS

Response of individual traditional rice cultivar for fertilizer on vegetative growth phase parameters such as plant height, number of tillers/plant and number of leaves/plant are significantly different at field conditions. For rice cultivars Dandumara, Dewaredderi, Akuramboda, Ingrisi wee, Rajes, Modaluwa and Suduru Samba, twice the recommended fertilizer dose is better while half of the recommended dose is suitable for Kiri Naran and Murungakayan-3. Recommended fertilizer dose is suitable for all the other cultivars. However, the climatic, agro-ecological as well as soil factors have to be given due attention as the availability of nutrients may be different in soils of different regions of the country.

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Assessment of allelopathic potential of some traditional rice cultivars in Sri Lanka

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Abstract- Allelopathy refers to the chemical inhibition of growth of one species by another. With the objectives of understanding allelopathic effects of sixty seven traditional rice cultivars, a field experiment and laboratory experiments were carried out in 2011 Yala season at Faculty of Agriculture, University of Ruhuna, Mapalana, Sri Lanka. Rice cultivars were transplanted according to the completely randomized block design with four replicates. Each replicate consisted of three rows of rice plants and data were collected from the middle row. After three months of transplanting, plant height (cm) and number of tillers/plant, were evaluated in traditional rice cultivars and total dry matter weight of weeds in 0.093 m² (1ft²) area encircled by the rice plant were evaluated in three replicates. According to the statistical analysis there were significant differences in plant height and tiller number/plant in traditional rice cultivars. Further there was a significant difference in average dry matter weight of weeds in 0.093 m² area encircled by the plant of rice cultivar but there were no correlations in between plant height of traditional rice cultivar or tiller number/plant of them with average dry matter weight of weeds in 0.093 m² area encircling rice plant emphasizing the non-significant effect of rice plant morphology in weed density. Separate experiments were carried out to see the allelopathic effects of these rice cultivars on germination of Barnyard grass (*Echinochloa crusgalli* L.) seeds. In one set of experiment three soil samples were collected from the soil area contacted with root system of the middle row rice plants in three row design. Twenty *Echinochloa crusgalli* L. seeds were sown in soil samples and watered according to the necessity. After one month, germination percentage of *Echinochloa crusgalli* (L.) was evaluated. In the other set of experiment, each 5 g of leaf sample from individual traditional rice cultivar were crushed and mixed with non-rice grown soil samples in three replicates. Twenty seeds of *Echinochloa crusgalli* (L.) were sown in each soil sample and germination percentage was counted one month after the seeding. According to the statistical analysis, there were significant differences in germination percentage of *Echinochloa crusgalli* L. in both soil types while germination percentage was significantly lower in soil samples collected from rice root zone. Furthermore, there was a strong correlation in between germination percentage of *Echinochloa crusgalli* (L.) in two types of soil samples. This study reveals the allelopathic effect of individual traditional rice cultivar on weeds in field condition and allelopathic effect of them on seed germination of *Echinochloa crusgalli* (L.) in root exudates and in leaf extracts as well. Root exudates of traditional rice cultivars *Murunga*, *Ran ruwan*, *Mudaliwi*, *Kirikara*, *Kahata Samba* *Molligoda Kalukanda* and *Sivuru wee* significantly suppressed the seed

germination of *Echinochloa crusgalli* while leaf extracts of rice cultivars *Rathel*, *Sudu samba*, *Kalu heenati*, *Mahakuru wee*, *Kotavalu*, *Galpa wee*, *Yakada wee*, *Gonabaru*, *Muthumala* and *Seedevi* significantly reduced the seed germination of *Echinochloa crusgalli* L. which emphasizes the potential usage of these rice cultivars for weed management after reconfirmation of the allelopathic effect.

Index Terms- Allelopathy, germination percentage, leaf extract, root exudates, traditional rice, weed density

I. INTRODUCTION

Allelopathy is the effect of one plant or microorganisms on growth of another plant or micro organism by releasing some chemical compounds into the environment (Rice et al. 1984) and it is a component of integrated weed management technology to reduce the herbicide use for sustainable agricultural development. This is an eco-friendly alternative approach to conventional weed control method, hence, exploitation of local resources to dissect the allelopathic effect of known plants are timely needed. The rice allelopathy may be one of the potent methods for sustainable agricultural system. Rice has been studied for allelopathic effects in different bio assays (Chou et al. 1991; Hassan et al.1996; Manechote et al. 1996; Ebana et al. 2001 and Kong et al. 2002). Results of Olofsdotter et al. (1889, 1999), Kraus et al. (2002), Kitazawa et al. (2005), and Kim and Shin (2008) have convinced the potential of rice allelopathy on controlling weeds in different ways. Though there is a real need for convenient, reliable, economical, efficient and repeatable universal methodology for screening rice for allelopathy, as cultivar shows different responses depending upon the screening method used, still such method has not been recommended. Crops or weeds such as *Echinochloa crusgalli* L. (Manechote et al. 1996), Nutgrass flat sedge (Hussan et al. 1996) and lettuce (Fujii et al. 1992) have been used as biological determinants in such allelopathy studies.

Allelopathic effect and competitive traits of rice cause weed suppression under field conditions. The critical period for yield reduction of rice due to weeds is the first month of the crop growth and during this period expression of allelopathy in rice is prominent (Olofsdotter, 2001).

Root exudation, leaching by dews and rains, and volatilization or decaying plant tissue from allelopathic plants results in release of compounds into the environment (Rice, 1984). These compounds

have been identified as alkaloids, flavonoids or phenolic compounds (Chau et al., 1999).

Allelopathic substances can be present in different parts of the plant; in leaves, flowers, roots, fruits, or stems. Further they can also be found in the surrounding soil as exudates from the root system. Other species are affected by these toxins in many different ways. The allelopathic effects of various parts of the same weed also differ for their effects on germination and on initial growth of plants (Economou et al. 2002; Aziz et al. 2008). The effects of allelopathic toxins on plants can be examined in a laboratory or in a greenhouse. Seeds are the easiest and least expensive to use as allelopathy determinant. In the presence of allelotoxins, seeds do not germinate as they do in the absence of the allelopathic substances (Mubeen et al. 2011). Plants can also be used for the same and chlorosis and eventually die in the presence of allelotoxins are the signs of toxicity to the chemicals. The greatest inhibition of germination percentage was recorded by rice seeds soaking in leaf extracts of *T. portulacastrum* (Mubeen et al. 2011).

The overuse or misuse of inorganic agrochemicals often causes adverse effect on environment such as imbalance of soil microorganisms, nutrient deficiency, and change of soil physicochemical properties, resulting in a decrease of crop productivity. The incorporation of allelopathic substances into agricultural management may reduce the use of agrochemicals and lessen environmental pollution.

Chuo (1999) has concluded 6 aspects on which future allelopathy researches must be focused on. Those are continuous survey of potential allelochemicals from natural sources, finding out practical ways of using allelochemicals in the field, understanding mode of action of different allelopathic chemicals, understanding the role of allelopathic chemicals in biodiversity and ecosystem function, exploration of advanced biotechnological tools to dissect allelopathic chemical genes in plants or microorganisms for biological control, and challenging the extraction of allelopathic compounds from the relevant source. The present study targeted: to find out allelopathic effects of traditional rice cultivars on weed density at field conditions, to understand the effect of plant height and tiller number/plant of rice cultivars on weed density in the field conditions, to assess allelopathic effect of root exudates on seed germination of *Echinochloa crusgalli* (L.) and to compare the allelopathic effects of root exudates with that of leaf extracts on seed germination of *Echinochloa crusgalli* (L.)

II. MATERIALS AND METHODS

The experiment was conducted both in the field and in the laboratory. In the field experiment land preparation was done after the field was treated with Glyphosate (N-phosphonomethyl glycine). Experiment was carried out in 2011 Yala season. Seeds of 67 traditional rice cultivars were collected from PGRC, Gannoruwa. Rice seedlings were raised in a Dapog nursery. Well grown rice seedlings of each cultivar were planted in the field (10 cm X 15 cm spacing) in three rows according to randomized complete block design so that 20 seedlings were in each row. The

spacing between adjacent lines of two different rice cultivars was 20 cm.

After three months, weeds were collected in to polythene bags, from the three replicates of each 0.093m² areas around the base of rice plant in the middle row of each rice cultivar. Weed samples were washed with water to remove contact soils in the root system. All the weeds were dried on papers under the fans for three days to remove excess water. After three days, weeds were oven dried at 70 oC for 10 days until the dry matter weight become constant. Finally, dry matter weights of the weed samples were recorded. Plant height and number of tillers/plant of traditional rice cultivars were also evaluated at the same time.

In a separate study soil samples were collected from the rhizosphere of the root system after three months of transplanting. Three replicates of soil samples from each rice cultivar were collected in to 100 ml plastic containers from the middle line of the rice cultivar. Mature seeds of *Echinochloa crusgalli* (L.) were collected from the field. Seeds of *Echinochloa crusgalli* (L.) were thoroughly washed away with clean water. Twenty seeds of *Echinochloa crusgalli* (L.) were sown in each soil sample and watered according to the necessity. After one month, number of germinated seeds was counted in three replicates.

In another set of experiment, 5 g of leaf samples from each traditional rice cultivar was crushed separately and mixed in plastic containers with autoclaved non-rice grown soil samples collected from the field. Cleaned seeds of *Echinochloa crusgalli* (L.) were sown in the prepared soil. A constant water level in the plastic containers was maintained throughout the experiment. Number of germinated seeds was calculated four weeks after the seeding of *Echinochloa crusgalli* (L.).

Control experiments for each experiment were done accordingly. Data were analyzed using SAS (System of statistical analysis) Inc. 9.2. (2010).

III. RESULTS AND DISCUSSION

According to the statistical analysis, plant height and number of tillers/plant in traditional rice cultivars were significantly different. Though the critical period for yield reduction in rice due to weeds is in the first month of crop growth (Olofsdotter et al. 1999) total dry matter weight of weed samples were collected three months after planting. The reason for collecting weeds after three months was that the variation of mutual shading due to plant height and number of tillers/plant was maxima at the 3 months after planting. Those factors remained almost the same during the early age of the crop growth. However there were no correlations between plant height of rice cultivar and tiller number of the rice cultivar with the dry matter weight of the weeds in the unit area of plant base. Though the screening methodology designed to test large amount of rice accessions in the field at once was inconvenience, the methodology is reproducible and the results give clear values related to effect of individual rice cultivar on seed germination suppression of *Echinochloa crusgalli* (L.).

Weed dry matter weight in 0.093 m² around the rice plant base in individual rice cultivar was varied from 0.86 g/0.093 m² (rice cultivar *Kalu wee*) to 37.967 g/0.093 m² (rice cultivar *Murunga*) (Table 1). Olofsdotter et al. (1999) emphasized allelopathy as a difficult factor to distinguish from competition and therefore such screening must be compared with data where resource competition can be eliminated as a factor in the experiment. According to the statistical analysis there were no correlations in between rice plant height Vs weed dry matter weight or rice number of tiller/plant Vs weed dry matter weight. This proves that effect of mutual shading due to plant height and number of tillers/plant of rice cultivar has not significantly affected on weed spreading in this cultivation. On the other hand there was a significant effect of rice cultivar on weed dry matter weight, emphasizing a minimum effect of weed competition on allelopathic effect of rice cultivars on weeds.

Table 1 Dry matter weight of weeds in 0.093 m² area of rice cultivar root base, germination percentage of *Echinochloa crusgalli* in soil samples collected from root base of traditional rice cultivars and germination percentage of *Echinochloa crusgalli* in leaf extracts of traditional rice cultivars

PGRC Acc. No.	Rice cultivar name	DMW of weeds (g/0.093m ²)	GM of <i>E.c</i> in soil samples	GM of <i>E.c.</i> in leaf extracts
2196	<i>Rathel</i>	1.07	3.33 ^g	0.00 ^d
2202	<i>Sudu samba</i>	2.29	3.33 ^g	0.00 ^d
2203	<i>Dik wee</i>	6.72	3.33 ^g	3.33 ^c
2340	<i>Weda Heenati</i>	5.53	3.33 ^g	3.33 ^c
2349	<i>Mas samba</i>	4.75	3.33 ^g	3.33 ^c
2866	<i>Randunipagal</i>	5.96	3.33 ^g	6.66 ^f
3071	<i>Polayal</i>	1.83	6.66 ^f	5.834 ^b
3072	<i>Thanthiri balan</i>	6.22	6.66 ^f	3.33 ^c
3131	<i>Dahanala 2014</i>	7.40	3.33 ^g	5.834 ^b
3132	<i>Heenati 309</i>	4.41	14.44 ^e	3.33 ^c
3136	<i>Pachchai perumal</i>	6.04	3.33 ^g	6.66 ^f
3142	<i>Molaga samba</i>	6.80	14.44 ^e	3.33 ^c
3142	<i>Heendik wee</i>	10.20	3.33 ^g	3.33 ^c
3158	<i>Kalubala wee</i>	4.96	3.33 ^g	3.33 ^c
3160	<i>Valihandiram</i>	6.74	14.44 ^e	3.33 ^c
3161	<i>Heen wee</i>	10.46	6.66 ^f	3.33 ^c
3164	<i>Heras</i>	13.85	3.33 ^g	3.33 ^c
3170	<i>Kalu heenati</i>	13.63	3.33 ^g	0.00 ^d
3171	<i>Sudu hetada</i>	15.19	14.44 ^e	3.33 ^c
3172	<i>Kalubala wee</i>	9.42	14.44 ^e	3.33 ^c
3174	<i>Podihatatha</i>	17.09	3.33 ^g	3.33 ^c
3183	<i>Hathiel</i>	5.13	3.33 ^g	3.33 ^c
3190	<i>Mahakuru wee</i>	35.517	3.33 ^g	0.00 ^d
3191	<i>Heendik wee</i>	15.19	3.33 ^g	3.33 ^c
3195	<i>Gallkatta</i>	9.14	3.33 ^g	3.33 ^c
3200	<i>Kalu heenati</i>	24.667	14.44 ^e	3.33 ^c
3203	<i>Kotavalu</i>	7.74	3.33 ^g	0.00 ^d
3214	<i>Matholuwa</i>	9.07	3.33 ^g	5.834 ^b
3341	<i>Galpa wee</i>	11.62	6.66 ^f	0.00 ^d
3387	<i>Kahata wee</i>	5.36	3.33 ^g	3.33 ^c
3388	<i>Moddai karuppan</i>	9.87	3.33 ^g	3.33 ^c

3390	<i>Rathu heenati</i>	2.28	40.00 ^b	13.333 ^a
3444	<i>Dik wee</i>	7.57	6.66 ^f	6.67 ^b
3445	<i>Yakada wee</i>	3.09	6.66 ^f	0.00 ^d
3472	<i>Masuran</i>	3.63	6.66 ^f	5.834 ^b
3473	<i>Ratu wee</i>	22.53	3.33 ^g	3.33 ^c
3515	<i>3515</i>	2.00	3.33 ^g	5.834 ^b
3543	<i>Gonabaru</i>	8.55	3.33 ^g	0.00 ^d
3548	<i>Kuruluthudu 2</i>	9.52	6.66 ^f	3.33 ^c
3550	<i>Bathkiri el</i>	8.75	3.33 ^g	3.33 ^c
3592	<i>Ranhiriyal</i>	22.927	3.33 ^g	3.33 ^c
3596	<i>Muthumala</i>	10.79	3.33 ^g	0.00 ^d
3605	<i>Seedeivi</i>	6.45	3.33 ^g	0.00 ^d
3634	<i>Thawalu</i>	12.94	20.00 ^d	3.33 ^c
3644	<i>Herath</i>	5.01	6.66 ^f	3.33 ^c
3662	<i>Mahasudu wee</i>	3.37	3.33 ^g	3.33 ^c
3663	<i>Murunga</i>	37.97	0.00 ^b	3.33 ^c
3664	<i>Tissa wee</i>	9.77	6.66 ^f	3.33 ^c
3668	<i>Ran ruwan</i>	5.40	0.00 ^b	3.33 ^c
3672	<i>Mudaliwi</i>	7.89	0.00 ^b	3.33 ^c
3674	<i>Kirikara</i>	4.37	0.00 ^b	3.33 ^c
3676	<i>Dena wee</i>	7.18	6.66 ^f	3.33 ^c
3684	<i>Rathkara</i>	11.81	14.44 ^e	6.67 ^b
3695	<i>Kahata Samba</i>	16.71	0.00 ^b	3.33 ^c
3697	<i>Molligoda</i>	0.97	0.00 ^b	5.834 ^b
3698	<i>Surumaniyan</i>	4.03	54.44 ^a	5.834 ^b
3707	<i>Heenati</i>	26.933	3.33 ^g	3.33 ^c
3710	<i>Sudhu balawee</i>	5.75	3.33 ^g	5.834 ^b
3712	<i>Kahata wee</i>	10.70	3.33 ^g	5.834 ^b
3713	<i>Kalukanda</i>	23.253	0.00 ^b	3.33 ^c
3721	<i>Manamalaya</i>	9.75	3.33 ^g	3.33 ^c
3725	<i>Sivuru wee</i>	26.933	0.00 ^b	3.33 ^c
3728	<i>Kalu wee</i>	0.86	6.66 ^f	5.834 ^b
3735	<i>Welihandiran</i>	3.48	6.66 ^f	5.834 ^b
3871	<i>Rathran wee</i>	10.04	3.33 ^g	5.834 ^b
3905	<i>Rathu wee</i>	2.83	6.66 ^f	3.33 ^c
3908	<i>Rathkara wee</i>	6.93	3.33 ^g	3.33 ^c

Superscript letters indicate DMRT groups. The same letters in the same row are not significantly differed.

PGRC: Plant genetic resource center, Gannoruwa, Sri Lanka

DMW: Dry matter weight

GM: Germination percentage

E.c.: *Echinochloa crusgalli*

According to the applied bio assay conditions, twenty three rice Both laboratory experiments and field experiments are needed to quantify the important interactions between different competitive variables (Niemeyer 1988), such as physical and chemical interference, including allelopathy. Field and laboratory or greenhouse studies must work together to get the exact variation explain by the allelopathy of rice. In the present study field experiment was carried out to understand the allelopathic effects of individual traditional rice cultivar and to understand whether morphological characters of rice cultivar such as plant height and tiller number/plant effect on the weed density or dry matter weight of weeds in unique area that encircle the root base of the rice plant. The laboratory experiments were carried out to understand the direct effect of allelopathy on *Echinochloa crusgalli* (L.) seed germination in soils contaminated with root exudates and in soils saturated with leaf extracts of traditional rice cultivars.

It was noticed that *Echinochloa crusgalli* (L.) germination was varied from 0% (*Murunga, Ran ruwan, Mudaliwi, Kirikara, Kahata Samba, Molligoda, Kalukanda, Sivuru wee* cultivars) to 54.48% (*Surumaniyan*) in soil samples collected from root zone of rice cultivars while the seed germination of *Echinochloa crusgalli* (L.) was significantly different in soil samples collected from root zones of different rice cultivars (Table 1).

Echinochloa crusgalli (L.) seeds were not germinated in soil samples mixed with leaf extracts of traditional rice cultivars *Rathel, Sudu samba, Kalu heenati, Mahakuru wee, Kotanavalu, Galpa wee, Yakada wee, Gonabaru, Muthumala* and *Seedeve*. There was a significant difference in between germination percentages of *Echinochloa crusgalli* (L.) seeds in soil samples collected from root zone of individual traditional rice cultivars and in the soil samples prepared with the leaf extracts of individual traditional rice cultivars. This condition has been revealed by Mubeen et al. (2011) where they used *T. portulacastrum* as a determinant for allelopathic effects.

However, there was a correlation in between seed germination of *Echinochloa crusgalli* (L.) in soil samples collected from root zone and seed germination of *Echinochloa crusgalli* (L.) in leaf extracts in soil mixture. This indicates that the pattern of allelopathic effect on seed germination of *Echinochloa crusgalli* (L.) in different rice cultivars are the same in root exudates and in leaf extracts though the amount of seed germination suppression is differed.

The results of the present study explain the effect of individual rice cultivar on weed density of the root zone and the effect of the same cultivars on seed germination of *Echinochloa crusgalli* (L.) in two different allelopathic exudates; from roots and leaf extract. Allelopathic potential of root exudates on seed germination of *Echinochloa crusgalli* was maxima in traditional rice cultivars *Murunga, Ran ruwan, Mudaliwi, Kirikara, Kahata Samba Molligoda Kalukanda* and *Sivuru wee* while allelopathic potential of leaf extract was maxima in rice cultivars *Rathel, Sudu samba, Kalu heenati, Mahakuru wee, Kotanavalu, Galpa wee, Yakada wee, Gonabaru, Muthumala* and *Seedeve*. These rice cultivars can be in cooperated in rice farming systems to reduce the usage of synthetic chemicals for weed management.

Still many factors must be taken in to account to eliminate environmental effect of the experiment such as type of weeds localized within a rice cultivar, irrigation methodology, season of cultivation and physiology of *Echinochloa crusgalli* (L.) seeds in the time of seeding those can affect on *Echinochloa crusgalli* (L.) seed germination other than that of allelopathy. More complex experimental procedures must be implemented for dissection of the total variation of allelopathy on weeds after exclusion of these factors.

ACKNOWLEDGMENT

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Synthesis, Characterization and Antimicrobial Studies of a Chiral Compound and its Metal Complexes

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Abstract- A chiral Mannich base, [1-(piperidin-1-yl)(thiophen-2-yl)methyl] thiourea (TPPTU) was prepared by treating thiophene-2-carbaldehyde piperidine and thiourea. Using TPPTU as a ligand, metal complexes of Mn(II), Co(II), Ni(II), Cu(II) and Zn(II) were prepared. Both the compound and complexes were characterized by physical methods such as elemental analysis, melting point and TLC and spectral methods such as IR, UV –Visible, ¹H NMR, ¹³C NMR and Mass spectral studies. For the complexes, molar conductivity, magnetic susceptibility and thermal studies were also been carried out. In vitro antimicrobial study was carried out for both the compound and complexes.

Index Terms- Mannich base complexes, Thiophene-2-aldehyde, Piperidine, Antimicrobial studies

I. INTRODUCTION

The compounds containing amide moieties such as urea, thiourea, nicotinic acid hydrazide, semi- and thiosemicarbazide and their derivatives have been investigated extensively due to their rapid coordinating tendencies [1- 7]. These ligands exhibit different tendency for coordination. It may take place through carbonyl oxygen in the case of urea and thionylsulphur in the case of thiourea. In both the cases possibility of coordination may through nitrogen atom of NH₂. Urea and Thiourea were highly exploited in the synthesis of Schiff bases because they easily undergo condensation reaction. During the recent years much work has been carried out in the metal complexes of Mannich bases. The study of Mannich reaction attracted the chemist owing to their wide range of pharmaceutical and industrial applications [8 - 12]. It has been reported that many Mannich compounds possess properties such as anti-bacterial, anti-fungal, anti-tumor, anti-convulsant, anti-inflammatory, anti-malarial, anti-biotic, anti-viral, anti-cancer, and anti-leishmanial. Mannich bases are also used as analgesic, cytotoxic, oxytocic, anti-psychotic, diuretic, centrally active muscle relaxant and tranquilizer. It exhibit complexation characteristic with many transition metal ions. Mannich base is a three component system obtained by reacting an aldehyde/ketone, a primary/secondary amine and a compound containing active hydrogen atom as substrate. Enormous research papers have been appeared in the literature for the synthesis of Mannich bases using formaldehyde. Although formaldehyde is usually used in the Mannich synthesis, the higher aldehydes such as succinaldehyde, benzaldehyde, acetaldehyde, anisaldehyde and their substituted products etc., are also reported. Mohamed

kassim et al., have reported the synthesis and characterization of metal complexes of N-(1-piperidinobenzyl)acetamide and N-(1-morpholinobenzyl)acetamide [M = Mn^{II}, Co^{II}, Ni^{II} and Cu^{II}]. In all the complexes, the ligand chelation occurs through its carbonyl oxygen and nitrogen atom of piperidine [13]. N-(1-piperidino(4-nitrobenzyl))acetamide and its metal complexes [M = Mn^{II}, Co^{II}, Ni^{II} and Cu^{II}] have been prepared and characterized. This study shows that the ligand forms complexes with metals through oxygen atom of carbonyl and nitrogen atom of piperidine [14]. N Raman et al., have synthesized and characterized metal complexes of Mannich bases [15,16]. Metal complexes of Mannich bases derived from urea as a substrate have been synthesized and characterized by [13, 17]. A Jameel et al., have synthesized and characterized Mannich bases using heteroaldehyde such as furan-2-carbaldehyde, thiophene-2-carbaldehyde and pyridine-2-carbaldehyde [5-6]. From the literature survey it is clearly revealed that for the synthesis of Mannich bases, aldehydes like formaldehyde, benzaldehyde, substituted benzaldehyde have been used along with secondary amines such as morpholine, piperidine and piperazine etc., and a compound containing an active hydrogen atom like alkyl ketones, phenols, carboxylic acid derivatives, heterocyclic compounds, alkynes and amides. This has been observed from the literature that a limited number of research works have been carried out in the synthesis of Mannich bases utilizing thiophene-2-carbaldehyde as a component. Now a day's tremendous investigation are going on for developing new drugs using heterocyclic derivatives. Heterocyclic compounds such as pyrrole, furan & thiophene derivatives show diverse pharmacological activities [18]. Thiophene nucleus has been established as the potential entity in the largely growing chemical world of heterocyclic compounds possessing promising pharmacological characteristics. The similar compounds synthesized through different routes bear variable magnitudes of biological activities. The knowledge of various synthetic pathways and the diverse physicochemical parameters of such compounds draw the special attention of medicinal chemists to produce combinatorial library and carry out exhaustive efforts in the search of lead molecules. Based on the above mentioned importance of heterocyclic compounds, nitrogen and oxygen containing compounds and their metal complexes, the present study provides a synthesis, characterization and biological studies of a Mannich base having thiophene nucleus and its metal complexes.

II. MATERIALS AND METHODS

2.1. Reactants

All the reactants and solvents used were of analytical grade and commercially available. All the solvents were dried before use by the literature methods and moisture was excluded from the glass apparatus using CaCl_2 drying tube. Urea, piperidine and thiophene-2-carbaldehyde were purchased from Merck Products and metal salts were used as received.

2.2. Measurements

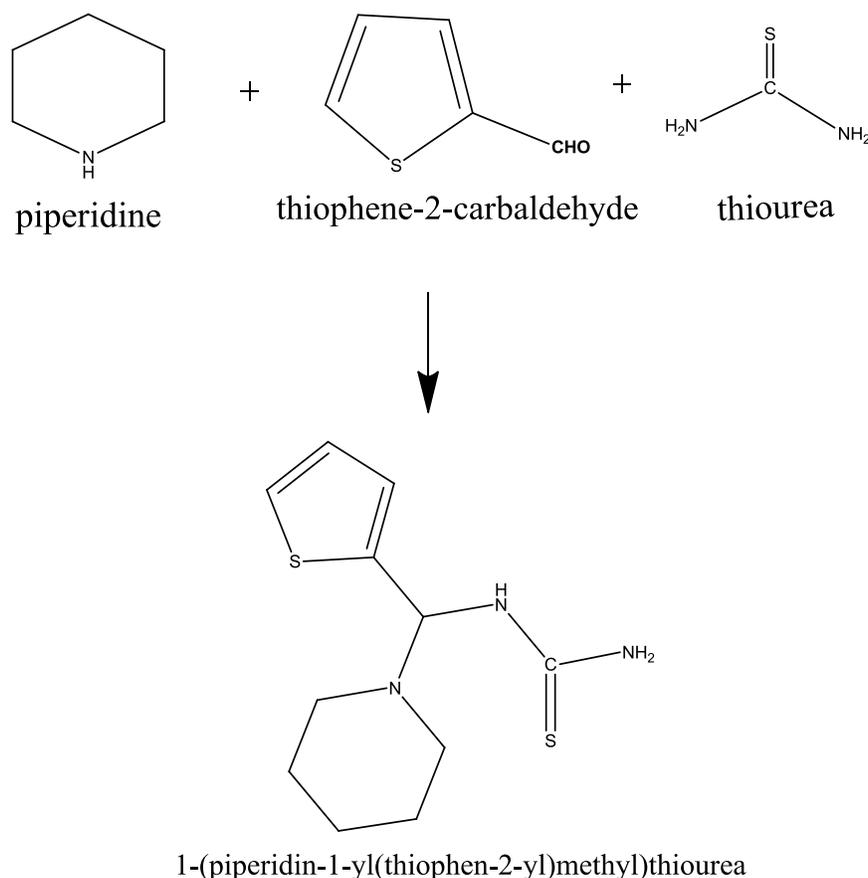
The melting point of the compounds were determined in open capillary tubes and are uncorrected the purity of the compounds was checked by TLC using silica gel G coated glass plate with methanol and ethyl acetate 1:1 as irrigant and iodine vapour as visualizing agent. The IR spectra were recorded on Shimadzu FT-IR affinity 1 using KBr pellets. The absorption in the UV-Vis region was recorded by a Perkin Elmer Lambda 35 Spectrophotometer using DMSO as solvents. ^1H NMR and ^{13}C NMR spectra were recorded on 300 MHz Shimadzu spectrometer

using DMSO-d_6 as solvent and TMS as an internal standard. Elemental analyses were carried out on a Perkin - Elmer series C, H, N & S analyzer 2000. Molar conductivity in DMF at room temperature was measured by Elico conductivity bridge type CM 82 T having conductivity cell with the cell constant 1.00 using 10^{-3} M solution of complexes. Magnetic measurements at room temperature were carried out by Gauoy's method.

2.3. Experimental

2.3.1 Synthesis of Mannich base

Thiophene-2-carbaldehyde, Piperidine and thiourea were taken in 1:1:1 ratio and reacted as shown in the Scheme – 1. 7.6 g (0.1 mole) of thiourea was taken in a round bottom flask and 10 mL of water was added. To this solution 9.8 mL (0.1 mole) of piperidine was added and stirred well for 15 min by keeping the reaction mixture on a magnetic stirrer. 9.2 mL (0.1 mole) of thiophene-2-carbaldehyde was added to the above mixture and stirring was continued under ice cold condition. The compound formed was filtered, washed and recrystallized using ethanol.



Scheme 1. Synthesis of 1-(piperidine-1-yl(thiophene-2-yl)methyl)thiourea

Preparation of Metal Complexes

The complexes were prepared by mixing the methanolic solution of the corresponding metal chlorides [Mn(II), Co(II), Ni(II), Cu(II) and Zn(II)] (0.1M) to the methanolic solution of the ligand in the mole ratio 1:2 respectively. The reaction mixture was refluxed on a water bath for 2 h. On cooling

solid obtained was filtered, washed with methanol and chloroform mixture and dried over anhydrous CaCl_2 in desiccators. The analytical data of the ligand and complexes are presented in Table – 1

Table – 1 ANALYTICAL DATA OF TPPTU AND ITS COMPLEXES

Compounds / Colour	M P ⁰ C / dec	Found (%) (Calculated)						$\lambda_m \Omega^{-1} \text{ cm}^2 \text{ mol}^{-1}$	μ_{eff} BM
		C	H	N	S	Cl	M		
TPPTU (Colourless)	130	51.70 (51.73)	6.69 (6.71)	16.42 (16.45)	25.09 (25.11)	---	----	----	----
Mn(TPPTU) ₂ (H ₂ O) ₂]Cl ₂ (Greenish yellow)	420-440	39.20 (39.28)	5.58 (5.69)	12.38 (12.49)	18.99 (19.07)	10.48 (10.54)	8.02 (8.17)	128.3	5.86
[Co(TPPTU) ₂ (H ₂ O) ₂]Cl ₂ (Greenish brown)	510-530	39.12 (39.05)	5.58 (5.66)	12.40 (12.42)	18.89 (18.95)	10.40 (10.48)	8.68 (8.71)	112.4	4.54
[Ni(TPPTU) ₂ (H ₂ O) ₂]Cl ₂ (Green)	450-480	38.98 (39.06)	5.60 (5.66)	12.37 (12.42)	18.92 (18.96)	10.39 (10.48)	8.60 (8.68)	132.2	3.82
[Cu(TPPTU) ₂ (H ₂ O) ₂]Cl ₂ (Dark green)	415-425	38.70 (38.78)	5.59 (5.62)	12.28 (12.34)	18.80 (18.83)	10.39 (10.41)	9.30 (9.33)	118.6	1.75
[Zn(TPPTU) ₂ (H ₂ O) ₂]Cl ₂ (colourless)	520-535	38.60 (38.68)	5.59 (5.61)	12.28 (12.30)	18.70 (18.78)	10.29 (10.38)	9.50 (9.57)	128.6	----

Antibacterial Activity

To study the antimicrobial activity, nutrient agar was used as a medium. This was prepared by dissolving 5 g of yeast extract, 10 g meat extract, 5 g of peptone, 5 g of NaCl and 20 g agar in 100 mL of distilled water in a clean conical flask and the pH was maintained at 7. The solution was boiled to dissolve the medium completely and sterilized by autoclaving at 7 kg pressure (121⁰C) for 15 minutes, after sterilization 20 mL media poured into the sterilized petri plates. These petri plates were kept at room temperature for some time, after a few minutes, the medium gets solidifies in plate. Then this was inoculated for 12 h. after the incubation, which was inoculated with microorganisms, using simple swabs. All these manipulation were carried out with atmospheric air under aseptic condition.

Antifungal activity

The potato dextrose agar PDA was used as a medium for antifungal activity, the nutrient agar was prepared by dissolving

20 g of potato extract, 20 g of agar and 20 g of dextrose in one liter of distilled water in a clean conical flask. The solution was boiled to dissolve the media completely and sterilized by autoclaving with 7 kg pressure (121⁰C) for 30 minutes, after the strelization 20 mL media was poured in to the sterilized petri plates. These plates were kept at room temperature for some time. After a few minutes, the medium get solidifies in plate. DMSO (0.5 mL) was used as solvent and clotrimazole (10 mg\disk) as control, in a typical procedure, a well made on the agar medium was inoculate with microorganism and it was filled with test solution using a micro pipette (50 mL) and the plate was incubated at 35⁰C for 72 hr. During this period the test solution diffuses and affects the growth of the inoculated microorganism. A zone was developed on the plate and the inhibition zone was measured by measuring the diameter of inhibited zone in mm, and the values are presented in the Table – 2.

Table – 2 ANTIMICROBIAL DATA OF TPPTU AND ITS COMPLEXES

Compounds	DMSO Extract added and Zone of inhibition 100 µl (mm/ml)		
	<i>Staphylococcus aureus</i>	<i>E.coli</i>	<i>A.niger</i>
TPPTU	10	10	10
[Mn(TPPTU) ₂ (H ₂ O) ₂]Cl ₂	25	20	10
[Co(TPPTU) ₂ (H ₂ O) ₂]Cl ₂	15	15	12
[Ni(TPPTU) ₂ (H ₂ O) ₂]Cl ₂	10	25	14
[Cu(TPPTU) ₂ (H ₂ O) ₂]Cl ₂	30	22	11
[Zn(TPPTU) ₂ (H ₂ O) ₂]Cl ₂	18	16	11
DMSO	-	-	-
STANDARD	30	25	10

III. RESULTS AND DISCUSSION

3.1 [1-(piperidin-1-yl(thiophen-2-yl)methyl)] thiourea (TPPTU) (a)

IR (KBr, cm⁻¹) 3444 (-NH Symm.str), 2950(CH Aromatic.str), 1645(N-H bending), 1150(C=S), 1103(C-N-C). **¹H NMR (500 MHz, CDCl₃ δ ppm)** 10.07 (s, 2H, NH₂), 7.79-7.20 (m, 3H, Ar-H), 5.45 (s, 1H, methine) 3.89 (s,1H, NH-(CO)), 2.80-2.30(m, 8H, piperidine). **¹³C NMR (100 MHz, CDCl₃ δ ppm).** 183(C =S), 144 142, 135 & 128 (Thiophene ring), 85 (C-H), 50, 47, 27, 26, & 24 (piperidine), MS(EI) m/z: (%) 255, (M⁺ +1) 256.14, 240, 185, 66

Characterization of complexes

Physical and analytical data of the complexes are presented in Table - 1. Molar conductivity values indicate the electrolytic nature of all the complexes.

IR spectra

The IR spectral data of the ligand and its metal complexes are presented in Table – 3, and the spectra are shown in fig 1. The IR

spectrum of ligand was compared with the IR spectra of the complexes to identify the coordination sites of the ligand. The IR spectrum of ligand showed a characteristic sharp band at 3412 cm⁻¹ and 1645 cm⁻¹ can be attributed to the ν (NH) stretching and bending ν (C=N) (amide II) observed, In the spectra of the complexes ν (C=S) mode of the free ligand is not absorbed indicating the enolisation of C=S followed by deprotonation. The ν (C=N) mode of the ligand appeared at 1645 cm⁻¹ in the spectrum of the ligand has been found shifted to lower wave numbers in the spectra of the complexes indicate the involvement of nitrogen atom of the azomethane in binding with the metal ion. The band appeared at 1150 cm⁻¹ due to ν(C-S-C) of thiophene moiety of the ligand has been shifted to lower frequency by 20 – 30 cm⁻¹ in the spectrum of each complex corroborating the coordination of sulphur atom of thiophene with the metal ion. The stretching ν(NH) of the ligand is not much altered in the spectra of the complexes indicate the non participation of nitrogen atom of NH₂. Hence it is concluded that the compound TPPTU act as a neutral bidentate ligand. Further all the complexes exhibits bands around 680 – 640 and 573 – 528 cm⁻¹ which are assignable to ν (M – N) and ν (M – S) respectively.

Table – 3 IR - SPECTRAL DATA OF TPPTU AND ITS COMPLEXES

Compounds	$\nu(NH)$	$\nu(CH)$	$\nu(C=N)$	$\nu(C-S-C)$	$\nu(M-S)$	$\nu(M-N)$
TPPTU	3412	2950	1645	1150	-----	----
[Mn(TPPTU) ₂ (H ₂ O) ₂]Cl ₂	3409	2950	1630	1131	513	683
[Co(TPPTU) ₂ (H ₂ O) ₂]Cl ₂	3418	2846	1615	1135	543	686
[Ni(TPPTU) ₂ (H ₂ O) ₂]Cl ₂	3411	2914	1600	1136	583	642
[Cu(TPPTU) ₂ (H ₂ O) ₂]Cl ₂	3416	2904	1604	1137	528	642
[Zn(TPPTU) ₂ (H ₂ O) ₂]Cl ₂	3405	2811	1604	1134	552	652

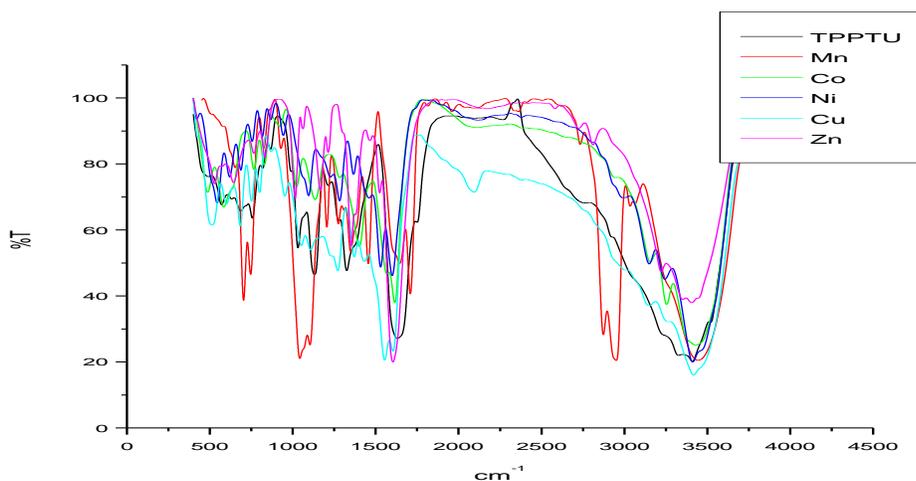


Fig : 1 IR spectra of ligand and complexes

UV – visible spectra

The electronic spectra of the ligand and its complexes were recorded in DMSO solution, the results are shown in Table - 5 and the spectra are shown in the fig 2. The electronic spectrum of Mn (II) complex gives two distinct transitions at 24271 cm⁻¹ and 19271 cm⁻¹ which are assignable to 6A_{1g}→4E_g and 6A_{1g}→4T_{1g} transitions respectively, which are typical of Mn(II) complexes with an octahedral coordination geometry[19]. For Co (II) complex, two distinct bands appeared at 26,455 cm⁻¹ and 15,510 cm⁻¹ are assignable to 4T_{1g} → 4T_{1g} (P) and 4T_{1g} → 4A_{2g} transitions respectively. These absorptions favor octahedral geometry. The electronic spectrum of Ni (II) complex display

two moderately intense bands with maxima centered in the region 12,432 – 12,875 cm⁻¹ and 27,397 cm⁻¹. Which are assignable to 3A_{2g} → 3T_{1g} and 3A_{2g} → 3T_{1g} (P) transitions. These transitions suggesting octahedral geometry. The electronic spectrum of Cu (II) complex exhibit three bands in the region 11,450 – 16400 cm⁻¹, 18,250 cm⁻¹ and 22,222 cm⁻¹ corresponding to 2B_{1g} → 2A_{1g}, 2B_{1g} → 2B_{2g} and 2B_{1g} → 2E_g respectively which are in good agreement with the distorted octahedral geometry. The Zn (II) complex is diamagnetic and the electronic spectrum of the complex is dominated only by ligand bands.

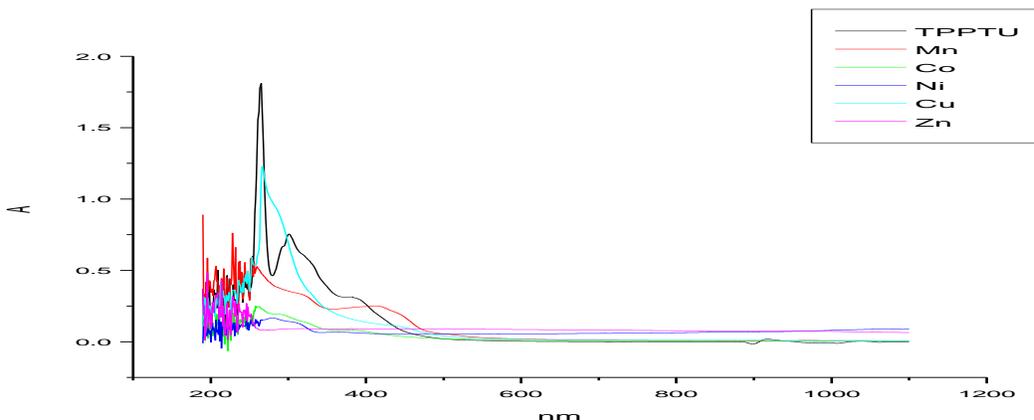


Fig: 2 UV spectra of ligand and complexes

¹H NMR Spectra

¹H NMR Spectra of the ligand and its zinc complex were recorded in CDCl₃ solution and the spectra are shown in fig 3. The ligand showed a singlet at δ 10.07 is assigned to NH₂ of thiourea moiety. A multiplet between δ 6.80 –7.76 is due to aromatic proton. A singlet appeared at δ 3.89 is assigned to methine proton. A multiplet at δ 2.80 – 1.60 is assigned to N – CH₂ and CH₂ protons of piperidine. A singlet appeared at δ 1.50

is attributed to –N = C – SH proton. In the spectra of the complex the multiplet δ 6.80 –7.76 is shifted to downfield confirms the participations of sulphur atom of thiophene. The signal due to SH proton of the ligand has been found shifted to downfield corroborating the involvement of nitrogen atom of azomethine. The signal appeared at δ 10.07 in the ligand is present in the complex also indicating the non involvement of nitrogen atom of the terminal NH₂ in complex formation.

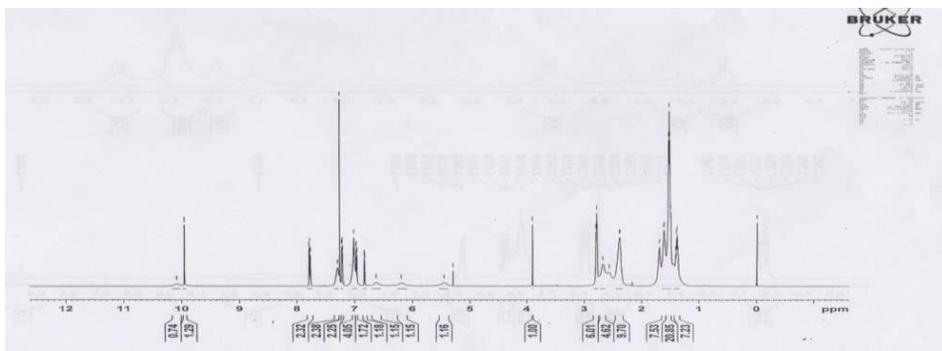


Fig : 3 ¹H NMR Spectrum of TPPTU.

¹³C NMR spectra

¹³C NMR spectrum of TPPTU is shown in the figure. The spectrum showed signals at 25.07, 25.31, 25.43, 49.87 and 50.38 are assigned to 2,3,4,1 and 1' respectively. A signal appeared at

85.02 is due to methine carbon(C - 9). The signals appeared at 124.05, 125.62, 125.77 and 135.15 are assigned to C - 6, 7, 5 and 8 respectively. A signal appeared at 183.00 is assigned to azomethine carbon (C - 10).

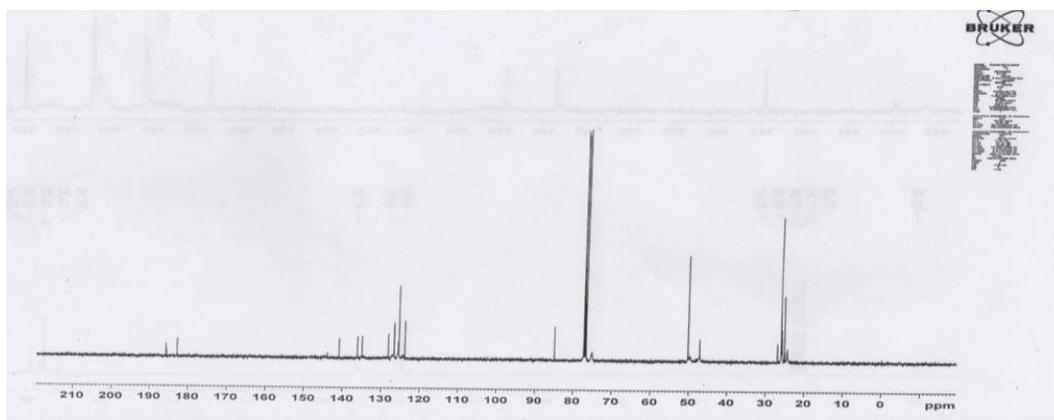


Fig – 4 ¹³C NMR spectrum of TPPTU

Based on the above data, the following structure has been proposed for the metal complexes.

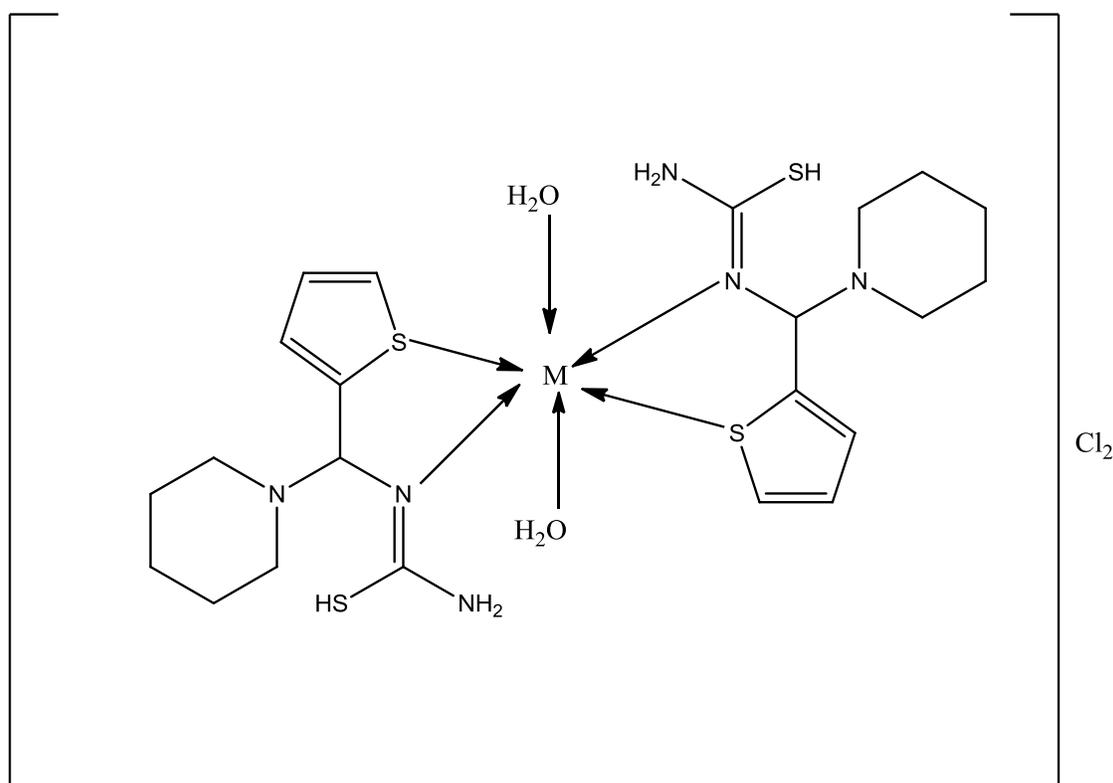


Fig: 5 General structure of the complexes

Antimicrobial studies

The ligand and complexes were screened for their invitro antibacterial and antifungal activities by disc diffusion method. The activities were done at 100 µg/mL concentration DMSO solvent using *S. aureus*, *E.coli* and *A.niger*. The standard drugs used are Gentamycin for bacteria and Amphotericin - P for fungi. The minimum inhibitory concentration (MIC) values are presented in the Table -2. The comparison of activity of the ligand and the complexes is given in the fig 1. From the table - 2 it has been observed that Cu (II) complex posses equivalent activity against *S.aureus* and moderate activity against *E.coli*

when compared with their standards. Ni(II) complex posses equivalent activity against *E.coli* and highest activity against *A.niger*. In general complexes possess more activity than the free ligand, the is may be explained on the basis of Overtone's concept of cell permeability, the ligand membrane that surrounds the cell favours the passage of only lipid – soluble materials which control the antimicrobial activity. On chelation, the polarity of the metal ion reduces considerably. This is due to overlap of the ligand orbital and the partial sharing of the positive charge of the metal ion with donor groups. Further it increases the delocalization of π electrons over the whole chelate

ring and enhances the lipophilic character of the metal complexes. This increased lipophilicity leads to breakdown of permeability barrier and permits the complexes to penetrate in to the lipid membrane.

IV. CONCLUSION

In summary, five complexes have been prepared using Mannich base, [1-(piperidin-1-yl(thiophen-2-yl)methyl)] thiourea (TPPTU) and characterized by physical and spectral methods. The metal ions were coordinated through the sulphur atom of thiophene and the nitrogen of the azomethine group. The binding of ligand to metal ions was confirmed by the analytical data, as well as spectral and magnetic studies. For all the complexes octahedral geometry have been proposed based on the analytical and spectra data. Some metal complexes were found to possess higher antibacterial and antifungal activities and some were moderate activities than the ligand.

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A New Soft Switching ZCS and ZVS High Frequency Boost Converter with an HI-Bridge Auxiliary Resonant Circuit to Drive a BLDC Motor

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Abstract- This paper presents a novel low-cost, highly efficient, reliable and compact motor drive topology for residential and commercial application. The Brushless DC (BLDC) motor is a simple robust machine which has found application over a wide power and speed of ranges in different shapes and geometry. This paper briefly reviews the fundamentals behind the motor and also the different types of BLDC motors with different geometries and then presents a new configuration for BLDC motor/generator, which does not use a permanent magnet in the rotor. A new soft-switching boost converter is proposed in this paper. The conventional boost converter generates switching losses at turn ON and OFF, and this causes a reduction in the whole system's efficiency. The proposed boost converter utilizes a soft-switching method using an auxiliary circuit with a resonant inductor and capacitor, auxiliary switch, and diodes. Therefore, the proposed soft-switching boost converter reduces switching losses more than the conventional hard-switching converter. The efficiency, which is about 91% in hard switching, increases to about 96% in the proposed soft-switching converter. In this paper, the performance of the proposed soft-switching boost converter is verified through the theoretical analysis, simulation, and experimental results.

Index Terms- Hybrid BLDC Motor, Auxiliary resonant circuit, boost converter, soft-switching boost converter, zero-current switching (ZCS), zero-voltage switching (ZVS).

In a conventional boost converter, the duty ratio increases as the output to input voltage ratio increases. But applications like HEV and EV require high step-up ratio and high efficiency power conversion. In such applications it becomes a major challenge to maintain high efficiency using conventional boost converter due to the required large duty ratio. For the high output voltage, the boost switch has to block a large voltage. At the same time for high power application like electric vehicle, the low input voltage causes large input current too low. Also with low duty cycle operation the rms ripple current through the boost converter diode and output capacitor becomes very high. These increase the losses enormously.

A new soft-switching boost converter with an auxiliary switch and resonant circuit is proposed in this paper. The resonant circuit consists of a resonant inductor, two resonant capacitors, two diodes, and an auxiliary switch. The resonant capacitor is discharged before the main switch is turned ON and the current flows through the body diode. These resonant components make a partial resonant path for the main switch to perform soft switching under the zero-voltage condition using the resonant circuit. Compared with other soft-switching converters, the proposed converter improves the whole system's efficiency by reducing switching losses better than other converters at the same frequency. The efficiency is improved due to reduction in switching losses. MATLAB simulations are performed to verify the theoretical analysis.

I. INTRODUCTION

This paper discusses about the usage of Soft Switching Boost Converter to power up the vehicle or BLDC Motor. In order to achieve the required voltage, the Soft Switching Boost Converter are boost the power and voltage at the desire level. Thus to make it cost effective; power converters and batteries are been used. The electrical charge is consolidated from the PV panel and directed to the output terminals to produce low voltage (Direct Current). The charge controllers direct this power acquired from the solar panel to the batteries. According to the state of the battery, the charging is done, so as to avoid overcharging and deep discharge. The voltage is then boosted up using the boost power converter, ultimately running the BLDC motor which is used as the drive motor for our vehicle application. In the course work, the characteristic features of the components; input dc either solar PV, battery, power Boost converter and BLDC motor required for the vehicle application were studied in real time and also were modelled.

II. OVERVIEW OF BLDC MOTOR

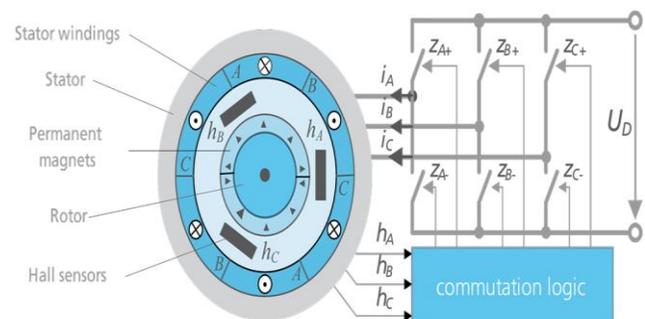


Fig-1. Input inverting stage of BLDC motor.

The control of PMLDC motors can be accomplished by various control techniques using conventional six pulse inverters which can be classified in two broad categories as voltage source

inverter (VSI) and current source inverter (CSI) based topologies. The controllers can further be divided on the basis of solid state switches and control strategies. The BLDCM needs rotor-position sensing only at the commutation points, e.g., every 60° electrical in the three-phases; therefore, a comparatively simple controller is required for commutation and current control. The commutation sequence is generated by the controller according to the rotor position which is sensed using Hall sensors, resolvers or optical encoders. These sensors increase the cost and the size of the motor and a special mechanical arrangement is required for mounting the sensors.

The components are DC-AC inverter, DC-DC converter, battery, and electric BLDC motor. DC-AC inverters supply voltage to the electric motor from the battery and also supply utility loads such as air conditioning and AC power outlet. DC-DC converters supply voltage to various vehicular loads set to operate at different voltages. In the near future, high power DC-DC converters will be needed for EVs since the vehicular power requirements are continuously increasing due to which the present day 12- V/14-V electrical system will be replaced by 42- V/300-V architecture. DC-DC converters are well developed for low and medium power applications, whereas development of highly efficient and cost effective high power DC-DC converters for vehicular applications is in continuous progress. This is partly due to the stringent Electromagnetic Interference (EMI) standards and also due to temperature related issues. The boost dc voltage is the input of the BLDC motor.

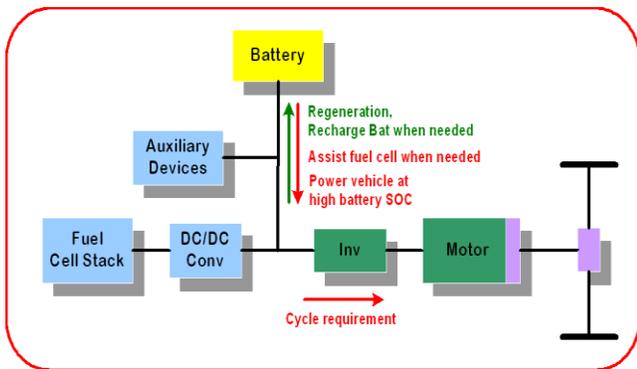


Fig-2. Driving process of high voltage BLDC motor.

III. HARD SWITCHING VS SOFT SWITCHING.

Recently, switch-mode power supplies have become smaller and lighter due to higher switching frequency. However, higher switching frequency causes lots of periodic losses at turn ON and turn OFF, resulting in increasing losses of whole system.

Semiconductors utilised in Static Power Converters operate in the switching mode to maximise efficiency. Switching frequencies vary from 50 Hz in a SCR based AC-DC Phase Angle Controller to over 1.0 MHz in a MOSFET based power supply. The switching or dynamic behaviour of Power Semiconductor devices thus attracts attention specially for the faster ones for a number of reasons: optimum drive, power dissipation, EMI/RFI issues and switching-aid- networks.

Present day fast converters operate at much higher switching frequencies chiefly to reduce weight and size of the filter components. As a consequence, switching losses now tend to predominate, causing the junction temperatures to rise. Special techniques are employed to obtain clean turn-on and turn-off of the devices. This, along with optimal control strategies and improved evacuation of the heat generated, permit utilisation of the devices with a minimum of deration.

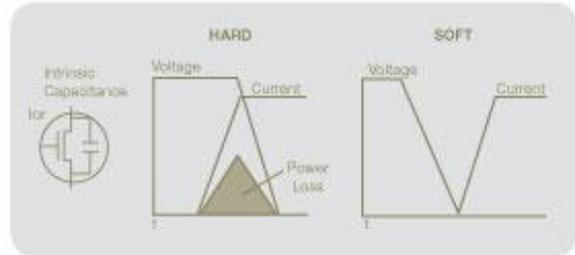


Fig-3. Hard and Soft Switching Waveform

IV. METHODS OF SOFT SWITCHING.

A. Design a High Frequency PWM Subsystem.

The carrier waveform used is Saw tooth waveform instead of Triangular waveform. When the reference value is more than the carrier waveform the output PWM signal is HIGH. The switching turn ON points is determined by the saw tooth waveform used.

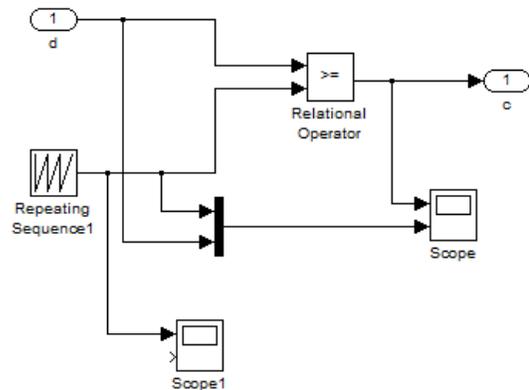


Fig-4. PWM subsystem.

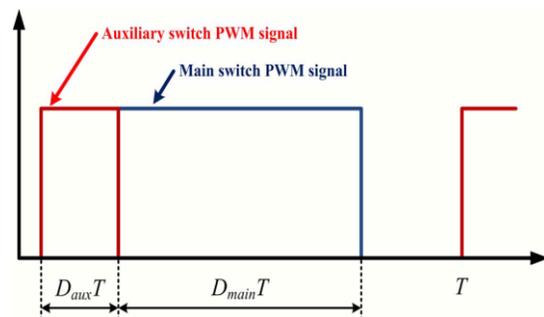


Fig-5. PWM signals of the main and auxiliary switch

The proposed Boost Converter has two switches namely main switch and auxiliary switch. The main switch has a duty ratio of 0.61 while that of auxiliary switch is 0.21. The main switch duty ratio determines the average output voltage. The function of auxiliary switch is to enable the main switch to operate soft switching. First the auxiliary switch is turned ON then the main switch is turned ON after some time delay. The resonant loop of the resonant inductor (Lr) and resonant capacitor (Cr) is completed by the turning ON of the auxiliary switch. By the help of resonance the auxiliary switch is made to operate at ZCS. As the snubber capacitor is discharged the current of the resonant loop flows through the anti-parallel diode of the main switch. By turning ON the main switch the ZVS is assured. As the resonant capacitor is fully discharged the auxiliary switch is turned OFF.

The PWM signal of the main switch is given some delay compared to auxiliary switch. The phase difference is obtained by delaying the carrier waveform. The main switch is turned ON while the auxiliary switch is still in the ON state.

B. Configuration of the proposed HI-Bridge Boost converter.

The proposed converter is shown in Fig. 6. The main switch (IGBT) and the auxiliary switch (IGBT1) of the proposed circuit enable soft switching through an auxiliary switching block, consisting of an auxiliary switch, two resonant capacitors (Cr and Cr2), a resonant inductor (Lr), and two diodes (D1 and D2).

The following assumptions are made

- 1) All switching devices and passive elements are ideal.
- 2) The input voltage (Vin) is constant.
- 3) The output voltage (Vo) is constant. (Output capacitor Co is large enough).
- 4) The recovery time of all diodes is ignored.

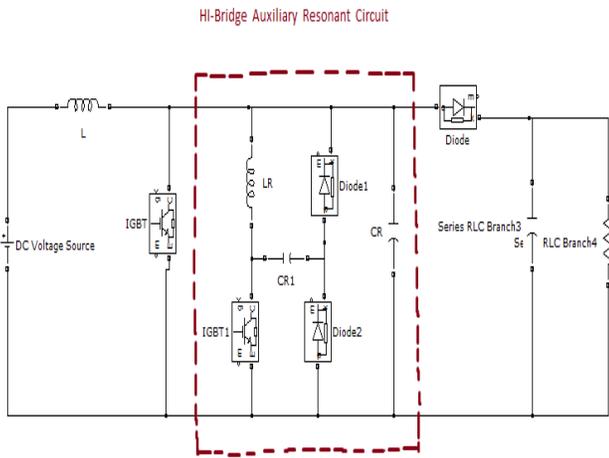


Fig-6. Schematic of the proposed soft-switching boost converter.

The main switch and auxiliary switch.

There are two switches in this paper. One is the main switch deal with a duty ratio and the other one is the auxiliary switch enables the main switch to operate with a soft switching. The

carrier, reference and pulse width modulation(PWM) waveforms of the main switch and auxiliary switch are illustrated in Fig. 4. After the auxiliary switch is turned on, the main switch is turned on. If the auxiliary switch is turned on, the resonant loop of the resonant inductor(Lr) and resonant capacitor(Cr) is made. The auxiliary switch operates with ZCS using the resonance. The current of the resonant loop flows across the anti-parallel diode of the main switch after the snubber capacitor is discharged. Thus, ZVS area is guaranteed by turning on the auxiliary switch. A point the auxiliary switch is turned off is the time the energy of the resonant capacitor(Cr) is fully discharged. The main switch set a voltage gain. A transfer function of the proposed soft switching boost converter is same to the conventional boost converter and that is given by the equation (1) .

$$G_v = (V_{out}/V_{in}) = 1/(1-D) \quad \text{-----} \quad (1)$$

Where Gv is a voltage gain and D is a duty ratio. The PWM has to be made with a delay between the main switch and auxiliary switch. A phase difference can be obtained by delaying the carrier waveform. The main switch always has to be turned on during the auxiliary switch turns on. Points which switches turn on at have to be fixed to realize a soft switching without resonance failure. A Sawtooth waveform is used as a carrier waveform instead of a triangular one. If a reference value is upper than a carrier one, the PWM output signal becomes high. Thus, switching turn on points can be fixed by using the sawtooth waveform.

V. SIMULATION AND OUTPUT.

A. PWM subsystem output waveform.

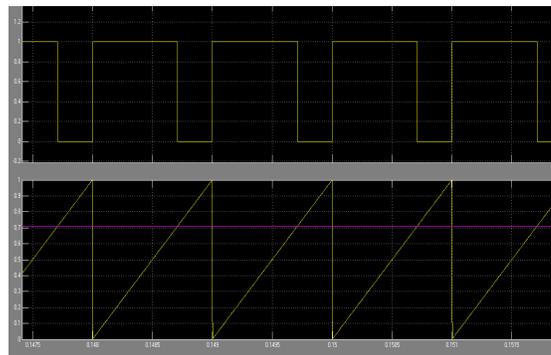
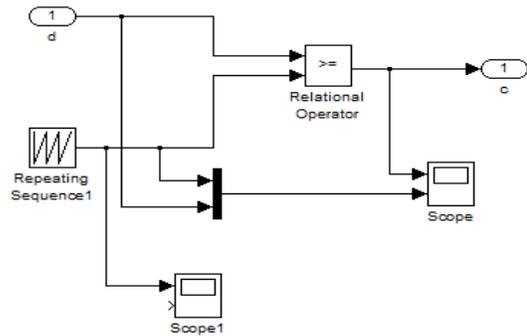


Fig-7. PWM subsystem and output waveform in MATLAB.

B. Simulation of HI-bridge soft-switching boost converter output waveform.

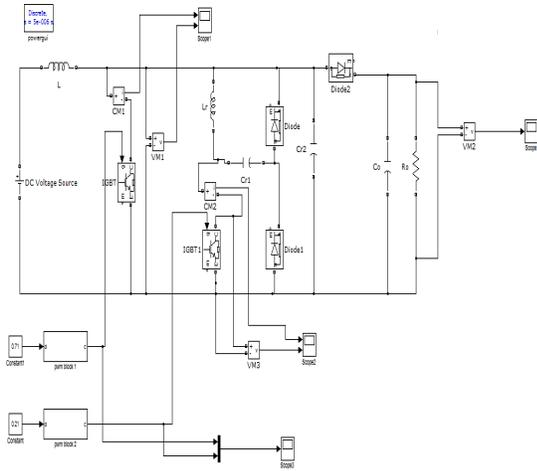


Fig-8. Simulink model of HI-bridge boost converter using auxiliary boost converter.

The above proposed boost converter with auxiliary resonant circuit is simulated in MATLAB-SIMULINK. The values of the circuit parameters are given below:

**TABLE-1
KEY DATA**

Parameters	Values
Input voltage (Vin)	130-170[V]
Output voltage (Vo)	400[V]
Switching Freq.(fsw)	30[KHz]
Resonant Cap. (Cr)	3.3[nF]
Resonant Cap. (Cr2)	30[nF]
Resonant Ind. (Lr)	20[μH]
Main Inductor (L1)	560[μH]

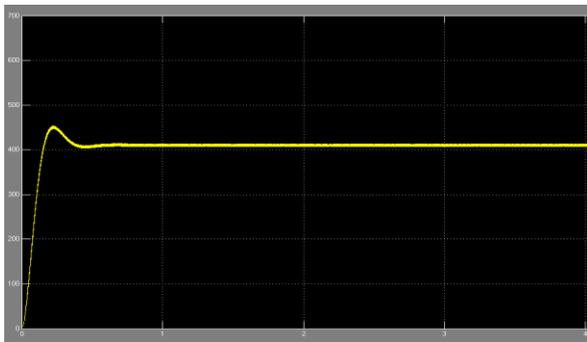


Fig-9. Output Voltage Vs Time Waveform.

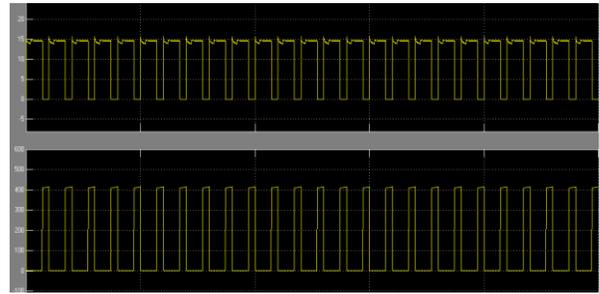


Fig-10. Main switch Current and Voltage

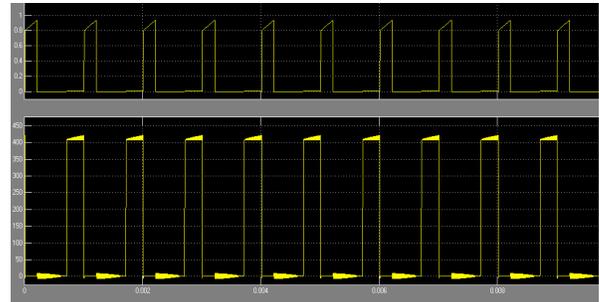


Fig-11. Auxiliary switch Current and Voltage

VI. DESIGN PROCEDURE

The following design procedure is based on the soft-switching turn-ON and turn-OFF requirements of the main switch, the main diode, and the auxiliary switch.

A. Resonant Capacitor (Cr)

The resonant capacitor (Cr) is selected to allow ZVS of the main switch. The charging time of the resonant capacitor (Cr) must be longer for ZVS of the main switch. Thus, for the resonant capacitor (Cr), it is more than ten times the output capacitance of the main switch.

Assume that the maximum current of the resonant inductor is I_{Lmax} , and the sum of the two inductor currents is the charging current of the resonant capacitor (Cr). In this case, the minimum resonant capacitor (Cr) is equal to 20 times the output capacitance of the main switch.

B. Parameters Design

$$D = 1 - (V_{in} (min) * \eta) / V_{out}$$

D= Duty Cycle.

$V_{in} (min)$ = Minimum input voltage.

V_{out} = Desired output voltage.

η = Efficiency of Converter

$$L = (V_{in} / \Delta I_L) * (V_{out} - V_{in}) * (1 / V_{out}) * (1 / f_s)$$

L = Inductance of main Inductor.

f_s = Switching frequency.

ΔI_L = Estimated Inductor ripple current.

$$\Delta I_L = (0.2 - 0.4) * I_{out} (max) * (V_{out} / V_{in}).$$

$I_{out} (max)$ = Maximum output current.

$$C_{out} (min) = (I_{out} (max) / f_s) * D / \Delta V_{out}.$$

$C_{out} (min)$ = Minimum output Capacitance.

VII. SIMULATION RESULTS

The simulation parameters are shown in Table II. This paper simulated the proposed converter by MATLAB software. The simulation was performed under a 30-kHz switching frequency and a 130~170-V input voltage. Figs. 10 and 11 show the simulation waveforms of the main and auxiliary switch voltage and current, respectively. Before the main switch is turned ON, the body diode is turned ON. As a result, the main switch enables zero-voltage switching and the auxiliary switch performs soft switching. The resonant capacitor (Cr2) is charged and discharged in the manner of a sine wave-form. At an input voltage of 130~170 V, the output voltage is adjusted to 400 V.

VIII. CONCLUSION

In this paper, a new soft-switching boost converter has been proposed that uses an auxiliary switch and resonant circuit. The main switch performs soft switching under the zero-voltage condition by using a resonant capacitor and inductor, as does the auxiliary switch. The efficiency, which is about 91% in hard switching, increases to about 96% in the proposed soft-switching converter.

A comparative study of CSI fed BLDC motor using Boost Converter are presented in this paper. Both the strategy significantly reduces the switching loss and cost thereby increasing the speed and efficiency of the BLDC motor drive system. The study is verified with the simulation results using MATLAB software. The results of the simulation model gives help in building hardware with expected results. The simulation saves time and manpower in making hardware models at initial stages and reduces the costing of research work.

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Strategies for Catchment Development Master Plan and Economic Aspects of Water Resource Planning

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Abstract- The economic aspects of water resource planning involve the evaluation so far, as practicable in monetary terms of the physical potentialities of the catchment for alternate courses of action involving types of uses, different configurations and sequences of development in time. Interpretation in terms of monetary values of the consequences of alternate courses of action, though most convenient way for comparison, is not always possible since extra market consequences, indirect benefits also become important influences in deciding the project acceptability. This is so because in a welfare economy, economic efficiency measured in terms of market value of what the economy produces is an imperfect measure of economic welfare. The measurement of benefits and costs of development programmes should extend beyond mere market values. This article deals with how these are to be addressed in terms of economic point of view and give some thoughtful contents as guidelines for the preparation of water resource catchment development master plan taking into account the needs of not only irrigated agriculture, but also the various other water uses so that the available water can be put to optimum use.

Index Terms- Catchment development, Economic rate of return, Irrigated agriculture, Master plan, Present value, Water resource development,

I. INTRODUCTION

Unlike other natural resources, water is a unique resource, which renews itself. It is due to its constant circulation in the ocean-atmosphere-earth-ocean system. No matter how much water is consumed in daily life, its amount seldom dwindles. With time and under certain conditions water regains its properties and becomes fit for reuse. This is probably the reason why water resources appear to be unlimited for a long time. The key consumer of fresh water is agriculture rather than industry. Irrigation of fields, orchards and estates claim almost 80% of the water consumed the world over. Unfortunately, 97.5% of all water resources on earth are salty. Consequently, fresh water including the one in glaciers accounts for only 2.5%. Even here the most accessible one is as little as 0.3%. More over the natural distribution is extremely uneven.

The demand for water is continuously on the increase with the growth of population, industry and agriculture. However, the total amount of available water remains more or less constant. This is bound to lead to scarcity of water, if not today, in the

foreseeable future. In order that such a scarcity does not occur and hamper the development of the country, it is very important to improve the efficiency of planning and management of our water resources economically.

In other words, a water resources plan, consistent with the overall economic, social and environmental policies of the country, is an important element to ensure that water resources contribute to the country's development objectives. Most development decisions today are multi-objective in nature, involving economic, social and environmental dimensions and values. However, until relatively recently, this fact was not seriously taken into consideration in planning for water resources development. Instead, economic development was considered to be a desirable end in itself, often with little regard to adverse effects on social or cultural systems and the natural environment. As the pace of economic development increases these effects can no longer be ignored.

In water resource planning, the normal questions that the planner is asked to answer through economic analysis are

- Which are the projects to be taken up?
- What are their scales of development?
- When are they to be commissioned?

The study involves the analysis of individual projects as well as the sub-catchment or system as a whole. In normal commercial practice, a rigorous financial analysis provides the answer. But, in the case of water resource which is a public good, the question of equity and other considerations makes the financial analysis an insufficient procedure. A broader economic benefit-cost analysis serves as more suitable criteria.

Without any doubt, conditions in the basin will change even if no planned development programmes are implemented. Therefore, the economic evaluation requires that the comparison be made between events predicted to occur if the development programmes are implemented and those predicted to occur if the planned programmes are not implemented. This is the with-and-without principle which should be preferred for adoption for project/catchment evaluation.

II. ECONOMIC PERFORMANCE INDICES

The following four methods or indices that are considered conceptually correct for comparing alternatives.

- The present worth method
- The rate of return method

- The benefit-cost ratio method
- The annual cost method.

However each method is having its own merits and demerits. Every method are very briefly and simply defined below

- The present worth method selects the project or alternative with the largest present worth of the discounted algebraic sum of benefits minus costs over its life.
- The rate of return is the rate of discount at which the algebraic sum of present worth of benefits minus costs equals zero. Alternatives having a rate of return exceeding the minimum acceptable value may be chosen.
- Benefit-cost ratio is the ratio of present worth of benefits to present worth of costs and the ratio should exceed unity.
- In annual cost method, benefits and costs are converted into a uniform annual figures and the alternative with the greatest annual net benefit is chosen.

Various study groups time to time used various methods for their studies. During 1960s benefit-cost ratio method was popularly used for assessing the feasibility of new projects. For simplicity they had also recommended that indirect or secondary benefits need not be considered. Later in 1964, some economists suggested that the economic benefit criteria should be adopted for approving irrigation projects and since then benefit-cost ratio criterion is being adopted for project appraisal. But the continued use of benefit-cost ratio is also in practices now a day. The World Bank uses internal rate of return criteria which is considered more suitable as a basis for making a choice between two investments and where financial return is the dominant consideration. The criteria that is followed at present is that the benefit cost ratio should equal or exceed 1.5 in normal case and should equal or exceed 1.0 in case of chronically drought prone areas.

III. BENEFITS AND COSTS

In the most general sense, benefits are the measure of effectiveness of a set of actions in achieving the set goals. The most convenient way to measure the benefits is in terms of market value of goods and services produced, but there are benefits which are not amenable to such measurements. Some benefits are correctly registered in markets such as the income from freely marketable crops. Some benefits are incorrectly registered by market prices as in the case of some food grains whose prices are controlled by Government. Some benefits are not registered in markets, but simulated market values can be obtained and for some others it is nearly impossible to think of any kind of market valuation. Examples of these two types are benefits from recreation in public parks and the value of beneficial landscape respectively. Thus benefits are not synonymous with monetary revenues.

Benefits should be measured without regard to whom these accrue. Thus, primary or direct as well as secondary or indirect

benefits are important. For simplicity, only primary benefits are usually evaluated, even though a study of secondary benefits is desirable to see whether they are significant and worth evaluating.

The most convenient way of assigning numerical benefits is to determine the market value of the output it produces. To have uniformity, the transportation costs should be deducted from the ultimate market prices to get the price at the point of production. If the production is expected to be very large relative to the current production, probably it may affect market prices. This should be considered in the analysis of benefits. The only way to do this is to evaluate the demand function for commodities in question considering pre-project and post-project conditions. Where market prices are distorted through Government subsidies, this should also be taken into account.

In cases where markets in the usual sense do not exist and therefore, the willingness to pay as a measure of social value or benefit cannot be evaluated, simulation of market prices can be resorted to. Examples are recreation, flood protection etc. Flood control benefits are calculated as the value of damage prevented on the assumption that the occupants of the flood plain may be willing to pay any price up to their potential damage in the absence of the scheme. In the case of recreation various methods are suggested to simulate the situation.

Alternate cost approach is another method of evaluating benefits where market prices are not true reflection of willingness to pay. A common case is the evaluation of benefits of hydropower projects. The alternative chosen should be the most economical and likely choice that would be adopted in the absence of the project under study. However, this method should be cautiously used as this presumes that a decision has already been made to achieve the objective by some means regardless of cost. Cost of a single purpose project when compared with the benefit from a component of a multipurpose project may distort the reality due to economy of scale and should be guarded against such mistakes.

In the most general sense, the cost of some particular commitment of resource may be defined as the benefits given up in the most productive alternate use of those resources. Thus costs are not to be equated to cash outflows alone. A very cheap development in terms of cash investment may cause very deleterious conditions at a downstream point. Therefore, in cost analysis, apart from monetary costs which are primary project costs, indirect or secondary costs as well as intangible costs should be taken into account. As in the case of benefits, only the direct project costs are considered for simplicity. However, a study of those secondary effects of projects which may reflect as a project cost ultimately should be analyzed and provided for.

The benefits and costs of projects occur over a period of time. Clearly, the value of a unit output accruing after ten years is not the same as that occurring at present. This necessitates the consideration of time value of benefits and costs. They must first be put on a common time base and discounted using suitable interest rate to a point in time, usually the present time or the

time at which decision is taken. The rate of interest should reflect the degree of preferences for an early realization of benefit from the project from the point of view of society. The selection of a proper interest rate is a tricky issue in planning. Many simplified solutions are usually adopted such as the interest on long-term borrowings by the Government, In Sri Lanka, an interest rate of 10% for benefit-cost ratio calculations of water resource development projects is presently followed.

Another factor to be considered in the analysis of benefits and costs is the uncertainty associated with the future prediction of benefits and costs. The uncertainty increases with the length of planning period. Yet, when decisions have to be taken which commit resources to long periods, it is not possible to predict values with complete accuracy. This situation can be taken care of by 'making an allowance for the uncertainty. One method would be to adjust the benefit and costs by a "correction factor" before discounting. Another method would be to add a risk factor to the discount rate. Sometimes the life expectancy estimates are adjusted downwards.

IV. MEASUREMENT OF BENEFITS AND COSTS

The direct benefits of new irrigation or supplementary irrigation project are the difference between the annual net income from farm produce with irrigation and annual net income without irrigation. The increase in the value of land as a result of the introduction of irrigation is also considered as a direct benefit. The indirect or secondary benefits include increased activities in business and trade and agro based processing and manufacturing activities. There are also intangible benefits such as greater stability and welfare to community, better health and new employment opportunities. Guidelines of Irrigation department for the preparation of Detailed Project Report for Irrigation and Multipurpose projects suggests that the annual benefits for computing benefit cost ratio should be taken as under

- A. Agricultural production in the area to be irrigated under pre-project conditions.
- B. Agricultural production in the area after completion of the project.
- C. Difference between (A) and (B)

The yield under pre-project and post-project conditions and the prices to be used for the crops may be obtained from the respective provincial Agricultural Department. The net income from farm produce should exclude the farming expenses such as fertilizers, seeds, labors etc. The cost shall consist of the following:

- Interest at the rate of 10% on the estimated cost of the project including cost of land development
- Operation and maintenance cost including that for head works
- Depreciation of the project based on assumed life of the project
- In the case of lift canals, charges for power and depreciation of pumping system

- The benefit-cost ratio is worked out 'as the ratio of annual benefits to annual costs.

Generally, a new hydropower project supplements an already existing network. The monetary benefits by satisfying the power demand projected through a power market survey will be equal to the prevailing regional price per unit. The expectation of an increase in power use, if current prices continue is based on the assumption that the value in use will exceed the price. If the power project is to serve an isolated area, then the benefits will equal to the area under the demand curve between amount of power available with and that available without the project.

Often, evaluation of power projects are done in terms of the cost of the most economical and likely alternative source that would be used to meet the power requirement in the absence of the hydroelectric project under study. The cost of generation by alternative methods must be determined as a part of the study to justify hydroelectric power.

Indirect benefits from power generation may arise due to factors like increased industrial activity as a result of the availability of cheap and reliable power supply. Intangible benefits include increased comforts and conveniences and improved living condition of people and also conservation of non- renewable fuels. The costs of hydropower generation shall consist of the following

- Incremental project construction costs attributable to power generation
- Costs of power components such as power house, generators, penstocks, transmission and distribution system etc
- Operation, maintenance and replacement costs of power components
- Depreciation costs.

The benefits from providing domestic water supply accrue to a larger spectrum of people in the society compared to other water uses. The benefits from municipal and industrial water supply projects can be measured by

- The customers willingness to pay for delivered water when such a measure can be deduced from market information
- The cost of the next best alternate source of supply for those customers who would clearly be supplied by that alternative in the absence of the present project.

The first method will be a more reasonable approach if sufficient data to develop the demand curve can be obtained. The costs attributable to domestic and industrial water supply will include

- The cost of source development. This may include the intake structures and/or the allocated part of a storage project

- Transmission, treatment and distribution costs including cost of local storages
- Operation, maintenance and replacement costs
- Depreciation costs.

Flood control benefits generally consist of two components as given below

- The damage prevented to the existing and future flood plain property that would exist in-the absence of the flood control project
- The enhanced productivity of the flood plain. The damage prevented should be computed based on the present status and anticipated conditions after the completion of the project.

The average annual damage should be based on at least 10 years data. If sufficient data is available, it will be advisable to construct a damage-frequency curve and determine the average annual damage corresponding to different frequency floods. Thus the level of protection provided by a given structure and the damage prevented can be correlated.

The damage due to floods may be to agricultural crops, structures and monuments and/or human lives. Some of the damages may be permanent losses, others may be capable of restoration through repairs, rehabilitation etc. A distinction should also be made between preventable and non-preventable damages as also between recurrent and non-recurrent losses. Care must be taken to avoid duplication of benefits. The costs of flood control projects will usually consist of

- Incremental project construction costs attributable to flood control including exclusive provisions like embankments, channel improvements etc.,
- Value of water and power foregone by virtue of reserving some of the storage for flood moderation
- Operation, maintenance and replacement costs.

Improved inland navigational facilities benefit the economy since it is a cheap mode of transport and effect saving of fuel. The benefits may accrue by way of

- The amount of cost saved by diverting the present traffic from higher cost modes of transportation to inland or coastal waterways
- The new traffic generated by the added navigational facilities. This is measured as the willingness to pay by the new water carrier customers
- The income of new business establishments stimulated by the added water transport facilities and savings to existing business which may shift to riverside locations
- Value of recreation provided by the improved waterway.

The following costs may be expected to accrue for any in land navigation project

- The construction of navigation features including channel, lock, navigational aids and other facilities
- Operation, maintenance and replacement costs
- Value of other benefits foregone as a result of operating the system to cater for irrigation
- Construction of recreation facilities, if such benefits are included.

The benefits from recreation are by way of a quality added to life whose value is beyond monetary measurement. But, the planner has to assign a value to this benefit in order to commensurate with other project purposes.

There are various methods of recreation benefit evaluation that have been proposed and used. The oldest practice is to select a value per visitor-day based on a judgment evaluation of the quality of the available recreation experience. Other methods are that using alternative-cost approach, user-assigned values evaluated through a questionnaire, correlating admission fee charged with the number of users who may pay for it etc.

The most successful method seems to be based on demand curve imputed from expenditures incurred to enjoy outdoor recreation. The recreational cost incurred by the user such as travel, food, lodging etc. reflect the value placed by the user on the particular recreational experience. The costs of recreation include

- Cost of construction of recreational facilities;
- Value of other benefits foregone as a result of creating these facilities such as maintenance of a certain reservoir level
- Operation, maintenance and replacement costs.

The benefits from water quality management measures are difficult to locate and quantify. These measures modify the damages inflicted by a given pollution concentration on the water users. The benefits would fall into one or more of the following classes

- Health improvement to people who use the water in untreated or inadequately treated form in the absence of the measures
- Reduced water treatment costs by downstream municipalities
- Reduced treatment costs by industries who draw water from downstream points
- Value of increased recreation stemming from better quality water
- Increased aesthetic value.

The cost of water quality management may include

- Construction of structures such as dams, treatment plants etc.,
- Operation, maintenance and replacement costs,
- Cost of solid waste disposal
- Increased air pollution by treatment of waste.

Benefits from development of fishery mainly come under two classes

- The commercial value of the fish catch
- The recreational value of fishing.

The commercial value of increased fish catch is evaluated in terms of the expected market prices whereas the benefits from recreation are evaluated as described in previous paragraph.

The costs may include costs of facilities such as fish ladders, value of benefits foregone, if any and the appropriate operation, maintenance and replacement costs.

The benefits from environmental conservation such as the preservation of rare species of flora and fauna or unique habitats come under intangible benefits since their monetary values are difficult to assess. The best practice may be to determine the incremental cost of preservation as a function of some quantitative measure of the amount of resource conserved such as the number of rare species of wild life or number of acres of rare flora conserved and make sure that they are compatible. The total cost of conservation should include the direct cost of conservation and the benefits foregone by reducing other project outputs.

V. FINANCIAL FEASIBILITY

In economic analysis, the question is not usually raised as to who will ultimately pay for the costs of the scheme. To say that a project's benefits to the nation will offset its costs is one thing, to decide on whether or not costs are to be recovered and if so the method of recovery is another. Thus financial feasibility of projects is a factor to be looked into.

Financial return through sale of production is not always possible in the case of water resources development which is by and large a collective good. For example, the flood control benefits are enjoyed by the general public especially those in the protected area, whether they choose to "buy" the benefits or not. Moreover, in our country, the majority affected in flooding is the economically weaker sections and charging them goes against the principle of income redistribution through development. Such social considerations, apart from technical difficulties of charging, provide reason for subsidizing or even making the service free.

At present, financial feasibility is not a criterion for approving irrigation projects in Sri Lanka. For multipurpose projects involving power generation, a financial return statement is prepared for the power component. The National Water Policy document recommends that the water rates charged should be adequate to cover the annual maintenance and operation charges and a part of the fixed costs of projects. For hydropower, urban and industrial water supply and navigation projects or these components in a multipurpose project, which have a ready market, it should generally be possible to attain financial viability.

VI. COSTS ALLOCATION OF WATER RESOURCE PROJECT

In the case of multi-purpose projects, it becomes necessary

to apportion costs among the various project purposes. There is no universal agreement on this issue. The basic principle underlying the allocation is that the savings derived through the use of the combined structure for numerous purposes should be shared equitably by all these purposes. The cost includes separable costs and joint costs. Separable costs are directly attributable to specific purposes and joint costs are shared among the different purposes. Allocated cost should be

- Not more than the benefits to be achieved by that purpose
- Not more than the cost of an alternate project built for that purpose
- Not less than the cost of items meant for the specific use of that purpose.

VII. CONCLUSION

Country like Sri Lanka, because of its small size does not have very large catchments, is not having guidelines for preparation of water resource development master plan. But the Indian standard 7560-1974 gives the guidelines for allocation of cost among different purposes of river valley projects. This describes various methods of allocating costs such as alternate cost method, benefit method, equal apportionment method etc. and their advantages, disadvantages and limitations. This can be used as guidelines for Sri Lanka also.

In conclusion none of the methods is suitable for all conditions and the choice of a particular method will be governed by its suitability in specific conditions.

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Production of Rubber Seed Pericarp Based Activated Carbon Using Microwave-Induced Different Chemical Activating Agent

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Abstract- Microwave assisted activated carbon from rubber seed pericarp (RSP) was successfully produced by using three different chemical activating agents of $ZnCl_2$, KOH, and H_3PO_4 . The process was carried out at 600W of irradiation power for 20 min. The absorption study was applied for these modified activated carbon samples under cationic methylene blue (MB) dye. The Carbonisation of RSP using $ZnCl_2$ (RSP-ZnCl) as activating agent was found the best as compared among the rest which high BET surface area, total pore volume and iodine number were 1689.00 m^2/g , 0.9321cc/g and 883.49 mg/g respectively. The adsorption capacity of RSP-ZnCl under MB was *ca.* 297.24 $mg\ g^{-1}$. This finding showed the feasibility of preparing activated carbon from RSP using $ZnCl_2$ activating agent via by microwave carbonisation technique.

Index Terms- Rubber seed Pericarp, Activated Carbon, Chemical Activation, Microwave irradiation, Methylene Blue,

I. INTRODUCTION

Activated carbon is one of the most important materials that have been widely used in many industrial fields of applications due to its excellent pore structure, high surface area and temperature stability [1, 2]. Yang et al. [3] state that the quality of the resulting activated carbon influenced by the raw material characteristics. Many research and study have been done in the production of activated carbon by using variety of type of starting material. Raw materials for the production of activated carbon include number of carbonaceous material such as wood, peat, brown coal, bituminous coal, lignite, coconut shells, almond shells, pits from peaches and other fruit. Activated carbon from rice husk for example was studied by Kalderis et al. [4], Kumagai et al. [5], Chen et al. [6], and Yan et al. [7]. Various types of nut shell such as pistachio nut shell, almond nut shell, *Syzygium jambolanum* nut shell and macadamia nut shell were also being used as precursor for activated carbon. The best of our knowledge, no investigations have reported by using Rubber Seed Pericarp (RSP) as precursor to produce activated carbon.

Rubber seed pericarp (RSP) is a biomass waste and currently has no commercial value [8]. This carbonaceous material is highly potential to be converted into useful, high-value adsorbent. According to Eka [9], Rubber tree (*Havea brasiliensis*) starts to bear fruits at four years of age. Normally, each fruit have

about three or four seed, which fall to the ground when the fruit ripens and splits. Each tree yields about 800 seeds (1.3 kg) twice a year. A rubber plantation is estimated to be able produced about 800 - 1200 kg rubber seed per ha per year, and these are normally regarded as waste. Malaysia is known as a one of the main rubber producing country that has 1.7 million hectares of rubber plantation. Therefore, based on estimate average of 1000 kg seed per ha/yr, annually production of rubber seeds in Malaysia would be 1.7 million metric tons. Usually, the pip of rubber seed is sent to oil-mills, but a huge amount of rubber seed pericarp leave as agricultural waste and becomes an environmental problem. Therefore, one of the solutions for this situation is to reuse this waste to produce activated carbon.

Currently, high quality activated carbon from biomass is produced by using the conventional slow heating pyrolysis technique. This technique however, consumed much energy and took more than 6 hours to complete [10]. Another new promising technique that can produce equally high quality activated carbon that utilizes relatively less energy in shorter time is by using microwave irradiation. Microwave irradiation uses electromagnetic waves that are directly absorbed within the molecules of a material causing them to vibrate and agitate rapidly that result to an increase in temperature [11]. This microwave irradiation involves 'volumetric heating' since it is possible for the entire volume of bulk material to be heated rapidly [10-12]. Preparation of activated carbons under microwave radiation from materials such as pitch, tobacco stem, waste tea, wood and cotton stalk have been reported in previous studies [13-17] which has evidenced that the microwave heating has the advantages over conventional heat treatment method such as high heating rate easy control of the heating process, and no direct contact between the heating source and the materials. Microwave radiation can heat or cause arcing in many objects, powdered samples can absorb such radiation and be heated efficiently. The main advantage of using microwave heating is that the treatment time can be considerably reduced, which in many cases represents a reduction in the energy consumption. In addition, the consumption of gases (N_2) used in the treatment can also be reduced toward 40 - 50 % if calculate based on the heating and cooling time during the reaction. In view of the possible advantages associated with the use of microwave heating systems, it was therefore we propose to study the effect of microwave heating combine with three different chemical activating agents i.e. $ZnCl_2$, KOH, and H_3PO_4 treatment in more

detail using a carbon precursor selected (*Rubber Seed Pericarp*) with a better defined microstructure than that used previously.

Matos et al. [18] claimed that the activation process is the most important part in the production of activated carbon. This process creates or increases porosity on the surface carbon materials. Generally, activated carbon can be prepared by one of the following two methods of activation which are by physical or chemical activation. Physical activation is a two-step process and relatively slow. It involves carbonization of a carbonaceous material followed by the activation of the resulting char at elevated temperature in the presence of suitable oxidizing gases such as carbon dioxide, steam, air or their mixtures [19, 20]. In chemical activation carbonization is done after the addition of substances which restrict the formation of tar. This is a single operation of activated carbon preparation. In this method, an activating agent like H_3PO_4 , $ZnCl_2$, and KOH are applied in large quantities and has to be removed in order to reveal the porous structure and to make the activated carbon to be accessible [21, 22]. Among the available choices of impregnating activating agents, KOH that has been reported to be more suitable for coal based precursors, while $ZnCl_2$ and H_3PO_4 are widely used for biomass based lignocellulosic precursors [23, 24].

Although large varieties of precursors have been used to produce activated carbon, the work related to the utilization of rubber seed pericarp as precursor has not been reported in literature. Hence, our study focused on the production of RSP activated carbon using different chemical activating agent. The activated carbon produced was evaluated based on product yield, iodine number, methylene blue adsorption capacity, and surface area development. These findings will be of useful in producing activated carbon from RSP for solid filtration or liquid/gas adsorbent material.

II. MATERIALS AND EXPERIMENTAL METHODS

A. Sample preparation

RSP were collected from the local rubber estate located in Jitra, Kedah, Malaysia. RSP were washed with distilled water to remove foreign materials and dried in an oven at $100\text{ }^\circ\text{C}$ for 24 hours. The dried RSP were pulverised to a fine powder using grinder and sieved through progressively finer screen to obtain particle size of $< 2.0\text{ mm}$. Sieving were accomplished by shaking the RSP powder in an Endecotts Shaker Model EFL2 for about 30 mins. The fined RSP were stored in an airtight container for further used. The proximate and ultimate analyses of powdered RSP and rubber seed pericarps activated carbon (RSPAC) were measured using thermal gravimetric analyser (TGA) and elemental analyser (EA) respectively [25].

B. Microwave-Carbonization Processes

A weight amount ($10.0 \pm 0.01\text{g}$) of RSP sample was mixed with 67 ml of different activating agents (KOH , $ZnCl_2$ and H_3PO_4) solution at various impregnation ratios (0.4 to 2.0 g g^{-1}) for 24 hr at room temperature. The impregnated sample was carbonized using a microwave oven at 600W for 20 min of irradiation time in the presence of nitrogen gas. Fig. 1 shows the schematic diagram for microwave irradiation treatment process. The irradiated samples were cooled at room temperature and washed with 0.1M HCl and left for overnight to isolate the

residual activator. The samples were then washed with distilled water to remove residual organic matter, and neutralised with base until the pH of filtrate reached 6.5 - 7, and dried in an oven at $110\text{ }^\circ\text{C}$ for 24 hours.

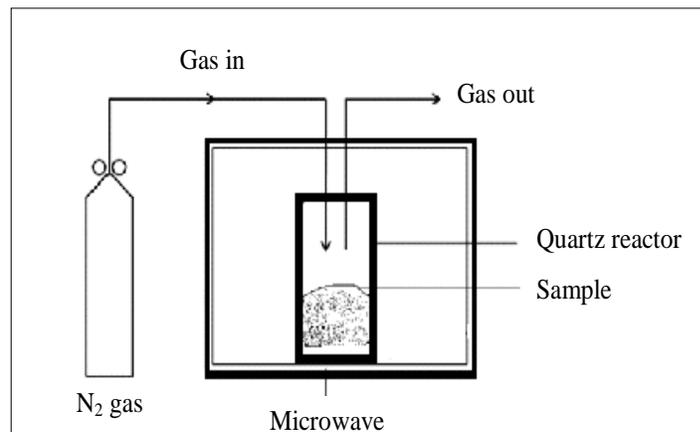


Fig. 1. Schematic diagrams of microwave unit for the preparation of RSPAC.

C. Analysis of Percent Yield and Iodine Number

The efficiency of activated carbon produced from RSP is evaluated based on product yield and iodine number [26]. The percent yield and iodine number of prepared activated carbon were calculated as follows:

$$\text{Yield (\%)} = \frac{W_f}{W_o} \times 100 \quad (1)$$

$$X/M = [A - (DF) (B) (S)] / M \quad (2)$$

Where W_f and W_o are the weight of activated carbon and dried rubber seed pericarp respectively (g). X/M is the iodine absorbed per gram of carbon (mg g^{-1}), A is the normality of standard iodine with 12693.0, B is the normality of sodium thiosulfate with 126.93, DF is the dilution factor, S is volume of sodium thiosulfate (mL) and M are the mass of carbon used (g). Iodine number is use to determine the adsorption capacity of activated carbon and it's indicate the porosity of the activated carbon [27]. Iodine number provides an approximation for the surface area and microporosity of activated carbon with good precision. The analysis of iodine was done based on the standard test method ASTM D4607.

D. Batch Adsorption studies

MB is a strong adsorption onto solid used in a wide variety of application. It was known as a common substances used in dying process due to its potential risk towards the survival aquatic compartment, ecosystem and environmental pollution [28]. Thus, it was chosen in this study. MB is a heterocyclic aromatic chemical component with a chemical formula of $C_{16}H_{18}N_3$ and a molecular weight of 319.85g mol^{-1} [29] Fig. 2 shows the chemical structure for MB. MB adsorption experiments were conducted to determine the optimum quality of the adsorbent for

maximum adsorption [30]. The MB solution for adsorption was prepared by dissolving MB in deionised water without pH adjustment. The adsorption test were carried out in a set of 250 ml conical flask containing 0.2 g of adsorbent and 150 mL dyes solutions with various initial concentrations range of 50-500 mg L⁻¹. The flask was placed on a shaker setting of 120 rpm for 24 hours to reach equilibrium. Then the samples were filtered to remove carbon and the residual concentration of MB in the filtrate was analyzed using Spectrophotometer at 664 nm wavelength. The MB uptake at equilibrium q_e (mg g⁻¹) was computed using equation 3.

$$q_e = \frac{(C_0 - C_e)V}{w} \quad (3)$$

Where C_0 and C_e are the initial and equilibrium concentrations of dye (mg L⁻¹) in the solution, V is the volume of the solution (L), and W is mass of the adsorbent used (g). While, equation 4 was used to calculate the percentage of MB adsorption based on the initial and equilibrium MB concentration.

$$\text{Adsorption (\%)} = \frac{C_0 - C_e}{C_0} \times 100 \quad (4)$$

The pore size and structure of the activated carbon was determined using N₂ adsorption Brunauer-Emmett-Teller (BET) and scanning electron microscope (SEM) respectively.

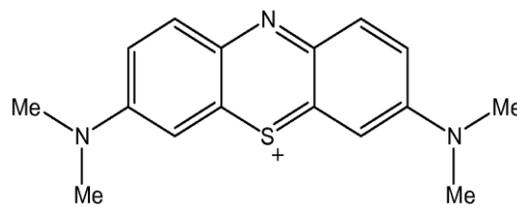


Fig. 2. Chemical Structure for Methylene Blue (MB)

III. RESULT AND DISCUSSION

Table 1 showed that waste RSP material is a carbonaceous material that contained high composition of carbon and high potential to become activated carbon. The percentage of carbon significantly increased after carbonization and activation process due to release of volatile matter during the activation as proven by decreased of volatile content in RSPAC. However, with reference to table 1, the RSPAC treated with ZnCl₂ produced the lowest amount of ash at 4.08% with high percent of fixed carbon at 45.06% in comparison to RSPAC treated with KOH and H₃PO₄, respectively.

Table. 1. Proximate and ultimate analyses of raw rubber seed pericarp (RSP) and rubber seed pericarp activated carbon (RSPAC) with different activating agent

Analysis	RSP	RSPAC		
		KOH	H ₃ PO ₄	ZnCl ₂
Proximate				
Moisture	3.60	8.48	9.59	4.88
Volatile Matter	94.25	70.05	53.89	45.44
Fixed Carbon	0.03	14.19	22.56	45.60
Ash	2.12	7.27	13.96	4.08
Ultimate				
Carbon	52.93	89.2	66.1	93.5
Hydrogen	6.24	2.48	2.27	1.76
Nitrogen	0.00	0.41	0.53	0.55
Sulphur	0.08	0	0	0
Oxygen*	40.75	7.91	31.1	4.19

Notes : * calculated by difference

A. Textural Characteristics of RSPAC

Fig. 3 compares the SEM micrographs of RSP and RSPAC treated with three different activating agents. The SEM micrograph of RSP (Figure 3a) shows smooth surface with no pore development. Comparatively, the SEM micrographs of RSPAC treated with different activating agents show pores development as depicted in figures 3 (b), (c) and (d). This phenomenon is mainly due to the released of volatile matter and reaction between activating agent and the carbon atom in the precursor [26, 32]. The SEM micrograph for ZnCl₂ treated RSPAC, however reveals high distribution of pore development. Comparatively, the KOH and H₃PO₄ treated RSPAC exhibit

some porosity with the latter showed development of hollow and rugged surfaces, respectively. Apparently, the mean pore diameter of all the treated RSPAC were about the same in the range of 2.4 – 2.9 nm.

In addition, the effect of pore development was also reflected on the surface area development. The ZnCl₂ treated RSPAC has the highest surface area of 1689 m² g⁻¹ in comparison to KOH and H₃PO₄ treated RSPAC at 392 m² g⁻¹ and 1589 m² g⁻¹, respectively. Therefore, the ZnCl₂ is found that to be an effective activating agent to produce activated carbon from RSP with high-surface area.

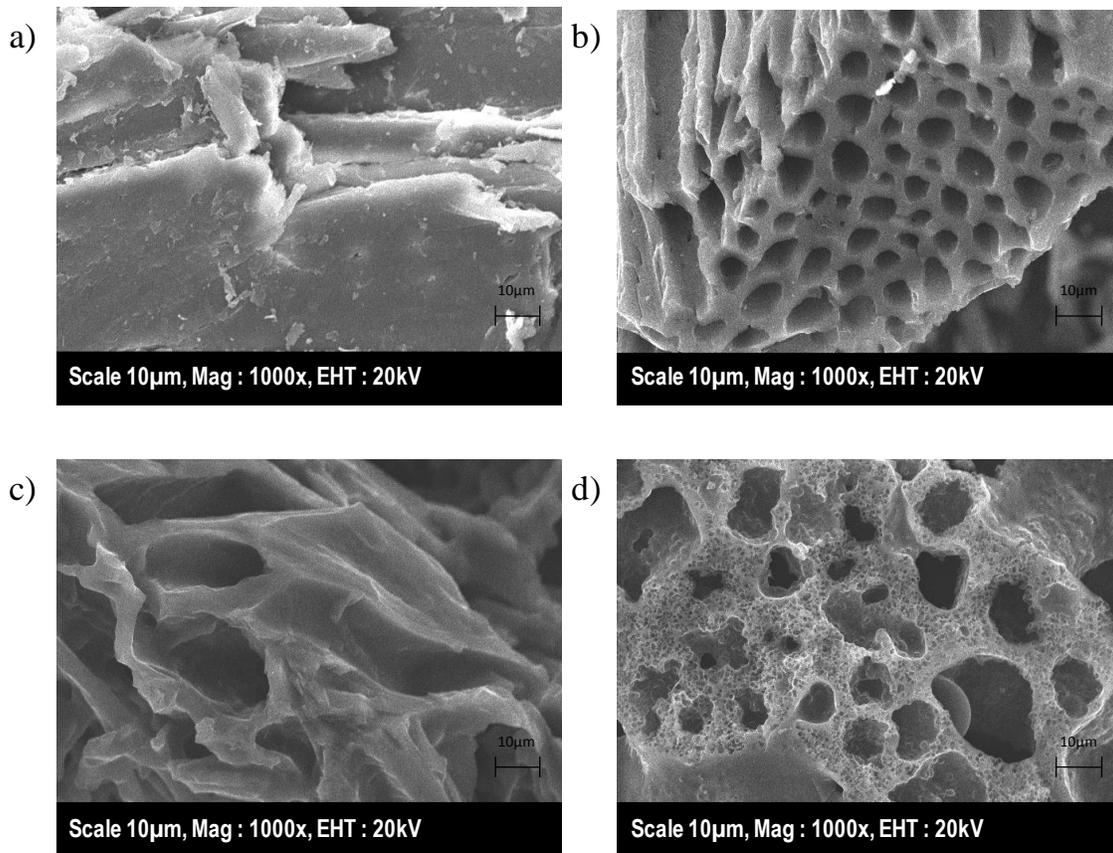


Fig. 3. SEM micrographs (1000x) of a) RSP and RSPAC treated with b) ZnCl₂ c) KOH and d) H₃PO₄

Table 2. Optimum surface characteristics of rubber seed pericarp activated carbon (RSPAC) treated with different chemical activating agents

Analyses	RSPAC		
	KOH	H ₃ PO ₄	ZnCl ₂
Percent Yield (%)	18.56	36.09	30.69
Iodine Number (mg/g)	561.16	700.38	883.49
MB Adsorption (mg/g)	56.89	287.92	297.24
BET surface area (m ² /g)	392.00	1589.00	1689.00

B. Percent Yield and Iodine Number

The percent yield and iodine number of RSPAC prepared by different activating agents is shown in Fig. 4. Expectedly, the results showed that KOH produced the lowest percent yield of activated carbon followed by $ZnCl_2$ and H_3PO_4 . RSP is a lignocellulosic material, with hemicelluloses, cellulose and lignin as the main components; and this type of material has been reported suitable to be treated with $ZnCl_2$ and H_3PO_4 activating agents [24]. It can be seen that the yields of activated carbon decrease with increasing impregnation ratios. The decrease in product yield might due to continuous release of volatile matters from the material creating more pores [26]. Further, it can be seen that the decrease in product yield correlates with increasing in iodine number, indicating an increasing in adsorption capacity of the materials.

From fig. 4, it also shows that iodine number increase with increasing the impregnation ratio of activating agent used. This is due to electrolytic action terms as swelling in the molecular structure of cellulose [26]. However, according to Ahmed et al. [26] they claimed that high concentration of activator could also lead to excessive dehydration and destruction of micropores that form larger pores and reduce adsorption efficiency.

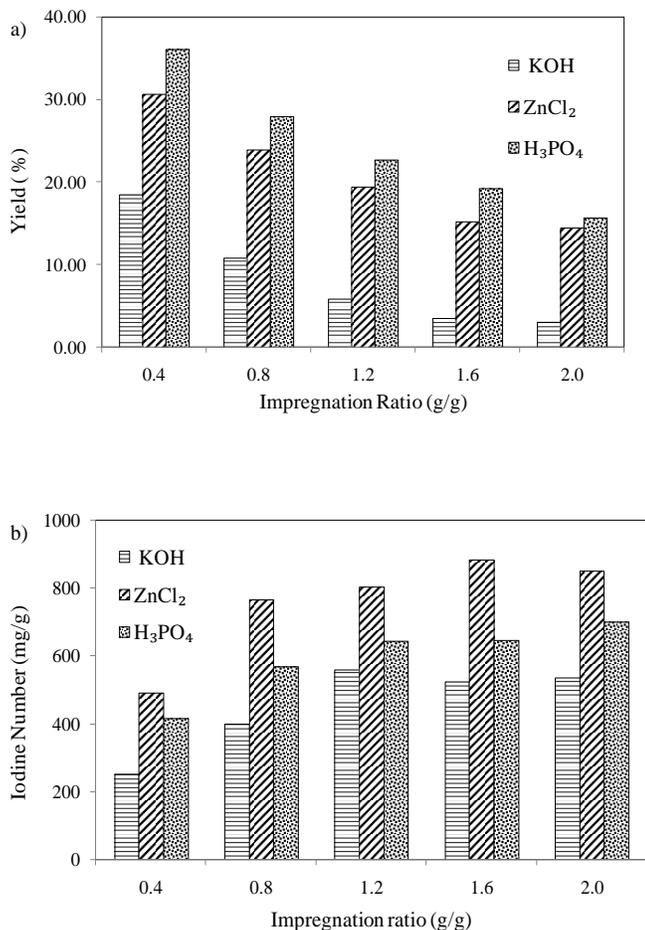


Fig. 4. a) Percent yield and b) Iodine number of treated RSPAC with different activating agent.

C. Methylene Blue (MB) Adsorption Analysis

MB is a relatively large molecule and often employed as adsorbates to evaluate the efficiency of activated carbon for removal of dyes. Fig. 5 compares the adsorption capacity of treated RSPAC with $ZnCl_2$, KOH and H_3PO_4 . The MB adsorption capacity was conducted based on the approximation of the highest iodine number to give the highest amount of adsorption. Apparently, the MB adsorption capacity for RSPAC treated with $ZnCl_2$ produced the highest amount of adsorption capacity with comparison to KOH and H_3PO_4 treated RSPAC. The amount of MB adsorption increase from about 65.54 to 297.24 mg g⁻¹ with increasing ratio of $ZnCl_2$ from 0.4 to 1.6, and decrease slightly at ratio of 2.0. Similar trend could be observed with KOH and H_3PO_4 . The fact that by increasing the ratio of activating agent, more pores would be created, however as the ratio arrives at the optimum value, the pores would be widened and burnt off [14, 26]. Therefore, the adsorption capacity of activated carbon would increase to a certain value and then decreased with ratio of activating agent.

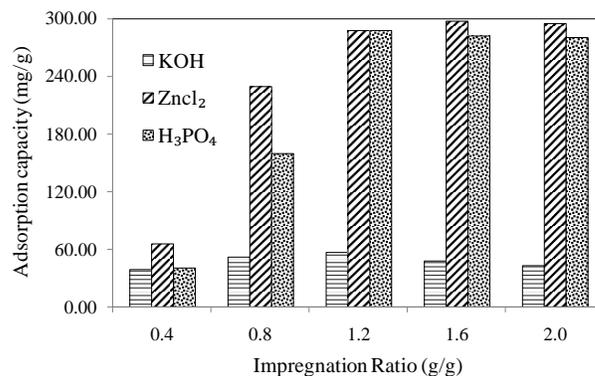


Fig. 5. MB adsorption capacity for RSPAC treated with $ZnCl_2$, KOH and H_3PO_4 .

IV. CONCLUSION

A study of the textural and adsorption characteristic of the activated carbon reveals the feasibility to prepare activated carbon from rubber seed pericarp (RSP) via microwave irradiation method using $ZnCl_2$ as activating agent. The activation process was conducted for 20 mins at the operating power of 600W resulted in a yield of 30.69% and iodine number of 883.49 mg/g. While the BET surface area, total pore volume and adsorption capacity of MB were 1689.00 m²/g, 0.9321cc g⁻¹ and 297.24mg g⁻¹ respectively. This research would significantly contribute to new findings in term of activated carbon production from abandon biomass waste using new heating technique.

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Network Security Vulnerabilities: Malicious Nodes attack

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Abstract- Network Security is always foremost and big issue in wired and wireless network. Wireless network, whether it is infrastructure mode or mobile adhoc mode, breaks the barriers of wired network and are easily accessible to everyone but everything is at a cost, the cost is in the form of increased susceptibilities and vulnerabilities of network. Packet delay is a result of poor utilization of network capacity when it is integrated with routing algorithms. Routing protocol contains very serious security issues in adhoc network. The code of AODV and DSDV are having such issues and new protocol are extended in the form of SEAD, SEAR and SAODV. This paper analyses the ways the security is breached by the hackers who emerge as malicious node in Infrastructure as well as in adhoc mode of network. The handiwork is prepared by way of Developing experimental Testbed and simulation in NS2 then proper measure are proposed in order to overcome all the problems.

Index Terms- Wireless Network, MAC, Intrusion Detection Systems and malicious node.

I. INTRODUCTION

Wireless networks are convenient, but it is dangerous if they do not employ latest methods of network security because the network's signal go beyond the boundaries of home and organization. If one connects to a network which is vulnerable, it is possible that any malicious node can easily steal everything and it can do that what one do on his/her device[55]. The nodes, nearby of such network might be able to access the information stored on authorized nodes and can use Internet connection to log on the web. Malicious node can impersonate the source node by forging RREQ message and Destination node can be impersonated by forging a RREP with its address as destination address. Malicious node can become a black hole to the entire sub network. IEEE 802.11i and 802.11-2007 provides RSNA methods for security of wireless network. WECA, the alliance for Wi-Fi devices provides WPA2 modes of security. These Standards for wireless network classifies security algorithms into: RSNA and Pre-RSNA. Pre-RSNA algorithms are the algorithms used before RSNA. Pre-RSNA security comprises the algorithms; WEP and IEEE 802.11 entity authentication. RSNA security comprises the algorithms like TKIP, CCMP, RSNA establishment and termination procedures, including use of IEEE 802.1X authentication, key management procedures and providing mechanisms for protecting management frames[61]. This paper discloses the main point of vulnerability of Pre-RSNA, RSNA and WPA2 Method by developing experimental testbeds and simulation in NS2 and provide its countermeasures.

II. BACKGROUND

Primary factors for security in a wireless environment are [55-61] : 1. Theft: Unauthorized users often try stealing data. 2. Access Control : Wireless networks have all the same access control vulnerabilities as wired networks; even it can be easily targeted. 3. Authentication: Unauthorized users can also log onto them illegally. 4. Encryption: Wireless routers support medium and strong levels of encryption 5. Protection : The best protection is to become familiar with WLAN and wireless router. Routing protocol issues: Black Hole Attack is attack at network integrity where full data loss happens. Message integrity, where the destination node is able to verify that the contents of message are not altered by malicious node. Node is understood selfish when it ignores requests from other nodes in order to save its own resources, it is compromised if it is insider and behaves maliciously. The Node becomes malicious node if it is attacker and cannot be authenticated itself as a legitimate node due to the lack of valid cryptographic information. AODV is extended to secure AODV for providing security features like integrity, authentication and non-repudiation[49].

Both the IEEE and WECA provide standard for WLAN in order to secure and reliable communication. WPA-2 is the Standard developed by WECA compatible with IEEE security mechanism. An Intruder has several ways to attack on a wireless network. The easiest method of attack is MAC spoofing by which malicious node can impersonate as an authorized wireless access point or as an authorized client. Security measure MAC filtering results in vulnerability of MAC spoofing such as [63]

1. MAC spoofing can be done to get access of wireless network.
2. MAC spoofing can be result in illegitimate use of Wireless Network for any kind of crime.
3. Internet Service Provider bind their services to a specific MAC address, unauthorized node may access of the service by using MAC address of authorised user.
4. Some software licences are based on MAC address, one malicious node uses it as authentic user.

Some solutions are there to solve the problem of MAC spoofing:

1. OS can check the MAC address entries and delete it automatically if there is some change in it.
2. MAC address at ARP can be compared with that of MAC address through OS whenever packets arrive to it
3. MAC address are stored in OS and received from OS, it can be checked directly from NIC.
4. Association of MAC address with IP address can solve the problem.

5. Encryption of the communication between the wireless PC and access point can also be used as a solution to the problem.

Various papers have been published showing how to crack WEP, this is very simple procedure and one need only a Bootable DVD of Backtrack which contains various utilities used for cracking. Aircrack is the most popular tool for this purpose which is used to attack WEP and WPA encryption[57].

WPA uses TKIP for security, which stands for Temporal Key Integrity Protocol. In the TKIP mode, the encryption keys are changed at set intervals. WPA2 can also be used for wireless encryption and is known as 802.11i standard/AES. The Problem by using WPA2 is that all the device on network must use WPA2 or compatible. If any of the device on the network that only supports WPA, this device will not be able to join the network unless router supports WPA/WPA2 mixed mode. Also WPA2 and advanced encryption such as CCMP-AES is understood secure way for home and small offices but the problem is that many AP still in use are good enough for security purposes but they are lacking Wireless-N or other advanced encryption of WPA2.

III. TOOLS AND MTHODS

Testbed

A typical scenario of WLAN is developed in which different nodes are considered connecting through an access points in order to test the pre-RSNA and RSNA Methods of Security. The developed scenario has a server with internet facility, the server is connected with various access points at different wings and these access points are accessed, as and when required, by various moving / stationery nodes. The equipments used for this scenario is fully compatible with IEEE and WPA2 standards and methods.

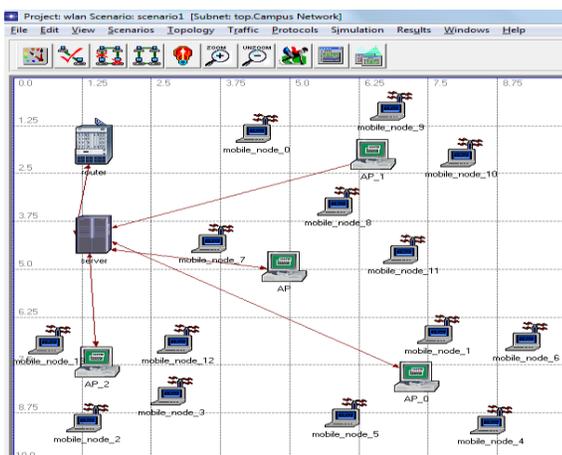


Figure 1 : Typical WLAN Scenario

Tools

A free open source Angry IP scanner tool scans the WLAN network and shows dead and alive nodes with their MAC Address that means providing various information of node(s) to

the malicious node(attacker) that may result in MAC address spoofing and in turn breaching the security.

Advanced ip scanner has also been used and they provide more advanced features which on the one hand are very useful for the Tester for WLAN networks but provides handy information to hackers.

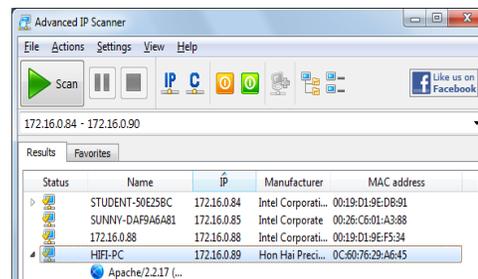


Figure2 : Advanced IP Scanner

Simulation

NS-2.35 is used for simulations which consist of the collection of network protocols to simulate many of the existing network topologies[29]. But NS-2.35 contains wireless ad-hoc routing protocols, it does not have any modules to simulate malicious node so a Black Hole patch is used to show one of serious security issue of routing Protocol. In black hole attack a malicious node waits RREQ messages[31]. When it receives an RREQ message, without checking its routing table, immediately sends a false RREP message to destination to itself, assigning a high sequence number before other nodes send a true one. So requesting nodes assume that route discovery process is completed and ignore other RREP messages and begin to send packets over malicious node. The typical scenario of simulation is as follows :

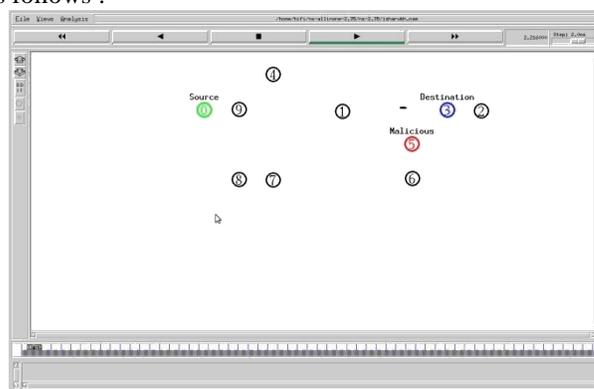


Figure 3 : Typical Scenario of NS2

Adding Patch in NS2 : NS2 provides limited functionality so patch is required for performing and simulation of suggested changes. The necessary changes or changes through patches are added through as per the following procedure:[49]

```
Patch -p1 -t1 <bh.patch
```

```
./configure  
make clean  
make  
make install
```


Table 1 : Showing RREP Message of Nodes

BH	BH	BH	WBH	WBH
s	s	r	s	r
1.007371858	1.007372152	1.012751242	1.007372152	1.012479842
5	3	2	3	2
RTR	RTR	RTR	RTR	RTR
---	---	---	---	---
AODV	AODV	AODV	AODV	AODV
44	44	44	44	44
[0	[0	[13a	[0	[13a
0	0	2	0	2
0	0	5	0	3
0]	0]	800]	0]	800]
-----	-----	-----	-----	-----
[5:255	[3:255	[5:255	[3:255	[3:255
0.177083333	0.177083333	0.177083333	0.177083333	0.177083333
30	30	30	30	30
2]	2]	2]	2]	2]
[0x4	[0x4	[0x4	[0x4	[0x4
1	1	1	1	1
[3	[3	[3	[3	[3
4]	4]	4]	4]	4]
10.000000]	10.000000]	10.000000]	10.000000]	10.000000]
(REPLY)	(REPLY)	(REPLY)	(REPLY)	(REPLY)

V. CONCLUSION AND FUTURE WORK

WLAN Security threats as pointed out can be addressed for Small office and Home office through economical methods such as by making OS to be dynamic, MAC address at ARP can be compared with that of MAC address taken through OS, MAC addresses can be checked directly from NIC. Association of MAC address with IP address can solve the problem and also encryption of the communication between the wireless PC and access point can also be used as a solution to the problem. Latest hardware and software can also help in achieving the better security. Hardware security modules can be used for big and military organization. Packet drop problem is sorted out by using SAODV algorithm instead of AODV protocol. Authentication and integrity in SAODV are achieved using digital signatures and message authentication codes. But all such security measure affects the speed, throughput, delay and other performance parameters and how much they affects the performance of the network, this may be known by developing performance model for performance evaluation as their future work for the researchers..

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Reduced Area & Improved Delay Module Design of 16-Bit Hamming Codec using HSPICE 22nm Technology based on GDI Technique

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Abstract- Gate diffusion input (GDI)—A new technique of low-power digital combinatorial circuit design is described. This technique allows reducing power consumption, propagation delay, and area of digital circuits while maintaining low complexity of logic design. Performance comparison with traditional CMOS and various pass-transistor logic design techniques is presented. The different methods are compared with respect to the layout area, number of devices, delay, and power dissipation.

Index Terms- GDI, VLSI, CMOS, SOI, Pass Transistors, Transmission Gate.

I. INTRODUCTION

Most of the VLSI applications, such as digital signal processing, image and video processing, and microprocessors, extensively use arithmetic operations. Addition, subtraction, and multiplication are examples of the most commonly used operations. Recently, building low-power VLSI systems has emerged as highly in demand because of the fast growing technologies in mobile communication and computation. The goal of this paper is designing a low-voltage and so low-power 16-bit hamming codec cell with the GDI technique. This technique that was recently developed and presented in [1], proposes an efficient alternative for logic design in standard CMOS and SOI technologies.

Hamming codec: Hamming codec includes mainly two sections, first one is hamming encoder and second one is hamming decoder. Hamming codes are used by hamming encoder to encode the input data as well as by hamming decoder to decode the encoded data. Hamming code is one of the most common error detecting and correcting codes used in Random access memory. In hamming code, k parity bit is added to an n -bit data word forming a new word of $n+k$ bits. The bit positions are numbered in sequence from 1 to $n+k$. Those positions numbered as a power of 2 are reserved for the parity bits. The remaining bits are the data bits. There is relationship between data length (n) and the number of parity that must be added is as follows,

$$2^k - k - 1 \geq n \dots\dots\dots 1.1$$

For example for 16 bit data, inequality goes to $2^k - k - 1 \geq 16$, so at $k=5$, above inequality satisfy, hence for 16 bit data number of

parity bit will be 5. Similarly for 128 bit data number of parity bit required is 8.

GDI Technique: GDI cell contains three inputs – G (common gate input of NMOS and PMOS), P (input to the source/drain of PMOS), and N (input to the source/drain of NMOS).

Bulks of both NMOS and PMOS are connected to N or P (respectively), so it can be arbitrarily biased at contrast with CMOS inverter. It must be remarked, that not all the functions are possible in standard P-Well CMOS process, but can be successfully implemented in Twin-Well CMOS or SOI technologies. GDI Technique allows improvements in design complexity level, transistor counts, static power dissipation and logic level swing.

TG Technology : Transmission gate logic circuit is a special kind of pass-transistor logic circuit. It is built by connecting a PMOS transistor and an NMOS transistor in parallel, which are controlled by complementary control signals. Both the PMOS and NMOS transistors will provide the path to the input logic “1” or “0”, respectively when they are turned on simultaneously. Thus, there is no voltage drop problem whether the “1” or “0” is passed through it. It contains the 20 transistors [2]

II. COMPARISONS WITH OTHER LOGIC

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Circuits were designed at the transistor level in a 0.35m twin-well CMOS process technology (V_{DD}, V_{SS}). Each set includes a logic cell implemented in three different techniques: GDI, CMOS and transmission gate. Cells were designed for a minimal number of transistors in each technique as shown in Table I. Most circuits were implemented with ratio of three to achieve the best power-delay performance. Same transitions of logic values were supplied to the inputs of the test circuits in each technique. Measured values apply to transitions in inputs connected to gate of transistors, in order to achieve a consistent comparison. Measurements were performed on test circuits that were placed between two blocks, which contain circuits similar to the device under test (DUT). The measured power is that of the DUT, including the power consumed by driving the next stage, thus accounting for the input power consumption and not just the power directly consumed from supply. This allows more

realistic environment conditions for test circuit, instead of the ideal input transitions of the simulator's voltage sources [3].

The performance evaluation is made with respect to the switching delay, transistor count and power consumed by Mod-GDI and CMOS logic. In CMOS the number of transistors used to realize a function is twice that of GDI. It is observed that GDI logic style has low area, low power and low delay when compared to TG and CMOS logic style.[4]

Among the forceful investigation in the field of low power, high speed digital applications due to the growing demand of systems like phones, laptop, palmtop computers, cellular phones, wireless modems and portable multimedia applications etc has directed the VLSI technology to scale down to nano-regimes, allowing additional functionality to be incorporated on a single chip[5].

Fig.1 introduce the design methodology of 2-input AND, OR & XOR gate by three different technologies (CMOS, TG & GDI). For 2-input AND gate & OR gate CMOS & TG technique uses 6T in each, however GDI tech. uses only 2T in each. For 2-input XOR gate, CMOS tech. uses 12T & TG tech. uses 8T, however GDI tech. uses only 4T. Since GDI tech. uses fewer transistors (T) in comparison to other technology, which cause to save the chip area as well as reduction of propagation delay.

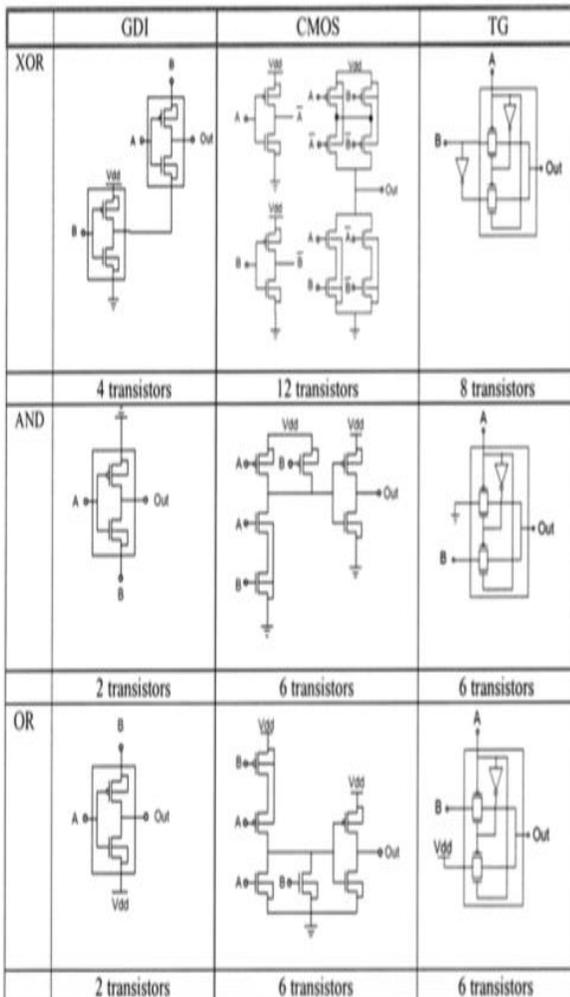


Fig.1 AND, OR and XOR module using GDI, CMOS, and TG design techniques.

III. HAMMING ENCODER

Hamming encoder encode the input data by adding the parity bit. For 16 bit data number of parity bit can be determined $2^k - 1 - k \geq 16$, so at $k=5$ above inequality satisfy hence total number of parity bit added should be 5. Suppose $IN_1, IN_2, \dots, IN_{16}$ are the input data and $P_1, P_2, P_4, P_8, \text{ and } P_{16}$ are the parity bits. Since parity bit always present at power of 2 positions. Since there is 5 parity bits so its positions will be $2^0, 2^1, 2^2, 2^3, \text{ and } 2^4$ that is $1^{st}, 2^{nd}, 4^{th}, 8^{th}, \text{ and } 16^{th}$ position. Hence encoded bit & its position can be arranged as

$P_1, P_2, IN_1, P_4, IN_2, IN_3, IN_4, P_8, IN_5, IN_6, IN_7, IN_8, IN_9, IN_{10}, IN_{11}, P_{16}, IN_{12}, IN_{13}, IN_{14}, IN_{15}, IN_{16}$.

Encoded bit position provides the information of position of data bit & parity bit at the output side of hamming encoder. 2^i to the power i (2^i) indicate the parity bit position at the output of encoder, where $i=0,1,2, \dots, k$ and k indicate the total no. of parity bit added in it. The bit position other than 2^i at the output of encoder indicates the data bit position. For n -bit data no. of parity bit required is k , where k satisfies following inequality $2^k - k - 1 \geq n$. In this inequality for 16-bit data, at $k=5$ inequality satisfy, so no. of parity bit required is 5 and its position at output of encoder must be $1^{st}, 2^{nd}, 4^{th}, 8^{th}, \text{ and } 16^{th}$.

Position of data bit at output of encoder can be evaluated by $2^k - k > p$ where 'p' & indicate the data bit position at input side of encoder & 'k+p' indicate the data bit position at output side of encoder. Suppose we would like to know the position of 5^{th} input data, in this case value of p will 5 & at $k=4$ inequality $2^k - k > p$ satisfy, hence its position at output side of encoder will be 'p+k' that is 9^{th} .

Fig.2 provide the design information of 2-input AND, OR & XOR gate by three different technologies (CMOS, TG & GDI). For 2-input AND gate & OR gate CMOS & TG technique uses 6T in each, however GDI tech. uses only 2T in each. For 2-input XOR gate, CMOS tech. uses 12T & TG tech. uses 8T, however GDI tech. uses only 4T. Since GDI tech. uses fewer transistors (T) in comparison to other technology, which cause to save the chip area as well as reduction of propagation delay.

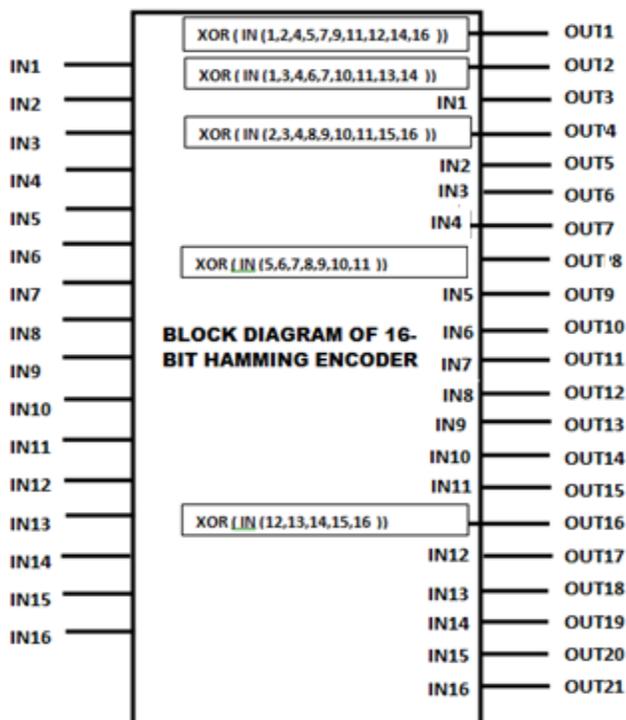


Figure 2: Block diagram of 16-bit hamming Encoder.

III.(A) Evaluation of parity bit

As it is clear that output of encoder is always in terms of input data bits and parity bits added to it. Now it is important to evaluate the parity bits. For this we developed a c-program based algorithm which is capable to evaluate parity bits as well as the position of input data bit at the output of encoder. Steps required to evaluate the parity bits are as follows

Step-1. Firstly n-bits input data of encoder is stored in array, suppose n-bit input data can be stored in array enco_inp[n]

Step-2. In this step no. of parity bit is evaluated, suppose k is integer variable then below code evaluate the no. of parity bit for n-bit data & its value will be stored in k.

```
for(int k=1;k<=100;k++){ if((pow(2,k)-k-1)>=n) break; }
```

Step-3. In this step position of input bit at output of encoder is decided and this has been stored at the appropriate position at its output. Array enco_op[n+k] stored the input data at its appropriate positions.

```
int a=1; int enco_op[n+k+1];
for(int j=1;j<=k;j++){ for(int i=a; i<=n; i++){
if((i+j)%int(pow(2,j))==0){
a++; break;}} enco_op[i+a]=enco_inp[i];}
```

Step-4. In this step parity bit is evaluated and placed it at appropriate position of output of encoder.

```
int c[k][n];
int a1,b1=1;
for(int j=1;j<=k;j++){ a1=1; for(int i=1; i<=n+k; i++){
if(int(i/int(pow(2,j)))!=0 && (i%int(pow(2,j)))>=int(pow(2,j-1))) && (i%int(pow(2,j)))<int(pow(2,j)) {
```

```
c[b1][a1]=enco_op[i];
a1++;}} b1++;}
```

above code stored the values of bits which can be XORed to evaluate parity bits in 2-D array c[k][n]. c[1][], c[2][], c[3][], c[4][], c[5][] stores the values of bits for 1st, 2nd, 4th, 8th & 16th position of parity bit respectively.

Below code evaluate the parity bits. P[1], p[2], p[3], p[4] & p[5] gives the value of parity bits .

```
int p[]={0,0,0,0,0};
for(int j=1;j<=k;j++){
for(int i=1; i<=n; i++){p[j]=p[j]^c[j][i];}
enco_op[int(pow(2,j-1))]=p[j];}
```

Hence parity bit can calculated as,

P1=p[1]=XOR (IN1, IN2, IN4, IN5, IN7, IN9, IN11, IN12, IN14, IN16)
P2=p[2]=XOR (IN3, IN6, IN7, IN10, IN11, IN14, IN15, IN18, IN19)
P4=p[3]=XOR (IN5, IN6, IN7, IN12, IN13, IN14, IN15, IN20, IN21)
P8=p[4]=XOR (IN9, IN10, IN11, IN12, IN13, IN14, IN15)
P16=p[5]=XOR (IN17, IN18, IN19, IN20, IN21)

IV. HAMMING DECODER

Hamming decoder is one that decode the encoded data. If m-bits are inputs to the hamming decoder then the no. check bit to detect & correct 1-bit error can be evaluated by inequality $2^{ck} - 1 \geq m$, where 'ck' indicate the total no. of check bit required. For example if total no of input to encoder is 21-bit then at ck=5 above inequality satisfy so, no. of check bit required is 5. Check bit evaluation by c-programming based algorithms includes following steps

Step-1: For n-bit input data to decoder, no of check can be evaluated as by c-programming based algorithms

```
for(int ck=1;ck<=100;ck++){
if((pow(2,ck)-1)>=n) break; }
```

In above code 'ck' stores the value of total no. of check bit required.

Step-2: In this step values of check bits can be evaluated. Below code evaluate the values of check bits, which are stored in ckb[1], ckb[2], ckb[3], ckb[4] & ckb[5].

```
int cc[k][n];
int a1,b1=1;
for(int j=1;j<=ck;j++){ a1=1; for(int i=1; i<=n; i++){
if((i%int(pow(2,j)))>=int(pow(2,j-1))) &&
(i%int(pow(2,j)))<int(pow(2,j)) {
cc[b1][a1]=enco_op[i]; a1++;}} b1++;}
int ckb[]={0,0,0,0,0};
for(int j=1;j<=ck;j++){ for(int i=1; i<=n; i++){
```

$$ckb[j]=ckb[j]^c[j][i];\}$$

Suppose check bits are C1, C2, C4, C8 & C16. These check bits are evaluated as.

$$C1= ckb[1]=XOR(1,3,5,7,9,11,13,15,17,19,21)$$

$$C2= ckb[2]=XOR(2,3,6,7,10,11,14,15,18,19)$$

$$C4= ckb[3]=XOR(4,5,6,7,12,13,14,15,20,21)$$

$$C8= ckb[4]=XOR(8,9,10,11,12,13,14,15)$$

$$C16= ckb[5]=XOR(16,17,18,19,20,21)$$

Fig.3 show the block diagram of 16-bit hamming decoder which has mainly consists one 11-input xor gate, two 10-input xor gate, One 8-input xor gate ,one 6-input xor gate, sixteen 2-input xor gate & one bit corrector circuit.

One bit corrector circuit is nothing but a 5 X 32 decoder which have capable to generate only min-terms like.

$$\sum m(3, 5, 6, 7, 9, 10, 11, 12, 13, 14, 15, 17, 18, 19, 20, 21).$$

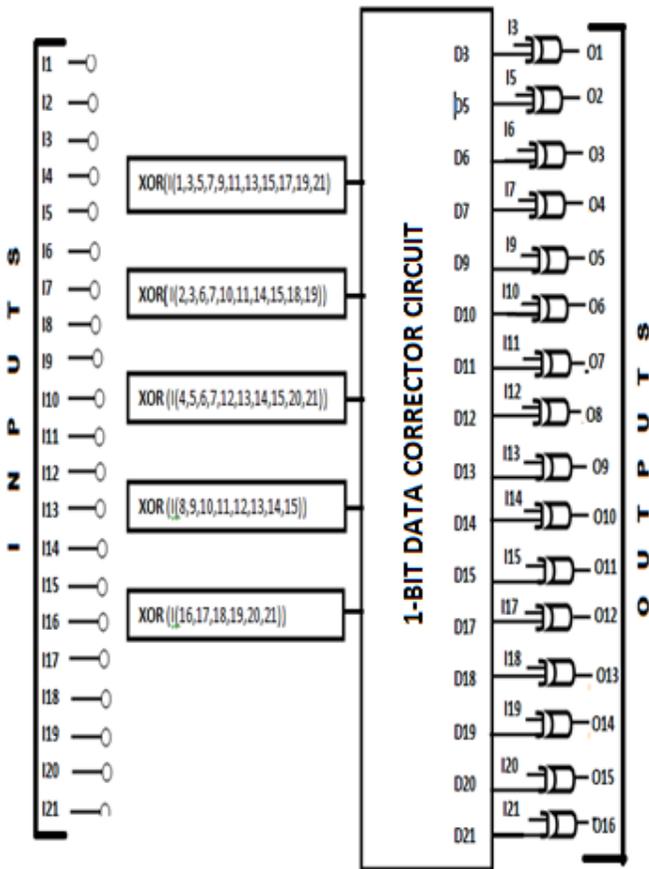


Figure 3: Block diagram of hamming Decoder.

V. SIMULATION RESULT

Simulation results consists of input waveform to the encoder, output waveform from encoder, input waveform to decoder & output from hamming decoder.

Input waveform for hamming encoder is shown in Fig.4, in this waveform 4, 16-bit data is given to the input of encoder and the data which are given to its inputs are 0101011011001001, 10000010010001101, 0111001011100000 & 1010000110100100.

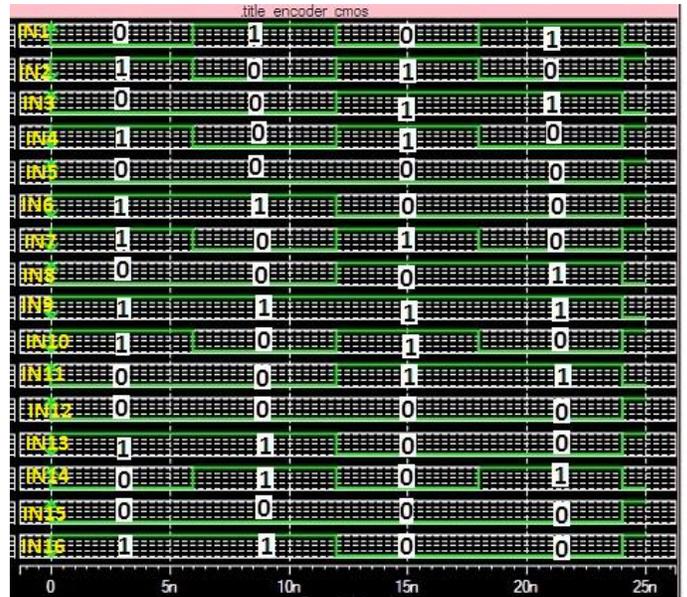


Figure.4 : Input waveform given to 16-bit hamming Encoder.

As we know that for n-input data of hamming encoder, no. of parity bits added to its output is k & its value can be evaluated when inequality $2^k - k - 1 \geq n$ satisfy. For 16-bit input data, at k=5, inequality satisfy that is why no of parity bit required is 5. Hence the no. of bits at its output side is 21. From its output waveform (Fig.5) output bits are 110110100110110001001, 001000000100100101101, 110111110010111000000, and 001001010001101100100.



Figure.5 : output waveform of 16-bit hamming Encoder.

Fig.6 show the input waveform which is given to the hamming decoder. From waveform it is clear that four 21-bit data are given as a input & these are

110110100110110001001, 0010000001001001101, 11011111000111000000, 000001010001101100100.

Bits inside the red circle indicate the error bit present at input side of decoder. Error bits are present at 3rd, 11th, 11th & 3rd positions respectively. As we know that 3rd bit-position of decoder input indicate the 1st bit input & 11th bit-position of decoder input indicate the 7th bit input of encoder. Since hamming codec has capacity to correct 1-bit data so, these bits must be corrected at output of decoder.

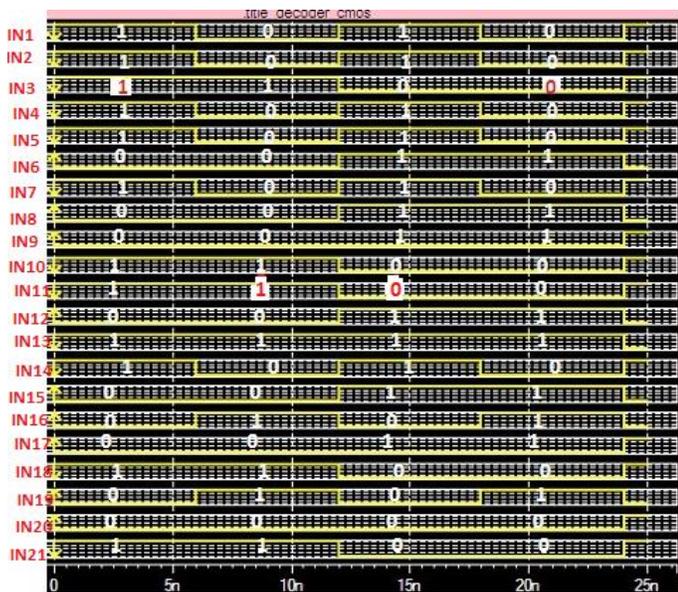


Figure.6 : Input waveform given to 16-bit hamming decoder.

Fig.7 indicate the output waveform of hamming decoder, in which error bit present at the input to decoder is corrected and data become original data which has given to the input of encoder. The original data from fig.7 are

0101011011001001, 10000010010001101, 011100011100000 & 010000110100100.

Bits inside the green bubble indicate the corrected bit by hamming decoder at output side of it.

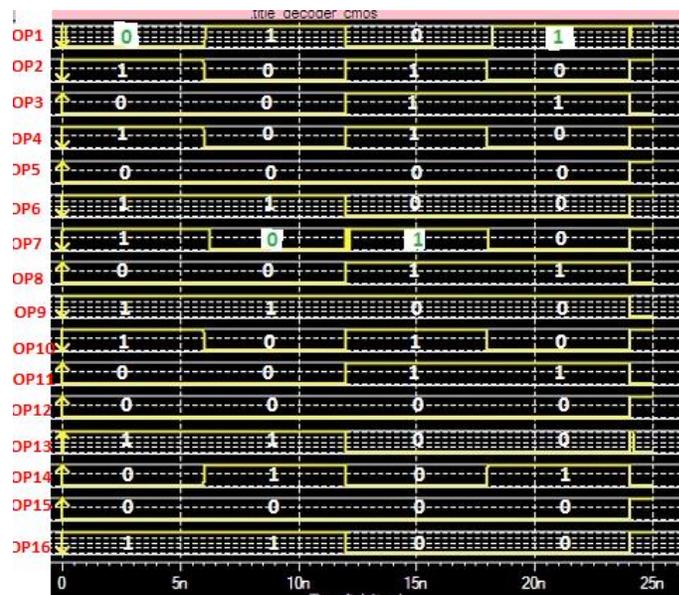


Figure.7 : output waveform of 16-bit hamming decoder.

VI. EXPERIMENTAL RESULT

Experimental result provide the information about no. of transistor usage by different technologies (CMOS, TG, GDI) as well as the simulation time taken by CPU by different technologies, which indicate the propagation delay.

Table.1 which is given below tells about the simulation time taken by CPU for both encoder as well as decoder by different technologies.

Table.1 Delay Table

	SIMULATION TIME IN SECOND TAKEN BY CPU		
	GDI	CMOS	TG
ENCODER	2.2	4.98	3.21
DECODER	5.62	12.76	8.37
TOTAL	7.82	17.74	11.58

From delay table it is clear that GDI tech. save 55.82% time over CMOS & 31.46% time over TG tech. in case of encoder. In case of decoder, GDI tech. save 55.95% time over CMOS and 32.85% over TG technology.

Table.2 confirms that GDI tech. save 66.67% chip area over CMOS & 50% over TG tech. in case of hamming encoder. In case of decoder GDI tech save 54.23% chip area over CMOS & 44.75% over TG technique.

Table.2 Transistor usage by module in three different technique.

		NO. OF TRANSISTORS USAGE		
		GDI	CMOS	TG
16-BIT HAMMIN G CODEC	ENCODER	160	480	320
	DECODER	432	944	782
TOTAL		592	1424	1102

Data given in table.1 & table.2 are graphically represented by a bar graph in fig.7, which show the simulation time delay as well as transistors counts in both hamming encoder as well as hamming decoder comparatively.

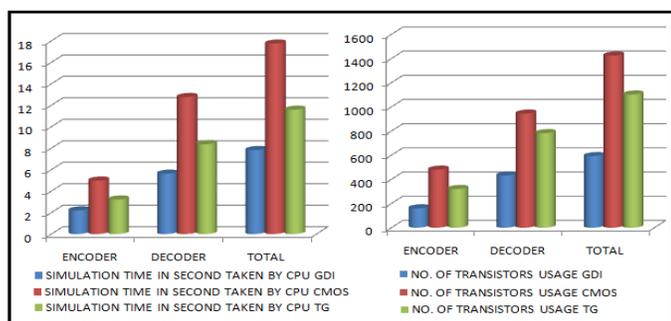


Figure.8 Graphical comparison [delay & area] of hamming codec by different techniques

VII. CONCLUSION

A GDI technique for low-power design was presented. An 16-bit Hamming Codec was designed using GDI. Numerous logic gates and high level digital circuits are implemented in various methods and process technologies, and their simulation results are discussed. Comparisons with existing TG and CMOS techniques were carried out, showing an up to 58.42% reduction of chip area in complete module using GDI over CMOS and up to 46.27% reduction of chip area using GDI over TG. In this cell, the GDI technique has been used for generating of intermediate functions of XOR and AND.

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Isolation and Identification of Enterohaemorrhagic *E. Coli* in Raw Beef

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Abstract- An investigation on occurrence of Enterohaemorrhagic *E. coli* in beef was carried out to determine the prevalence rate in Thrissur. A total of 175 fresh beef samples were collected from four retail outlets and two slaughter houses located at Thrissur. Hundred gram of the material was taken from each sample. The isolation and identification was carried out by FDA method with necessary modification. Five samples were positive for Enterohaemorrhagic *E. coli* and virulence gene *stx 1* was obtained from two isolates using polymerase chain reaction. None of the isolates was positive for *stx 2* and *eae A* genes.

Index Terms- Enterohaemorrhagic, *E. coli*, virulence gene, *stx1*, *stx 2*, *eae A*

I. INTRODUCTION

Enterohaemorrhagic *E. coli* (EHEC) is an emerging foodborne pathogen of public health importance. It is becoming one of the greatest microbiological challenges which hit the food industry over the last two decades. The main source of infection is through ingestion of contaminated and undercooked meat and meat products with EHEC organisms. The food can be contaminated at any point in production, processing, transportation and distribution.

According to WHO (2008) diarrhoeal diseases alone, which are foodborne, can bring about mortality of 1.5 million children every year worldwide. Although most of these diarrhoeal deaths occur in poor countries, foodborne diseases are neither limited to developing countries nor to children. It is estimated that in the United States only, foodborne diseases result in 37.2 million illnesses, 228,744 hospitalizations, and 2,612 deaths each year. Among the EHEC strains, *E. coli* O157: H7 has recognized as an emerging cause of food-borne epidemics. The infection is associated with severe devastating or life - threatening systemic manifestations like Haemorrhagic Colitis (HC) and Haemorrhagic Uraemic Syndrome (HUS) in humans (Amstrong *et al.*, 1996)

The formation of World Trade Organization (WTO) has significantly increased trade in foods of animal origin and live animals between different countries. But emergence and re-emergence of diseases due to **pathogenic bacteria** are the key issue of the new pattern of meat food trades. Currently, India ranks as the third largest exporter of beef in the world. The current study was focused on determining prevalence of EHEC in beef in Thrissur, since the data on the occurrence rate are lacking from our state.

II. MATERIALS AND METHODS

For the isolation and identification of EHEC organisms, the method described by Meng *et al.* (2001) was used with some modifications.

One hundred and seventy five fresh beef samples of 100 g each were collected from four retail outlets namely Mannuthy, Kuriachira, Sakthan Nagar and Chettupuzha and two slaughter house one at Kuriachira (SH 1) and at Thrissur (SH 2). The samples were taken from rump and back regions were found to be contaminated more through contact with intestinal contents and hide. The samples were collected aseptically in sterilized polythene bags and transported to the laboratory under chilled condition. The samples were processed upon arrival on the laboratory on the same day of collection.

The samples were homogenized in a stomacher for three minutes. From the homogenized sample 25 g was weighed and added to 225 ml of Trypticase Soya Broth (TSB) supplemented with Novobocin (20 mg/l) for pre enrichment and incubated for 24 h. at 37°C. After incubation 0.1 ml of the primary enriched broth were transferred to 10 ml of selective enrichment EC O157: H7 broth at 37 °C for 24 h. After incubation a loopful of the inoculum was plated on Cefixime Tellurite- Sorbitol Mac Conkey (CT- SMAC) agar and 4-methylumbelliferyl -beta- D-glucuronide (MUG EC O157) agar (Fujisawa *et al.* 2000) and incubated at 37 °C for 24 h. The colonies showing characteristics neutral grey green colonies with smoky centers on CT- SMAC agar were then subjected to primary and secondary biochemical identification test. Then the identification of virulence genes (*stx 1*, *stx 2* and *eae A* genes) was carried out using polymerase chain reaction (Louie *et al.*, 1994).

III. RESULTS

Of the 175 samples screened, five had colonies characteristics of EHEC organisms on CT- SMAC agar. The colonies on CT- SMAC agar appeared as neutral grey with smoky center and having a diameter of one to two centimeters. On further plating on MUC EC agar, colonies appeared non fluorescent under UV illumination which was the typical character of *E. coli* O 157: H7 strains (March and Ratnam, 1986). Out of five positive samples, two were from Kuriachira. One sample each from Mannuthy, Sakthan Nagar and Chettupuzha possessed EHEC organisms out of 31, 40 and 24 samples respectively. All the samples collected from two slaughter houses were negative for EHEC organisms.

The isolates obtained were Gram negative, short rods, catalase positive, oxidase negative, sorbitol non fermentative and IMViC +++-.

The results of polymerase chain reaction revealed that two isolates from five positive samples possessed *stx 1* gene where as none of the isolates were carrying *stx 2* and *eae A* gene.

IV. DISCUSSION

Of the 175 fresh beef samples screened, the prevalence rate of EHEC was 2.86 per cent.

The present study revealed that the occurrence of EHEC in beef was 2.86 per cent which is in accordance with the results of Fantelli and Stephan (2001) who had isolated EHEC from 2.37 per cent beef sample and Baumgartner and Grand (1995) who had reported 2.4 per cent occurrence in beef samples. Desmarchelier and Grau (1997) reported slightly higher occurrence rate of Enterohaemorrhagic *E. coli* (3.7 per cent) from raw beef samples. Suthienkul *et al.* (1990) could not isolate any *E. coli* O157: H7 from retail meat. A high occurrence rate (6.36 per cent) was reported by Voravuthikunchai *et al.* (2002).

In the present study, 5.71 per cent positive beef samples were obtained from Kuriachira, followed by Chettupuzha (4.17 per cent), Mannuthy (3.23 per cent) and Sakthan Nagar (2.5 per cent). No positive samples were obtained from any of the two slaughter houses from which beef samples were collected. This is in agreement with the study results of Hiko *et al.* (2008) in which they have reported that the rate of occurrence of *E. coli* O 157: H7 was higher from butcher shops (7.8 per cent) compared to municipality and export abattoirs. The results of recent study also resemble with the report by Stampi *et al.* (2004) that all the strains of *E. coli* O157 recovered in the study were from meat samples collected from small retailers.

On statistical analysis, no significant difference ($p < 0.05$) was noticed between any two sources in occurrence of EHEC in beef samples.

Strategies to reduce EHEC in foods will depend much on hygienic and sanitary production and processing practices. This is to reduce the colonisation, transmission and cross contamination of EHEC in foods and the environment. An effective control measure for this pathogen has to target the farm, processing plants and the environments. At all these stages, strict adherence to standard operating measures must be practiced. The study also suggested the need for stringent food safety measures through the implementation of hygienic practices at all levels from the production to the consumption.

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Quantification of intramolecular interactions in the metal complexes of beta-hydroxy ketone derivatives (O-O donors) and benzotriazole derivatives (N-O donors) in solution

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Abstract- The stabilities of ternary complexes of metal ions (copper, nickel, zinc and cobalt) with beta-hydroxy ketone (BHK) derivatives and benzotriazole (BTAZ) derivatives in 50% water + 50% dioxane medium in 0.1 M KNO_3 ionic strength at 25°C using potentiometric pH titrations have been established. The data reveal that the copper forms more stable complexes, which is followed by zinc ion complexes with these ligands. Both nickel and cobalt form complexes with similar stabilities. The stabilities of these complexes are further quantified with $\Delta \log K$ values, intra-molecular equilibrium constants and percentage of stacking interaction in the ternary systems. The observed positive $\Delta \log K$ values suggest that the flexible side chain alkyl moiety (butyl group) or aromatic moiety (phenyl group) in BHK ligand overlaps with the fixed aromatic moiety of BTAZ ligand in the ternary complex, which results in the enhanced stabilities for the (BHK-Bu)-Metal(II)-BTAZ and (BHK-Ph)-Metal(II)-BTAZ systems. Interestingly, the positive $\Delta \log K$ values for both BHK-Bu and BHK-Ph ligands in their corresponding ternary complexes are about the same. This suggests the flexible butyl or phenyl sidechain of BHK is overlapping with the triazole ring, but not the phenoxy ring of the BTAZ ligand.

Index Terms- Ternary complexes, mixed ligand complexes, stability constants, intramolecular interactions, stacking interactions.

I. INTRODUCTION

Metal-ligand complexes have several applications in various fields. Some of the utilities include in the biological systems¹ development of luminescent materials^{2,3} color stabilizing agents for toners in color photography^{4,5} and catalysts⁶. In these applications, the metal ligand complexes act as charge controlling agents, because the metal-ligand complexes are excellent in heat resistance and environment resistance in the medium. These properties of metal complexes directly depend on (i) the structure of the ligand and (ii) the stability of metal-ligand complexes against the heat, light and their solubility properties. For example, in order to develop a luminescent material with excellent properties, the first requirement is the investigation of the stabilities of metal-ligand complexes. The easy and quick technique to find out the properties of metal ligand complexes is

potentiometric technology⁷ and is being used in exploring the interactions of metal ligand(s) complexes in solution^{8,9,10}.

In general the stability of metal ligand complexes is estimated by the strength of the interaction between the metal ion and the ligands. However, in some cases, the intramolecular non-covalent interactions between ligands can contribute a significant role in the overall binding energy of the complex. These interactions include hydrogen bonding, hydrophobic interactions, and stacking interactions between the ligands of the complex. Most of the time the predicted stabilities of the metal ligand complexes, based on the pK_a values of the ligands, differ from the experimental values. This is because of the fact that the intramolecular interactions present between the coordinated ligands in the metal complex and also these interactions are depend on the orientation of the side chains of the ligands.

In order to get more information on the intramolecular interactions and their contribution towards the overall stability of metal ligand complexes, in this investigation, we selected beta-hydroxy ketone (BHK) derivatives and benzotriazole(BTAZ) derivatives as ligands, and Cu(II), Ni(II), Zn(II) and Co(II) as metal ions in the formation of metal ligand complexes.

The metal complexes of beta-hydroxy ketone (BHK) and benzotriazole (BTAZ) derivatives have several industrial applications. For example, metal complexes of BHK are known to use as a fluorescent probes or insecticides¹¹ whereas metal complexes of BTAZ used as catalysts in organic synthesis¹².

The selected beta-hydroxy ketone derivative has a methyl or ethyl or butyl or aromatic substitution in a flexible side chain and this side chain is not involved in the metal coordination. The selected second ligand, benzotriazole derivative, which has benzotriazole ring connected to ethanol or phenol side chain, and this side chain involved in the coordination with the metal ion. In this report we show that the flexible butyl and phenyl side chain of beta-hydroxy ketone involves in the intramolecular interaction with the benzotriazole ring, but not phenoxy ring of benzotriazole derivative.

The objective of this investigation is to identify the intramolecular interactions and their contributions towards the overall stabilities of metal-ligand complexes. In this investigation we explore, how the side chain groups from BHK interact with fixed aromatic moieties of bound BHK ligand to the metal ion and its effect on the overall stability of the ternary metal-ligand complexes in solution.

II. EXPERIMENTAL

The ligands from beta-hydroxy ketone (BHK) derivatives are shown in Figure 1 (a)-(d). The BHK ligands consisting of trifluoromethyl group in the compound. The listed ligands differ from each other at their terminal positions. The formula (a) is abbreviated as BHK-Me, the formula (b) is abbreviated as BHK-Et, the formula (c) is abbreviated as BHK-Bu, and the formula (d) is abbreviated as BHK-Ph, where BHK is $\text{CF}_3\text{-C(OH)=CH-C(=O)-CH}_2\text{-}$, Me is methyl, Et is ethyl, Bu is butyl and Ph is $\text{-CH}_2\text{-phenyl}$ group.

The ligands from benzotriazole (BTAZ) derivatives are shown in Figure 1 (e) and (f). The listed two ligands differed by the nature of substituted alcohol group. The formula (e) is abbreviated as BTAZ-Alk-OH, and the formula (f) is abbreviated as BTAZ-Ph-OH, where Alk is $\text{-CH}_2\text{-CH}_2\text{-}$ and Ph is -phenyl group.

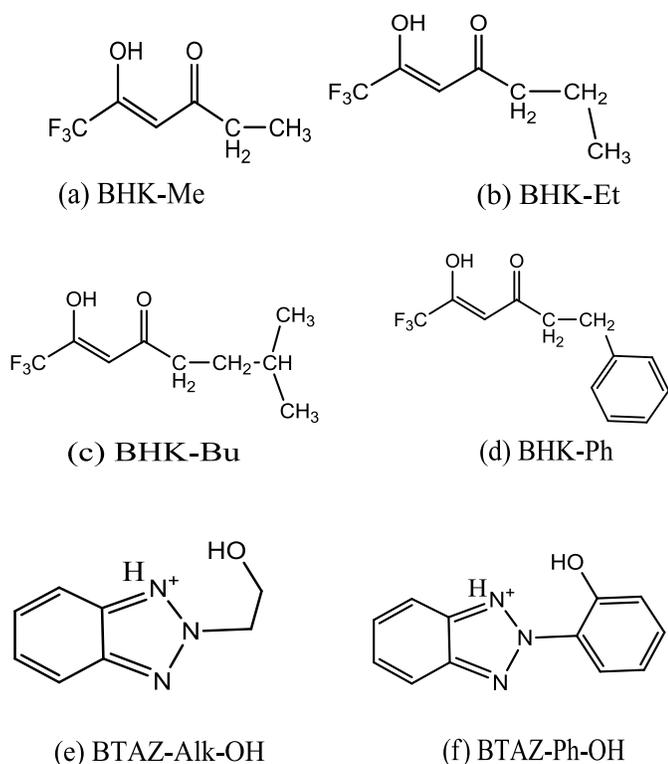


Figure 1. Beta-hydroxy ketone (BHK) derivatives (a)-(d) and Benzotriazole (BTAZ) derivatives (e) and (f).

The above ligands are synthesized and purified in our laboratory (unpublished data).

Metal salts of Cu(II), Ni(II), Co(II) and Zn(II) were AR grade chemicals. All the metal ions were standardized with disodium salt of EDTA¹³. Carbonate free sodium hydroxide was prepared and standardized by titration with potassium acid phthalate¹⁴.

Stock solutions of metal ion were prepared from double distilled water. For every titration, fresh solid ligand was weighed out into the reaction cell to avoid possible hydrolysis.

The experimental method consisted of potentiometric titration of the free ligands with standard sodium hydroxide in the absence and in the presence of above mentioned metal ions being investigated. The titrations were carried out in a

magnetically stirred double-walled reaction cell maintained at 25°C. The ionic strength was maintained constant by using 0.10M KNO_3 as a supporting electrolyte and relatively low concentration of the ligand and metal ion ($1 \times 10^{-3}\text{M}$). During the course of titration a stream of nitrogen was passed over the solution to eliminate the adverse effect of atmospheric carbon dioxide. For every titration, fresh solid ligand was weighed out into the reaction cell to avoid possible concentration effects.

A digital pH meter with a combination electrode was used to determine the hydrogen ion concentration. The electrode system was calibrated by direct titration of acetic acid, and the observed pH meter reading was compared with the actual hydrogen ion concentration. The pH regions below 3.5 and above 10.5 were calibrated by measurement in HCl and NaOH solutions, respectively.

All the titrations were conducted in dioxane-water (50:50) solvent system. The pK_w^c values were validated for 25°C and 0.1 M ionic strength using the Debye-Huckel equation for water and dioxane mixture¹⁵. The pK_w values, the dielectric constants and densities were obtained from Harned and Owen¹⁶. No turbidity or precipitation was noticed at any time during the titration of metal ions with the ligands.

III. CALCULATIONS

The ionization constants of various ligands were calculated using the computer program PKAS⁷. Entire pH range from the titration data has been given for the calculation of pK_a values using the computer program. All the formation or stability constants were subjected to refinement using the computer program BEST⁷. The refinement of the stability constants of binary and ternary systems were done by considering all possible species present in the solution, i.e., HL^+ , HA, L⁻, A⁻, ML, ML_2 , MA, MA_2 and MAL etc, where L and A are different ligands in the complex. The refined values for these complexes thus obtained are given in Tables 1-3. The error limits in these constants were minimized (sigma fit is 0.001).

Table 1 – Ionization constants (pK_a) of Beta-hydroxy ketone derivatives and Benzotriazole derivatives, $\mu = 0.10 \text{ mol dm}^{-3}$ (KNO_3) at Temp = 25°C, Solvent 50% water + 50% dioxane

Ligand	pK_a	pK_{2a}
(a) BHK-Me	9.88 ± 0.04	-
(b) BHK-Et	9.99 ± 0.04	-
(c) BHK-Bu	10.16 ± 0.04	-
(d) BHK-Ph	10.36 ± 0.03	-
(e) BTAZ-Alk-OH	6.55 ± 0.02	9.82 ± 0.02
(f) BTAZ-Ph-OH	6.74 ± 0.04	10.22 ± 0.04

Table 2 – Stability constants[†] ($\log K$) for the metal(II)-ligand (1:1) binary complexes, $\mu = 0.10 \text{ mol dm}^{-3}$ (KNO_3) at Temp = 25°C, Solvent 50% water + 50% dioxane

Ligand	Cu(II)	Ni(II)	Zn(II)	Co(II)
(a) BHK-Me	6.62	4.45	3.62	3.56
(b) BHK-Et	6.33	4.24	3.33	3.25
(c) BHK-Bu	6.03	3.92	3.13	2.89

(d) BHK-Ph	6.01	3.81	3.12	2.92
(e) BTAZ-Alk-OH	8.71	5.98	6.28	5.83
(f) BTAZ-Ph-OH	8.65	5.78	6.01	5.63

† standard deviation ±0.02 to ±0.04

Table 3 – Stability constants[†] (log K) for the BHK-metal(II)-BTAZ(1:1:1) ternary complexes, $\mu = 0.10 \text{ mol dm}^{-3}$ (KNO_3) at Temp = 25°C, Solvent 50% water + 50% dioxane

Ternary Complex	Metal ion			
	Cu(II)	Ni(II)	Zn(II)	Co(II)
(BHK-Me)-(Metal)- (BTAZ-AlkOH)	14.98	9.82	9.52	8.68
(BHK-Me)-Metal- (BTAZ-Ph-OH)	14.91	9.72	9.42	8.67
(BHK-Et)-(Metal)- (BTAZ-Alk-OH)	14.82	9.71	9.38	8.38
(BHK-Et)-Metal- (BTAZ-Ph-OH)	14.72	9.62	9.22	8.29
(BHK-Bu)-(Metal)- (BTAZ-Alk-OH)	14.91	9.88	9.52	8.75
(BHK-Bu)-Metal- (BTAZ-Ph-OH)	14.83	9.74	9.28	8.55
(BHK-Ph)-(Metal)- (BTAZ-Alk-OH)	15.39	9.92	9.79	8.88
(BHK-Ph)-Metal- (BTAZ-Ph-OH)	15.34	9.75	9.54	8.71

† standard deviation ±0.02 to ±0.04

IV. RESULTS AND DISCUSSION

Dissociation constants of ligands

The potentiometric titration of BHK ligands took one mole of base per mole of ligand to complete deprotonate the ligand. The dissociation constant (pK_a) for these ligands were calculated from the experimental points taken between $a=0$ and $a=1$ (a is moles of bases added per mole of ligand). The pK_a values for BHK ligands were calculated by taking into consideration of species HA and A, where HA is protonated ligand and A is a deprotonated ligand. The pK_a values for these ligands are listed in Table 1. The single pK_a value from the dissociation of H^+ is from the $-\text{OH}$ group on the ligand.

The potentiometric titration curve of BTAZ ligands show an inflection at $a=1$ followed by buffer region at high pH. The pK_a and pK_{2a} for these ligands were calculated between $a=0$ and $a=1$, and $a=1$ and $a=2$ respectively and the constants are listed in Table 1. The protonation constants were calculated by taking into consideration of the species, H_2L , HL and L, where H_2A and HL are protonated ligand and L is deprotonated ligand.

The calculated pK_a values for these ligands are listed in Table 1. The pK_a values for BHK ligands increase in the order $-\text{CH}_3 < -\text{CH}_2-\text{CH}_3 < \text{butyl} < -\text{CH}_2-\text{Ph}$. This increase can be explained based on the fact that increase in hydrophobicity of the ligand increases pK_a value. In this case, the hydrophobicity increases from $-\text{CH}_3$ to $-\text{CH}_2-\text{Ph}$, which weakens the ionization

of proton and therefore increases the pK_a value the ligand. Similar trend is noticed in the pK_a values of BTAZ ligands.

Stabilities of binary complexes

The interaction of metal ions (Cu^{2+} , Ni^{2+} , Zn^{2+} and Co^{2+}) with BHK ligands in a 1:1 ratio at 25°C took one mole of base per mole of metal ion, i.e., $m=1$ (m is moles of based added per mole of metal ion) followed by buffer region till $m=3$, indicating simultaneous formation of 1:1 metal ligand complex between $m=0$ and $m=1$. The formation constants for the metal-ligand complexes were calculated in the upper buffer region taking into consideration of pK_a value of the ligand. All the stability constants for the binary complexes are listed in Table 2.

The interaction of metal ions (Cu^{2+} , Ni^{2+} , Zn^{2+} and Co^{2+}) with BTAZ ligands in a 1:1 ratio at 25°C gave inflection at $m=2$ (m is moles of based added per mole of metal ion) followed by buffer region till $m=5$, indicating simultaneous formation of 1:1 metal ion complex with BTAZ ligands in between $m=0$ and $m=2$. All the stability constants for the binary complexes are listed in Table 2.

Stabilities of Ternary Complexes

The interaction of metal ions (Cu^{2+} , Ni^{2+} , Zn^{2+} and Co^{2+}) with BHK and BTAZ ligands in a 1:1:1 ratio at 25°C gave inflection at $m=3$ indicating simultaneous formation of 1:1:1 mixed ligand complex between $m=0$ and $m=3$. This was further confirmed by the species distribution curves (Figure 2).

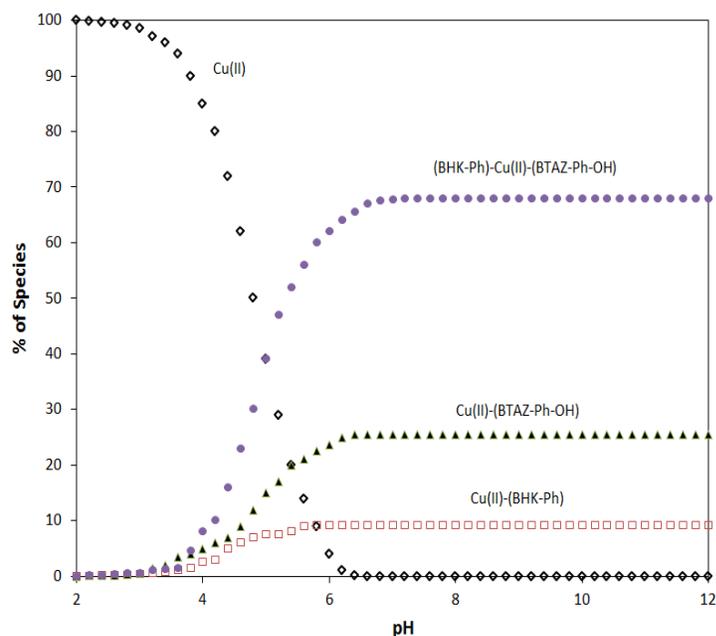


Figure 2. Distribution of various species present in the ternary complex formation between Cu(II), BHK-Ph and BTAZ-Ph-OH over the pH range from 2-12

The stability constants for the mixed ligands and metal ion complexes were calculated in the upper buffer region taking into consideration of pK_a value of both the ligands. All the constants so calculated are listed in Table 3.

Quantification of the Stabilities of Ternary Complexes

The ligand-ligand interactions between the alkyl and aromatic side chain of the bound ligands to metal ion in the ternary complex may result in an enhancement of stability of the complex, relative to the stabilities of their corresponding binary complexes. This kind of stability in the ternary complexes can be quantified in terms of $\Delta \log K$ values (the difference between the overall ternary complexes and the corresponding binary complexes), and these values are listed in Table 4.

Table 4 –Stabilities of BHK-metal(II)-BTAZ (1:1:1) ternary complexes in terms of $\Delta \log K$ values

Ternary Complex	Metal ion			
	Cu(II)	Ni(II)	Zn(II)	Co(II)
(BHK-Me)-(Metal)-(BTAZ-AlkOH)	-0.35	-0.61	-0.38	-0.71
(BHK-Me)-Metal-(BTAZ-Ph-OH)	-0.36	-0.51	-0.21	-0.52
(BHK-Et)-(Metal)-(BTAZ-Alk-OH)	-0.22	-0.51	-0.23	-0.70
(BHK-Et)-Metal-(BTAZ-Ph-OH)	-0.26	-0.40	-0.12	-0.59
(BHK-Bu)-(Metal)-(BTAZ-Alk-OH)	0.17	0.02	0.11	0.03
(BHK-Bu)-Metal-(BTAZ-Ph-OH)	0.15	0.04	0.14	0.03
(BHK-Ph)-(Metal)-(BTAZ-Alk-OH)	0.67	0.13	0.39	0.13
(BHK-Ph)-Metal-(BTAZ-Ph-OH)	0.68	0.16	0.41	0.16

It appears that the $\Delta \log K$ values are positive for (BHK-Bu)-Metal(II)-(BTAZ) and (BHK-Ph)-Metal(II)-(BTAZ) system and where $\Delta \log K$ values are negative for BHK ligands having aliphatic side chain with methyl and ethyl groups. This clearly suggests that the flexible butyl and aromatic moiety in BHK ligand overlaps with the aromatic moiety of fixed BTAZ ligand in the ternary complex (Figure 3), which results in the enhanced stabilities for the (BHK-Bu)-Metal(II)-BTAZ and (BHK-Ph)-Metal(II)-BTAZ systems.

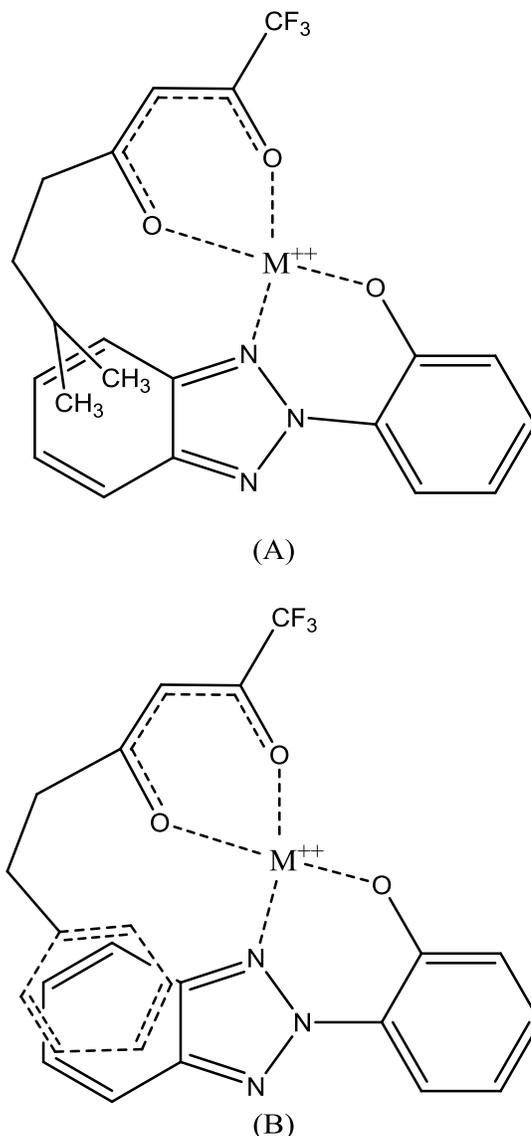


Figure 3. Tentative and simplified structure of ternary complex of (A) (BHK-Bu)-Metal(II)-(BTAZ-Ph-OH), and (B) (BHK-Ph)-Metal(II)-(BTAZ-Ph-OH), showing the intramolecular interaction between flexible side chain of BHK ligand with the heterocyclic ring of fixed BTAZ-Ph-OH ligand

Interestingly, the $\Delta \log K$ values for both (BHK-Bu)/(BHK-Ph)-Metal(II)-(BTAZ-Alk-OH) and (BHK-Bu)/(BHK-Ph)-Metal(II)-(BTAZ-Ph-OH) are about the same. This suggests that butyl and phenyl moiety of BHK is overlapping with the triazole ring, but not the phenoxy ring of the BTAZ ligand. The copper complexes exhibit larger positive $\Delta \log K$ or lower negative $\Delta \log K$ values, which is followed by zinc. The cobalt and nickel show about the same $\Delta \log K$ values.

The positive $\Delta \log K$ values are transformed into intramolecular equilibrium constant and percentage of stacking interaction in the ternary system, and these values are listed in Tables 5 and 6. The intra-molecular equilibrium and percentage of stacking between the butyl and phenyl moieties of the BHK

and BTAZ ligands in the ternary complex are calculated with the following equations (1) and (2):

$$K_1 = (10^{\Delta \log K}) - 1 \quad (1)$$

$$\% \text{ of (TernaryComplex)}_{\text{stacking}} = (K_1 / (1 + K_1)) * 100 \quad (2)$$

where K_1 is intra-molecular equilibrium constant, which is a dimensionless constant.

Table 5 – Quantification of ligand-ligand interactions in (BHK-Bu)-metal(II)-BTAZ (1:1:1) ternary complexes in terms of $\Delta \log K$, Intra-molecular equilibrium constant (K_1) and Percentage of Stacking[‡]

Metal(II)	(BHK-Bu)-Metal-(BTAZ-AlkOH)			(BHK-Bu)-Metal-(BTAZ-Ph-OH)		
	$\Delta \log K$	K_1	% of Stacking	$\Delta \log K$	K_1	% of Stacking
Cu(II)	0.17	0.48	32.39	0.25	0.41	29.21
Ni(II)	0.02	0.05	4.51	0.04	0.09	8.79
Zn(II)	0.11	0.29	22.38	0.14	0.38	27.56
Co(II)	0.03	0.07	6.67	0.03	0.07	6.67

[‡]overlap between the butyl side chain of BHK over the heterocyclic ring of benzotriazole.

Table 6 – Quantification of ligand-ligand interactions in (BHK-Ph)-metal(II)-BTAZ (1:1:1) ternary complexes in terms of $\Delta \log K$, Intra-molecular equilibrium constant (K_1) and Percentage of Stacking[‡]

Metal(II)	(BHK-Ph)-Metal-(BTAZ-AlkOH)			(BHK-Ph)-Metal-(BTAZ-Ph-OH)		
	$\Delta \log K$	K_1	% of Stacking	$\Delta \log K$	K_1	% of Stacking
Cu(II)	0.67	3.67	78.62	0.68	3.78	79.11
Ni(II)	0.13	0.35	25.87	0.16	0.44	30.81
Zn(II)	0.39	1.45	59.26	0.41	1.57	61.09
Co(II)	0.13	0.35	25.87	0.16	0.44	30.82

[‡]overlap between the phenyl side chain of BHK over the heterocyclic ring of benzotriazole.

According to the data in Tables 5 and 6, the intra-molecular equilibrium constant is high for copper complexes compared to other metal ternary complexes. The percentage of stacking is also high for copper complexes, followed by zinc complexes and about the same for nickel and cobalt complexes.

V. CONCLUSIONS

We report stabilities of ternary complexes of metal ions (copper, nickel, zinc and cobalt) with beta-hydroxy ketone derivatives and benzotriazole derivatives in 50% water + 50%

dioxane medium using potentiometric technology. The calculated data suggests that copper forms more stable complexes, which is followed by zinc ion complexes with these ligands. Both nickel and cobalt form about the same stable complexes. The stabilities of these complexes are quantified with $\Delta \log K$ values, intra-molecular equilibrium constants and percentage of stacking interaction in the ternary systems. The striking positive $\Delta \log K$ values suggest that side chain butyl and phenyl moiety in BHK ligand overlaps with the aromatic moiety of BTAZ ligand in the ternary complex, which results in the enhanced stabilities for the (BHK-Bu)/(BHK-Ph)-Metal(II)-BTAZ system. Interestingly, the $\Delta \log K$ values for both (BHK-Bu)/(BHK-Ph)-Metal(II)-(BTAZ-Alk-OH) and (BHK-Bu)/(BHK-Ph)-Metal(II)-(BTAZ-Ph-OH) are about the same. This suggests the aromatic moiety of BHK is overlapping with the triazole ring, but not the phenoxy ring of the BTAZ ligand.

In view of the utilities of metal complexes of beta-hydroxy ketone and benzotriazole derivatives in the chemical and biochemical fields, the established unexpected stabilities, from the intramolecular interactions, for the reported ternary complexes may serve as good model complexes in the design and development of chemical probes. The ligand-ligand interactions in the metal-ligand complexes are directly related to the overall stability of the chemical probe. Our data also suggest that copper and zinc complexes may be superior to the nickel and cobalt complexes.

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Electronic Properties of $\text{Co}_{1-x}\text{Sb}_x$

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Abstract- Thermo-power and magnetization measurements of $\text{Co}_{1-x}\text{Sb}_x$ ($0 < x < 0.5$) are presented here. The estimation of Fermi energy, energy of d-band edge and density of states using Kolomoets' two band model indicates that the electronic structure of the alloys may be described by cobalt 3d bands overlapping broader antimony p bands. The Fermi level is located slightly below the d-band edge. On increasing antimony, the Fermi level and d-band edge shifts to high energy side filling the d-band and causing a decrease in magnetic moment.

Index Terms- Thermo-power; Fermi Energy; Density of states; Magnetic Moments.

I. INTRODUCTION

Properties such as resistivity, thermoelectricity of transition metals, intermetallic compounds have been studied earlier [1,2,3]. Magnetic properties of bulk amorphous alloys are also studied extensively. Soft magnetic metallic glasses have wide variety of applications such as position sensor, solenoid valves, magnetic sensor etc.[4].

Studies of thermoelectricity in metals, alloys and semiconductors yield information about electronic structure and about the interactions between electrons and both lattice vibrations and impurities. Their practical applications include the measurement of temperature, generation of power, cooling and heating etc.[5]. Thermo-power S , is sensitive to many factors. The addition of impurities can change the thermo-power of pure metal [6]. In a non-cubic material [7], two samples from such a non-cubic crystal cut in different directions may be thermoelectrically different even if each sample is highly homogeneous. Thermo-power also depends on electron diffusion, phonon drag and magnon drag effects.

In case of pure metals and alloys, it is observed that phonon drag and magnon drag effects are prominent at Debye temperatures much lower than room temperature. Above room temperature, their influence over the thermo-power is negligible and only the electron diffusion component plays an important role [8].

Thermoelectric properties of many magnetic metals have been reported [9,10]. For pure cobalt it is observed that the crystal structure hcp or fcc is not an important parameter in determining S . It is of greater interest to note that the S Vs T curve goes through a very deep minimum at 600K and then abruptly changes slope near the Curie point [10]. The value of S remains negative in the temperature range 0-1200K.

Metallic glasses prepared from transition ferromagnetic metal and metalloid such as $\text{Co}_{1-x}\text{B}_x$, $\text{Co}_{1-x}\text{P}_x$ etc. [11,12,13] have been extensively investigated for their importance. We report

here thermoelectric properties of $\text{Co}_{1-x}\text{Sb}_x$ alloys where $x = 0.17, 0.25, 0.33, 0.36, 0.40$ and 0.44 .

II. EXPERIMENTAL

The samples of $\text{Co}_{1-x}\text{Sb}_x$ were synthesized by first preparing CoSb in induction furnace and annealing. Then cobalt was added to it in appropriate weight proportion and again melted in induction furnace. The samples then were again annealed.

To confirm the formation of $\text{Co}_{1-x}\text{Sb}_x$ samples produced by above mentioned CoSb route, XRD patterns were obtained by using the D500 Siemens, Germany and the Rigaku, Japan diffractometers (both use Copper target).

A flat sample held between two platinum electrodes is sandwiched between two spring-loaded copper rods. These copper rods are insulated electrically from the sample by inserting mica sheets between the rods and the platinum electrodes. Further the rods are heated unequally by two identical furnaces to ensure a constant temperature difference adjustable between 5K and 10K and the average temperature of the sample variable from room temperature to about 600K.

III. RESULT

The XRD patterns of all the samples $\text{Co}_{1-x}\text{Sb}_x$ were obtained using $\text{K}\alpha_1$ and $\text{K}\alpha_2$ ($\lambda_1 = 1.54051\text{\AA}$ and $\lambda_2 = 1.54433\text{\AA}$ respectively) emission lines of copper. The inter-planer distance 'd' and the relative intensities corresponding to all samples of $\text{Co}_{1-x}\text{Sb}_x$ are listed in Table 1 and 2.

All the thermo-power measurements ($S_d, \mu\text{V}/\text{K}$) have been carried out between room temperature and 510K (Fig.1). It is observed that thermo-power is negative for all the samples at all the temperatures (T). All the S_d Vs T curves, except the one corresponding to $x = 0.36$, exhibit a change in the sign of slope between room temperature and 350K. It indicates that some kind of order-disorder transition has already occurred. This transition is certainly not due to ferromagnetic to paramagnetic or hcp to fcc transitions which occur at 1100K and 700K in case of cobalt.

Also since S_d is not proportional to $1/T$ after transition, it is not a phonon drag effect [14]. Possibly it is due to spin orbit scattering, electron-electron scattering or magnon drag [15].

In the range $0.17 \leq x \leq 0.33$, this transition is followed by a linear portion between 350K and 450K and as x increases the slope decreases. Above 450K these curves become nonlinear. Corresponding to $x = 0.40$ and 0.44 the curves are nonlinear and rather steep between 350K and 500K. In the case of sample with

$x = 0.36$, this transition is missing and the curve is almost flat and nonlinear.

Table 1: Miller Indices (hkl), Intensities (I/I_0) and Inter-

hkl	X = 0.17			X = 0.20			X = 0.25			X = 0.33		
	I/I_0	dobs	dcal	$I/I_0$	dobs	dcal	$I/I_0$	dobs	Dcal	$I/I_0$	dobs	dcal
101	100	2.816	2.816	100	2.842	2.841	100	2.839	2.839	100	2.879	2.879
002	91	2.041	2.036	19	2.598	2.595	-	-	-	11	2.611	2.624
102	81	1.949	1.949	49	2.061	2.061	79	2.061	2.056	60	2.077	2.087
110				43	1.961	1.961	63	1.962	1.963	40	1.988	1.988
201				14	1.617	1.614	-	-	-	12	1.635	1.636
112				-	-	-	-	-	-	7	1.580	1.585
103				16	1.539	1.542	40	1.539	1.536	13	1.548	1.560
202				15	1.422	1.421	34	1.461	1.419	11	1.434	1.439
113							35	1.295	1.294	-	-	-
210							-	-	-	-	-	-
211							38	1.248	1.246	9	1.261	1.263
104							-	-	-	5	1.221	1.219

planar distances (d) (observed and calculated) corresponding to system $Co_{1-x}Sb_x$ ($x = 0.17, 0.20, 0.25, 0.33$).

Table 2: Miller Indices (hkl), Intensities (I/I_0) and Inter-

hkl	X = 0.36			X = 0.40			X = 0.44		
	I/I_0	dobs	dcal	I/I_0	dobs	Dcal	I/I_0	dobs	Dcal
101	100	2.847	2.847	100	2.852	2.852	100	2.855	2.854
002	8	2.598	2.601	5	2.602	2.607	8	2.602	2.606
102	65	2.062	2.066	52	2.066	2.070	64	2.068	2.071
110	52	1.964	1.964	46	1.967	1.967	45	1.969	1.969
201	17	1.617	1.617	19	1.618	1.618	17	1.620	1.621
112	11	1.566	1.567	7	1.567	1.567	10	1.568	1.571
103	18	1.541	1.544	17	1.543	1.543	18	1.544	1.548
202	16	1.421	1.423	17	1.423	1.423	13	1.425	1.427
113				20	1.296	1.296	5	1.297	1.303
210				8	1.293	1.293	-	-	-
211				13	1.248	1.248	13	1.249	1.251
104				10	1.213	1.213	7	1.215	1.217

planar distances (d)(observed and calculated) corresponding to system $Co_{1-x}Sb_x$ ($x = 0.36, 0.40, 0.44$).

The magnetic measurements of these samples between room temperature and 600K indicate constant magnetic moments. Hence magnetic moments computed at room temperature are listed in Table 3 to facilitate the comparison. It is observed that except for $x = 0.20$ the magnetic moment decreases linearly as x increases (Fig. 2).

I. DISCUSSION

The electronic structure of transition metals, particularly Fe, Co and Ni is determined by the electronic population of overlapping 4s and 3d bands. Further, the Fermi level in these metals is near, yet below the top of the density of states curve for the d band. Therefore, the electronic structure of Co-Sb alloys

may be described in terms of 4s and 3d bands, the overlapping of which is influenced by a broader antimony p band. The Fermi level in these alloys should lie near the top of d band as in cobalt and CoSb [16]. On the basis of band theory, the negative sign of the thermo-power as observed by us indicates the presence of holes i.e. more than half filled band [17]. Further the magnetic moments in all our samples are less than that in cobalt. This too implies that the d band is almost full is applicable here.

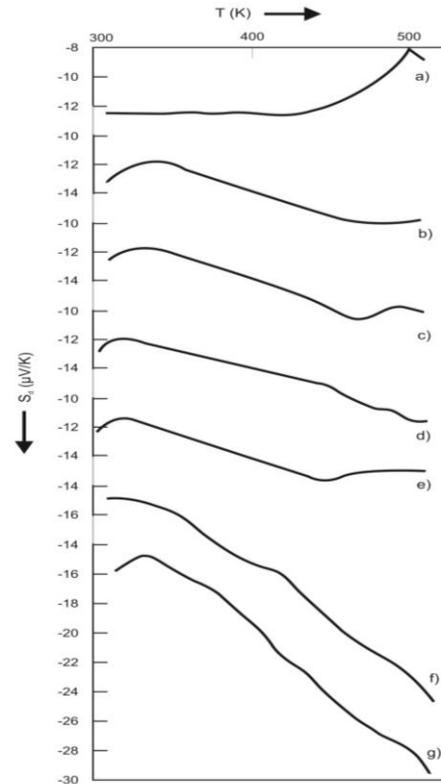


Figure 1: Thermopower S_d ($\mu V/K$) Vs absolute temperature T (K) corresponding to $Co_{1-x}Sb_x$.

a) $x = 0.36$, b) $x = 0.33$, c) $x = 0.17$, d) $x = 0.20$,
e) $x = 0.25$, f) $x = 0.44$, g) $x = 0.40$.

Table 3: Magnetic moment, Fermi Energy, Top of the d-band and Density of states corresponding to $Co_{1-x}Sb_x$.

X	E_F (eV) (± 0.02 eV)	E_d (eV) (± 0.02 eV)	$N_d(E_F)$ (states/eV unit cell at 400K)	Magnetic moment (μ_B) ($\pm 0.05\mu_B$)
0.17	1.06	1.11	1140	1.25
0.20	1.08	1.13	1150	1.35
0.25	1.10	1.15	1130	1.05
0.33	1.12	1.17	1170	0.70
0.36	1.14	1.18	930	0.50
0.40	1.16	1.19	1880	0.45
0.44	1.18	1.21	1800	0.15

If the thermo-power is free from all transitional effects then the electron diffusion thermo-power S_d at temperature T using a two band model is given by [5,15].

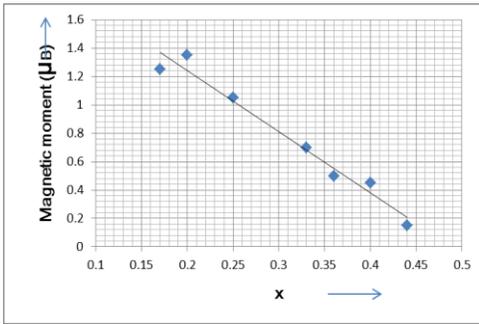


Figure 2: Magnetic Moment μ_B Vs x in $Co_{1-x}Sb_x$

$$S_d = -\frac{\pi^2 K^2 T}{3|e|} \left[\frac{3}{2E_F} - \frac{1}{N_d(E)} \cdot \frac{dN_d(E)}{dE} \right] \text{ at } E = E_F \quad -- (1)$$

Where E_F = Fermi energy, $N_d(E)$ = density of states of d electrons at energy E.

If the $N_d(E)$ Vs E curve has a minimum or maximum or if $N_d(E)$ is independent of E in the vicinity of the Fermi energy then

$$\frac{1}{N_d(E)} \cdot \frac{dN_d(E)}{dE} \ll \frac{3}{2E_F}$$

we get

$$E_F = -\frac{\pi^2 K^2 T}{2S_d |e|}$$

i.e. $S_d = \frac{-\pi^2 K^2 T}{2|e| E_F}$

Since Fermi energy in metals and alloys is weakly dependent on temperature, a plot of S_d Vs T should be a straight line passing through origin. If the initial nonlinear transitional portion of the curve is ignored then the linear portion in the temperature range $350K \leq T \leq 450K$ is indeed a straight line which passes through origin after extrapolation in cases where $(0.17 \leq x \leq 0.33)$. The Fermi energies computed from the slope are listed in Table 3. They are of the same order as reported for 3d metals [18,19,20] and are observed to increase as the content of antimony is increased. This is indicative of continuous filling of d bands. Also the decreasing magnetic moment (except for $x = 0.20$) indicates the continuous filling of d band as the content of antimony increases. The exception for $x=0.20$ may be due to the increase in the difference between spin up and spin down densities of states near Fermi energy.

For $x > 0.36$, the linear portions of S_d Vs T curves do not pass through the origin when extrapolated. This means

$$\frac{1}{N_d(E)} \cdot \frac{dN_d(E)}{dE}$$

is large and temperature dependent. This would happen where $N_d(E_F)$ changes rapidly even for small changes in Fermi energy. Hence it is difficult to compute directly the Fermi energies corresponding to these samples. However a linear

relationship is observed between Fermi energies and x (Fig.3) corresponding to $0.17 \leq x \leq 0.33$. Hence extrapolating this line the Fermi energies corresponding to $0.36 \leq x \leq 0.44$ are estimated. These values are also indicated in Table 3. These Fermi energies are substituted in equation (1) and the densities of states are calculated at 400K and are also reproduced in Table 3. It is observed that N_d is nearly constant in $0.17 \leq x \leq 0.36$ and rises rapidly for $x = 0.40$ and $x = 0.44$ (Fig.4)

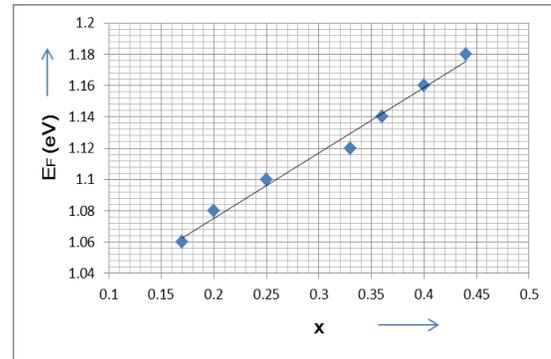


Figure 3: Fermi Energy E_F Vs x in $Co_{1-x}Sb_x$

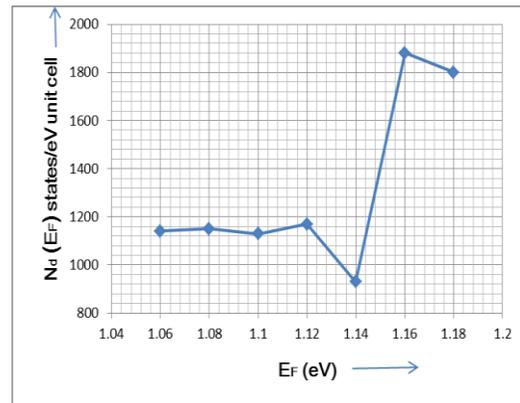


Figure 4: Density Of States of $Co_{1-x}Sb_x$ near Fermi Energy

The gross features of the density corresponding to similar alloys of 3d metals are of same order [19,21]. Our densities of states at different Fermi energies are near the top of the d band. They are compared with the density of states curve for CoAs [22] near top of the d band. It is interesting to note that in both the cases N_d rises sharply.

It is possible to calculate E_d using S_d Vs γ curve [20] where E_d is d band edge closest to Fermi level and $\gamma = (E_d - E_F)/kT$. Values of E_d calculated in this manner are reproduced in Table 3. It is observed that $E_d > E_F$ and E_d increases with the contents of antimony. However $(E_d - E_F)$ decreases with increasing Sb content indicating filling of d band and reduction in magnetic moment. This observation is consistent with magnetic measurements.

II. CONCLUSION

The increasing antimony in Co-Sb alloys shifts the Fermi level (E_F) and d band edge (E_d) to high energy side where $E_d > E_F$. However ($E_d - E_F$) decreases with increasing Sb content. This causes a rapid decrease in magnetic moment and rapid increase in density of states near Fermi level for $x > 0.36$.

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Biochemical Changes in Grapevines Roots in Responses to Osmotic Stress

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Abstract- We studied osmotic stress-induced biochemical changes in hydroponically grown plants of grapevine, *vitis vinifera* (var. doukkali). Our focus was on the effect of peg (applied at 0,2 , 0,4 or 0,8 MPa) on roots hydrogen peroxide, polyphenols, and proline

Osmotic stress induced an accumulation of proline and hydrogen peroxide in a dose dependent manner. The total amount of the phenolic increased after high level of stress (0,8MPa) and decrease under 0,2 and 0,4 MPa and start to increase after 24h. These findings could offer a partial explanation for the physiological role of the varying endogenous levels of proline that could govern the mechanism of osmotic stress tolerance in drought grapevine cv. Doukkali.

Index Terms- Vitis vinifera- hydrogen peroxide- osmotic stress- proline- polyphenols

Abbreviations: DW: dry weight- FW: fresh weight- PEG: polyethylene-glycol- Pro, proline; WC, water content.

I. INTRODUCTION

Grapevine an important economical crop is widely distributed throughout the arid and semiarid regions of the world. Grapevines grown in the Mediterranean zone are usually subject to water stress conditions caused by high evaporative demand and low soil water availability (Rodrigues *et al.*, 2008). It is also well known that grapevine varieties are characterized by high heterogeneity concerning their adaptation ability to such adverse environmental conditions (Schultz, 2003; Duan *et al.*, 2007). Doukkali cv. is a local variety cultivated in the region of doukkala (morocco) Characterised as semi arid region and wich know increasing salinity.

Drought and salt stress are the main abiotic stresses subjected to plants during their whole growth and development and are also one of the major causes of osmotic stress to plants under natural conditions (Xiong *et al.*, 2002). Plants under these conditions initiate some defense mechanism to reduce stress injury such as accumulation of organic compounds like polyamines and proline.

Proline is most common osmolyte and osmoprotectant in plants under stress conditions (Hasegawa *et al.*, 2000), and is often considered to be involved in stress resistance mechanisms and osmotic adjustment in stressed tissues of plant (Ashraf and Foolad, 2007). When exposed to drought or a high salt content in soil, many plants have been observed to accumulate high amounts of proline, (Mansour 2000). Trotel *et al.*, 1996 suggest

that proline is a nitrogen source available for recovery from stress and for restoration of growth. Additionally, it was shown that proline possesses antioxidant capacity, either as a potent ROS scavenger (Matysik *et al.* 2002) or by protecting and stabilizing ROS scavenging enzymes and activating alternative detoxification pathways (Szabados and Savouré 2010).

Therefore, this paper was aimed to study the changes occurring in proline, hydrogen peroxide and phenolic compounds in the roots of grapevine plants growing hydroponically under PEG osmotic stress.

II. MATERIAL AND METHODS

II.1. Plant material and osmotic treatments

The study was carried out with hydroponically grown grapevine cuttings (*Vitis vinifera* L.) var. Doukkali, a high-quality table grape variety in Morocco. Hardwood cuttings of grapevines were collected at the dormant bud stage from the vineyard of Doukkala (El jadida, Morocco) and planted in sand for rooting in growth chamber at 28°C, 70% humidity, and 16h/8h photoperiod. After 4-months, the well-developed healthy plants were transferred to hydroponic culture containing the Hoagland nutrient solution (Hoagland, ref). The nutrient solution was renewed every 4 days. Plants were grown in the same conditions as described above. For osmotic treatments, PEG-20000 was added to the nutritive solution in order to obtain a final osmotic potential of -0.2 MPa, -0.4 MPa and -0.8 MPa. Samples were taken after 0, 6, 12, 24 and 48h and stored at -20°C until use or immediately used for PAs extraction.

II.2. Determination of water content (WC)

In addition to fresh weight (FW), dry weight (DW) was determined after desiccation at 70°C for 48 h. Leaf water content was estimated using the equation: $WC = (FW - DW/FW) * 100$.

II.3. Hydrogen peroxide content

Hydrogen peroxide was measured by using Sergiev *et al.*, (1997) method. Samples (300 mg) were extracted with 3 ml of 0.1 % trichloroacetic acid (TCA). After centrifugation at 4500 rpm during 20 min an aliquot (0,5ml) of the supernatant was added to 1 ml of 1 mM potassium iodure and 10 mM phosphate buffer, pH7 (1:2; v/v). H₂O₂ concentration of the supernatant was evaluated by comparing its absorbance at 390 nm to a standard calibration curve.

II.4. Proline content

The free proline was measured by using Bates et al., (1973) method. Fresh plant material (300 mg) was homogenized in 40% methanol. After centrifugation at 4500 rpm during 20 min the supernatant was reacted (at 100°C) with ninhydrin and glacial acetic acid for 1h, and then kept in an ice bath. The chromophore was extracted with toluene and warmed to room temperature and then absorbance was recorded at 528 nm using L-proline as a standard.

II.5. Determination of total phenolic contents

The total phenolic compounds were extracted with a solution of ethanol/water/ chloroform (1v/1v/2v) using an Ultra Turrax homogenizer following the protocol described by Darné et al. (1979). The water-ethanol phase containing phenolic compounds was separated from the organic phase containing lipids, chlorophylls and other pigments. The ethanol was removed from the aqueous-phase using a rotavapor at low pressure at 35°C. The

aqueous solution containing the phenolic compounds was adjusted to a desired volume. Phenolic compounds were determined using Folin–Ciocalteu reagent method by reading the absorbance at 765 nm according to the method of Ainsworth and Gillespie (2007). Gallic acid was used as a standard and the results were expressed as milligrams of gallic acid equivalent (GAE)/ g of fresh weight.

III. RESULTATS

III.1. Induced changes in WC

WC in the leaves decreased significantly with the increase of PEG concentration when compared with the control ($P < 0.05$) (Figure 1). This effect was more severe with -0.8 MPa and after 48h of treatment.

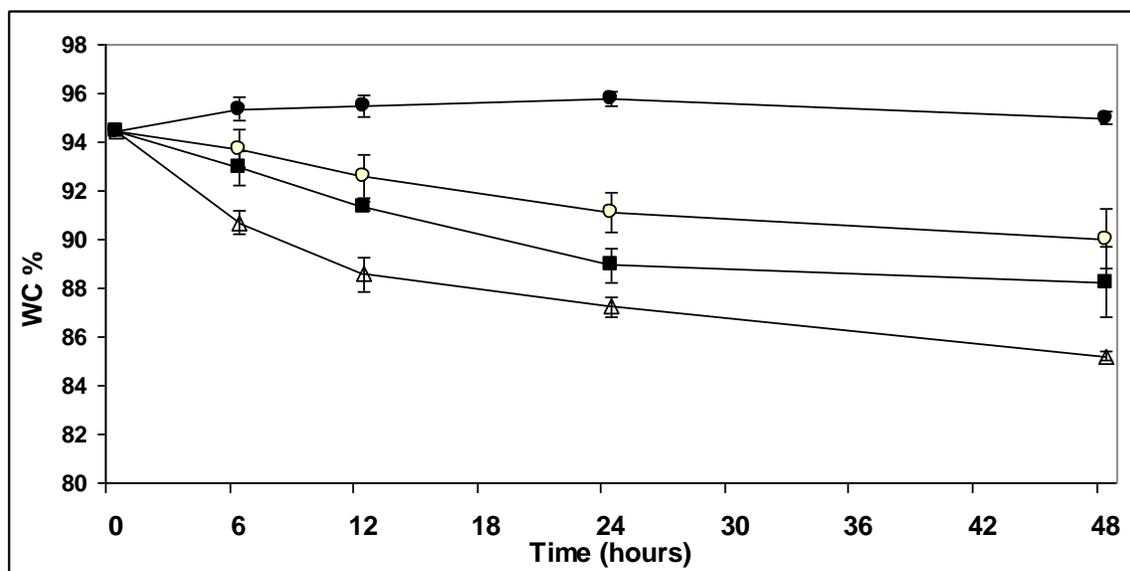


Figure 1. Time course change of water content in grapevine roots subjected to different levels of PEG-induced osmotic stress. PEG was added to the nutritive solution of hydroponic cultures in order to obtain a final osmotic potential of -0.2 MPa (○), -0.4 MPa, (■) and -0.8MPa (△). For control (●) no PEG was added. Values represent the means (\pm SE) of three replicates.

III.2. Induced changes in Proline content

Time course change of free Pro accumulation in response to different concentrations of PEG is shown in Figure 2. In response to PEG, Pro content started to increase after 6h of treatment. Pro accumulation increased with increasing PEG

concentration. It reached a maximum after 24h of treatment and its level started to decrease thereafter. This increase was highly noticeable with the highest osmotic pressure used (-0.8 MPa).

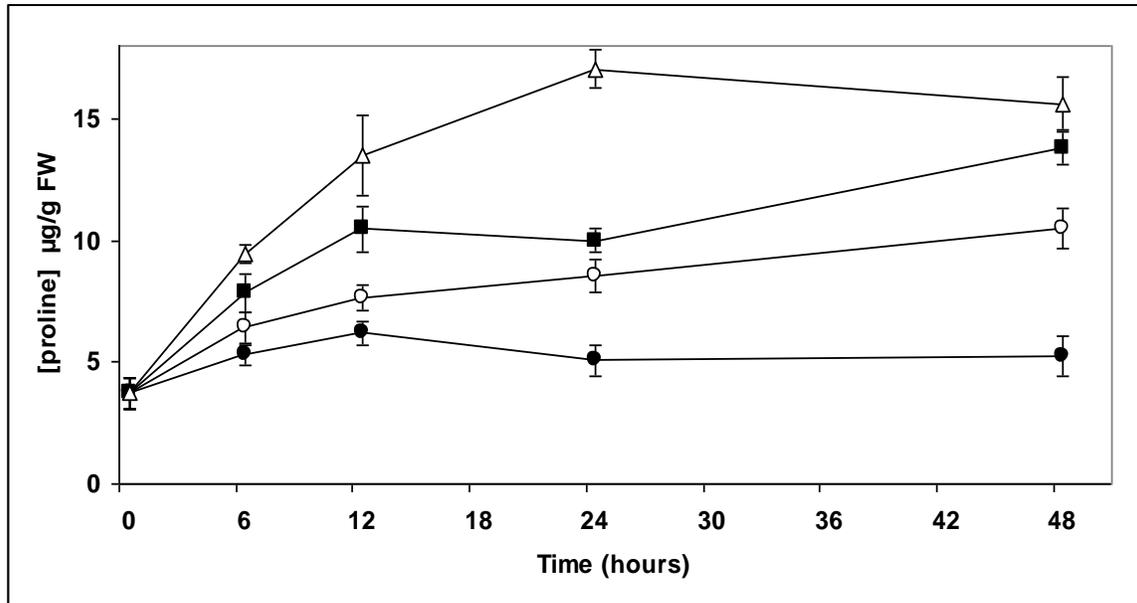


Figure 2. Time course change of free proline accumulation in grapevine roots subjected to different levels of PEG-induced osmotic stress. PEG 20000 was added to the nutritive solution of hydroponic culture in order to obtain a final osmotic potential of -0.2 MPa (○), -0.4 MPa (■) and -0.8 MPa (△). For control (●) no PEG was added. Values represent the means (\pm SE) of three replicates.

III.3. Induced changes in Hydrogen peroxide content

As shown in figure 6, PEG induced an increase in H_2O_2 contents in roots, in a dose-dependent manner. Under 0.8 MPa H_2O_2 accumulation was enhanced after 6h of stress and reached a maximum after 48 h and continue to increase (Figure 3).

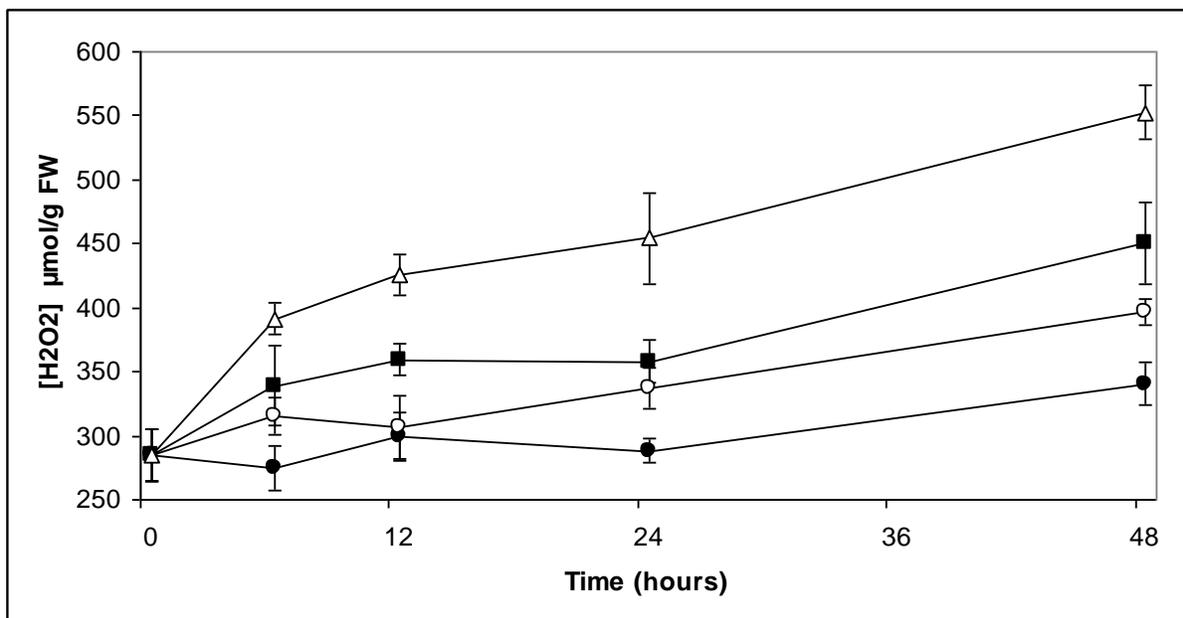


Figure 3. Time course change of hydrogen peroxide accumulation in grapevine roots subjected to different levels of PEG-induced osmotic stress. PEG was added to the nutritive solution of hydroponic cultures in order to obtain a final osmotic potential of -0.2 MPa (○), -0.4 MPa (■) and -0.8 MPa (△). For control (●) no PEG was added. Values represent the means (\pm SE) of three replicates.

III.4. Induced changes in total polyphenols content

The effect of osmotic stress on total phenols is shown in figure 4, at 0,8 MPa gave the highest content of total phenol after

24h of treatment. Under 0,2 and 0,4 MPa a slight decrease in TPC was observed in the beginning of the experiment and start to increase after 24h (**Figure 4**).

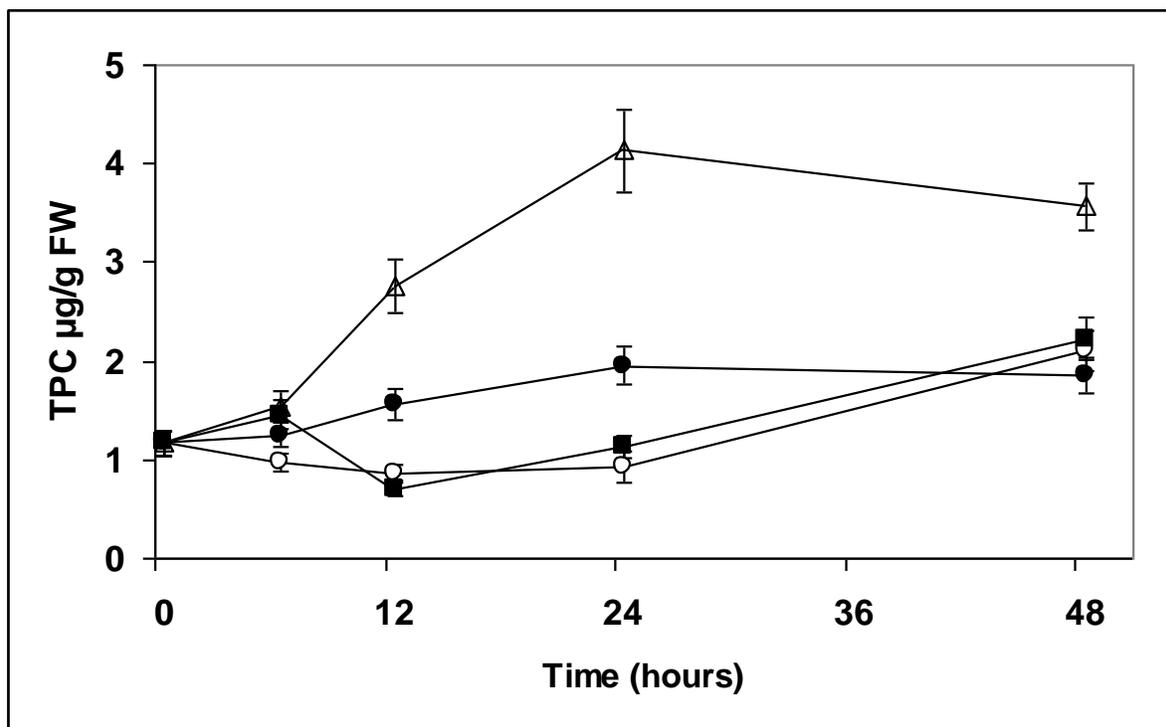


Figure 4. Time course change of polyphenols accumulation in grapevine roots subjected to different levels of PEG-induced osmotic stress. PEG was added to the nutritive solution of hydroponic cultures in order to obtain a final osmotic potential of -0.2 MPa (○), -0.4 MPa (■) and -0.8 MPa (△). For control (●) no PEG was added. Values represent the means (\pm SE) of three replicates.

IV. DISCUSSION

When grapevine was exposed to 0.2, 0.4 and 0.8 PEG for 2 days, the proline and hydrogen peroxide content in roots increased with PEG concentration (**Fig. 2, 3**), while the WC decreased with the increase of PEG concentration. Those results showed that the degree of plant injury of grapevine under water deficit increased with the PEG concentration and stress duration.

In this study, we show, using the whole plant system of grapevine that a conspicuous effect of salt stress on proline titers may already be observed after 6 h of stress. Plants accumulate compatible solutes, such as proline, in response to stresses to facilitate water uptake (Ashraf and Foolad, 2007). Proline accumulation was correlated to a variety of stress conditions and is now regarded as a major non-enzymatic antioxidant (Szabados and Saviouré, 2010) The accumulation of compatible solutes may help to maintain the relatively high water content necessary for plant growth and cellular function (Kishor *et al.*, 1997) And was associated to salt stress tolerance (Ramanjulu, and Sudhakar 2001; Madan *et al.* 1995. Giridara Kumar *et al.*, 2003) and water stress tolerance (Toumi *et al.*, 2007). In the present study, proline content increased with increase in PEG concentration (**Figure 2**). This increase could be explained by the activation of biosynthetic enzyme such as P5CS, which is the key regulatory and rate

limiting stress-inducible enzyme in proline biosynthetic pathway (Vaseva *et al.*, 2012), Activation of P5CS resulted in free proline accumulation in drought-stressed plants, in accordance with previous reports (Yamada *et al.*, 2005), or possible involvement and activation of other enzymes involved in proline biosynthesis, such as P5CR (Szabados and Saviouré, 2010), or the possible down-regulation of enzymes involved in proline catabolism. this increase of proline content with increase in severity and duration of stress helped the plants to maintain tissue water status (**Figure1**) and avoid the drought induced damages (Jiang and Huang, 2002). These results support a direct correlation between the degree of osmotic stress and proline accumulation, which is in agreement with previously studies revealing that the level of proline increased in parallel with the severity of environmental stress in different plant species (Chen and Kao, 1995; Sofu *et al.*, 2004; Claussen 2005) and that proline concentration could be used as a biochemical marker for drought stress level (Sofu *et al.*, 2004).

Phenol accumulation could be a cellular adaptive mechanism for scavenging oxygen free radicals during stress (Mohamed and Aly, 2008). Several studies have reported that total phenol production is stimulated by salt and drought stress (Hanan *et al.*, 2008; Muthukumarasamy *et al.*, 2000).

V. CONCLUSION

The result of this experiment indicates that osmotic stress caused a number of biochemical changes in grapevine plant, including decreased water content, and increased proline content and total phenolic compounds. The increased synthesis of proline, total phenolic content and earlier in stressed plants exhibited a protective mechanism against the cellular structures from oxidative damage.

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An Investigation into Risk Factors and Preventive Measures in Building Construction Projects in Abuja FCT, Nigeria.

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Abstract- This study is design to investigate the risk factors and preventive measures in building construction projects in Abuja FCT, Nigeria. A descriptive survey research design was adopted for the study. Two research questions and one hypothesis guided the study. The study was carried out in the entire building construction project in Abuja, Nigeria. A total of 116 respondents comprising 58 contractors and 58 registered site engineers were used as population of the study. A structured questionnaire containing sixty six (66) items was developed by the researcher and used for the study. Cronbach Alpha, Mean and Standard Deviation were used as the statistical tools to analyze the data, while t- test statistic was employed to test the null hypothesis of the study at 0.05 level of significance. The findings of the study revealed among others that contracting companies should identify and adequately quantify project risk factors. Adding a risk premium to quotation and time estimation has to be supported by governmental owner organizations and other agencies in the local construction sector. Training courses should also be provided to construction professionals on how to deal with and minimize risks in building projects.

I. INTRODUCTION

Compared to other industries, the construction industry is at or near the top in the annual rate of business failures and resulting liabilities (Chapman 2001). This is because it is a risky business with too many uncertainties that management has to deal with. These uncertainties stem from a variety of external and internal factors. Faisal (2003) stated that Building construction industry is characterized by having many players of multiple disciplines who are brought together at various stages throughout a single project. This feature adds more complexity to the whole construction process which is a collection of time-consuming undertakings. There is no doubt that construction is a key activity in any economy, it influences, and is influenced by, the gross domestic product (GDP) of any nation. The construction industry is a vital part of the Nigeria economy (Musa 2005). It provides jobs for about 3 million people creating 8% slice of the Nigeria's gross domestic product (Levy, 2002). He also stated that in Nigeria, building construction industry directly employs about .9 million people and accounts for about 4% of the national GDP. Economically speaking, the building construction sector typically accounts for 35 to 40% of the construction market (Barrie and Paulson, 1992). Building construction produces structures ranging from small retail stores to urban redevelopment complexes, from grade schools to complete new universities,

hospitals, commercial office towers, theaters, government buildings, recreation centers, light manufacturing plants and warehouses. Construction is also a vital activity in the Nigerian economy. It contributes substantially in the Nigeria GDP and employment generation. The building construction sector has played a crucial role in extending job opportunities for the Nigeria labor force. Expansion of construction activities has generated a lot of jobs for skilled, semi-skilled and unskilled workers. The number of domestic construction workers increased from 12.8 thousands in 1993 to 40.3 thousands in 2000 (Hillson 2002).

The management of risks is a central issue in the planning and management of any business venture. Unfortunately, the local construction industry seems to lack the ability to identify, analyze and assess risk associated with running the business. Throughout the world, the construction industry has changed rapidly over the past decade; companies are now faced with more risk and uncertainty than before. Clients are more likely to engage in litigation when things go wrong. Risk in construction has been the subject of attention because of time and cost overruns associated with projects. Perry and Hayes (2005) define risk as an uncertain event or condition that, if it occurs, has a positive or negative effect on a project objective. Jaffari (2002) also defined risk as the exposure to loss, gain, or the probability of occurrence of loss/gain multiplied by its respective magnitude. Kartam and Kartam, (2001) has defined risk as the probability of occurrence of some uncertain, unpredictable and even undesirable events that would change prospects for the probability on a given investment. Base on the foregoing, therefore, Musa, (2005) outlined some of the circumstance that constitute risk in building construction site to include; supply of defect materials, occurrence of accidents and variations in labor and equipment productivity. Similarly, Levy (2002) noted that some risk factors in building construction site include occurrence of accidents because of poor safety procedures; supply of defective materials and varied labor and equipment productivity. According to him, environmental factors, difficulty in accessing the site and adverse weather conditions also constitute the risk in our construction site. Defective design (incorrect), un-coordinated design (structural, mechanical, electrical), inaccurate quantities, lack of consistency between bill of quantities, drawings and specifications, rushed design and awarding the design to unqualified designers are some critical factors that resulted to risk in construction site (Jaffari 2002).

Simmons, Ahmed, Azhar and Ahmed (2001) provided a definition for the risk management as the sum of all proactive

management-directed activities, within a program that is intended to acceptably accommodate the possibly failures in elements of the program. Building construction industry is widely associated with a high degree of risk and uncertainty due to the nature of its operating environment. There exist no comprehensive study explaining the causes of risks among construction companies; moreover research covering the subject matter has tended to identify the symptoms rather than causes. It is within this analytical context that the study on the investigation into risk factors and preventive measures in building construction projects in FCT Abuja, Nigeria is been carried out.

II. RESEARCH QUESTIONS

The study provides answer to the following questions.

- What are the risk factors in building construction projects in FCT Abuja, Nigeria?
- What are the preventive measures of these factors in building construction projects in FCT Abuja, Nigeria?

III. HYPOTHESIS

The null hypothesis was tested at 0.05 level of significance.

HO₁: There is no significance difference between the mean responses of contractors and site engineers on the risk factors in building construction projects in FCT Abuja, Nigeria.

IV. MATERIALS AND METHODS

The research design adopted for this study is a descriptive survey research design where questionnaire are used to determine the opinions of respondents on the issue under investigation.

The study was carried out in some selected building construction site in Abuja FCT. A total of 100 respondents comprising 50 building contractor and 50 site engineers from Abuja FCT constitute the population for the study. A structured questionnaire developed by the researcher and validated by three experts from Industrial and Technology Education and Building Technology Department, Federal University of Technology, Minna was used as instrument for data collection.

V. RESULTS

Research question 1

What are the risk factors in building construction projects in FCT Abuja, Nigeria?

Table 1. Mean Response of Contractors and site Engineers on the Risk Factors in Building Construction Projects in FCT Abuja, Nigeria.

SN	ITEMS	X_1	X_2	X_t	Remark	
1	Unavailable labor, materials and equipment	3.54	3.58	3.56	Agreed	
2	Undefined scope of working		3.23	3.08	3.16	Agreed
3	High competition in bids	3.08	3.75	3.42		Agreed
4	Inaccurate project program		3.38	3.58	3.48	Agreed
5	Supply of defect materials,		3.42	3.31	3.37	Agreed
6	Occurrence of accidents and variations in labor and equipment productivity.		3.42	3.23	3.33	Agreed
7	Occurrence of accidents because of poor safety procedures;		3.42	3.46	3.44	Agreed
8	Supply of defective materials and varied labor and equipment productivity.		3.33	3.31	3.32	Agreed
9	Environmental factors,	3.33	3.62	3.48		Agreed
10	Difficulty in accessing the site	3.46	3.50	3.48		Agreed
11	Adverse weather conditions		3.75	3.31	3.53	Agreed
12	Defective design (incorrect),		3.58	3.15	3.42	Agreed
13	Un-coordinated design (structural, mechanical, electrical),		3.69	3.23	3.47	Agreed
14	Inaccurate quantities,		3.08	3.67	3.38	Agreed
15	Lack of consistency between bill of quantities, drawings and specifications,		2.85	3.50	3.18	Agreed
16	Rushed design	3.54	3.58	3.56		Agreed
17	Awarding the design to unqualified designers	3.62	3.33	3.48		Agreed
18	Poor communications between the home and field offices (contractor side)	3.50	2.50	3.00		Agreed
19	Inflation	3.72	2.80	3.26		Agreed
20	Delayed payments on contract	3.75	3.67	3.71		Agreed
21	Financial failure of the contractor	3.62	2.89	3.26		Agreed
22	Unmanaged cash flow		3.98	3.66	3.82	Agreed
23	Exchange rate fluctuation	2.79	3.44	3.12		Agreed

24	Monopolizing of materials due to closure and other unexpected political conditions	3.22	3.45	3.34		Agreed
25	Difficulty to get permits	2.67	2.98	2.83		Agreed
26	Ambiguity of work legislations	3.03	3.21	3.12		Agreed
27	Legal disputes during the construction phase among the parties of the contract	2.90	3.02	2.96		Agreed
28	Delayed disputes resolutions		2.56	2.78	2.67	Agreed
29	No specialized arbitrators to help settle fast	3.23	3.10	3.17		Agreed
30	Rushed bidding process	3.44	2.91	3.18		Agreed
31	Gaps between the Implementation and the specifications due to misinterpretation of drawings and specifications		2.77	2.54	2.66	Agreed
32	Undocumented change orders		3.72	3.25	3.49	Agreed
33	Lower work quality in presence of time constraints		3.21	2.60	2.91	Agreed
34	Design changes	3.56	3.42	3.49		Agreed
35	Actual quantities differ from the contract quantities		3.56	3.67	3.62	Agreed
36	Segmentation of Gaza Strip		2.67	2.55	2.61	Agreed
37	Working at hot (dangerous) areas	2.87	2.62	2.75		Agreed
38	New governmental acts or legislations	3.87	3.00	3.44		Agreed
39	Unstable security circumstances (Invasions)	3.49	3.78	3.64		Agreed

Key N = Number of Contractor; N = Number of site Engineers; X_1 = Mean of Contractors; X_2 = Mean of site Engineers; X_t = Average Mean of Contractor and site Engineer.

Analysis of mean responses of the two groups of respondents from Table 1 revealed that all the items under this sub-heading are rated agreed with mean ranging from 2.61 – 3.71. This signifies that all the items are the risk factors in building construction projects in FCT Abuja, Nigeria.

Research question 2.

What are the preventive measures of risk factors in building construction projects in FCT Abuja, Nigeria?

Table 2: Mean Response of the Contractors and site Engineers on the Preventive Measures of Risk Factors in Building Construction Projects in FCT Abuja, Nigeria?

SN	ITEMS	X_1	X_2	X_t	Remark
1	By paying true attention and coordinate correctly between design disciplines.	3.21	3.28	3.25	Agreed
2	By introducing insurance premiums for accidents and injuries	2.99	2.78	2.89	Agreed
3	By applying effective training and increasing awareness of safety precautions.	3.87	2.69	3.28	Agreed
4	By sharing Inflation and exchange rate fluctuation risks	2.91	3.88	3.40	Agreed
5	By including contract clauses that define the required parameters and conditions for sharing.	3.44	3.08	3.26	Agreed
6	By updating project information and add risk premiums to time estimation at the project planning stage	3.45	3.29	3.37	Agreed
7	By close supervision to subordinates for minimizing abortive work	3.77	3.81	3.79	Agreed
8	By increasing the working hours	3.01	3.12	3.07	Agreed
9	By coordinating closely with sub-contractors	3.90	3.65	3.78	Agreed
10	Change the sequence of work by overlapping Activities	3.34	2.98	3.16	Agreed

11	Increase manpower and/or equipment	3.78	3.09			
12	Available labor, materials and equipment	3.54	3.58	3.56		Agreed
13	Well defined scope of working	3.23	3.08	3.16		Agreed
14	Accurate project program	3.38	3.58	3.48		Agreed
15	Supply of quality materials,		3.42	3.31	3.37	Agreed
16	Provision of adequate and proper safety procedures;		3.42	3.46	3.44	Agreed
17	Easy accessibility to the site		3.46	3.50	3.48	Agreed
18	Good design (correct),	3.58	3.15	3.42		Agreed
19	Well coordinated design (structural, mechanical, electrical),		3.69	3.23	3.47	Agreed
20	Accurate quantities,		3.08	3.67	3.38	Agreed
21	Consistency between bill of quantities, drawings and specifications,		2.85	3.50	3.18	Agreed
22	Awarding the design to qualified designers	3.62	3.33	3.48		Agreed
23	Proper and effective communications between the home and field offices (contractor side)	3.50	2.50	3.00		Agreed
24	Prompt payments of contract		3.75	3.67	3.71	Agreed
25	Good management of cash flow	3.98	3.66	3.82		Agreed
26	Proper documentation of change orders	3.72	3.25	3.49		Agreed
27	Change the construction method	3.45	3.76	3.61		Agreed

Key N = Number of Contractor; \bar{N} = Number of site Engineers; X_1 = Mean of Contractors; \bar{X}_2 = Mean of site Engineers; X_t = Average Mean of Contractor and site Engineer.

Hypothesis one

There is no significance difference between the mean responses of contractors and site engineers on the risks factors in building construction projects in FCT Abuja, Nigeria.

Table 3. t-test Analysis of Contractors and site Engineers on the Risk Factors in Building Construction Projects in FCT Abuja, Nigeria. $N_1=58, N_2= 58$

SN	ITEMS	SD_1	SD_2	t	Remark	
1	Unavailable labor, materials and equipment	0.49	0.51	-0.20	NS	
2	Undefined scope of working		0.41	0.51	0.86	NS
3	High competition in bids	0.50	0.95	-0.63	NS	
4	Inaccurate project program		1.06	0.76	-0.06	NS
5	Occurrence of accidents and variations in labor and equipment productivity.		0.13	0.24	1.00	NS
6	Occurrence of accidents because of poor safety procedures;		0.50	0.76	-0.27	NS
7	Supply of defective materials and varied labor and equipment productivity.		0.58	1.19	0.98	NS
8	Environmental factors,	0.60	0.48	0.20	NS	
9	Difficulty in accessing the site	0.90	0.56	-0.67	NS	
10	Adverse weather conditions		0.44	0.19	-0.07	NS
11	Defective design (incorrect),		0.99	0.11	0.67	NS
12	Un-coordinated design (structural, mechanical, electrical),		0.76	1.06	0.44	NS
13	Inaccurate quantities,		0.78	1.12	-0.12	NS
14	Lack of consistency between bill of quantities, drawings and specifications,		0.88	0.34	0.79	NS
15	Rushed design	0.33	0.99	0.22	NS	
16	Awarding the design to unqualified designers	0.21	0.64	0.09	NS	
17	Poor communications between the home and field offices (contractor side)	0.45	0.54	0.66	NS	
18	Inflation	0.12	0.32	0.23	NS	
19	Delayed payments on contract	0.49	0.67	0.90	NS	

20	Financial failure of the contractor	0.40	0.79	0.34		NS	
21	Unmanaged cash flow		0.30	0.42	0.44		NS
22	Exchange rate fluctuation	0.67	0.66	-0.67		NS	
23	Monopolizing of materials due to closure and other unexpected political conditions	0.29	0.29	-0.08		NS	
24	Difficulty to get permits	0.39	0.48	0.67		NS	
25	Ambiguity of work legislations	0.27	0.67	0.55		NS	
26	Legal disputes during the construction phase among the parties of the contract	0.39	0.57	0.78		NS	
27	Delayed disputes resolutions		0.67	0.45	0.66		NS
28	No specialized arbitrators to help settle fast	0.54	0.34	0.44		NS	
29	Rushed bidding process	0.44	0.91	0.18		NS	
30	Gaps between the Implementation and the specifications due to misinterpretation of drawings and specifications		0.77	0.54	-0.66		NS
31	Undocumented change orders		0.72	0.25	0.49		NS
32	Lower work quality in presence of time constraints		0.21	0.60	-0.91		NS
33	Design changes	1.06	1.02	-0.49		NS	
34	Actual quantities differ from the contract quantities		0.56	0.67	0.62		NS
35	Segmentation of Gaza Strip		1.07	0.55	-0.61		NS
36	Working at hot (dangerous) areas	0.87	0.60	0.05		NS	
37	New governmental acts or legislations	1.17	1.00	0.44		NS	
38	Unstable security circumstances (Invasions)	0.49	0.77	-0.64		NS	

Key N_1 = Number of Contractor; N_2 = Number of site Engineers \bar{SD}_1 = Standard deviation of Contractors; SD_2 = Standard deviation of site Engineers; t-test; S = Significant; NS = Not significant.

Table 3 revealed that the t-test analysis accept all the null hypotheses of each items at 0.05 level of significance, meaning that there is no significance difference for all the items.

e. Close supervision to subordinates for minimizing abortive work

VI. FINDINGS

The following are the Findings relating to the risk factors in building construction projects in FCT Abuja, Nigeria.

- Unmanaged cash flow
- Actual quantities differ from the contract quantities
- Delayed payments on contract
- Rushed design
- Supply of defective materials and varied labor and equipment productivity.
- Design changes
- Occurrence of accidents because of poor safety procedures;
- Gaps between the Implementation and the specifications due to misinterpretation of drawings and specifications

Findings related to the Preventive Measures of Risk Factors in Building Construction Projects in FCT Abuja, Nigeria

- Consistency between bill of quantities, drawings and specifications,
- Provision of adequate and proper safety procedures;
- By including contract clauses that define the required parameters and conditions for sharing.
- Coordinating closely with sub-contractors

VII. DISCUSSION OF FINDINGS

Research question one dealt with the risk factors in building construction projects in FCT Abuja, Nigeria. The findings as indicated in Table 1 revealed that all the risk factors identified in building construction projects in FCT Abuja, Nigeria were correct. This finding is in agreement with the views of Musa, (2003) who stated that some circumstance that constitute risk in building construction site include; supply of defect materials, occurrence of accidents and variations in labor and equipment productivity. Supporting the above statement, Levy (2002) noted that some risk factors in building construction site include occurrence of accidents because of poor safety procedures; supply of defective materials and varied labor and equipment productivity. According to him, environmental factors, difficulty in accessing the site and adverse weather conditions also constitute the risk in our construction site. Defective design (incorrect), un-coordinated design (structural, mechanical, electrical), inaccurate quantities, lack of consistency between bill of quantities, drawings and specifications, rushed design and awarding the design to unqualified designers are some critical factors that resulted to risk in construction site (Jaffari 2001).

Research question two dealt with the preventive measures of risk factors in Building construction projects in FCT Abuja, Nigeria. The findings in Table two revealed that, all the twenty seven (27) items were accepted by both the contractors and the

engineers as the preventive measures of risk factors. This finding is in agreement with the view of

VIII. RECOMMENDATION

Based on the critical risk factors identified in the study, it was recommended that

1. Contracting companies should compute and consider risk factors by adding a risk premium to quotation and time estimation. This trend has to be supported by governmental owner organizations and other agencies in the construction sector.
2. Training courses should also be provided for engineers and project managers on how to deal and minimize risks in building projects.
3. Contractors should endeavor to prevent financial failure by practicing a stern cash flow management and minimizing the dependence on bank loans.
4. Contractors should learn how to share and shift different risks by hiring specialized staff or specialized sub-contractors.
5. Contracting firms should utilize computerized approaches used for risk analysis and evaluation such as a risk package which integrates with widely used programs like Microsoft Project and Microsoft Excel.

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Awareness in Physiotherapy among High School Students

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Abstract- The demand to the physiotherapy continues to increase, due to the increasing of aging population. The University Grant Commission (UGC) has started degree program in physiotherapy to address this demand in 2007, by providing high school level science students to enter this program based on the grade achieved from the advanced level exam. The aim of this study was to assess the level of awareness about physiotherapy among advanced level science students in the Kandy educational zone and to assess the sources form which they could obtain information regarding physiotherapy. A structured survey consisting of three parts was used, and eight hundred and fifteen high school level Sinhala medium science students from nine schools in Kandy zone in Sri Lanka were approached. Of these, Seven hundred and seventy six completed questionnaires were returned (95% response rate). The students were not much aware of physiotherapy as a career, treatment method and its applications in disease conditions other than sports injuries. Television, internet, and newspapers/magazine were the most cited source of information for physiotherapy. There is a need for a programme to educate the general public in Sri Lanka about Physiotherapy both as a therapeutic modality and as a prospective career pathway

Index Terms- Awareness, High school students, Physiotherapy, Profession, Science

I. INTRODUCTION

In the healthcare sector, professions like those of Doctors and Nurses are well known than the other paramedical professions like Physiotherapy¹. However, the physiotherapist plays a major role in providing health care and it is a highly recognized profession worldwide. Physiotherapy is a healthcare profession engaged with human function and movement and maximizing potential. Also physiotherapists work in a wide-ranging of health settings including intensive care, mental illness, stroke recovery, occupational health, and care of the elderly. Physiotherapy is certainly far more than fixing musculoskeletal sports injuries although that is perhaps the most common perception of the profession. It uses physical approaches to promote, maintain and restore physical, psychological and social well-being, taking account of variations in health status and it is science-based, committed to extending, applying, evaluating and reviewing the evidence that underpins and informs its practice and delivery the exercise of clinical judgment and informed interpretation is at its core². The main concern of physiotherapy is rehabilitation which is defined as "The restoration of an individual part or parts back to normal or near normal function after a disabling disease, injury, addiction or incarceration"³. According to the reports of World Health Organization, the number of aging people (more

than 65 years old) will increase from 600 million to 2 billion between 2000 and 2050 worldwide and the estimated over 60 population in Sri Lanka will be 21.9% by 2031 making it the fastest aging country in south Asia⁴. This will decline savings resulting in a reduction in investments since less savings create less capital, and eventually a decline in the economic growth of Sri Lanka. As physiotherapy plays a major part in rehabilitation of aging people, interest in this profession is also expected to increase globally in the future⁵. Although, a large number of schools, universities and other higher education institutes, clubs etc. in Sri Lanka are involved in numerous sports programmes, only a handful of them are obtaining the regular services of a physiotherapist unless they have injured players/athletes. Unfortunately, this is even true for most of the national teams also.

When planning one's future career, it is important to have information about various occupations and professions that are related to his/her field of study. Even though a few people have an idea about their future career pathways in advance, majority of them are uncertain about it. For most people, these plans are usually made during their early and late adolescence. A majority of school children are also unaware about career opportunities open to them and most of them analyse their career prospects by looking at the social status of the occupation of their choice and the opportunities for career development^{6,7}. The situation in Sri Lanka also same to other countries as they decide their future career according to the results they get from their advanced level examination. Until recently, Sri Lankan state universities offered only a limited number of degree programmes for the students who obtain good results at the Advanced level examination in biology stream at the end of their high school careers. Those were (in the order of merit) Medicine, Dentistry, Veterinary Medicine, Agriculture and Bio- Sciences. Although, a number of new courses including Physiotherapy and other Para-medical sciences, Nursing, Molecular biology etc. have been introduced in the recent years, public awareness about these courses seems to be not yet adequate. As a result, most parents and teachers still press the biology stream students to enter medical schools, subjecting them to unnecessary mental and physical stresses. Therefore the aim of this study was to investigate the level of awareness regarding various aspects of physiotherapy among advanced level science stream students in the Kandy educational zone, Sri Lanka and also to assess the sources form which they could obtain information regarding physiotherapy. The authors hope that the study would generate valuable information that could be used to further educate the general public in Sri Lanka about Physiotherapy both as a therapeutic modality and as a prospective career pathway.

II. METHODS

Instrumentation

A survey was implemented in this study. The questionnaire was modified and adapted, with permission, from a similar study done by Jayawardana, et al., (2011).⁸The questionnaire contained three parts, (parts A, B and C). Part A consisted of subjective information of the students including gender, grade and field of study. Part B consisted of seven close ended questions which had four sub questions under each to evaluate the awareness about physiotherapy. Those questions were to assess the awareness in physiotherapy as a career and as a treatment method in sports and other disease conditions. Each sub question contained three responses (yes, no and don't know).Part C consisted of a close ended question with multiple responses to identify the source of information regarding the physiotherapy profession.

Participants and procedure

High Schools with Sinhala medium advanced level classes in Kandy educational zone were identified from the data base of the Director of Education (planning), Central province, Sri Lanka. Permission to carry out the study in the selected schools was also obtained from the same office and ethical approval was granted by the Faculty of Medicine, University of Peradeniya. From a total of eighteen schools in Kandy zone, a sample of 815 Sinhala medium science stream students were selected from nine schools using envelop method. Students who were unwilling to participate in the research, absent on the day of data collection and Tamil and English medium students were excluded from the study. Anonymity of respondents was maintained during data entry, data analysis and write-up phases. Data were analysed

using Statistical Package for the Social Sciences Version 17 (IBM Cooperation, NY, USA).

III. RESULTS

Subjective data

Eight hundred and fifteen students were given survey packs and seven hundred and seventy six questionnaires were completed and returned (95% response rate). There were 320 males and 456 females among the respondents.

Awareness in physiotherapy

In general, the awareness about physiotherapists, structure of a physiotherapy unit and the availability of physiotherapy services was unsatisfactory (Questions 1, 2 and 3). The true answer rates for these questions were 32%, 17% and 34% respectively (Table 1). Interestingly, 95% of students did not know that electrical modalities are available at physiotherapy units. In average, more than a half of the study population (62%) was not aware of treatment methods used in physiotherapy (Question 4), and 64% did not know when to meet a physiotherapist (Question 5). Generally, 54% of students were not aware how the physiotherapy helps in sports injury management (Question 6). A vast majority of student were unaware about the uses of physiotherapy in other disease conditions than sports injuries (Question 7), mainly in chest conditions like bronchitis (80%). The overall awareness about physiotherapy (as indicated by true answers to the questions in Part A of the questionnaire -Table 1) was approximately 30.5%.

Table 1: Analysis of answers to the questions in Part B of the questionnaire

Topic Question	Sub Questions	Right answer %	Wrong answer %	Don't know %
1. Physiotherapy is,	a. Practiced by the doctors	42	52	6
	b. A branch of acupuncture	34	60	6
	c. Practiced by masseurs	26	68	6
	d. An indigenous treatment method	26	68	6
2. A Physiotherapy unit (Department of Physical Medicine/ DPM) includes	a. A gymnasium with exercising machines, gym balls and other equipment	20	72	8
	b. Electrical modalities	1	95	4
	c. a section for manual treatments using bandages, tapes and splints	23	69	8
	d. A therapeutic pool	23	69	8
3. Places where the physiotherapy services can get	a. Private clinics	36	56	8
	b. Government hospitals	35	57	8
	c. Private hospitals	36	57	7
	d. NGOs	30	63	7
4. Physiotherapy treatments include	a. Manual therapy	34	60	6
	b. Ice/Heat therapy	31	63	6
	c. Hydrotherapy	25	69	6
	d. Electrotherapy and exercise therapy	36	58	6
5. Do you know when to meet a physiotherapist?	a. When you have an injury	27	67	6
	b. When there is is pain arising in any	36	58	6

	body part with or without a known cause			
	c. When you feel pain or discomfort in any of the sporting technique	39	56	5
	d. When you have fever or flu.	18	76	6
6. When a sport injury happens, physiotherapy,	a. Involves reducing the pain	42	51	7
	b. Can be used to improve the quality of muscles	43	50	7
	c. Helps to regain the full motion of the joints as it was before the injury	40	53	7
	d. Helps to prevent complications after injury	33	61	6
7. Uses of physiotherapy in any other conditions than in sport injuries	a. Neurological conditions (stroke, Parkinson)	36	57	7
	b. Musculoskeletal conditions (Osteo-Arthritis)	46	48	6
	c. Pediatric conditions (Cerebralpalsy)	23	71	6
	d. Chest conditions (Bronchitis)	14	80	6

Source of information about physiotherapy

The commonest source to obtain information regarding physiotherapy was television programs (44.6%), followed by the internet and newspapers/magazines (39.8% and 36.3% respectively). Sources mentioned less often were books (24.5%),

teacher/ counsellor/ coach (23.1%), friends (22.7%) and career literature (21.4%), and those cited least often were the family physician (10.6%) and family physiotherapist (5.5%). (Figure1)

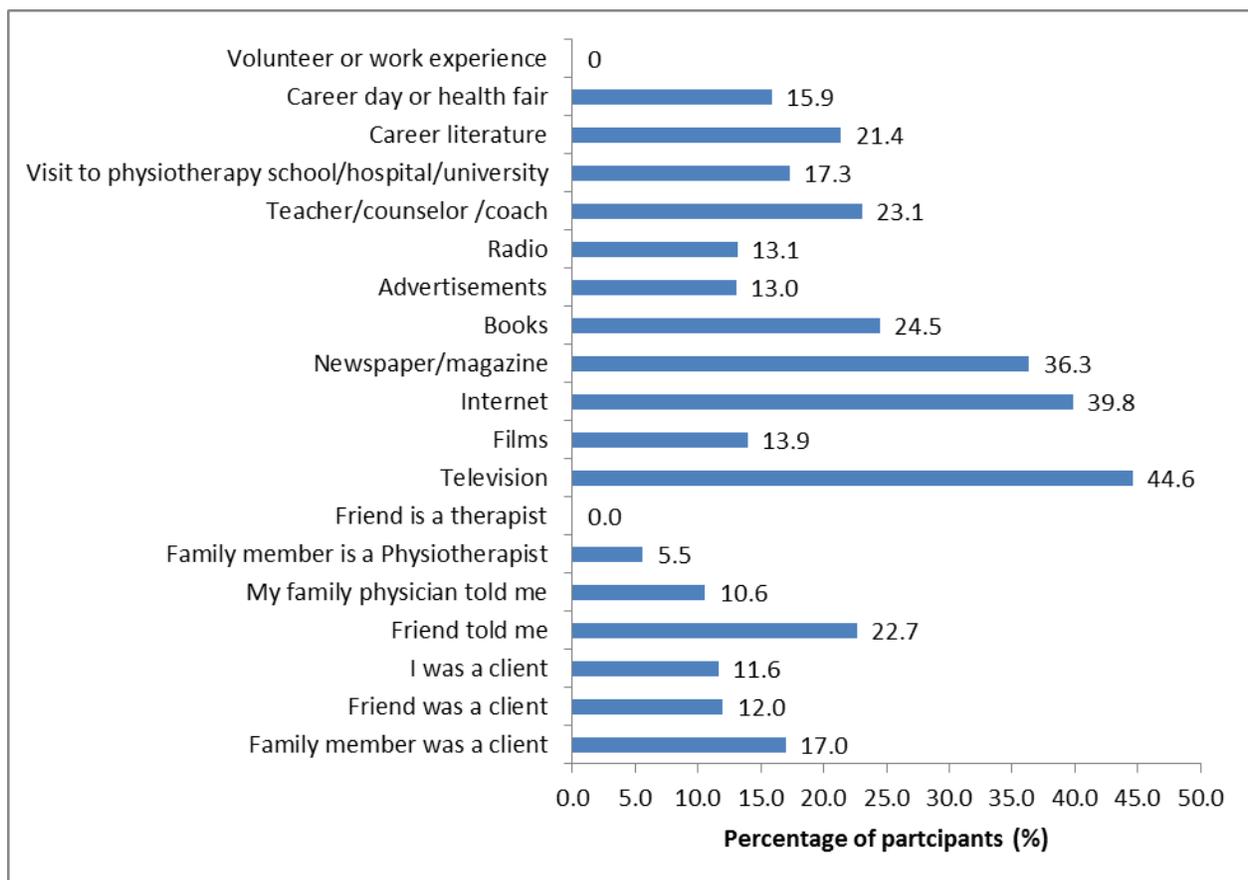


Figure 1: Sources of information about physiotherapy

IV. DISCUSSION

In general, more than half (63%) of high school students were unaware of physiotherapy profession and its applications in patient management. This finding suggest that the high school students in Kandy zone, Sri Lanka are less informed about physiotherapy compared to students in Japan⁶. This is probably due to the following factors: (1) until the year 2006, a BSc in Physiotherapy degree programme was not offered by the state Universities in Sri Lanka. Although a diploma course was available, entrance to that was not directly based on the Advanced Level examination. Hence, high school students paid less attention to this field. (2) The general public has only a little or limited access to physiotherapy. (3) Unavailability of information regarding the scope of physiotherapy, both as a profession and as a treatment modality in Sri Lanka. However, since 2006, two state Universities (Peradeniya and Colombo) and also the Defence University have started degree programmes in physiotherapy and two or three batches have already graduated. As a result, the awareness about physiotherapy seems to be increasing too. This is evident from the fact that the minimum Z score needed to enter the physiotherapy undergraduate programme in a state University has become the 4th highest (after Medicine, Dentistry and Molecular Biology), according to the latest data from the University grants commission of Sri Lanka⁹.

Many high school students thought that physiotherapy is practiced by either doctors (52%) or masseurs (68%). This may also be the cause for huge misunderstanding that one should see a physiotherapist when having a fever /flu. Also, 68% of students believe physiotherapy is an indigenous method of treatment (Table 1). Sri Lanka faces considerable challenges in delivering reliable and quality healthcare services across the nation. Pain management has been described as a fundamental human right that should be available in primary care settings, yet pain management services in Sri Lanka are not given priority. Most physiotherapy services are confined to large hospitals, often in private sector and located in urban areas and provision in public or government hospitals appears to be inadequate. The reason for this misunderstanding on physiotherapy may be inappropriate accessibility to physiotherapy services in Sri Lanka.

It was also evident from the results of this survey that a majority of the participants did not have a clear idea about the scope of physiotherapy. For instance, 95% of the students were unaware of availability of electrical modalities in physiotherapy units and 60%, 63%, 69% and 58% of the students were unaware about usage of manual therapy, ice/heat therapy, hydrotherapy and electro/exercise therapy respectively. Moreover, approximately 64% were unaware about the use of physiotherapy in conditions like bronchitis, stroke, Parkinson, cerebral palsy and osteoarthritis (Table 1). The factor for the low level of accuracy in responses to the statements concerning use of physiotherapy in other disease conditions than sport injuries may be due to unfamiliarity on the part of the respondents of cardiopulmonary physiotherapy and exercise therapy that are frequently carried out in musculoskeletal, neurology, paediatric and cardiopulmonary settings.

The unsatisfactory level of awareness about the scope and importance of allied health care professions such as

physiotherapy may be one of the causes for higher competition for medicine among science stream students when they entering to the university. One reason for above finding may be due to that physiotherapy is still limited only to the urban areas in Sri Lanka and the limited availability of career information resources. Also the highest reputation on medical profession and inappropriate beliefs about physiotherapy career may be some other reasons. However a lower degree of awareness in physiotherapy expressed by the healthcare- aspiring students in Sri Lanka is in contrast with the findings by Ogiwara and Nozoe (2005) which showed that science students and healthcare aspiring students were more knowledgeable about physiotherapy compared to the literary and non-healthcare aspiring students in Japan⁶.

Based on the analysis, television, internet and magazines/newspapers are the highest rated sources of information regarding Physiotherapy in Sri Lanka (Figure 1). However, the fact that most of the students did not possess adequate and/ or accurate information regarding physiotherapy, both as a treatment modality and as a profession, suggest that even those sources are not providing enough information. This situation is unlikely to change unless those who are in the profession of Physiotherapy work actively towards educating first, the mass media and then the general public through them. After all, half of the general public is dependent on mass media for acquisition of information on their health and illness¹⁰.

This study was designed to assess high school students' awareness and their sources of information on the physiotherapy profession. Awareness of physiotherapy was found to be low amongst the science students who participated in the study. Mass media was considered to be the most influential source of information and many respondents cited television as the source of information. Based on the findings of the survey, the authors feel that those who are in the profession of physiotherapy in Sri Lanka should play a more active role in educating the public.

V. ACKNOWLEDGEMENT

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The Learning Styles and the Preferred Teaching-Learning Strategies of First Year Physiotherapy Students

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Abstract- Adults have different learning styles. Thus the aim of this study was to determine the preferred learning style and specific teaching-learning methods of physiotherapy students. A cross sectional study was conducted on 36 first year physiotherapy students at the department of physiotherapy, Faculty of Allied Health Sciences, University of Peradeniya, Sri Lanka. The students were asked to rank lectures, tutorials, practical and self-study from the most preferred to the least preferred one. The most preferred teaching-learning method among all the students was lectures (61%), followed by practical (27%), self-study (6%) and tutorials (6%). there was no significant difference among male and female students on the preferred VARK mode. In conclusion, the results of this study showed that the educators' awareness of the various learning styles may create effective learning environment for students.

Index Terms- Learning style, Physiotherapy students, Teaching-learning methods, Gender

I. INTRODUCTION

The trends of education have changed from a teacher-centered to the student-centered learning in recent years. Therefore it is essential to identify different learning styles and the instruction should modify to match up with adults preference [1, 2]. VARK was developed by Flemming and Mills [3] based on sensory modes which are used for taking information. It includes Visual (V), Auditory (A), Read/Write (R) and the Kinesthetic (K) sensory modalities. Visual learners use things that they can see and auditory learners use things which they can hear to process the information. The read and write learners use words that they can see and kinesthetic learners prefer experience and practice to acquire information.

The first year physiotherapy students gain knowledge through various instructional methods including lectures, practical, tutorials, etc. Having an understanding on students learning styles may help to develop learning strategies and this may enhance the performance of students. A study done by Poonam [4] showed that most of medical students preferred practical/dissection as their learning style. However to the best of my knowledge, none of the studies have done this among physiotherapy students. Therefore the aim of the present study was to gain an understanding of the learning style preferences of first year physiotherapy students and to find out the most preferred instructional methods which may helpful on formulating teaching learning strategies to improve performances of the students.

II. METHOD

Instrumentation

A survey was implemented in this study. A self-administered questionnaire which contained two parts, (parts A and B) was used for the data collection. Part A consisted of general demographic information (name, age, gender) and part B was the latest version (7.1) of the VARK questionnaire, which was developed by Flemming, to determine the learning style preferences of the students. VARK questionnaire consisted of 13 questions with four options each and the respondents could choose more than one option if they found them suitable.

Participants and procedure

First year physiotherapy students in the Department of Physiotherapy, faculty of allied Health Sciences, University of Peradeniya, Sri Lanka were participated in this study. A total of 36 students voluntarily participated in the study (Male and females). All the data were collected in November 2013. The purpose of the study was explained to the students and the hard copies of the questionnaires were distributed to the students who volunteered to take the analysis. The completed questionnaires were collected after 15-20 minutes and they were evaluated by using previously validated scoring instructions which were available on the VARK website.

Descriptive statistics was used to analyze the students' preferences of the various VARK components, as well as their preferences for the various teaching-learning methods. The Students' t-test was utilized to compare the VARK scores for the male and female students.

III. RESULTS

According to the results, students prefer a single mode (unimodal), two modes (bimodal), three modes (trimodal) or all four modes (quadrimodal) of the information presentation. The percentage of unimodal preference was 74% and only 26% students had multimodal preferences. Amongst the multimodal learning style, the most preferred mode was bimodal (Fig 1).

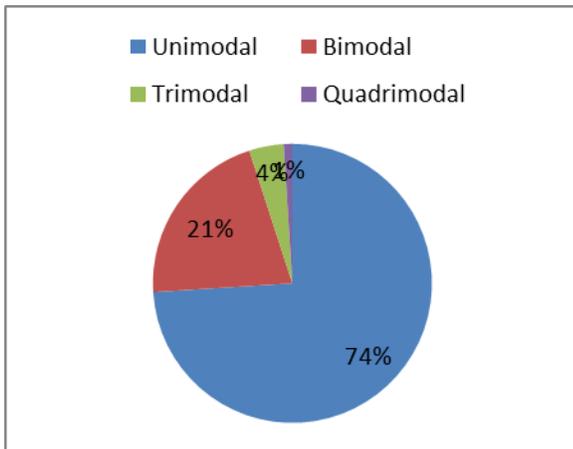


Fig 1: Percentage of students with unimodal, bimodal, trimodal and quadrimodal preferences

Of the 26% of unimodal learning style, kinesthetic (8%) was the most preferred mode and the visual (5%) was the least preferred mode of information presentation.

Various teaching-learning methods such as a. direct instruction methods (lectures and demonstrations), b. interactive instruction methods (tutorials), c. experimental learning methods (practical and dissections) and d. independent study methods (self-study) are used to impart and acquire knowledge of the basic sciences during first year of the physiotherapy curriculum. The most preferred teaching-learning method among all the students was lectures (61%), followed by practical (27%), self-study (6%) and tutorials (6%) (Fig 2). Even the female students preferred self-study and tutorial, male students preferred lectures and practical only as their teaching-learning method (Fig 3).

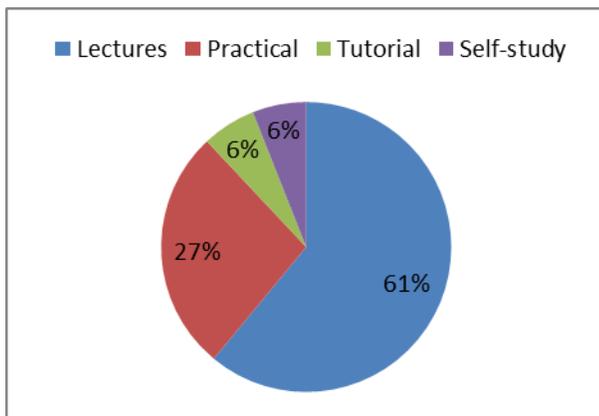


Fig 2: Preferences about teaching learning methods among first year physiotherapy students

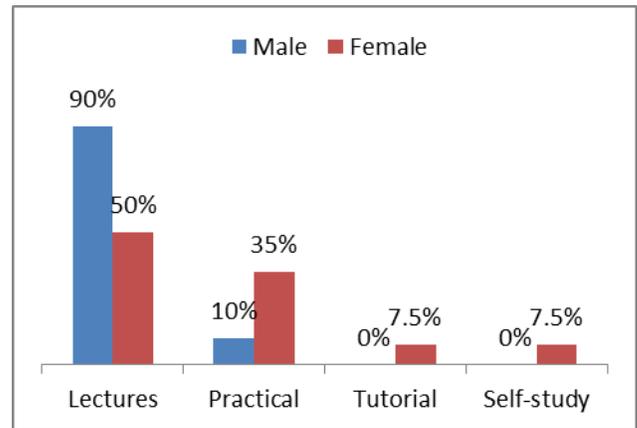


Fig 3: Comparison of preference of teaching-learning methods among male and female students

Table 1 shows the comparison of the preferences for the four VARK modalities of the female and male students. It was observed that there was no significant difference among male and female students on the preferred VARK mode.

Table 1: Comparison of VARK scores of male and female students

VARK mode	Male/Female student	Mean+_ SD	P value
Visual	Female	3.12±1.92	0.48
	Male	3.6±1.58	
Auditory	Female	4.31±2.69	0.74
	Male	4.60±1.50	
Read-Write	Female	3.73±1.56	0.56
	Male	4.10±2.07	
Kinesthetic	Female	5.15±1.57	0.29
	Male	5.80±1.81	

IV. DISCUSSION

In the field of education, understanding on students' different learning styles and their preferences on that styles are helpful to in developing academic curriculum. Thus the present study administered the VARK questionnaire to the first year physiotherapy students to determine their learning style preferences. A majority of the students (74%) preferred unimodal learning style which indicated that they preferred single mode of information presentation. The results of previous studies which were conducted among first year medical students from various other countries reported dissimilar results as their most preferred learning style is multimodal varied from 59-85% [5, 6-8]. Furthermore, in the unimodal learning style category, most preferred mode was the kinesthetic one, followed by the visual, auditory and the read-write ones. The findings of this study were dissimilar to the results of the studies conducted by Baykan and Nacar [9], Poonam [4], Lujan and DiCarlo [10] and Nuzhat et al., [5] among medical students. The variations in the learning preferences of physiotherapy students could be due to the differences in the teaching methodologies.

The results of this study revealed that lectures were the most preferred teaching methodology of both male and female students. However this finding was not associated with the finding that the most favored learning style of the students of the present study was the kinesthetic one. Further, it was observed that there was no significant difference on learning style among male and female students. This finding was dissimilar with the study done by Poonam [3] and this study indicated that the choice of the teaching methodologies was not affected by the learning styles of the students.

The findings of this study cannot be generalized due to the small sample size. In future, further studies need to be conducted find the whether the learning style change when the students' progress from first year to fourth year in physiotherapy curriculum.

V. CONCLUSION

The proper understanding on learning styles may not only helpful for teachers, but also it provides opportunity to students to identify their blunders and maximize their performances.

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Sri Lankan Physiotherapy Students' Preferences Regarding Lecture Courses

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Abstract- Teaching and learning activities are challenging area for students and teachers as well. Therefore the aim of this study was to explore the preferences of physiotherapy students in Sri Lanka about various aspects of lecture courses. A structured survey consisting of ten closed-ended questions was developed, and thirty six first year physiotherapy students in the department of physiotherapy, Faculty of Allied health Sciences, University of Peradeniya, Sri Lanka were approached in this study. Most of the students reported preferring lectures with clinical demonstration. They preferred morning lectures for a maximum of sixty minutes for each lecture, and they preferred to receive information about the lecture topic in advance. The students said that home assignments were beneficial after the lectures, and they agreed with the compulsory attendance for lectures. The results of this study conclude that educators should be aware on students' learning preferences when they developing curriculum.

Index Terms- Physiotherapy education, physiotherapy students, Teaching methodologies, Sri Lanka

I. INTRODUCTION

The learning environment is a key element of effective learning and performance of a student. Thus the effective teaching carrying more weight on this and it is very critical for students, especially in professional field such as physiotherapy. The teaching should be targeted to fulfill the goals and the effectiveness of teaching can be measured by several tools and one is the performance of students.

Many educators face challenging problems on education and the burning problem is the student satisfaction with the learning environment. The learning style is differing from student to student [1] and it is the responsibility of educators to modify their teaching style accordingly. Even some recent studies have targeted to the students' views about academic preparation [2], learning environment [3], use of teaching techniques [4], styles [5] and curriculum change [6, 7] in the field of other health care professionals, not much consideration has been given to their perceptions of the basic aspects of teaching methodologies in the field of physiotherapy education. Thus this study aimed to explore the preferences of dental students in India regarding various aspects of lecture courses.

II. METHOD

Instrumentation

A structured survey that consisted of ten close ended questions was developed to find the preferences of physiotherapy

students regarding various aspects of lecture courses using the guidance of study done by Parolia [8]. Last seven questions were answered on a five-point Likert-type scale.

Participants and procedure

First year physiotherapy students in the Department of Physiotherapy, faculty of allied Health Sciences, University of Peradeniya, Sri Lanka were participated in this study. A total of 36 students voluntarily participated in the study (Male and females). All the data were collected in November 2013. The purpose of the study was explained to the students and the hard copies of the questionnaires were distributed to the students who volunteered to take the analysis. The completed questionnaires were collected after 15-20 minutes.

III. RESULTS

According to the results, 72% of the students preferred lectures with clinical demonstration, while 28% preferred lectures with power point presentation. About 63% agreed with length of lecture should be 1hour, and all the students preferred early morning classes over afternoon classes. Thirty one percent of the students agreed that handouts should be distributed after the lectures, and 61% agreed that there should be homework assignments with the lectures. Forty two percent of students agreed with that the lecture should be announced in advance and that attendance for lectures should be compulsory (Fig 1). Forty two percent disagreed with the change in marking system from numbers to letter grades. The majority of the students preferred lectures to be learning-oriented rather than exam-oriented, while 64 percent strongly agreed that the clinical demonstration should be conducted after the lecture rather than before (Fig 2).

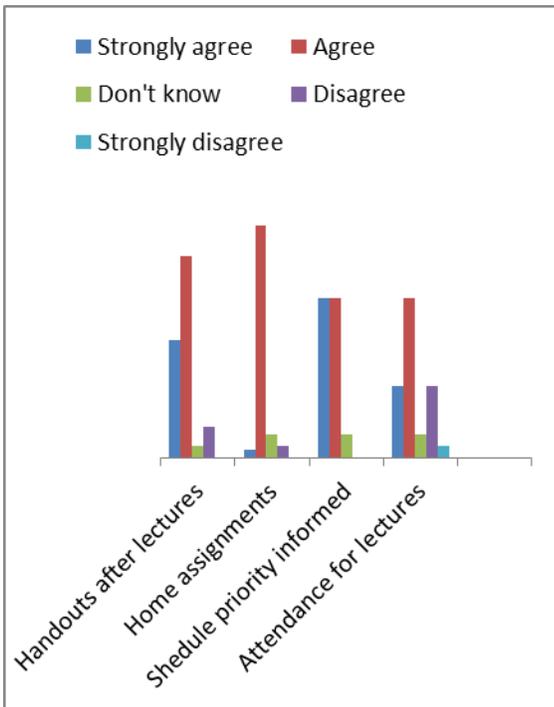


Fig 1: Physiotherapy students' preferences regarding handouts, homework assignments, schedule, and attendance required

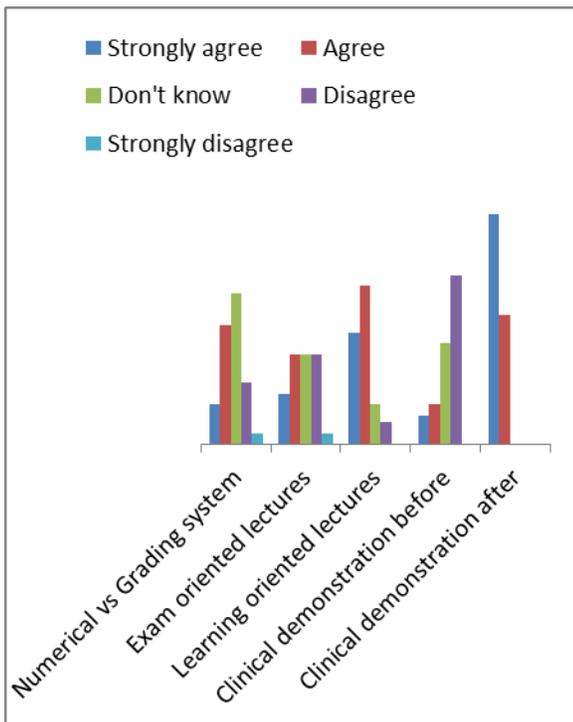


Fig 2: Physiotherapy students' preferences regarding grading system, learning vs. exam oriented lectures, and timing of clinical demonstration with lecture

IV. DISCUSSION

Satisfaction of students regarding their lecture course curriculum and learning environment is a challenging issue. In

preclinical physiotherapy education, didactic and clinical training is summarized into four years or less. They complete biomedical science courses during their first year and patient clinical experience is gained in rest of the years for their graduation. Disparity between learning and mode of delivery of instruction is a one of the main point of student hindrance.

This study was designed to implore the preferences of a group of physiotherapy undergraduates in Sri Lanka about the various aspects of teaching methodologies. The majority of the students agreed that teaching methodology should include lecture with clinical demonstration as the use models help students to understand the topic better. Furthermore students secondly preferred lectures with power point as it use diagrams and symbolic devices such as graphs, flow charts and hierarchies to make student understand about the topic. The results of this study are not agreement with the previous studies on duration of lecture. [9-12]. Majority of the students preferred sixty minutes lecture duration. However the recent studies done by Stuart et al., [13] and Arredonodo et al., [14] revealed that the lecture time should be less than sixty minutes as student concentration rose sharply to reach a maximum in ten to fifteen minutes and fell steadily thereafter. According to the 2007 Bachelor of Science in physiotherapy (BSc in Physiotherapy) curriculum requires more than 1000 total lecture hours. If using thirty- to forty-minute lectures, the targeted total lecture hours in four years of 240 days/academic year may not be achieved. Our study also found that the students preferred early morning classes, as during this time level of concentration is maximum and they felt lethargic in the evening classes with meal they got for their lunch break.

The Faculty of Allied Health Sciences was established in 2006 as the 8th faculty of University of Peradeniya with minimum resources. Hence students had to face many difficulties of finding additional information as their library facilities were not fully established. This was expressed by many students as they have preferred distribution of handouts after the lectures. The recent studies have found that handouts produce a positive effect on students' academic performance [15-17]. Majority of students agree with homework assignment after the lecture. This may be because assignments encourages student initiative and builds a sense of responsibility and commitment towards schoolwork. Further it may establish a communication link between students, parents and teachers. Further, majority of students preferred clinical demonstration after the theory class. The reason for this could be that students will be able to correlate hands on experience with the theoretical knowledge.

V. CONCLUSION

According to the findings of this study, educators in the field of physiotherapy should try to address the preferences of the students when preparing the lectures and developing curriculum.

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The author greatly appreciates the participation in this study of the first year physiotherapy students in the Department of Physiotherapy, Faculty of Allied Health sciences, University of Peradeniya, Sri Lanka.

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Awareness on Acute Knee Soft Tissue Injury Management among Rugby Players

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Abstract- Knee soft tissue injuries are more common among rugby players. Thus this study aimed to assess the awareness on acute soft tissue injury management using PRICE principle among rugby players in Kandy zone. A retrospective whole population survey was conducted among under 17 and 19 school level rugby players who had undergone knee soft tissue injuries in Kandy zone, Sri Lanka. A self-administered questionnaire which was developed according to the PRICE principle on acute soft tissue injury management was used as the data collection tool. A total of 45 rugby players in seven rugby playing schools in Kandy zone were participated the study. According to the results none of the players followed the PRICE principle correctly to manage acute soft tissue injuries. Even the players not following all the five components of PRICE principle accurately, they have followed each component separately, such as protection (75%), rest (57%), ice (37%), compression (60%) and elevation (8%). This study identified that 40% got recurrent injuries and 38% of players missed at least one match due to inappropriate soft tissue injury management. In conclusion, the results of this study showed, the lack of awareness on use of the PRICE principle for knee soft tissue injury management which should be adapted by the Kandy zone school level rugby players in Sri Lanka.

Index Terms- Awareness, acute, soft tissue injury, PRICE principle

I. INTRODUCTION

Rugby is an intense sport, consisting of both running play and contact play. Playing rugby appears to impose both psychological and physiological stress on the players. In fact, the incidence of injury during a rugby match is high compared with other sports [1]. The lower limb injuries are more common among rugby players; other than that, upper limb, neck and head in varying order [2].

Rugby is a famous sport in Sri Lanka. At present, rugby is very popular in Kandy, which has the best club level team in the Island [3]. As a school sport, rugby rates high than other sports. In the history of school rugby, Kingswood College, Kandy, was the first school that initiate school rugby in Sri Lanka. Later, Trinity, from Kandy was also initiate rugby and the first match between these two schools was played in 1906 [4]. At present, many schools are playing rugby in this area and most of the schools are boys' schools. At the same time, these schools are the main source of club level and national level players in this country.

As a sport, rugby boasts at most injuries at school level that the age from 11-18 categories [5]. It contributes to most injuries of the knee [6] that consists of soft tissues, such as muscles, ligaments, tendons and menisci [7]. In sports, these soft tissues can undergo sprain, strain, damage to cartilage and overuse [8]. Mainly muscle and ligament injuries are more common during matches and training [9], and the main cause of injury to the knee being the tackle, due to hit forcibly by other players [10].

The players in rugby are wealthy and socially well recognized. Due to the lack of aware about early rehabilitation program after an injury to knee, they can suffer from a lifelong disability. In addition to that, it may prevent injured from playing rugby or other sports. Thus, in the acute stage, it is essential to begin the effective PRICE principle as soon as possible. Here, "P" stands for Protection, "R" for Rest, "I" for Ice, "C" for Compression and "E" for Elevation. The goal of the protection and rest is to avoid further injury and reduce the blood supply to injured area which has a high blood flow during the activity [11]. In this case it is necessary to ensure: normal range of motion, normal strength, normal neuromuscular function and normal aerobic capacity to minimize economic, social, physical and psychological problems to the player. Therefore, after an injury, it is essential to begin PRICE principle. Thus this study was to assess the awareness of acute soft tissue injury management using PRICE principle.

II. METHOD

Instrumentation

A retrospective survey was implemented in this study. A self-administered questionnaire which contained three parts, (parts A, B and C) was used for the data collection. Part A and C consisted of additional items of the students including gender, grade, school and about the number of matches missed. Part B consisted of five close ended questions to identifying application of PRICE principle in acute soft tissue injury management. Pre-test was carried out among ten players to refine the final instrument.

Participants and procedure

Under 17 and 19 years old school level rugby players who have under gone knee soft tissue injury in the Kandy zone were participated in this study. Rugby players in seven schools were selected as the population of this study. All the data were collected from October to November 2010. Each player was given information about the project and invited to participate. Those choosing to do so were required to provide written

informed consent and complete the questionnaire anonymously. The questionnaire was self-administered, with physiotherapists available to answer questions and assist where necessary. Each subject was given a questionnaire to fill within the given time. They were asked to put a 'x' mark in the relevant boxes

III. RESULTS

According to the study, 45 players who had undergone knee soft tissue injury could be found. During the acute stage none of the players were sticking on the all the steps in the PRICE principle (Fig 1).

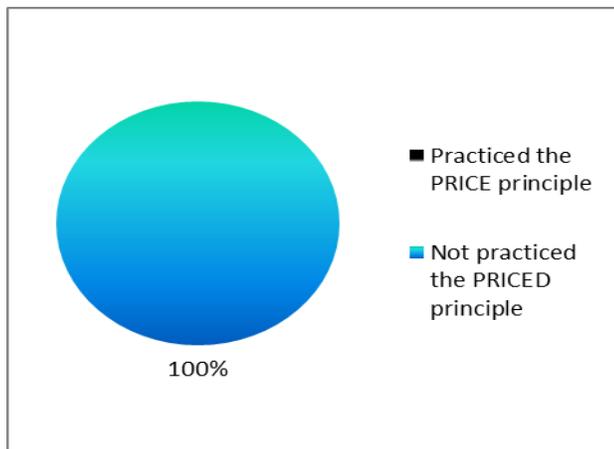


Fig 1: Percentage of implementation of PRICE principle in acute stage

Even if the players were not following all the five components of acute stage accurately, they have followed each component separately, for instance protection (75%), rest (57%), ice (37%), compression (60%) and elevation (8%) (Fig 2).

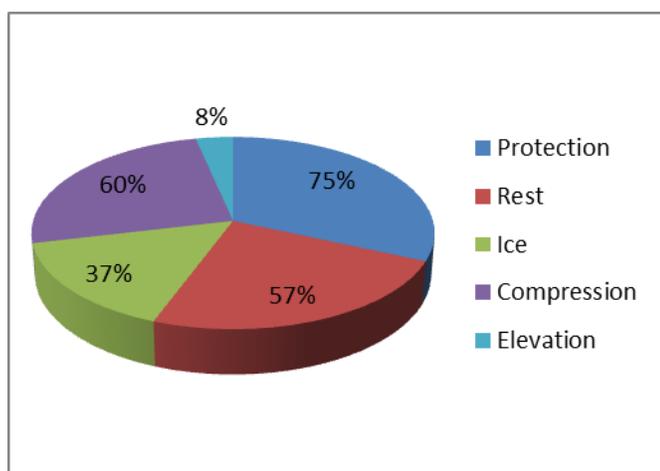


Fig 2: Implementation of PRICE

The study identified that the 40% of the players have got recurrent injuries and 38% of players missed at least one match due to the injury.

IV. DISCUSSION

Soft tissue refers to tissues that connect, support or surround other structures and organs of the body. This may include muscles, tendons, ligaments, fascia, nerves, fibrous tissues, fat, blood vessels and synovial membranes. Generally soft tissue injury involves sprain, strain or direct blow to the muscle, tendon or a ligament. The time period of initial 48-72 hours after a soft tissue injury called as acute soft tissue injury [12]. Repetitive motions and overuse can cause a higher level of scar tissue and stresses the alignment of the body. Ignoring imbalances and pain can put your body into a never ending injury cycle. In order to successfully recover from an injury or to alleviate pain from overuses, the body needs to restore its proper balances and the scar tissue eliminated from the injured tissues [13]. Therefore the rehabilitation plays a major role in this issue to bring the patient back to the desired activity level. Hence, it is necessary to eliminate pain and reestablish range of motion, and coordination, while avoiding the loss of muscle strength and endurance, during the period the athlete cannot train maximally [11]. To the best of our knowledge, this study is the first to assess the implementation of PRICE principle in acute soft tissue injury management in Sri Lanka.

It is important to manage an injury immediately. The goal of acute treatment for acute injuries is to limit internal bleeding as much as possible and prevent or relieve pain, in order to improve conditions for subsequent treatment and healing of the injury. Measures to limit bleeding after an acute injury have traditionally been called ICE therapy an acronym for Ice (cooling), compression (with a pressure bandage), and Elevation (of the injured part of the body). Recently this acronym has been expanded to PRICE, with "P" standing for protection and "R" for Rest. The PRICE principle has become well established [11]. It is recommended that treatment be started as soon as possible after a quick preliminary examination to rule out major dislocations or fractures and to determine which area requires treatment. Later, a more detailed examination can be made. To be effective, PRICE treatment must begin as soon as possible after an injury and must continue for 2 days to reduce bleeding and plasma exudation. In this study, the percentage of implementation of PRICE principle to manage acute soft tissue injuries is zero.

A previous study on pattern and management of sports injuries at national sports festival in Nigeria revealed that cryotherapy and bandaging (form of compression) were the most frequently used treatment modalities during the games. In addition to that, it had concentrated on importance of cryotherapy. It is emphasized that it should be made abundantly available in the form of portable cold spray for easy transportation and application during the game [14]. As the above study was concerned about I-Ice; C-compression and R-rest as other issues of PRICE principle. In addition to that all five components should be fulfilled in equal proportion. Even though they have followed each component separately, the present study is concerned about not only on the usage of each component of PRICE, but also on the correct technique and way of usage of them. The result zero means school level rugby players do not apply PRICE principle in the accurate and efficient manner after having an injury.

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Initial Experience of Musculoskeletal Physiotherapy Problem Based- Learning

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Abstract- The purpose of this study was to assess third year physiotherapy students' perception and views about initial experience of PBL in Musculoskeletal physiotherapy soon after the clinical placement. The self-administered questionnaire measured perception of PBL on a 5-point Likert type rating scale and focus group discussion used to evaluate the PBL among third year physiotherapy students of the Department of Physiotherapy, University of Peradeniya. Eighteen females and six males responded (comprising 75% of the total sample). Most students were positive that PBL contributed to improve communication skills, critical thinking and makes fun. However female students expressed that they enjoyed group work and it was effective in fulfilling learning objectives. These same views were expressed during focus discussion, female students made reference to enjoying the group work of PBL. This concludes that PBL has facilitated learning concepts in musculoskeletal physiotherapy and helped students to manage patients confidently during their clinical training.

Index Terms- Female; Male; Musculoskeletal physiotherapy; Problem-based learning; Perception

I. INTRODUCTION

Problem based learning (PBL) is a popular teaching learning method and is used in many educational programs of health care professionals all over the world (1-4). Students acquire knowledge and problem solving skills via a patient problem which is presented in a case scenario during PBL group (5). PBL is mainly structured around small group discussions and the tutor is a part of the PBL session in facilitating the group discussion to the requisite depth (6-8). Three recent studies conducted among medical nursing and physiotherapy students in Sri Lanka has stated that students have endorsed the educational benefits of PBL and their perceptions on PBL method were very positive and consider it as an effective way of learning (9-11).

The four year BSc (Hons) physiotherapy degree program commenced at Universities of Peradeniya and Colombo in 2006. The physiotherapy students do not undertake any PBL sessions during their module series and the program mainly utilizes conventional lecture series supported by practical skill classes and clinical postings. Musculoskeletal physiotherapy is a main subject which discusses the diagnosis, treatment and prevention of muscle, soft tissue and joint problems and students learn this module at their third year studentship to support their clinical training. As they have not experienced PBL in their curriculum, this study aimed to investigate the third year physiotherapy

students' perception and views about initial experience of PBL in Musculoskeletal physiotherapy soon after the clinical training.

II. METHODS

Participants and study design

Thirty two third year undergraduate physiotherapy students of the Department of Physiotherapy, Faculty of Allied Sciences, University of Peradeniya participated in this study. A total of 8 sessions were allocated to cover four case scenarios related to common musculoskeletal conditions over a period of 2 months (April 2012 – July 2012) using PBL tutorial strategy. A deliberate effort was made to ensure that, the case scenarios selected for PBL tutorial strategy.

The 32 students were randomly divided into three groups of 11, 11, and 10 students each. The PBL procedures and processes were carefully explained to the students. The PBL materials consisted of four written problems involving hypothetical patients. The printed scenarios were circulated on Friday mornings and the group PBL discussion took place on the following Monday evenings. Each one of the case scenario was discussed in two PBL sessions. Students discussed the case scenario using their existing knowledge at the first session. At the second session, students discussed the case after going through given references. The materials available to the students for research were the Faculty library, personal texts, notes and electronic facilities.

Data collection

Two methods were used for collecting data. Firstly, At the end of the PBL course (8th session), the students were requested to evaluate the sessions by means of a self-administered questionnaire which contained a 5 point Likert scale to indicate their responses. The questionnaire was organized in 2 sections: demographic details and the 14 items to obtain the students' perception of the experienced PBL sessions. Students were requested to fill in the evaluation questionnaire and hand it in as they were leaving the lecture theatre. The participation was voluntary and anonymous.

The second method for collecting data was a focus group discussion. After the third year students attended their clinical training, three separate focus group sessions including females in two groups and males in one group were conducted. Sessions were moderated by the author and another lecturer attached to the department of physiotherapy. Discussion lasted between 59-70 minutes. Open ended questions focusing on student perceptions of problem based learning in general were used. In order to ensure the consistency across groups, the following topics were

used to prepare set of open-ended questions to guide the discussion:

- I. Students' experiences during their PBL sessions
- II. Perceived differences between lectures and PBL
- III. Role of the staff and faculty to implement PBL
- IV. Recommendations for further improvement of PBL

Because this study was primarily descriptive, descriptive information was presented for numerical data analysis. Focus group discussion replies were read and re-read in order to identify emerging themes as headings under which categories most of the data can categorize.

III. RESULTS

Quantitative findings:

The questionnaire ratings showed a reasonable internal consistency (Cronbach's alpha 0.79), so the total score from the questionnaire was used in some of the analysis. The total questionnaire scores demonstrated that, as a group, the students were positive about this approach to learning (mean 56.7, SD 4.9, compared with the maximum possible score of 70).

There was no significant gender difference between the total questionnaire scores of females (55.9) and males (59.0), so the PBL task seemed equally appropriate for female and male according to the quantitative measures. Most mean ratings were within the range of 3.6-4.4, showing 'agreement' with positive statements about PBL. The lowest rating (means 3.6 male; 3.6 female) revealed that PBL promotes less student participation in learning process. Male and female students revealed significant differences in their responses to two attitude statements ($p < 0.05$), based on independent t-tests. Looking at the individual attitude ratings (max 5, min 1):

Female students expressed:

- PBL is more effective in fulfilling learning objectives (Female's mean rating 4.0, SD 0.72 v male's mean rating 4.8, SD 0.40)
- PBL is more interesting and provides more learning fun (Female's mean rating 3.67, SD 0.68 v male's mean rating 4.3, SD 0.51)

Male students expressed slightly greater improvement of their communication skills (mean rating 4.17; SD 0.75, compared with the females average of 3.83, SD 0.78), but this did not reach significance. These quantitative findings suggest that both male and female were positive about their initial experience of PBL. However, there were some indications that male were slightly more favorable about the collaborative nature of the learning task.

Focus group findings:

In accordance with the topics listed above, four distinct themes emerged during the focus group discussions. Differences of opinion in the female and male are reported.

Experiences

The male and female students' experiences during the PBL sessions varied but the prevailing view was that they thoroughly enjoyed the experience.

"Working as a group is better than work alone and it makes more fun while working as a group" (Female physiotherapy student)

"PBL group discussions were enjoyable" (male physiotherapy student)

Not only the fun but also they had to work hard. The hours and intensity of study increased for most of the male students. The study load on one case scenario was high within the group and time is also limited.

"I had to study hard with the responsibilities make within the group" (Male physiotherapy student)

The challenge reported by most of the both male and female students was logistic of team work.

"I felt that a lot of times everybody did not do equal shares with the group work" (Female physiotherapy student)

"What I find difficult to sense is, you know, it was difficult to get the ideas from some members as they feel shy to talk" (Male physiotherapy student)

Male students pointed to the gender impact of having to deal with female students within the group. Female students agreed with having male students as their group members.

"I think that within the group there should be at least two male students. Otherwise it is difficult to make and express our ideas" (Male physiotherapy student)

"The help of male students is essential when doing a group work" (Female physiotherapy student)

Both gender physiotherapy students asked to reduce the first session time duration and increase the second session time duration. Moreover they felt that the resources like internet facility, books and journals within the department and faculty are adequate to conduct future PBL sessions.

"It would be good if the time allocate for second session is increased by reducing the time allocate for first session" (Female physiotherapy student)

"I felt the resources in the department are enough to conduct PBL sessions and support got from the staff and the faculty was better" (Male physiotherapy student)

Knowledge and skills

Upon entering the PBL sessions, both male and female students are confronted with their own very limited knowledge compared to that of other members within the group. As a result they were motivated to study hard.

"I felt that I am empty while sharing factual knowledge with other members" (Male physiotherapy student)

"I was motivated to study hard by comparing others knowledge" (female student)

Both genders had equally experienced deficiencies in basic knowledge and in their ability to apply it. Deficiencies in basic science modules like anatomy and physiology were mentioned and confirmed by both genders.

"Anatomy is the very worst" (Male physiotherapy student)

"There is a lot I do not know yet. I find it very frustrating when discussing anatomy in the first session of PBL with current knowledge" (Female physiotherapy student)

Both male and female students also observed that some anatomy and physiology areas were difficult; they did understand those during the group discussion than from textbooks:

“On my first PBL session I didn’t remember the anatomy of the brachial plexus and during the second session discussion one member of our group explain it clearly with images. Within that discussion that knowledge was drilled into me, and then I could remember it even now what it is which I find difficult to learn from text books” (Female physiotherapy student)

In general both male and female students felt well prepared with regard to clinical skills in particular. However, it was confusing for the students when different hospitals and physiotherapists had different notions of treatment protocol. Therefore students recommended to schedule future PBL sessions within the clinical training under the guidance of clinical coordinators.

“But you can never do it right, because each physiotherapist has his own method and says: no, you have to do it this way. And next time, when you do it like that, another physiotherapist will tell you: no, you should do it this way” (Male physiotherapy student)

“It is better to conduct PBL sessions within the free time in clinical training under clinical coordinators. From that we can get an idea about their different treatment protocols” (Female physiotherapy student)

Female physiotherapy students felt their listening and presentation skills were developed with the PBL group work. Hence they stated that their respect for others views also improved. However male physiotherapy students valued the PBL sessions guidance on use of resources like books, journals and internet. Furthermore male students felt their communication skills were developed with PBL.

“I learnt to work as a group which I did not practice previously in relation to academic work. I helps me to listen and respect others views. That gave me a valuable base during my clinical rotation while handling patients.” (Female physiotherapy student)

“I have not read many books during the lecture time. But I had to go through several books, journal articles and internet to search new knowledge in PBL discussions.” (Male physiotherapy student)

“At the second session I had to present what I learnt, it improves my presentation skills by reducing fear to the audience which I had experienced previously” (Female physiotherapy student)

“I had to communicate in English while doing the PBL discussions and it encourage me to talk in English. Also improved my communication skills” (Male physiotherapy student)

Both male and female valued the PBL sessions, which helped them, refresh and integrate their prior knowledge and skills and fill the most important gaps in their knowledge, thereby improving their preparedness for the clinical training.

“I think lectures as well as PBL both should be in the curriculum. I do not think a lecture only is the ideal way to teach students” (Male physiotherapy student)

Clinical reasoning

One of the most dramatic differences with lecture method was the self-regulated learning which students had learned as separate entities within a time period, although the PBL targeted to improve student directed learning through critical thinking. This was experienced by both male and female students.

“During the lectures we learn everything in packages, you know: stretching, mobilization, orthopedic examination... And in clinical training you need to do mix up all these to make a treatment protocol to apply to a real patient. With the PBL case scenario all these were able to do by imagine the case as a real patient” (Female physiotherapy student)

“PBL helps me to think deeper on one area, which we do not practice previously during the lectures” (Male physiotherapy student)

The students said that use of real patient as the case scenario in the PBL sessions will be more important than just a case written in the piece of paper. Both genders express this idea as a recommendation for future PBL sessions and they also said that it will be very useful to conduct these PBL sessions at the clinical training setup.

“It is better to conduct the PBL session in the clinical setup. Because it will help us to experience the real clinical setup and reduce our fear to real patients and exams by improving our confidence to tackle the problems rise during the clinical training.” (Female physiotherapy student)

Learning

There was general agreement that motivation to study increased during PBL discussions. The main motivators were case scenario and group members. Both gender students enjoyed being able to apply their knowledge gain from PBL in their clinical training.

“I did not have time to study with the extra works. But I was really motivated to study within the group” (Male physiotherapy student)

“When other group members discuss the matters in the case then you do not want to make a fool of yourself. So yes, that motivated me to really study some subject matter” (Female physiotherapy student)

Most of the female physiotherapy students expressed that they learnt to share knowledge, manage time and respect to others views. Also male physiotherapy students accept those views as they felt more comfortable while working with female students at later PBL sessions as the female students attitudes were changed day by day.

“I felt I know something that I can share with others and it helps to improve their knowledge and my critical thinking capability also” (Male physiotherapy student)

“I learnt to work as a group which I did not practice previously in relation to academic work. It helps me to listen and respect others views. That gave me a valuable base during my clinical rotation while handling the patients.” (Female physiotherapy student)

“I learnt how to manage time with the limited time given to discuss the case scenario” (Male physiotherapy student)

Discussion

Both the quantitative measures of attitudes to PBL and the focus group discussion comments suggested that the students

were generally positive about their initial experience of PBL in musculoskeletal physiotherapy. The positive experience that students associated with PBL correspond quite closely to the features that Spencer and Jordan (12) identify as most conducive to adult learning. They describe adults as learning most from task that relate to the learners interest and goals, connect with previous knowledge focus on real world problem in a process that is participatory, reflective and based on mutual trust and respect.

Both male and female physiotherapy students were generally positive about the PBL experience, and there were no gender difference in total attitudes scores. However some gender differences emerged on specific attitude statements. Female students, according to the quantitative attitude ratings, were more interested and felt that PBL was more effective in fulfilling learning objectives. These quantitative findings were in some ways supported by the qualitative responses gain from the focus group discussion. Female students were more likely to refer to working with others as a group, and collaboration, when explaining what they had experience from the PBL. The value that female placed on the connected learning style was noted by several previous researches (13-15).

Belenky et al. (14) and Gawelek et al. (15) have noted that female do not always have a "voice" in class. But this was not compatible with our study findings which the quantitative evaluations provided evidence that male physiotherapy students felt indefinite to voice their opinion during the PBL group discussions due to the less number of male students within the group. Many PBL groups consisted of less number of males due to less number of male students in the participated physiotherapy student group. This was observed in all the physiotherapy undergraduate batches studying at the department of Physiotherapy, Faculty of Allied Health Sciences, University of Peradeniya, Sri Lanka.

Students felt well prepared for clinical practice and did not feel daunted by a large gap between lectures and clinical training with the experience they got from the PBL. Negative experiences were related to the increased workload, time consuming and perceived knowledge deficiencies. Although these feelings differed somewhat amongst the students, they were largely deemed to be a normal aspect of their first experience of PBL.

Third year physiotherapy students of both sexes were generally positive about their initial experience of problem-based learning during musculoskeletal module. Both male and female students valued the experiences that group work provided for developing and sharing knowledge, applying theory to practice, learning about each other's and respect others views. However the gender difference were limited by the small number of male students and further research into implement PBL to other modules is needed.

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A Taxonomy of Cloud Computing

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Abstract- Today, computing becomes steadily more important and more used. Cloud computing has appeared as an accepted computing model for processing very large volume of data. Cloud computing is an unavoidable trend in the future computing development of technology. In this paper, we have discussed the computing taxonomy and their relationship with cloud computing. Then we have discussed the essential characteristics, layered service model architecture and deployment model of cloud environment. Last we have identified the several research challenges, cloud adoption challenges along with the applications of cloud computing. This paper is for those who have heard first time the term “cloud computing” and wants to know about its taxonomy. Also this paper will provide an idea of design challenges of cloud computing and help in identifying important research directions in this area.

Index Terms- Cloud Architecture, Cloud computing, Cloud computing issues, Distributed computing

I. INTRODUCTION

With the invention of internet, notion of computing has changed. Earlier only one processor was used for computing purpose. Later on, concept of parallel computed has accelerated the computing process. Parallel computing and distributed computing are ways of utilizing parallelism in computing to accomplish higher performance. Several processing elements are used to solve a problem. Grid computing, cluster computing, utility computing and cloud computing are some of the variations of distributed computing based on the functionality and features they are providing [1].

Today, computing becomes steadily more important and more used. The amount of data exchanged over the network or stored in a computer is constantly increasing. Thus, the processing of this increasing mass of data requires more computer equipment to meet the various needs of organizations [2]. Cloud computing is an unavoidable trend in the future computing development of technology. Its critical importance lies in its capability to provide all the users with high performance and consistent calculation. Cloud computing is the evolution of distributed computing, grid computing, and many other techniques. In cloud computing data is moving from desktop system to data centers. By means of virtualization technology, one physical host can be virtualized into multiple virtual hosts and use these hosts as a basic computing unit. [3].

In this taxonomy we have tried to elaborate cloud computing architecture along with its strength, weakness, challenges and applications in current scenario based on the current advances from academia. This paper is organized as follows: Section 2

discusses the overview of the cloud environment. Section 3 discusses the challenges for cloud environment. Section 4 discusses the advantages, disadvantages and applications of cloud environment.

II. CLOUD OVERVIEW

2.1 Definition

Cloud Computing refers to both the applications delivered as services over the Internet and the hardware and systems software in the datacenters that provide those services. The basic idea of cloud computing is managing and scheduling uniformly computing resources that are connected by a network, and constituting a computational resources pool which provides user service according to their needs. The network which provides resources is called “cloud”. From the point of view of the user, the resources in the “cloud” can be extended unlimitedly, and can be assessed at any time, used according to need, and paid according to usage [4].

Cloud can also be defined as a type of parallel and distributed system consisting of a collection of inter-connected and virtualized computers that are dynamically provisioned and presented as one or more unified computing resources based on Service Level Agreements (SLA) established through negotiation between the service providers and consumers [5].

Cloud computing is Internet-based computing, whereby shared resources, software and information are provided to computers (hardware) and other devices on-demand, like the electricity grid [6].

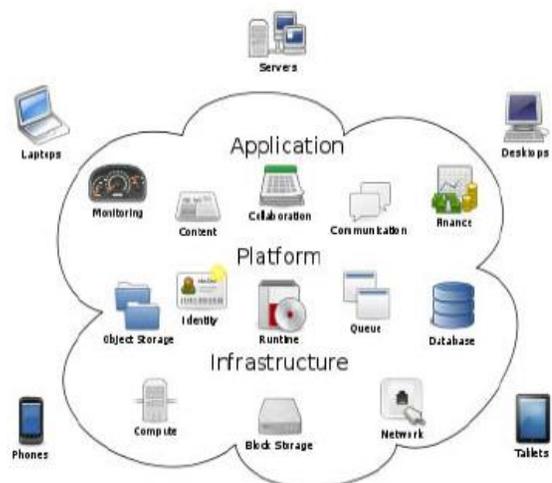


Figure 1: cloud computing [7]

National Institute of Standards and Technology (NIST) has defined the Cloud Computing model by describing its essential

characteristics, three cloud services models and four cloud deployment models as shown in figure 2 where its layered architecture is shown.

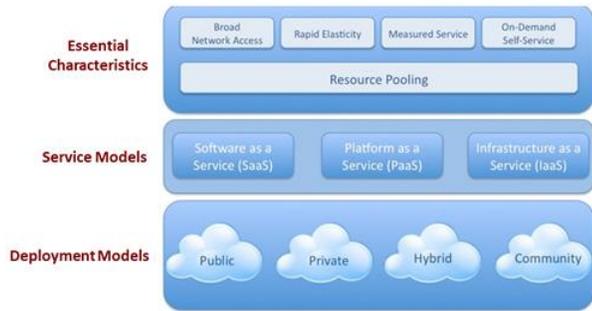


Figure 2: model of cloud computing [8]

2.2 Essential Characteristics

Essential characteristics of cloud computing system are as follows:

- Elasticity and Scalability: Elasticity is the ability to expand or shrink a computing resource in real time, based on the user's computing requirements. Cloud platform can be expanded or shrink dynamically according to the circumstances of the application and the number of the users.
- Virtualization: The most important characteristic is virtualization in cloud computing. With virtualization, one physical resource can be made to look like multiple virtual resources. Cloud computing provides resources to users through virtualization technology. Due to this feature provider can run multiple application and operating systems in a single physical machine by partitioning the available resources which results in reduction in hardware cost and optimization of workload.
- Large scale infrastructure: There are more than one million servers in Google's cloud computing platform, and more than hundreds of thousands of servers in IBM, Amazon, Microsoft, Yahoo and other cloud services platform. So, Cloud computing environment will give users super computing capabilities.
- Ubiquitous: The services provided by the cloud computing are not customized for a specific application. The users can choose different applications according to their needs. Different users can run different applications in the same platform. Also user can access the application from any place at any time where internet facility is available.
- Utility based pricing: When customers use a cloud infrastructure that utilizes more resources, they pay for this. However, when the peak load is over, the cloud infrastructure shrinks, or scales down, to the required resources. At this point in time, the customer is only paying the reduced infrastructure cost. They pay only for the resources they use [6].

2.3 Cloud service model architectures

There are three Cloud Services Models and these three fundamental classifications are often referred to as "SPI model" i.e. software, platform or infrastructure respectively.

- Cloud Software as Service: In the software as a service model, the same software is provided to different customers

via Internet. The software no longer resides on the consumer's workstation. Under the SaaS model, the software provider is responsible for the creation, updating, and maintenance of software, including the responsibility for licensing the software. Customers usually rent the software on per usage basis. A good example could be web-based email running on a cloud infrastructure. Typical examples for SaaS offerings are Google Apps such as Google Mail and Google Docs and Spreadsheets and Salesforce.com [6].

- Cloud Platform as Service: In this model, the computing platform is made available as a service. Customers can develop, test, and deploy their applications on the cloud. The user of the service is responsible for the creation, updating, and maintenance of the application. Customers of PaaS do not control the underlying infrastructure as SaaS users do, but control over the deployed applications. Typical examples of PaaS are Google App Engine which allows applications to be run on Google's infrastructure, Windows Azure, Engine Yard and Force.com [8].
- Cloud Infrastructure as Service: In the infrastructure as a service model, the consumer can provision fundamental computer resources such as processors, storage, and networking resources. An infrastructure provider (IP) makes an entire computing infrastructure available "as a service". Rather than purchasing servers, data storage, and networking equipment, customers rent these resources provisioned over a network. Infrastructure services are built on top of a standardized, secure, and scalable infrastructure. Amazon Web Services with its Elastic Compute Cloud (EC2) for processing and Simple Storage Service (S3) for storage and Joyent who provide a highly scalable on-demand infrastructure for running Web sites and rich Web applications are examples of IAAS.

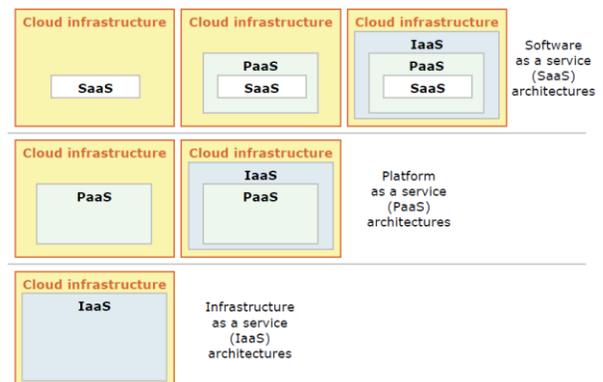


Figure 3: cloud service model architectures [6]

2.4 Cloud deployment models

The four cloud computing models are as follows:

- Public Cloud: A public cloud is one in which a third-party provider makes resources, such as applications and other computing resources, to the general public via the Internet. It is offered on a pay-per-usage model. The cloud service provider is responsible for setting up the hardware, software, applications, and networking resources. Public clouds do not imply that the user's data is public. In many cases, access control mechanisms are required before the user can make use of cloud resources. The advantage of public clouds is

that they allow client to build on-demand virtual systems on almost any scale with minimal in-house hardware [8].

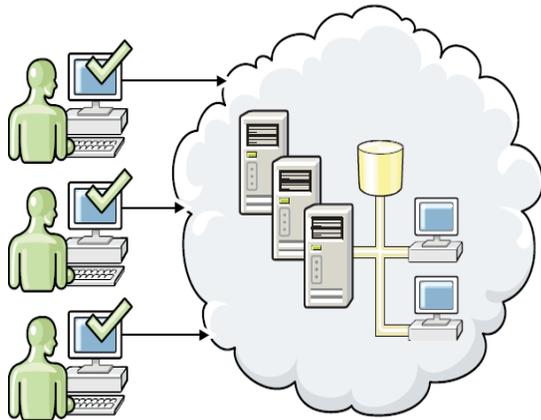


Figure 4: model of public cloud [6]

- **Private Cloud:** This type of the cloud is available exclusively for a single organization. Private Cloud intentionally limits access to its resources to service consumers that belong to the same organization that owns the cloud. The infrastructure is managed and operated for one organization only. The main aim is to uphold a consistent level of control over security, privacy, and governance. With a private cloud, computing resources are pooled and managed internally. This provides for greater efficiencies. Resources can be applied dynamically according to demand. A private cloud allows the enterprise to continue to follow workflow and security procedures. This ensures that the correct level of “code” is executing. These types of clouds are not burdened by network bandwidth and availability issues or potential security exposures that may be associated with public clouds. Private clouds can offer the provider and user greater control, security, and resilience. IBM Smart Business Development and Test Cloud is an example of a private cloud [8].

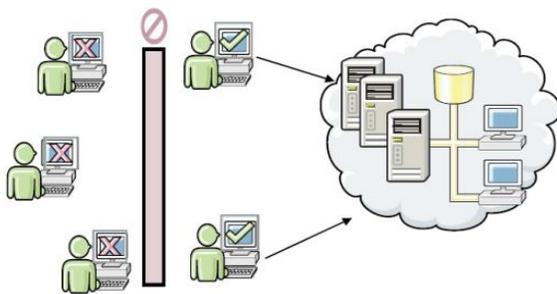


Figure 5: architecture of private cloud [6]

- **Hybrid Cloud:** Hybrid clouds are combinations of public and private clouds that work together. In this model, IT typically outsources noncritical information and processing to the public cloud, while keeping business critical services and data in their control. The hybrid cloud environment works to seamlessly integrate external applications on other private and public clouds, with your in-house processes.

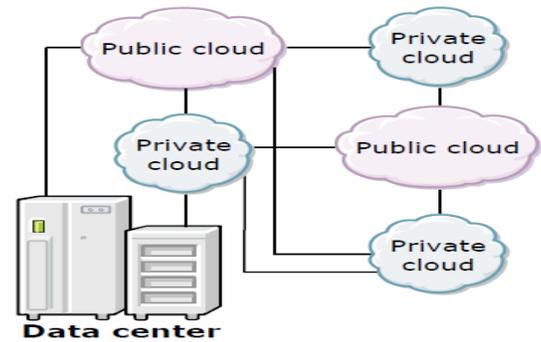


Figure 6: model for hybrid cloud [6]

- **Community Cloud:** A community cloud can be a private cloud purchased by a single user to support a community of users, or a hybrid cloud with the costs spread over a few users of the cloud. A community cloud is often set up as a sandbox environment where community users can test their applications, or access cloud resources [6].

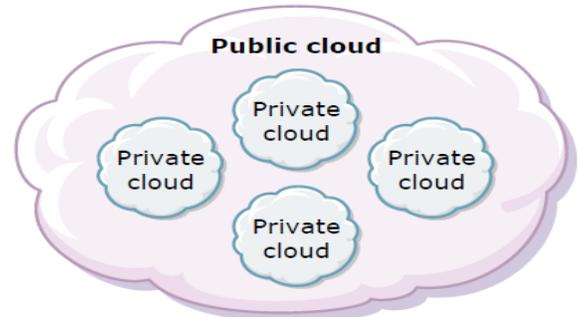


Figure 7: community cloud [6]

III. CHALLENGES

3.1 Research challenges

Although cloud computing has been widely adopted. But still its analysis is in its early stages, and some scientific challenges remain unsolved by the scientific community. Some main challenges are:

- **Security:** Due to dynamic scalability, service abstraction, location transparency, openness of cloud and shared virtualized resources by multi-tenant features of cloud computing models it is difficult to maintain data confidentiality, data integrity. So there is need of security model which will increase the consumer’s trust in cloud computing service provider. Data security in cloud computing is a contractual and technical issue [10].
- **Load Balancing:** In cloud environment, servers are continuously monitored and when one becomes non responsive then a load balancing mechanism is called to avoid system failure. There is a need of efficient load balancing strategy which will ensure the virtualization, availability, even load distributions in data center and elasticity. This will improve the customer satisfaction level and help service provider to achieve scalability [11].
- **Stored data management:** There is an exponential increase in data stored across the network due to data outsourcing. So the stored data management has become a main challenge

for successful implementation of cloud computing. How can we distribute the data to the cloud for optimum storage of data while maintaining fast access [2].

- Automated service provisioning: Elasticity is the most important feature of cloud environment. Due to this feature resources can be allocated or released according to demand. How then can we use or release the resources of the cloud, by keeping the same performance as traditional systems and using optimal resources.
- Energy Management: Efficient utilization of energy is another big challenge in cloud environment. It has been estimated that the cost of powering and cooling accounts for 53% of the total operational expenditure of data centers. So cloud service providers are under huge pressure to decrease energy use. The objective is not only to cut down energy cost in data centers, but also to fulfill government regulations and environmental standards [12].

3.2 Adoption challenges

As Cloud Computing is still in its early development stage, so there are some issues associated its adoption in present form. These are:

- Security: Storing your data and installing your software at someone else's storage media and using someone else's CPU requires a trustworthy environment. So the security issues prevent the smooth adoption of cloud environment.
- Costing: Due to on demand and elastic nature of cloud environment, client can enjoy the services through the available interface. But client is not aware of the resources used by him. Non transparent cost model prevent the smooth adoption of cloud environment.
- Service Level Agreement: It is essential for client to obtain guarantees from cloud service providers on service delivery. These are ensured through Service Level Agreements (SLAs) finalized between the client and service providers. SLA should be defined in such a way that it has a suitable level of granularity i.e. there must be a balance between expressiveness and complicatedness, so that they can cover most of the clients expectations and is relatively simple to be implemented, and enforced by the resource allocation mechanism on the cloud. In addition, different cloud service models will need to form different SLA. This also raises a number of implementation problems for the cloud providers [13].

IV. PROS, CONS & APPLICATIONS

4.1 Advantages

- Pay as per usage: From client's perspective, utility-based payment model allows client to only use the amount of service they actually need, and only pay for the amount of service they have actually used. Also these services are available in uninterrupted manner.
- Zero upfront investment: From service provider's perspective, there is no requirement for up-front investment in hardware and software. It just leases resource from the cloud as per requirement and pay for the usage. So working

expenditure is the only expenditure and maintenance headache is very less.

- Less Operational Cost: Flexibility and scalability of a cloud environment is also an added advantage for cloud and service provider. It enables easy and fast scaling of required computing resources on demand. This results in large saving as resources can be freed to minimize operating costs when service requirement is low.

4.2 Disadvantages

When a client wants to use cloud it requires an upfront investment in the combination of the client's infrastructure and applications with a Cloud.

- Due to unavailability of standards for the IaaS, PaaS, and SaaS interfaces, it becomes very difficult to choose cloud provider.
- Client has to depend on the promise of the service provider in context of availability, security, reliability, performance and Quality of the Service (QoS) of the resources.
- Client is not aware of the actual server on which his data is stored or processing.
- To use cloud's services, user has to transfer his own data on cloud. So due to transfer data back and forth there is a higher security and privacy risks related to data.

4.3 Applications

There are many different areas where cloud computing have applications. Some major areas in which cloud computing have applications are:

Data Processing Applications:

- Document processing: It can be used to convert very large collections of documents from one format to another (e.g., from *Word* to *PDF*), or encrypts the documents.
- Video trans-coding: It can be used to convert one video format to another. (e.g., from AVI to MPEG).
- Image processing: The image-processing application support image conversion (e.g., enlarging an image or creating thumbnails). It can also be used to compress or encrypt images.
- Data mining: It can support searching very large collections of records to locate items of interests.

Batch Processing Applications:

- Report Generation: It has applications in daily basis, weekly basis, monthly basis, and annual basis activity reports generations for organizations in retail, manufacturing, and other economic sectors.
- Processing, aggregation, and summing up of daily transactions for financial institutions, insurance companies, and healthcare organizations.
- Inventory management for large organizations.
- Bill processing and processing of payroll data.
- Keeping record of software development (e.g., nightly updates of software repositories).
- Automatic checking and verification of software and hardware systems [11].

V. CONCLUSION

Cloud computing is a latest technology extensively studied in present years. It is a model through which IT services are delivered and charged on the basis of usage.

But still present technologies are not developed enough to utilize its full capacity. There are many untouched issues in this domain, including security management, stored data management, load balancing, automatic service provisioning and energy management have just started to receive attention from academician and industry. So, we believe that still there is a wide scope of research in this field.

Our proposed taxonomy will help researcher to understand cloud computing architecture along with its strength, weakness, challenges and applications.

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A Set with Special Arrangement and Semi-Group on a New System Called the Stacked System

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Abstract- This paper put a new mathematical system (stacked system) interested in arranging elements in a manner simple analytical set (according to the importance of the element in the set) and to prove that this system is a semi-group and prove some properties of semi-groups in this system.

Index Terms- Stacked system , Stacked set , Stacked semi-group , the order element on stacked system, The level stacked system , The path on stacked –system .

I. INTRODUCTION

There is no doubt that the progress of science and technology has led to the development of tools serve this development, and creating a language to explain and translate this harmony.

We are in a world filled with many of the complex relationships between the elements, and these overlap in the relationships between them confirms that we are still in the way of expanding the simple concept of sets.

Each set has a simple arrangement, whether from the largest to the smallest, or vice versa, or the order of elements according to their role in influencing their sets, and out of this sets.

But there is no study speaks clearly about the order of the elements affected each other within the same group. Simple concept of the set could not explain some of the relationships between the elements of this set .

Every element of this set has its own environment, making the bloc with elements of the same set concept is a little .

Suppose that there is a factory produces three varieties of products and each product has three sizes of packaging. This means that the set of products (S) of this factory has nine elements (three rows and three columns).

S =

packaging	Products		
	x_{11}	x_{12}	x_{13}
	x_{21}	x_{22}	x_{23}
x_{31}	x_{32}	x_{33}	

Table 1

Suppose that the purchasing power of each row (the product) and each column (the package) was distributed as in the table 2

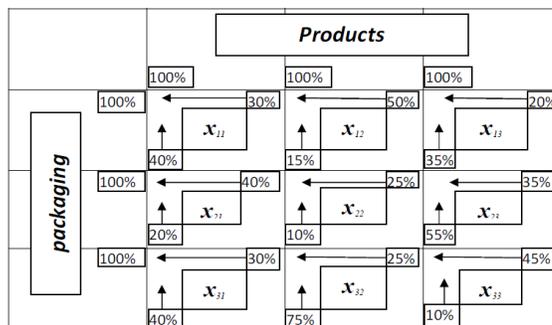


Table 2

Now, What is the most sales of products? And what is next?. And the next?

It is noted that these questions are designed to explain a particular order of these elements in this set is not like we know each arrangement. It can determine the order of any element calculates its relationship with the four elements that affect it in rank within the set and that affect it (two elements in the same row and two in the same column).

In general this study delve into the depths of the relations between the element in the same set .

The conversion of these sets into sets arranged a special arrangement that takes into account the relationship between each constituent element in the same group .Since the set theory assumes that the order of sets is a binary operations, and make this a semi-group (S , <) and (S , >) , this study is transforming this new arrangement to the semi-group system .

II. PRELIMINARIES

2.1 Definition^[7]

A set X is a collection of elements (numbers, points, herring, etc.); we write $x \in X$, to denote x belonging to X. Two sets X and Y are defined to be equal, denoted by $X = Y$, if they are comprised of exactly the same elements: for every element x, we have $x \in X$ if , and only if $x \in Y$.

2.2 Definition^[7]

A subset of a set X is a set S each of whose elements also belongs to X: If $s \in S$, then $s \in X$. We denote S being a subset of X by $S \subseteq X$.

2.3 Definition^[6]

If X and Y are subsets of a set Z , then their intersection is the set, $X \cap Y = \{z \in Z : z \in X \text{ and } z \in Y\}$.

More generally, if $\{A_i : i \in I\}$ is any, possibly infinite, family of subsets of a set Z , then their intersection is : $\bigcap_{i \in I} A_i = \{z \in Z : z \in A_i \text{ for all } i \in I\}$. It is clear that $X \cap Y \subseteq X$ and $X \cap Y \subseteq Y$. In fact, the intersection is the largest such subset: if $S \subseteq X$ and $S \subseteq Y$, then $S \subseteq X \cap Y$. Similarly, $\bigcap_{i \in I} A_i \subseteq A_j$ for all $j \in I$. $X \cap Y$.

2.4 Definition^[6]

If X and Y are subsets of a set Z , then their union is the set, $X \cup Y = \{z \in Z : z \in X \text{ or } z \in Y\}$. [2]

More generally, if $\{A_i : i \in I\}$ is any, possibly infinite, family of subsets of a set Z , then their union is

$\bigcup_{i \in I} A_i = \{z \in Z : z \in A_i \text{ for some } i \in I\}$. It is clear that $X \subseteq X \cup Y$ and $Y \subseteq X \cup Y$. In fact, the union is the smallest such subset: if $X \subseteq S$ and $Y \subseteq S$, then $X \cup Y \subseteq S$. Similarly, $A_j \subseteq \bigcup_{i \in I} A_i$ for all $j \in I$.

2.5 Definition^[6]

If X and Y are sets, then their difference is the set, $X - Y = \{x \in X : x \notin Y\}$. The difference $Y - X$ has a similar definition and, of course, $Y - X$ and $X - Y$ need not be equal. In particular, if X is a subset of a set Z , then its complement in Z is the set, $X^C = Z - X = \{z \in Z : z \notin X\}$.

2.6 Definition^[3]

Two sets are said to be disjoint if their intersection is empty; that is, if they have no elements in common. A collection $\{A_i : i \in I\}$ of sets is said to be disjointed if A_i and A_j are disjoint for all i and j in I with $i \neq j$.

2.7 Definition^[3]

The symmetric difference of A and B , $A \Delta B$ is defined by $A \Delta B = A \setminus B \cup B \setminus A$.

2.8 Property^[4]

All $A, B, C \in V$ satisfy the following laws.

Commutativity: $A \cup B = B \cup A$, $A \cap B = B \cap A$;

Associativity: $(A \cup B) \cup C = A \cup (B \cup C)$, $(A \cap B) \cap C = A \cap (B \cap C)$;

Distributivity: $A \cup (B \cap C) = (A \cup B) \cap (A \cup C)$, $A \cap (B \cup C) = (A \cap B) \cup (A \cap C)$;

De Morgan Laws: $A - (B \cap C) = (A - B) \cup (A - C)$, $A - (B \cup C) = (A - B) \cap (A - C)$.

2.9 Definition^[7]

Observe that if X and Y are finite sets, say, $|X| = m$ and $|Y| = n$ (we denote the number of elements in a finite set X by $|X|$), then $|X \times Y| = mn$.

2.10 Definition^[4]

Given a set X , one could collect all the subsets of X to form a new set. This procedure is called the power set operation.

1.4.11 Axiom^[4]

(Power Set). For every set x , there exists a (unique) set, called the power set of x , whose elements are exactly subsets of

x . This set is denoted by $P(x)$. Then : $\emptyset \in P(x)$ for every set $x \in V$. Also $x \in P(x)$. If $x = \{a, b, c, d\}$ then $P(x) = \{\emptyset, \{a\}, \{b\}, \{c\}, \{d\}, \{a, b\}, \{a, c\}, \{a, d\}, \{b, c\}, \{b, d\}, \{c, d\}, \{a, b, c\}, \{a, b, d\}, \{a, c, d\}, \{b, c, d\}, \{a, b, c, d\}\}$.

2.11 Axiom^[4]

(Comprehension, defining subsets). Given a property $p(y)$ of sets, for any set A , there exists a (unique) set B such that $x \in B$ if and only if $x \in A$ and $p(x)$ holds.

2.12 Convention^[4]

The notation $\{x \in A \mid p(x)\}$ stands for the set of all $x \in A$ which satisfy $p(x)$.

2.13 Definition^[7]

If X and Y are (not necessarily distinct) sets, then their Cartesian product $X \times Y$ is the set of all ordered pairs (x, y) , where $x \in X$ and $y \in Y$. The plane is $\mathbb{R} \times \mathbb{R}$. The only thing we need to know about ordered pairs is that $(x, y) = (x^*, y^*)$ if and only if $x = x^*$ and $y = y^*$.

2.13 Definition^[2]

If A is a non-void set, a non-void subset $R \subseteq A \times A$ is called a relation on A . If $(a, b) \in R$ we say that a is related to b , and we write this fact by the expression $a \sim b$.

2.14 Definition^[2]

the several properties which a relation may possess.

- 1) If $a \in A$, then $a \sim a$. (reflexive)
- 2) If $a \sim b$; then $b \sim a$. (symmetric)
- 2') If $a \sim b$ and $b \sim a$, then $a = b$. (anti-symmetric)
- 3) If $a \sim b$ and $b \sim c$; then $a \sim c$. (transitive).

2.15 Definition^[2]

A relation which satisfies 1), 2'), and 3) is called a partial ordering. In this case we write $a \sim b$ as $a \leq b$. Then:

- 1) If $a \in A$, then $a \leq a$.
- 2') If $a \leq b$ and $b \leq a$, then $a = b$.
- 3) If $a \leq b$ and $b \leq c$, then $a \leq c$.

2.16 Definition^[2]

A linear ordering is a partial ordering with the additional property that, if $a, b \in A$, then $a \leq b$ or $b \leq a$.

2.17 Definition^[9]

The mathematical systems is a set of interacting or interdependent components forming an integrated whole or a set of elements (often called 'components') and relationships which are different from relationships of the set or its elements to other elements or sets.

2.18 Definition^[9]

A binary operation on a set S is a mapping of the Cartesian product $S \times S$ into S .

2.19 Definition^[9]

Let S be a set with a binary operation, written multiplicatively. An identity element of S is an element e of S such that $ex = x = xe$ for all $x \in S$.

2.20 Definition^[9]

A binary operation on a set S (written multiplicatively) is associative when $(xy)z = x(yz)$ for all $x, y, z \in S$.

2.21 Definition^[9]

A binary operation on a set S (written multiplicatively) is commutative when $xy = yx$ for all $x, y \in S$.

2.22 Definition^[5]

Let S be a set and $\sigma : S \times S \rightarrow S$ a binary operation that maps each ordered pair (x, y) of S to an element $\sigma(x, y)$ of S. The pair (S, σ) (or just S, if there is no fear of confusion) is called a groupoid.

2.23 Definition^[5]

A groupoid $(S, *)$ we shall mean a non-empty set S on which a binary operation * is defined. That is to say, we have a mapping $* : S \times S \rightarrow S$. We shall say that $(S, *)$ is a semigroup if * is associative, i.e. if $(\forall x, y, z \in S) ((x, y)*, z)* = (x, (y, z)*)*$.

2.24 Definition^[9]

A semigroup is an ordered pair of a set S, the underlying set of the semigroup, and one associative binary operation on S. A semigroup with an identity element is a monoid. A semigroup or monoid is commutative when its operation is commutative.

2.25 Definition^[9]

Let S be a semigroup (written multiplicatively). Let $a \in S$ and let $n \geq 1$ be an integer ($n \geq 0$ if an identity element exists). The nth power a^n of a is the product $x_1 x_2 \dots x_n$ in that $x_1 = x_2 = \dots = x_n = a$.

2.26 Definition^[5]

S is a finite semigroup if it has only a finitely many elements.

2.27 Definition^[5]

A commutative semigroup is a semigroup S with property : $(\forall x, y \in S) (xy = yx)$.

2.28 Definition^[5]

If there exists an element 1 of S such that $(\forall x \in S) x1 = 1x = x$ we say that 1 is an identity (element) of S and that S is a semigroup with identity.

2.29 Definition^[5]

If S has no identity element then it is very easy to adjoin an extra element 1 to S to form a monoid. We define $1S = S1 = S$ for all s in S, and $11 = 1$, and it is a routine matter to check that $S \cup \{1\}$ becomes a monoid

2.30 Definition^[5]

If there exists an element 0 of S such that $(\forall x \in S) x0 = 0x = 0$ we say that 0 is a zero element of S and that S is a semigroup with zero.

2.31 Definition^[5]

Let $A \neq \emptyset$ be a (nonempty) subset of a semigroup (S, σ) . We say that (A, σ) is a subsemigroup of S, denoted by $A \leq S$, if

A is closed under the product of S: $\forall x, y \in A: x \sigma y \in A$, that is, $A \leq S \Leftrightarrow A^2 \subseteq A$.

2.32 Definition^[8]

A non-empty subset A of a semigroup S is called a left ideal if $SA \subseteq A$, a right ideal if $AS \subseteq A$, and a (two-sided) ideal if it is both a left and a right ideal.

2.33 Definition^[1]

A subsemigroup I of a semigroup S is called an interior ideal of S if $SIS \subseteq I$.

2.34 Definition^[1]

A subsemigroup I of a semigroup S is called a bi-ideal of S if $ISI \subseteq I$.

2.35 Definition^[1]

We call a non-empty subset L of S which is a left ideal of S to be prime if for any two ideal A and B of S such that $AB \subseteq L$, it implies that $A \subseteq L$ or $B \subseteq L$.

III. STACKED SET ,SYSTEMS AND SEMI-GROUPS

3.1 Stacked Set And Systems

3.1.1 Definition

Let T_α be a finite set, where T_α be a stacked set if and only if $a_\alpha \in T_\alpha, \alpha \in N/0, \alpha$ is the number of methods stacking elements in the set, and it is called paths $(P_1, P_2, \dots, P_\alpha)$.

Ex: (T_2) is times stacking two paths (columns and rows).

(T_2) is in terms of operations between the elements in the form like a matrix $(n \times n) \cong T_2$, that mean we have a stacked in two paths, any element that has a link package, with two classes of elements of T_2 :

	C_1	C_2	C_3	C_4	C_5	....	C_n
R_1	a_{11}	a_{12}	a_{13}	a_{14}	a_{15}	....	a_{1n}
R_2	a_{21}	a_{22}	a_{23}	a_{24}	a_{25}	....	a_{2n}
R_3	a_{31}	a_{32}	a_{33}	a_{34}	a_{35}	....	a_{3n}
R_4	a_{41}	a_{42}	a_{43}	a_{44}	a_{45}	....	a_{4n}
R_5	a_{51}	a_{52}	a_{53}	a_{54}	a_{55}	....	a_{5n}
....
R_n	a_{n1}	a_{n2}	a_{n3}	a_{n4}	a_{n5}	....	a_{nn}

Table 3

Elements in this case are in the case of stack in the form of packages each of which has to do with some of the elements, So we cannot call them matrix, and the matrices known. just we say it is in stack. This stacking is possible to have a regular or irregular.

The question here is how to distinguish the rows of columns, meaning that when we say that this path of rows or columns?.

3.1.2 Definition

If T_2 is stacked set then T_2 has two paths, C_i and $R_i (1 \leq i \leq n)$ such that $C_1 \cap C_2 \cap \dots \cap C_n = \emptyset, R_1 \cap R_2 \cap \dots \cap R_n = \emptyset$, and $C_\rho \cap R_\sigma = \{a_{\rho\sigma} | a_{\rho\sigma} \in T_2\}$.

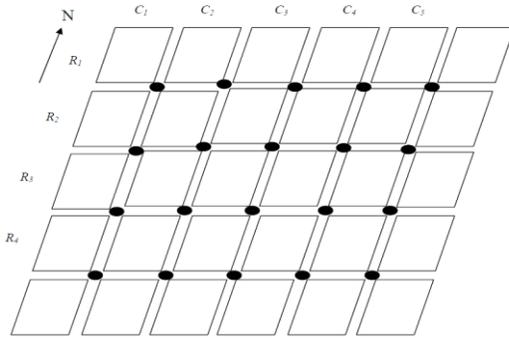
Then

$$\prod_{i \in n} C_i = \prod_{i \in n} R_i = \emptyset,$$

and

$$C_\rho \cap R_\sigma = \{ a_{\rho\sigma} \mid a_{\rho\sigma} \in T_2 \}.$$

So it could be likened to the idea of the order of the set (T), as the city square in shape, with parallel paths from north to south and another parallel from east to west, and must be no intersections between the two types of paths .



Figures 1

3.1.3 Definition

Any set $A \notin \emptyset$ has at least one stack or stack is T_1 , and the set \emptyset is T_0 .

From this concept we define paths inside the sets that define it, or some type of disassembly in the definition of the set and of the elements inside the sets .

3.2 Paths in stacked set

3.2.1 Definition

P_ρ is path on T_α if $\forall a \in T_\alpha \Leftrightarrow a \in P_\rho, 1 \leq \rho \leq \alpha$,and T_α has α paths $\alpha \in N$.

3.2.2 Definition

If $T_{(\alpha, n)}$ is stacked set then it has α paths $[P_1, P_2, \dots, P_\alpha]$, and any path contains n sub-paths . such that $P_\rho = P_{\rho 1} \cup P_{\rho 2} \cup \dots \cup P_{\rho n}$, $\rho \in \{ 1, 2, \dots, \alpha \}$, and $P_{\rho\gamma} \cap P_{\rho\delta} = \emptyset . (\gamma, \delta \in \{ 1, 2, \dots, n \})$.

3.2.3 Definition

Any path P_ρ in T_α , contains a disjoint sub-paths $P_{\rho\sigma}$.and any sub-path $P_{\rho\sigma}$ (if $\alpha \geq 3$)contains a disjoint sub- sub-paths $P_{\rho\sigma\beta}$. Then, $P_{11} \cap P_{12} \cap \dots \cap P_{1n} = \emptyset$, $P_{21} \cap P_{22} \cap \dots \cap P_{2n} = \emptyset$, \dots , $P_{\alpha 1} \cap P_{\alpha 2} \cap \dots \cap P_{\alpha n} = \emptyset$.

3.2.4 Definition

If $T_{(\alpha, n, m)}$ is stacked set then it has α paths $[P_1, P_2, \dots, P_\alpha]$, and any path contains n sub-paths . such that $P_\rho = P_{\rho 1} \cup P_{\rho 2} \cup \dots \cup P_{\rho n}$, $\rho \in \{ 1, 2, \dots, \alpha \}$, and any sub-path has m sub-sub-paths $P_{\rho\sigma} = P_{\rho\sigma 1} \cup P_{\rho\sigma 2} \cup \dots \cup P_{\rho\sigma m}$. ($\rho, \sigma, m, n \in N/0$) .

3.2.5 Theorem

the total elements in the stacked set T_α is $\wp(T_\alpha) = \wp(P_\rho)$.

proof :

From definition of the paths, P_ρ is path on T_α if $\forall a \in T_\alpha \Leftrightarrow a \in P_\rho, 1 \leq \rho \leq \alpha$. then $\wp(T_\alpha) = \wp(P_\rho)$.

3.2.6 Theorem

the total elements in the stacked set $T_{(\alpha, n)}$ is $\wp(T_{(\alpha, n)}) \leq m n$, that's where the total elements in the sub-path $P_\rho \sigma$ is $\wp(P_\rho \sigma) \leq m . (\rho, \sigma, m, n \in N)$.

proof :

Let $T_{(\alpha, n)}$ is stacked set ,then from definition above , it has α paths $[P_1, P_2, \dots, P_\alpha]$, and any sub-path has n elements . such that $\wp(T_{(\alpha, n)}) = \wp(P_\rho)$, $P_\rho = P_{\rho 1} \cup P_{\rho 2} \cup \dots \cup P_{\rho n}$, $\rho \in \{ 1, 2, \dots, \alpha \}$, and $P_{\rho\gamma} \cap P_{\rho\delta} = \emptyset . (\gamma, \delta \in \{ 1, 2, \dots, n \})$, then $\wp(T_{(\alpha, n)}) = \wp(P_\rho) = \sum_{i=1}^n \wp_i(P_{\rho\gamma})$. And when ; $\wp(P_\rho \sigma) \leq m$. Then ; $\wp(T_{(\alpha, n)}) = \wp(P_\rho) \leq m n$.

3.2.7 Example

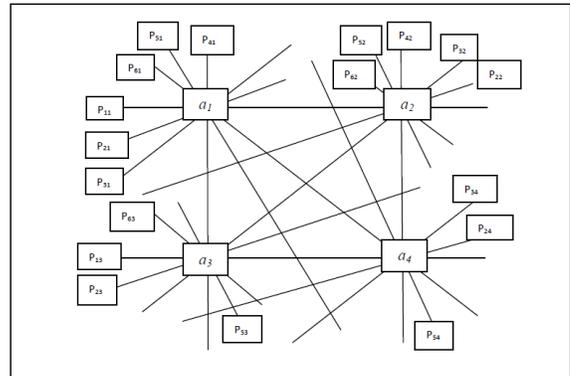


Figure 2 $T_{(6,4)}$

$$P_1 = P_{11} \cup P_{12} \cup P_{13} \cup P_{14} = \{ a_1, a_2 \} \cup \emptyset \cup \{ a_3, a_4 \} \cup \emptyset = T_{(6,4)}$$

$$P_2 = P_{21} \cup P_{22} \cup P_{23} \cup P_{24} = \{ a_1 \} \cup \{ a_2 \} \cup \{ a_3 \} \cup \{ a_4 \} = T_{(6,4)}$$

$$P_3 = P_{31} \cup P_{32} \cup P_{33} \cup P_{34} = \{ a_1 \} \cup \{ a_2, a_3 \} \cup \emptyset \cup \{ a_4 \} = T_{(6,4)}$$

$$P_4 = P_{41} \cup P_{42} \cup P_{43} \cup P_{44} = \{ a_1, a_3 \} \cup \{ a_2, a_4 \} \cup \emptyset \cup \emptyset = T_{(6,4)}$$

$$P_5 = P_{51} \cup P_{52} \cup P_{53} \cup P_{54} = \{ a_1 \} \cup \{ a_2 \} \cup \{ a_3 \} \cup \{ a_4 \} = T_{(6,4)}$$

$$P_6 = P_{61} \cup P_{62} \cup P_{63} \cup P_{64} = \{ a_1, a_4 \} \cup \{ a_2 \} \cup \{ a_3 \} \cup \emptyset = T_{(6,4)}$$

3.2.8 Example

The stacked set $T_{(4,5)} = P_{1(5)} \cup P_{2(5)} \cup P_{3(5)} \cup P_{4(5)}$, so :
 $T_{(4,5)} = [P_{1,1} \cup P_{1,2} \cup P_{1,3} \cup P_{1,4} \cup P_{1,5} \cup P_{2,1} \cup \dots \cup P_{2,5} \cup P_{3,1} \cup \dots \cup P_{3,5} \cup P_{4,1} \cup \dots \cup P_{4,5} \cup P_{5,1} \cup \dots \cup P_{5,5}]$,
 We note in this example also
 $P_{1,1} \cap P_{1,2} = \emptyset$.

4.4 The stacked-systems

4.4.1 Definition

The system (T_α, τ) called stacked - system if and only if $a_\gamma \tau b_\beta = \min_0 (a_\gamma, b_\beta)$, and the system looking for (zero

convergence), and The system (T_α, \lceil) called stacked - system if and only if $a_\gamma \lceil b_\beta = \max_0(a_\gamma, b_\beta)$, and the system looking for (zero spacing). a_γ and $b_\beta \in T_\alpha$.

4.4.2 Definition

The system (T_α, τ) called stacked - system if and only if $a_\gamma \tau b_\beta = \min_t(a_\gamma, b_\beta)$, and the system looking for (convergence of t), and The system (T_α, \lceil) called stacked - system if and only if $a_\gamma \lceil b_\beta = \max_t(a_\gamma, b_\beta)$, and the system looking for (spacing of t). a_γ and $b_\beta \in T_\alpha, t \in \mathcal{R}$.

4.4.3 Definition

The order element on stacked system T_α , where the system looking for zero convergence or zero spacing, is amount contributes to this element in the system, and this estimate is calculated relationship of this element in every path that contains this element, then the element order of $a_\gamma, (O_0(a_\gamma))$:

$$O_0(a_\gamma) = \lceil a_\gamma \rceil_0 = \left[\frac{|a_{\gamma 1}|}{\sum_{i=1}^\alpha |a_{\gamma i}|} + \frac{|a_{\gamma 2}|}{\sum_{i=1}^\alpha |a_{\gamma i}|} + \dots + \frac{|a_{\gamma \alpha}|}{\sum_{i=1}^\alpha |a_{\gamma i}|} \right] / \alpha$$

$$= \left[\sum_{i=1}^\alpha \frac{|a_{\gamma i}|}{\sum_{i=1}^\alpha |a_{\gamma i}|} \right] / \alpha$$

4.4.4 Definition

The order element on stacked system T_α , where the system looking for convergence of t (or spacing of t), is amount contributes to this element in the system, and this estimate is calculated relationship of this element in every path that contains this element, then the element order of $a_\gamma, (O_t(a_\gamma))$:

$$O_t(a_\gamma) = \lceil a_\gamma \rceil_t = \left[\frac{|a_{\gamma 1} - t|}{\sum_{i=1}^\alpha |a_{\gamma i} - t|} + \frac{|a_{\gamma 2} - t|}{\sum_{i=1}^\alpha |a_{\gamma i} - t|} + \dots + \frac{|a_{\gamma \alpha} - t|}{\sum_{i=1}^\alpha |a_{\gamma i} - t|} \right] / \alpha$$

$$= \left[\sum_{i=1}^\alpha \frac{|a_{\gamma i} - t|}{\sum_{i=1}^\alpha |a_{\gamma i} - t|} \right] / \alpha$$

4.4.5 Definition

The order stacked set T_α in zero convergence system is set $O_0(T_\alpha) = \{x_1, x_2, \dots, x_n\}$ if $\lceil x_1 \rceil_0 < \lceil x_2 \rceil_0 < \dots < \lceil x_n \rceil_0$. And the order stacked set T_α in zero spacing system is set $O_0[T_\alpha] = \{x_n, x_{n-1}, \dots, x_1\}$ if $\lceil x_1 \rceil_0 > \lceil x_2 \rceil_0 > \dots > \lceil x_n \rceil_0$.

The order stacked set T_α , where the system looking for convergence of t (or spacing of t), is set $O_t(T_\alpha) = \{x_1, x_2, \dots, x_n\}$ if $\lceil x_1 \rceil_t < \lceil x_2 \rceil_t < \dots < \lceil x_n \rceil_t$. And the order stacked set T_α in zero spacing system is set $O_t[T_\alpha] = \{x_n, x_{n-1}, \dots, x_1\}$ if $\lceil x_1 \rceil_t > \lceil x_2 \rceil_t > \dots > \lceil x_n \rceil_t$.

4.4.6 Definition

- If (T_α, τ) or (T_α, \lceil) is stacked - system then $\forall a_\alpha, b_\beta \in T_\alpha$:

$\text{Max}_t(a_\alpha, b_\beta) = a_\alpha \lceil b_\beta$, and $\text{Min}_t(a_\alpha, b_\beta) = a_\alpha \tau b_\beta$

- If (T_α, τ) or (T_α, \lceil) is stacked - system then $\forall a_\alpha, b_\beta \in T_\alpha$:

$$\text{max}_t(a_\alpha, b_\beta) = \begin{cases} a_\alpha : \text{if } \lceil a_\alpha \rceil_t > \lceil b_\beta \rceil_t \\ b_\beta : \text{if } \lceil b_\beta \rceil_t > \lceil a_\alpha \rceil_t \end{cases}$$

$$\text{min}_t(a_\alpha, b_\beta) = \begin{cases} a_\alpha : \text{if } \lceil a_\alpha \rceil_t < \lceil b_\beta \rceil_t \\ b_\beta : \text{if } \lceil b_\beta \rceil_t < \lceil a_\alpha \rceil_t \end{cases}$$

- If $a_\alpha = t, (\lceil a_\alpha \rceil_t)$ then we suppose that $|a_\alpha - t| = \Delta t$

$$\sum_i |a_i - t|$$
, and where $\alpha \in \{1, \dots, i\}$ then, we compensate $|a_\alpha - t| = 0$.
- If $\lceil a_\alpha \rceil_t = \lceil b_\beta \rceil_t$ (one order element in two different places) so we have many type of this system, and if $\lceil a_\alpha \rceil_t \neq \lceil b_\beta \rceil_t$ the system is type-1.

4.4.7 theorem

If the system is type-1, and $\lceil a_\alpha \rceil_t = \lceil b_\beta \rceil_t$, then $a = b$. a, b is element in this system.

proof:

from the definition above, if $\lceil a_\alpha \rceil_t = \lceil b_\beta \rceil_t$ (one order element in two different places) so we have many type of this system, and if $\lceil a_\alpha \rceil_t \neq \lceil b_\beta \rceil_t$ the system is type-1. so if the system is type-1, and $\lceil a_\alpha \rceil_t = \lceil b_\beta \rceil_t$, then $a = b$ (one order element one place).

4.4.8 Definition

The level stacked -system (IT_α) is defined as if the system looking for convergence of t, then $IT_\alpha = \{1, 2, \dots, n\}, n \in \mathbb{N}/0$. And if the system looking for spacing of t, then $IT_\alpha = \{n, n-1, \dots, 1\}, n \in \mathbb{N}/0$. Any element in T_α has only one element corresponding in IT_α , and in the same staking.

The IT_α helps us to calculate the min_t and the max_t in any a stacked-system. We arrange the elements of the smallest to the largest, or the opposite is true, according to the following concept $L: T_\alpha \rightarrow IT_\alpha, l: T_\alpha \rightarrow IT_\alpha$

$l(a_\eta) = 1$ if $\lceil a_\eta \rceil_t$ is smallest, if the system looking for convergence of t, $L(a_\eta) = n$ if $\lceil a_\eta \rceil_t$ is largest, if the system looking for spacing of t.

3.3 The stacked-semigroups

3.3.1 Definition

The minimum or maximum cost element is an element that can be an alternative for all elements with it in the same row and column, and symbolized by: $\text{min}_t\{\text{cost}(T_\alpha)\}$, or $\text{max}_t\{\text{cost}(T_\alpha)\}$.

3.3.2 Theorem

- 1- If \lceil is an operation on the system (T_α, \lceil) in type -1 system, then $a \lceil b = \lceil(a, b) = \max_t(a, b) = a \vee b$, $a, b \in T_\alpha$.
- 2- If τ is an operation on the system (T_α, τ) in type -1 system, then $a \tau b = \tau(a, b) = \min_t(a, b) = a \vee b$, $a, b \in T_\alpha$.

proof :

- 1- let \lceil is an operation on the system (T_α, \lceil) , $a, b \in T_\alpha$, so $a \lceil b = \max_t(a, b)$, then $\max_t(a, b) = a$, (if $\lceil a \rceil_t > \lceil b \rceil_t$), or $\max_t(a, b) = b$ if $\lceil b \rceil_t > \lceil a \rceil_t$, and the system is type-1 then ($\lceil a \rceil_t \neq \lceil b \rceil_t$) so $\max_t(a, b) = a$ or b mean $a \vee b$.
- 2- let τ is an operation on the system (T_α, τ) , $a, b \in T_\alpha$, so $a \tau b = \min_t(a, b)$, then $\min_t(a, b) = a$, (if $\lceil a \rceil_t < \lceil b \rceil_t$), or $\min_t(a, b) = b$ if $\lceil b \rceil_t < \lceil a \rceil_t$, and the system is type-1 then ($\lceil a \rceil_t \neq \lceil b \rceil_t$) so $\min_t(a, b) = a$ or b mean $a \vee b$.

3.4 The stacked-semigroup

3.4.1 Definition

A binary operation on a stacked set T_α is a mapping of the Cartesian product

$T_\alpha \times T_\alpha$ into T_α .

3.4.2 Definition

The staked-groupoid is stacked-system, with binary operation.

3.4.3 Theorem

The stacked-system (T_α, τ) and (T_α, \lceil) (in definition 3.1) is a groupoid and called a stacked-groupoid.

Proof :

- 1- Let $a, b \in T_\alpha$, from definition 6.4.6, $a \tau b = \min_t(a, b)$ if the system looking for convergence of t , from that $a \tau b = a \vee b \in T_\alpha$, ($a \vee b = a$ or b), then certainly $\forall a, b \in T_\alpha$, $a \tau b \in T_\alpha$, that mean $\tau : T_\alpha \times T_\alpha \rightarrow T_\alpha$, and from definitions 7.2.1, and 7.2.2, the relation τ is a binary operation and the stacked-system is stacked-groupoid.
- 2- Let $a, b \in T_\alpha$, from definition 6.4.6, $a \lceil b = \max_t(a, b)$ if the system looking for spacing of t , from that $a \lceil b = a \vee b \in T_\alpha$, ($a \vee b = a$ or b), then certainly $\forall a, b \in T_\alpha$, $a \lceil b \in T_\alpha$, that mean $\lceil : T_\alpha \times T_\alpha \rightarrow T_\alpha$, and from definitions 7.2.1, and 7.2.2, the relation \lceil is a binary operation and the stacked-system is stacked-groupoid.

3.4.4 Theorem

If the systems (T_α, τ) and (T_α, \lceil) are a stacked-systems (type - 1) then τ and \lceil are associative.

proof :

- Let $a, b, c \in T_\alpha$, $((a \tau b) \tau c) = ((a \vee_t b) \tau c) = ((a \vee_t b) \vee c) = (a \vee_t (b \vee_t c)) = (a \vee_t (b \tau c)) = (a \tau (b \tau c))$, then τ is associative relation.
- Let $a, b, c \in T_\alpha$, $((a \lceil b) \lceil c) = ((a \vee_t b) \lceil c) = ((a \vee_t b) \vee c) = (a \vee_t (b \vee_t c)) = (a \vee_t (b \lceil c)) = (a \lceil (b \lceil c))$, then \lceil is associative relation.

3.4.5 Definition

A stacked-semigroup is a stacked-system T_α , with associative binary operation.

3.4.6 Theorem

- (i) If the systems (T_α, τ) is a stacked-system (type - 1), then (T_α, τ) is a semigroup and called a stacked-semigroup.
- (ii) If the systems (T_α, \lceil) is a stacked-system (type - 1), then (T_α, \lceil) is a semigroup and called a stacked-semigroup.

proof :

- (i) Let $a, b \in T_\alpha$, from definition 6.4.6, $a \tau b = \min_t(a, b)$ if the system looking for convergence of t , from that $a \tau b = a \vee b \in T_\alpha$, ($a \vee b = a$ or b), then certainly $\forall a, b \in T_\alpha$, $a \tau b \in T_\alpha$, that mean $\tau : T_\alpha \times T_\alpha \rightarrow T_\alpha$, and from definitions 7.2.1, and 7.2.2, the relation τ is a binary operation.

Let $a, b, c \in T_\alpha$, $((a \tau b) \tau c) = ((a \vee_t b) \tau c) = ((a \vee_t b) \vee c) = (a \vee_t (b \vee_t c)) = (a \vee_t (b \tau c)) = (a \tau (b \tau c))$, then τ is associative relation. then from definition 7.2.5, the stacked-systems (T_α, τ) is a semigroup and called a stacked-semigroup.

- (ii) Let $a, b \in T_\alpha$, from definition 6.4.6, $a \lceil b = \max_t(a, b)$ if the system looking for spacing of t , from that $a \lceil b = a \vee b \in T_\alpha$, ($a \vee b = a$ or b), then certainly $\forall a, b \in T_\alpha$, $a \lceil b \in T_\alpha$, that mean $\lceil : T_\alpha \times T_\alpha \rightarrow T_\alpha$, and from definitions 7.2.1, and 7.2.2, the relation \lceil is a binary operation.

Let $a, b, c \in T_\alpha$, $((a \lceil b) \lceil c) = ((a \vee_t b) \lceil c) = ((a \vee_t b) \vee c) = (a \vee_t (b \vee_t c)) = (a \vee_t (b \lceil c)) = (a \lceil (b \lceil c))$, then \lceil is associative relation. then from definition 7.2.5, the stacked-systems (T_α, \lceil) is a semigroup and called a stacked-semigroup.

3.4.7 Theorem

- (i) If the semigroup (T_α, τ) is a stacked-semigroup (type - 1), then (T_α, τ) is a commutative semigroup.
- (ii) If the semigroup (T_α, \lceil) is a stacked-semigroup (type - 1), then (T_α, \lceil) is a commutative semigroup.

proof :

- (i) Let $x, y \in T_\alpha$ then $x \tau y = x \vee_t y = y \vee_t x = y \tau x \in T_\alpha \Rightarrow x \tau y = y \tau x \Rightarrow (T_\alpha, \tau)$ is a commutative semigroup.
- (ii) Let $x, y \in T_\alpha$ then $x \lceil y = x \vee_t y = y \vee_t x = y \lceil x \in T_\alpha \Rightarrow x \lceil y = y \lceil x \Rightarrow (T_\alpha, \lceil)$ is a commutative semigroup.

3.4.8 Theorem

- (i) If the semigroup (T_α, τ) is a stacked-semigroup, then (T_α, τ) is a finite semigroup.
- (ii) If the semigroup (T_α, \lceil) is a stacked-semigroup, then (T_α, \lceil) is a finite semigroup.

proof :

- (i) From definition 2.6 , any set is finite semigroup if it has only a finitely many elements . from definition 3.1 , T_α is a stacked finite set ,then (T_α , τ) is a finite semigroup .
- (ii) And so (T_α , \lceil) is a finite semigroup .

3.4.9 Theorem

The stacked-semigroups (T_α , τ) and (T_α , \lceil) have an identity element ,

proof :

let (T_α , τ) is a stacked-system so (T_α , τ) is a semigroup , so it is looking for convergence of t , and let $T_\alpha = \{ x_1 , x_2 , \dots , x_n \}$ so T_α is finite set , then $x_a \tau x_b = \min_t (x_a , x_b)$, $\forall x_a , x_b \in T_\alpha$, there is exist $x_e \in T_\alpha$, and it is the last element we looking for it in the system such that $\forall x \in T_\alpha , x \tau x_e = x_e \tau x = x$, then x_e is the identity element , and so if the system looking for spacing of t (T_α , \lceil) , then $T_\alpha = \{ x_n , x_{n-1} , \dots , x_1 \}$, and $\forall x \in T_\alpha , x \lceil x_e = x_e \lceil x = x$, then x_e is the identity element .

3.4.10 Theorem

The stacked-semigroups (T_α , τ) and (T_α , \lceil) have zero element.

Proof :

Let (T_α , τ) is a stacked-system so (T_α , τ) is a semigroup with an associative binary composition in T_α . It is looking for convergence of t , and let $T_\alpha = \{ x_1 , x_2 , \dots , x_n \}$ then $x_a \tau x_b = \min_t (x_a , x_b)$, $\forall x_a , x_b \in T_\alpha$, there is exist $x_{zero} \in T_\alpha$ such that $x_1 \tau x_2 \tau \dots \tau x_n = \min_t (x_1 , x_2 , \dots , x_n) = x_{zero}$, that mean x_e is the nearest convergence of t element we looking for it , so $\forall x \in T_\alpha , x_{zero} \tau x = x \tau x_{zero} = x_{zero}$. then x_{zero} is the zero element . If the system looking for spacing of t (T_α , \lceil) , then the zero element is the furthest spacing of t element.

3.4.11 Lemma

- i. In the stacked-semigroup (T_α , \lceil) the identity element $x_e = l(1)$, such that $T_\alpha = \{ x_n , x_{n-1} , \dots , x_1 \}$, $n \in N/0$.
- ii. In the stacked-semigroup (T_α , τ) the identity element $x_e = l(n)$, such that $T_\alpha = \{ x_1 , x_2 , \dots , x_n \}$, $n \in N/0$.

proof :

From the theorem 4.7, any stacked-semigroup has an identity element ,it is the last element of the order set T_α , so if the system looking for convergence of t ,then $x_e = x_n$, and it is) corresponds the element n in $l(T_\alpha)$, so $x_e = l(n)$. if the system looking for spacing of t , the element $x_e = x_1$ in (T_α , \lceil) corresponds the element 1 in $l(T_\alpha)$, then $x_e = l(1)$.

3.4.12 Lemma

- i. In the stacked-semigroup (T_α , \lceil) the zero element $x_{zero} = l(n)$ if $T_\alpha = \{ x_1 , x_2 , \dots , x_n \}$.
- ii. In the stacked-semigroup (T_α , τ) the zero element $x_{zero} = l(1)$

Proof :

from the theorem 4.8, any stacked-semigroup has a zero element ,it is the first element of the order set T_α , so if the system looking for convergence of t ,then $x_{zero} = x_1$. and it is corresponds the element 1 in $l(T_\alpha)$, so $x_{zero} = l(1)$. if the system looking for spacing of t , the element $x_{zero} = x_n$ in (T_α , \lceil) corresponds the element n in $l(T_\alpha)$, then $x_{zero} = l(n)$.

3.4.13 Theorem

If (T_α , τ) and (T_α , \lceil) are a stacked-semigroups, then $[x_\alpha] = \{ x_\alpha \}$, $\forall x_\alpha \in (T_\alpha , \tau)$, or $\forall x_\alpha \in (T_\alpha , \lceil)$.

Proof :

- i. let (T_α , τ) is a stacked-semigroup $\Rightarrow T_\alpha$ is finite set $\Rightarrow |T_\alpha| = n$, $n \in N$, then $\forall x \in T_\alpha : x^1 = x$, $x^2 = x \tau x = x$, $x^3 = x \tau x \tau x = x$, so $x^n = x \tau x \dots \tau x$ (to repeat it n times) = $x \Rightarrow [x_\alpha] = \{ x_\alpha \}$.
- ii. let (T_α , \lceil) is a stacked-semigroup $\Rightarrow T_\alpha$ is finite set $\Rightarrow |T_\alpha| = n$, $n \in N/0$, then $\forall x \in T_\alpha : x^1 = x$, $x^2 = x \lceil x = x$, $x^3 = x \lceil x \lceil x = x$, so $x^n = x \lceil x \dots \lceil x$ (to repeat it n times) = $x \Rightarrow [x_\alpha] = \{ x_\alpha \}$.

3.4.14 Definition

- i. Let $A_\alpha \subseteq T_\alpha$ be a (nonempty) subset of a stacked-semigroup (T_α , τ) . We saying that (A_α , τ) is a stacked- subsemigroup of (T_α , τ) denoted by $A \leq T$, if A_α is closed under the product of $T_\alpha : \forall x , y \in A_\tau ; x \tau y \in A_\tau$.
- ii. Let $B_\alpha \subseteq T_\alpha$ be a (nonempty) subset of a stacked-semigroup (T_α , \lceil) . We saying that (B_α , \lceil) is a stacked- subsemigroup of (T_α , \lceil) , denoted by $B_\alpha \leq T_\alpha$, if B_α is closed under the product of $T_\alpha : \forall x , y \in B_\alpha ; x \lceil y \in B_\alpha$.

3.4.15 Theorem

If (T_α , τ) and (T_α , \lceil) , be stacked-semigroups, then any element in the power set of the set T_α with τ or \lceil is a stacked-subsemigroup.

proof :

- 1- let (T_α , τ) be a stacked-semigroup, then $\forall x \in T_\alpha , x^2 = x \tau x = x \vee x = x \in (\{ x \} , \tau) \subseteq (T , \tau)$, $\forall x , y \in T_\alpha : x \tau y = (x \vee_t y) \in (\{ x , y \} , \tau) \subseteq (T_\alpha , \tau)$ so $\forall x_1 , x_2 \dots x_n \in T_\alpha : x_1 \tau x_2 \tau \dots \tau x_n = (x_1 \vee_t x_2 \vee_t \dots \vee_t x_n) \in (\{ x_1 , x_2 , \dots , x_n \} , \tau) \subseteq (T_\alpha , \tau)$. So any subset in T_α with τ is staked - subsemigroup on T_α , but the set of all subset in T_α is power set of T_α , so any element in the power set of the set T_α with τ is a stacked-subsemigroup.
- 2- let (T_α , \lceil) be a stacked-semigroup, then $\forall x \in T_\alpha , x^2 = x \lceil x = x \vee x = x \in (\{ x \} , \lceil) \subseteq (T , \lceil)$, $\forall x , y \in T_\alpha : x \lceil y = (x \vee_t y) \in (\{ x , y \} , \lceil) \subseteq (T_\alpha , \lceil)$ so $\forall x_1 , x_2 \dots x_n \in T_\alpha : x_1 \lceil x_2 \lceil \dots \lceil x_n = (x_1 \vee_t x_2 \vee_t \dots \vee_t x_n) \in (\{ x_1 , x_2 , \dots , x_n \} , \lceil) \subseteq (T_\alpha , \lceil)$. So any subset in T_α with \lceil is staked - subsemigroup on T_α , but the set of all subset in T_α is power set of T_α , so any element in the power set of the set T_α with \lceil is a stacked-subsemigroup

3.4.16 Example

If there are three distribution centers, consumer products of the type (A, B, C), where they are transported to sales centers (X, Y, Z) at a cost, as in the following table:

	X	Y	Z
A	1	3	2
B	4	5	1
C	7	3	1

Table 4

So there is a process of transferring between (A, B, C) and (X, Y, Z).

Transportation between A and X cost 1, so

- cost (A,X) = 1 ≡ 1₁₁
- cost (A,Y) = 3 ≡ 3₁₂
- cost (A,Z) = 2 ≡ 2₁₃
- cost (B,X) = 4 ≡ 4₂₁
- cost (B,Y) = 5 ≡ 5₂₂
- cost (B,Z) = 1 ≡ 1₂₃
- cost (C,X) = 7 ≡ 7₃₁
- cost (C,Y) = 3 ≡ 3₃₂
- cost (C,Z) = 1 ≡ 1₃₃ .

And T_{2,3} (Non-Order) = { 1₁₁, 3₁₂, 2₁₃, 4₂₁, 5₂₂, 1₂₃, 7₃₁, 3₃₂, 1₃₃ } .

or T_{2,3} =

1	3	2
4	5	1
7	3	1

Table 5

If we were looking for a less expensive transfer this means the search for convergence of elements from zero

Then :

- 1- $[1_{11}]_0 = [(1/(1+3+2)) + (1/(1+4+7))] / 2 = 0.125$.
- $[3_{12}]_0 = 0.38636$.
- $[2_{13}]_0 = 0.41667$.
- $[4_{21}]_0 = 0.36667$.
- $[5_{22}]_0 = 0.47727$.
- $[1_{23}]_0 = 0.175$.
- $[7_{31}]_0 = 0.60985$.
- $[3_{32}]_0 = 0.27273$.
- $[1_{33}]_0 = 0.17045$.

- 2- So : $\forall a_\alpha, b_\beta \in T_{2,3} \Rightarrow [a_\alpha]_0 \neq [b_\beta]_0 \Rightarrow (T_{2,3}, \tau)$ is type - 1 .
- 3- $IT_{3,2}(0) = \{ 1_{11}, 1_{33}, 1_{23}, 3_{32}, 4_{21}, 3_{12}, 2_{13}, 5_{22}, 7_{31} \}$.

or IT_{3,2}(0) =

1	6	7
5	8	3
9	4	2

Table 6

- 4- $|IT_{3,2}| = n = 9$.
- 5- $\text{Min}_0(4_{21}, 3_{12}) = 4_{21} \tau 3_{12} = 4_{21}$.
- 6- $\text{Min}_0(1_{11}, 7_{31}) = 1_{11} \tau 7_{31} = 1_{11}$.
- 7- $X_{\text{zero}} = x_1 = 1_{11}, x_e = x_9 = 7_{31}$.

3.5 stacked-ideal

3.5.1 remark

The stacked-semigroup T_α means (T_α, τ) and (T_α, ⌈).

3.5.2 Definition

A non-empty subset I_α of a stacked-semigroup (T_α, τ) or (T_α, ⌈) is called a stacked-ideal if T_αI_α ⊆ I_α, and I_αT_α ⊆ I_α.

3.5.3 Theorem

Let I_α is a stacked-ideal of the stacked-semigroup (T_α, τ), |I_α| = r, T_α = {x₁, x₂, ..., x_r, ... x_n}, and the level stacked-semigroup(IT_α) = {1, 2, ..., r, ..., n}, then I_α = {x₁, x₂, ..., x_r}, and I_α(x) ∈ {1, 2, ..., r} .

Proof :

- Let I_{α(r)} is a stacked-ideal of the stacked-semigroup (T_α, τ), |I_{α(r)}| = r, T_α = {x₁, x₂, ..., x_r, ... x_n}, so the level stacked-semigroup(IT_α) = {1, 2, ..., r, ..., n}, $\forall x \in I_{\alpha(r)} \Rightarrow x \tau T_{\alpha} \in I_{\alpha(r)} \Rightarrow$ If $1 \leq s \leq r$ then $x_s \in I_{\alpha(r)} \Rightarrow I_{\alpha(r)} = \{x_1, x_2, \dots, x_r\}$.
- Next, $IT_{\alpha}(x_1) = 1, IT_{\alpha}(x_2) = 2, \dots, IT_{\alpha}(x_r) = r \Rightarrow x_1 = \text{img}(1), x_2 = \text{img}(2), \dots, x_r = \text{img}(r) \Rightarrow \forall x, y \in IT_{\alpha}, x \leq y, \text{img}(x) \tau \text{img}(y) = \text{img}(x)$, and $1 \leq 2 \leq \dots \leq r$, then $\forall t \in IT_{\alpha}, t \leq r \Rightarrow \text{img}(t) \tau \text{img}(r) = \text{img}(r) \tau \text{img}(t) = \text{img}(t)$, but $T_{\alpha} I_{\alpha} \subseteq I_{\alpha(r)}$, and $I_{\alpha} T_{\alpha} \subseteq I_{\alpha}$, so $\text{img}(t) \in I_{\alpha(r)} \Rightarrow \forall t \leq r$, and $|I_{\alpha(r)}| = r$ then $t \in I_{\alpha(r)} \Rightarrow I_{\alpha(r)} = \{\text{img}(1), \text{img}(2), \dots, \text{img}(t), \dots, \text{img}(r)\} \Rightarrow$ the level-stacked-ideal (I_α) = {1, 2, ..., r} $\Rightarrow \forall x \in I_{\alpha(r)}$ then $l(x) \in \{1, 2, \dots, r\}$.

3.5.4 Theorem

Let I_{α(r)} is a stacked-ideal of the stacked-semigroup (T_α, ⌈), |I_{α(r)}| = n - r + 1, T_α = {x₁, x₂, ..., x_r, ... x_n}, and the level stacked-semigroup(IT_α) = {1, 2, ..., r, ..., n}, then I_{α(r)} = {x_r, x_{r+1}, x_{r+2}, ..., x_n}, and I_{α(r)}(x) ∈ {1, 2, ..., n - r + 1} .

Proof :

- Let I_{α(r)} is a stacked-ideal of the stacked-semigroup (T_α, ⌈), |I_{α(r)}| = n - r + 1, T_α = {x₁, x₂, ..., x_r, ... x_n}, so the level stacked-semigroup(IT_α) = {1, 2, ..., r, ..., n}, from the definition (4.11), $\forall x \in I_{\alpha(r)} \Rightarrow x \lceil T_{\alpha} \in I_{\alpha(r)}$. If $r \leq s \leq n$ then $x_s \in I_{\alpha(r)} \Rightarrow I_{\alpha(r)} = \{x_r, x_{r+1}, x_{r+2}, \dots, x_n\}$.
- Next, $IT_{\alpha}(x_r) = 1, IT_{\alpha}(x_{r+1}) = 2, \dots, IT_{\alpha}(x_n) = n \Rightarrow x_r = \text{img}(1), x_{r+1} = \text{img}(2), \dots, x_n = \text{img}(n - r + 1) \Rightarrow \forall x, y \in IT_{\alpha}, x \leq y, \text{img}(x) \tau \text{img}(y) = \text{img}(x)$, and $(n \geq r$ and $r, n \in \mathbb{N}/0)$, so $1 \leq 2 \leq \dots \leq n - r + 1$ then $\forall t \in IT_{\alpha}, t \leq n - r + 1 \Rightarrow \text{img}(t) \tau \text{img}(n - r + 1) = \text{img}(n - r + 1) \tau \text{img}(t) = \text{img}(n - r + 1)$, but $T_{\alpha} I_{\alpha(r)}, I_{\alpha} T_{\alpha} \subseteq I_{\alpha(r)}$

so $\text{img}(t) \in I_{\alpha(r)} \Rightarrow r \leq t \leq n - r + 1$, and $|I_{\alpha(r)}| = n - r + 1$, then $t \in I_{\alpha(r)} \Rightarrow I_{\alpha(r)} = \{ \text{img}(1), \text{img}(2), \dots, \text{img}(t), \dots, \text{img}(n - r + 1) \} \Rightarrow$ the level-stacked-ideal $(IT_{\alpha}) = \{ 1, 2, \dots, n - r + 1 \} \Rightarrow \forall x \in I_{\alpha(r)}$ then $l(x) \in \{ 1, 2, \dots, n - r + 1 \}$.

3.5.5 Theorem

Any a stacked-ideal I of the stacked-semigroup T_{α} be an interior ideal.

Proof :

- 1- Let I is a stacked-ideal of stacked-semigroup $(T_{\alpha}, \tau) \Rightarrow T_{\alpha}I, IT_{\alpha} \subseteq I$, then $\forall s \in I, \forall x, y \in T_{\alpha}, x \tau s = s \tau x = (x \vee s) \in I$ and $x \tau s \tau y = y \tau s \tau x = ((x \vee s) \vee y) \in I$, then $T_{\alpha}IT_{\alpha} \subseteq I$ so I is an interior ideal, and any a stacked-ideal I of the stacked-semigroup be an interior ideal.
- 2- Let I is a stacked-ideal of stacked-semigroup $(T_{\alpha}, \sqcup) \Rightarrow T_{\alpha}I, IT_{\alpha} \subseteq I$, then $\forall s \in I, \forall x, y \in T_{\alpha}, x \sqcup s = s \sqcup x = (x \vee s) \in I$ and $x \sqcup s \sqcup y = y \sqcup s \sqcup x = ((x \vee s) \vee y) \in I$, then $T_{\alpha}IT_{\alpha} \subseteq I$ so I is an interior ideal, and any a stacked-ideal I of the stacked-semigroup be an interior ideal.

3.5.6 Theorem

Any a stacked-ideal I of the stacked-semigroup T_{α} be bi-ideal.

Proof :

- 1- Let I is a stacked-ideal of stacked-semigroup $(T_{\alpha}, \tau) \Rightarrow T_{\alpha}I, IT_{\alpha} \subseteq I$, then $\forall s, t \in I, \forall x \in T_{\alpha}, x \tau s = s \tau x = (s \vee x) \in I$ and $(s \tau x) \tau t = t \tau (x \tau s) = ((s \vee x) \vee t) = s \vee x \vee t \in I$, then $IT_{\alpha}I \subseteq I$ so I is bi-ideal, and any a stacked-ideal I of the stacked-semigroup T_{α} be bi-ideal.
- 2- Let I is a stacked-ideal of stacked-semigroup $(T_{\alpha}, \sqcup) \Rightarrow T_{\alpha}I, IT_{\alpha} \subseteq I$, then $\forall s, t \in I, \forall x \in T_{\alpha}, x \sqcup s = s \sqcup x = (s \vee x) \in I$ and $(s \tau x) \sqcup t = t \sqcup (x \sqcup s) = ((s \vee x) \vee t) = s \vee x \vee t \in I$, then $IT_{\alpha}I \subseteq I$ so I is bi-ideal, and any a stacked-ideal I of the stacked-semigroup T_{α} be bi-ideal.

3.5.7 Theorem

If I is a stacked-ideal of stacked-semigroup T_{α} , then I be not completely prime.

Proof:

Let I is a stacked-ideal of stacked-semigroup T_{α} , then $\forall x, y \in T_{\alpha}, x \tau y = x \vee y$ (or $x \sqcup y = x \vee y$). if $x \vee y \in I$, there are three cases, $x \in I$ or $y \in I$ or $x, y \in I$ but the definition of the prime has just two cases, $x \in I$ or $y \in I$ so any a stacked-ideal I of a stacked-semigroup T_{α} be not completely prime.

3.5.8 Theorem

If I is a stacked-ideal of stacked-semigroup T_{α} , then I is completely semiprime.

Proof :

Let I is a stacked-ideal of stacked-semigroup T_{α} , then $\forall x \in I: x^2 = x \tau x = x \in I$ (or $x \sqcup x = x \in I$), so from the definition of the completely semiprime, $x^2 \in I$ implies that $x \in I$. So any a stacked-ideal I of stacked-semigroup T_{α} is completely semi prime.

3.5.9 lemma

If I is a stacked-ideal of T_{α} , then I is a stacked-subsemigroup of T_{α} .

Proof:

If $IT_{\alpha} \subseteq I$ or $T_{\alpha}I \subseteq I$, then certainly $I \subseteq I$, since $I \subseteq T_{\alpha}$.

3.5.10 Definition

The stacked-ideal I of T_{α} are T_{α} itself and $\{0\}$. A stacked-ideal I of T_{α} such that $\{0\} \subset I \subset T_{\alpha}$ (strictly) is called proper-stacked.

3.5.11 Theorem

If any an ideal-stacked I of a stacked-semigroup T_{α} with $\{0\}$, then $I = T_{\alpha}$.

Proof :

- 1- Let $I_{\alpha(r)}$ is a stacked-ideal of the stacked-semigroup (T_{α}, τ) , $|I_r| = r$, and the level stacked -semigroup $(IT_{\alpha}) = \{1, 2, \dots, r, \dots, n\}$, then $l(x) \in \{1, 2, \dots, r\}, \forall x \in I_{\alpha(r)}$, and $IT_{\alpha}(n) = 0 \Rightarrow \text{img}(0) = n$, but the stacked-ideal I with $\{0\}$, and from the definition to the zero element of the stacked-semigroups $l(0) = n$, since $r = n \Rightarrow I = T_{\alpha}$.
- 2- Let $I_{\alpha(r)}$ is a stacked-ideal of the stacked-semigroup (T_{α}, \sqcup) , $|I_r| = n - r + 1$, and the level stacked -semigroup $(IT_{\alpha}) = \{1, 2, \dots, r, \dots, n\}$, then $l(x) \in \{r, r+1, \dots, n\}_{T_{\alpha}} \equiv \{1, 2, \dots, n - r + 1\}, \forall x \in I_{\alpha(r)}$, and $IT_{\alpha}(1) = 0 \Rightarrow \text{img}(0) = 1$, but the stacked-ideal I with $\{0\}$, and from the definition to the zero element of the stacked-semigroups $(T_{\alpha}, \sqcup), l(0) = 1$, since $n - r + 1 = 1 \Rightarrow n - r = 0 \Rightarrow n = r \Rightarrow I = T_{\alpha}$.

3.5.12 Theorem

The a stacked-semigroup T_{α} be the proper-stacked.

Proof :

From the Definition 3.5.10 and theorem 3.5.11 it is proofed

3.5.13 Theorem

Let I_{γ}, I_{β} are a stacked-ideals of a stacked-semigroup (T_{α}, τ) , $I_{\gamma} \cap I_{\beta} \neq T_{\alpha}$, and $|I_{\gamma}| \leq |I_{\beta}|$ then $I_{\gamma} \cap I_{\beta} = I_{\gamma}$, and $I_{\gamma} \cup I_{\beta} = I_{\beta}$.

Proof :

Let $I_{\gamma} = \{x_1, x_2, \dots, x_r\}, I_{\beta} = \{x_1, x_2, \dots, x_s\}, \Rightarrow IT_{\alpha}(I_{\gamma}) = \{1, 2, \dots, r\}, IT_{\alpha}(I_{\beta}) = \{1, 2, \dots, s\}$, and if $|I_{\gamma}| \leq |I_{\beta}|$, then $r \leq s \Rightarrow IT_{\alpha}(I_{\gamma}) \subseteq l(I_{\beta})$, but $IT_{\alpha}(I_{\gamma}) \subseteq IT_{\alpha}$ and $IT_{\alpha}(I_{\beta}) \subseteq IT_{\alpha} \Rightarrow I_{\gamma} \subseteq I_{\beta} \subseteq T_{\alpha} \Rightarrow I_{\gamma} \cap I_{\beta} = I_{\gamma}$, and $I_{\gamma} \cup I_{\beta} = I_{\beta}$.

3.5.14 Theorem

Let I_φ, I_δ are a stacked-ideals of a stacked-semigroup (T_α, τ) , $I_\varphi \cap I_\delta \neq T_\alpha$, and $|I_\varphi| \leq |I_\delta|$ then $I_\varphi \cap I_\delta = I_\gamma$, and $I_\varphi \cup I_\delta = I_\delta$.

Proof :

Let $I_\varphi = \{x_r, x_{r+1}, \dots, x_n\}$, $I_\delta = \{x_s, x_{s+1}, \dots, x_n\}$, $\Rightarrow IT_\alpha(I_\varphi) = \{1, 2, \dots, n-r+1\}$, $IT_\alpha(I_\delta) = \{1, 2, \dots, n-s+1\}$, and if $|I_\varphi| \leq |I_\delta|$, then $n-r+1 \leq n-s+1 \Rightarrow r \geq s$, when $I_\varphi = \{x_n, x_{n-1}, \dots, x_r\}$, and $I_\delta = \{x_n, x_{n-1}, \dots, x_s\}$, so $IT_\alpha(I_\varphi) \subseteq I(I_\delta)$, but $IT_\alpha(I_\varphi) \subseteq IT_\alpha$ and $IT_\alpha(I_\delta) \subseteq IT_\alpha \Rightarrow I_\varphi \subseteq I_\delta \subseteq T_\alpha \Rightarrow I_\varphi \cap I_\delta = I_\varphi$, and $I_\varphi \cup I_\delta = I_\delta$.

3.5.15 Lemma

If I and J are a stacked-ideals of a stacked-semigroup T_α with $I \cap J \neq T$ then $I \cap J$, and $I \cup J$ is a stacked-ideals.

Proof :

I, J are a stacked-ideals of a stacked-semigroup T_α , and $|I| \leq |J|$ or $|J| \leq |I|$, then from the theorem 4.16 and theorem 4.16, $I \cap J = I$ and $I \cup J = J$ that if $|I| \leq |J|$ or $I \cap J = J$, and $I \cup J = I$ that if $|J| \leq |I|$. In both cases, true, $I \cap J$, and $I \cup J$ is a stacked-ideals.

3.5.16 Definition

A stacked-ideal I of a stacked-semigroup T_α is said to be minimal-stacked, if for all stacked-ideals J of T_α , $J \subseteq I$ implies that $J = I$.

3.5.17 Theorem

The only minimal-stacked of a stacked-semigroup T_α is $I = \{e\}$.

Proof :

Let I is a stacked-ideal of the stacked-semigroup $T_\alpha = \{x_1, x_2, \dots, x_n\}$ and $I = \{x_1\}$, so there is no stacked-ideal $J : J \subseteq I$, just only $I = J$, and a stacked-ideal I of a stacked-semigroup T_α is said to be minimal-stacked, if for all stacked-ideals J of T_α , $I \subseteq J$ implies that $I = J$, then the only minimal-stacked of a stacked-semigroup T_α is $I = \{x_1\} = \{e\}$.

3.5.18 Lemma

If I is a minimal-stacked ideal, and J is any stacked-ideal of T_α , then $I \subseteq J$

Proof :

The only minimal-stacked of a stacked-semigroup T_α is $I = \{e\} = \{x_1\}$, J is any stacked-ideal of T_α so $\{x_1\} \subseteq J \subseteq T_\alpha$, then $I \subseteq J$.

3.5.19 Theorem

Let x_r is element of a stacked-semigroup (T_α, τ) , then $(x_r T_\alpha, \tau) = (T_\alpha x_r, \tau)$ is a stacked-ideal of T_α , and $(x_r T_\alpha, \tau) = (T_\alpha x_r, \tau) = I_{\alpha(r)}$

Proof :

Let the stacked-semigroup $T_\alpha = \{x_1, x_2, \dots, x_r, \dots, x_n\}$, hence $x_r T_\alpha = x_r \tau [x_1, x_2, \dots, x_r, \dots, x_n] = T_\alpha x_r = \{x_r \tau x_1, x_r \tau x_2, \dots, x_r \tau x_r, x_r \tau x_{r+1}, \dots, x_r \tau x_n\} = [x_1, x_2, \dots, x_r$

, $x_r, \dots, x_r] = \{x_1, x_2, \dots, x_r\}$, then $[\{x_1, x_2, \dots, x_r\}, \tau] = (I_{\alpha(r)}, \tau)$ is stacked-ideal $\Rightarrow (x_r T_\alpha, \tau) = (T_\alpha x_r, \tau) = I_{\alpha(r)}$ and it is stacked-ideal of (T_α, τ) .

3.5.20 Theorem

Let x_s is element of a stacked-semigroup (T_α, τ) , then $(x_s T_\alpha, \tau) = (T_\alpha x_s, \tau)$ is a stacked-ideal of (T_α, τ) , and $(x_s T_\alpha, \tau) = (T_\alpha x_s, \tau) = I_{\alpha(s)}$.

Proof :

Let the stacked-semigroup $T_\alpha = \{x_1, x_2, \dots, x_s, x_{s+1}, \dots, x_n\}$, hence $x_s T_\alpha = x_s \tau [x_1, x_2, \dots, x_s, x_{s+1}, \dots, x_n] = T_\alpha x_s = \{x_s \tau x_1, x_s \tau x_2, \dots, x_s \tau x_s, x_s \tau x_{s+1}, \dots, x_s \tau x_n\} = [x_s, x_s, \dots, x_s, x_{s+1}, \dots, x_n] = \{x_s, x_{s+1}, \dots, x_n\}$, then $[\{x_s, x_{s+1}, \dots, x_n\}, \tau] = (I_{\alpha(s)}, \tau)$ is stacked-ideal $\Rightarrow (x_r T_\alpha, \tau) = (T_\alpha x_r, \tau) = I_{\alpha(s)}$, and it is stacked-ideal of (T_α, τ) .

3.5.21 Theorem

Let $x_r T_\alpha$ is stacked-ideal of the stacked-semigroup (T_α, τ) then $[x_r T_\alpha]^c = \{x_{r+1}, x_{r+2}, \dots, x_n\}$,

Proof :

Let the stacked-ideal $x_r T_\alpha$ of the stacked-semigroup $T_\alpha = \{x_1, x_2, \dots, x_r, \dots, x_n\}$, hence $x_r T_\alpha = [x_1, x_2, \dots, x_r]$, so $[x_r T_\alpha]^c = T_\alpha - x_r T_\alpha = \{x_{r+1}, x_{r+2}, \dots, x_n\}$.

3.5.22 Theorem

Let $x_r T_\alpha$ is stacked-ideal of the stacked-semigroup (T_α, τ) then $[x_r T_\alpha]^c = \{x_1, x_2, \dots, x_{r-1}\}$,

Proof :

Let the stacked-ideal $x_r T_\alpha$ of the stacked-semigroup $T_\alpha = \{x_1, x_2, \dots, x_{r-1}, x_r, x_{r+1}, \dots, x_n\}$, hence $x_r T_\alpha = [x_r, x_{r+1}, \dots, x_n]$, so $[x_r T_\alpha]^c = T_\alpha - x_r T_\alpha = \{x_1, x_2, \dots, x_{r-1}\}$.

3.5.23 Theorem

Let $T_\alpha = \{x_1, x_2, \dots, x_{r-1}, x_r, x_{r+1}, \dots, x_n\}$, is stacked-set, then :

- 1- $\{[(x_r T_\alpha, \tau)]^c\} = \{(x_{r+1} T_\alpha, \tau)\}$.
- 2- $\{[(x_r T_\alpha, \tau)]^c\} = \{(x_{r-1} T_\alpha, \tau)\}$.

Proof:

Let $T_\alpha = \{x_1, x_2, \dots, x_{r-1}, x_r, x_{r+1}, \dots, x_n\}$,

- 1- From theorem above $[(x_r T_\alpha, \tau)]^c = \{x_{r+1}, x_{r+2}, \dots, x_n\}$, and from theorem above $\{(x_{r+1} T_\alpha, \tau)\} = \{x_r, x_{r+1}, \dots, x_n\} \Rightarrow \{(x_{r+1} T_\alpha, \tau)\} = \{x_{r+1}, x_{r+2}, \dots, x_n\}$, so $\{[(x_r T_\alpha, \tau)]^c\} = \{(x_{r+1} T_\alpha, \tau)\}$.
- 2- From theorem above $\{[(x_r T_\alpha, \tau)]^c\} = \{x_1, x_2, \dots, x_{r-1}\}$, and from theorem above $\{(x_{r-1} T_\alpha, \tau)\} = \{x_1, x_2, \dots, x_r\} \Rightarrow \{(x_{r-1} T_\alpha, \tau)\} = \{x_1, x_2, \dots, x_{r-1}\}$, so $\{[(x_r T_\alpha, \tau)]^c\} = \{(x_{r-1} T_\alpha, \tau)\}$

3.5.24 Theorem

Let $T_\alpha = \{x_1, x_2, \dots, x_r, \dots, x_n\}$ is stacked-set, and $I_{\alpha(r)}$ is the stacked-ideal of the stacked-semigroup (T_α, τ) then $[I_{\alpha(r)}]^c$ is not, stacked-ideal of (T_α, τ) , and it is not stacked-subsemigroup in (T_α, τ) .

Proof

Let $T_\alpha = \{x_1, x_2, \dots, x_r, \dots, x_n\}$ is a stacked-semigroup $I_{\alpha(r)} = \{x_1, x_2, \dots, x_r\}$ is stacked-ideal in T_α , then $[I_{\alpha(r)}]^c = \{x_{r+1}, x_{r+2}, \dots, x_n\} \Rightarrow \{x_1\} = \{0_{T_\alpha}\} \notin [I_{\alpha(r)}]^c = \{x_{r+1}, x_{r+2}, \dots, x_n\} \Rightarrow x_1 \tau [I_{\alpha(r)}]^c = 0_{T_\alpha} \tau [I_{\alpha(r)}]^c = 0_{T_\alpha} \notin [I_{\alpha(r)}]^c$ then from the definition of the ideal and the stacked-subsemigroups, $[I_{\alpha(r)}]^c$ is not stacked-ideal in T_α , and it is not subsemigroup in T_α .

3.5.25 Theorem

Let $T_\alpha = \{x_1, x_2, \dots, x_r, \dots, x_n\}$ is stacked-set, and $I_{\alpha(r)}$ is the stacked-ideal of the stacked-semigroup (T_α, τ) then $[I_{\alpha(r)}]^c$ is not, stacked-ideal of (T_α, τ) , and it is not stacked-subsemigroup in (T_α, τ) .

Proof

Let $T_\alpha = \{x_1, x_2, \dots, x_r, \dots, x_n\}$ is a stacked-semigroup $I_{\alpha(r)} = \{x_r, x_{r+1}, \dots, x_n\}$ is stacked-ideal in T_α , then $[I_{\alpha(r)}]^c = \{x_1, x_2, \dots, x_{r-1}\} \tau \{x_n\} = \{0_{T_\alpha}\} \tau [I_{\alpha(r)}]^c = \{x_1, x_2, \dots, x_{r-1}\} \tau x_n \tau [I_{\alpha(r)}]^c = 0_{T_\alpha} \tau [I_{\alpha(r)}]^c = 0_{T_\alpha} \notin [I_{\alpha(r)}]^c$ then from the definition of the ideal and the stacked-subsemigroups, $[I_{\alpha(r)}]^c$ is not stacked-ideal in T_α , and it is not subsemigroup in T_α .

3.5.26 Theorem

Let the stacked-ideal $x_r T_\alpha$ of the stacked-semigroup $(T_\alpha, \tau) = [\{x_1, x_2, \dots, x_r, \dots, x_s, \dots, x_n\}, \tau]$, and $r \leq s \leq n$, then $x_r T_\alpha \cup x_s T_\alpha = x_s T_\alpha$

Proof:

Let the stacked-ideal $x_r T_\alpha$ of the stacked-semigroup $T_\alpha = \{x_1, x_2, \dots, x_r, \dots, x_s, \dots, x_n\}$, and $r \leq s \leq n$, hence $x_r T_\alpha = \{x_1, x_2, \dots, x_r\}$, $x_s T_\alpha = \{x_1, x_2, \dots, x_r, \dots, x_s\}$, then $x_r T_\alpha \cup x_s T_\alpha = \{x_1, x_2, \dots, x_r\} \cup \{x_1, x_2, \dots, x_r, \dots, x_s\} = \{x_1, x_2, \dots, x_r, \dots, x_s\} = x_s T_\alpha$.

3.5.27 Theorem

Let the stacked-ideal $x_r T_\alpha$ of the stacked-semigroup $(T_\alpha, \tau) = [\{x_1, x_2, \dots, x_r, \dots, x_s, \dots, x_n\}, \tau]$, and $r \leq s \leq n$, then $x_r T_\alpha \cup x_s T_\alpha = x_r T_\alpha$

Proof:

Let the stacked-ideal $x_r T_\alpha$ of the stacked-semigroup $T_\alpha = \{x_1, x_2, \dots, x_r, \dots, x_s, \dots, x_n\}$, and $r \leq s \leq n$, hence $x_r T_\alpha = \{x_r, x_{r+1}, \dots, x_s, x_{s+1}, \dots, x_n\}$, $x_s T_\alpha = \{x_s, x_{s+1}, \dots, x_n\}$, then $x_r T_\alpha \cup x_s T_\alpha = \{x_r, x_{r+1}, \dots, x_s, x_{s+1}, \dots, x_n\} \cup \{x_s, x_{s+1}, \dots, x_n\} = \{x_r, x_{r+1}, \dots, x_s, x_{s+1}, \dots, x_n\} = x_r T_\alpha$.

3.5.28 Theorem

Let the stacked-ideal $x_r T_\alpha$ of the stacked-semigroup $(T_\alpha, \tau) = [\{x_1, x_2, \dots, x_r, \dots, x_s, \dots, x_n\}, \tau]$, and $r \leq s \leq n$, then $x_r T_\alpha \cap x_s T_\alpha = x_r T_\alpha$

Proof:

Let the stacked-ideal $x_r T_\alpha$ of the stacked-semigroup $T_\alpha = \{x_1, x_2, \dots, x_r, \dots, x_s, \dots, x_n\}$, and $r \leq s \leq n$, hence $x_r T_\alpha = \{x_1, x_2, \dots, x_r\}$, $x_s T_\alpha = \{x_1, x_2, \dots, x_r, \dots, x_s\}$, then $x_r T_\alpha \cap x_s T_\alpha =$

$\{x_1, x_2, \dots, x_r\} \cap \{x_1, x_2, \dots, x_r, \dots, x_s\} = \{x_1, x_2, \dots, x_r, \dots, x_s\} = x_r T_\alpha$.

3.5.29 Theorem

Let the stacked-ideal $x_r T_\alpha$ of the stacked-semigroup $(T_\alpha, \tau) = [\{x_1, x_2, \dots, x_r, \dots, x_s, \dots, x_n\}, \tau]$, and $r \leq s \leq n$, then $x_r T_\alpha \cap x_s T_\alpha = x_s T_\alpha$

Proof:

Let the stacked-ideal $x_r T_\alpha$ of the stacked-semigroup $T_\alpha = \{x_1, x_2, \dots, x_r, \dots, x_s, \dots, x_n\}$, and $r \leq s \leq n$, hence $x_r T_\alpha = \{x_r, x_{r+1}, \dots, x_s, x_{s+1}, \dots, x_n\}$, $x_s T_\alpha = \{x_s, x_{s+1}, \dots, x_n\}$, then $x_r T_\alpha \cap x_s T_\alpha = \{x_r, x_{r+1}, \dots, x_s, x_{s+1}, \dots, x_n\} \cap \{x_s, x_{s+1}, \dots, x_n\} = \{x_r, x_{r+1}, \dots, x_s, x_{s+1}, \dots, x_n\} = x_s T_\alpha$.

3.5.30 Theorem

Let (T_α, τ) is stacked-semigroup, $T_\alpha = \{x_1, x_2, \dots, x_n\}$, then $x_1 T_\alpha = \{x_1\}$, $x_2 T_\alpha = \{x_1, x_2\}$, ..., $x_r T_\alpha = \{x_1, x_2, \dots, x_r\}$, $x_n T_\alpha = T_\alpha$.

Proof:

From the theorems it is easy to proof it: $x_1 T_\alpha = I_{\alpha(1)}$, $x_2 T_\alpha = I_{\alpha(2)}$, ..., $x_r T_\alpha = I_{\alpha(r)}$, ..., $x_n T_\alpha = I_{\alpha(n)} = T_\alpha$.

3.5.31 Theorem

Let (T_α, τ) is stacked-semigroup, $T_\alpha = \{x_1, x_2, \dots, x_n\}$, then $x_n T_\alpha = \{x_n\}$, $x_{n-1} T_\alpha = \{x_{n-1}, x_n\}$, ..., $x_r T_\alpha = \{x_r, x_{r+1}, \dots, x_n\}$, $x_1 T_\alpha = T_\alpha$.

Proof:

From the theorems it is easy to proof it: $x_n T_\alpha = I_{\alpha(n)}$, $x_{n-1} T_\alpha = I_{\alpha(n-1)}$, ..., $x_r T_\alpha = I_{\alpha(r)}$, ..., $x_1 T_\alpha = I_{\alpha(1)} = T_\alpha$.

3.5.32 Theorem

Let the stacked-ideal $x_r T_\alpha$ of the stacked-semigroup $(T_\alpha, \tau) = \{x_1, x_2, \dots, x_r, \dots, x_n\}$, then $[x_r T_\alpha]^c = \{x_{r+1}, x_{r+2}, \dots, x_n\}$ is a new stacked-semigroup.

Proof:

Let the stacked-ideal $x_r T_\alpha$ of the stacked-semigroup $T_\alpha = \{x_1, x_2, \dots, x_r, \dots, x_n\}$, hence $[x_r T_\alpha]^c = \{x_{r+1}, x_{r+2}, \dots, x_n\}$.

(1) $\forall x_t, x_s \in [x_r T_\alpha]^c$, $n \geq t \geq r$, and $n \geq s \geq r \Rightarrow x_t, x_s \in [x_r T_\alpha]^c$, hence $x_t \tau^1 x_s = (x_t \vee_t x_s) \in [x_r T_\alpha]^c$, then τ^1 is a binary operation, so: $[x_r T_\alpha]^c \times [x_r T_\alpha]^c \rightarrow [x_r T_\alpha]^c$.

(2) $\forall x_m \in [x_r T_\alpha]^c$, $x_m \tau^1 (x_t \tau^1 x_s) = x_m \vee_t (x_t \vee_t x_s) = (x_m \vee_t x_t) \vee_t x_s = (x_m \tau^1 x_t) \tau^1 x_s \Rightarrow ([x_r T_\alpha]^c, \tau^1)$ is associative system, from (1) and (2) $[x_r T_\alpha]^c = (\{x_{r+1}, x_{r+2}, \dots, x_n\}, \tau^1)$ is a new stacked-semigroup.

3.5.33 Theorem

Let the stacked-ideal $x_r T_\alpha$ of the stacked-semigroup $(T_\alpha, \tau) = \{x_1, x_2, \dots, x_r, \dots, x_n\}$, then $[x_r T_\alpha]^c = \{x_1, x_2, \dots, x_{r-1}\}$ is a new stacked-semigroup.

Proof:

Let the stacked-ideal $x_r T_\alpha$ of the stacked-semigroup $T_\alpha = \{x_1, x_2, \dots, x_r, \dots, x_n\}$, hence $[x_r T_\alpha]^c = \{x_1, x_2, \dots, x_{r-1}\}$.

(1) $\forall x_t, x_s \in T_\alpha, r > t \geq 1$, and $r > s \geq 1 \Rightarrow x_t, x_s \in [x_r T_\alpha]^c$, hence $x_t \tau^{-1} x_s = (x_t V_t x_s) \in [x_r T_\alpha]^c$, then τ^{-1} is a binary operation, so: $[x_r T_\alpha]^c \times [x_r T_\alpha]^c \rightarrow [x_r T_\alpha]^c$.

(2) $\forall x_m \in [x_r T_\alpha]^c, x_m \tau^{-1} (x_t \tau^{-1} x_s) = x_m V_t (x_t V_t x_s) = (x_m V_t x_t) V_t x_s = (x_m \tau^{-1} x_t) \tau^{-1} x_s$ ($[x_r T_\alpha]^c, \tau^{-1}$) is associative system, from (1) and (2) $[x_r T_\alpha]^c = (\{x_{r+1}, x_{r+2}, \dots, x_n\}, \tau^{-1})$ is a new stacked-semigroup.

3.5.34 Theorem

Let $x_s T_\alpha$ and $x_t T_\alpha$ are tow stacked-ideal of stacked-semigroup (T_α, τ) , if $s \geq t$ then $x_s T_\alpha \setminus x_t T_\alpha = x_s T_\alpha \cap [x_t T_\alpha]^c$, and it is not stacked-ideal on (T_α, τ) , but it is a new stacked-semigroup.

Proof :

- 1- Let $x_s T_\alpha$ and $x_t T_\alpha$ are tow stacked-ideal of stacked-semigroup (T_α, τ) , if $s \geq t$ then $x_s T_\alpha \setminus x_t T_\alpha = x_s T_\alpha - x_t T_\alpha = [\{\{x_1, x_2, \dots, x_t, \dots, x_s\} - \{x_1, x_2, \dots, x_t\}\}, \tau] = [\{x_{t+1}, x_{t+2}, \dots, x_s\}, \tau]$ (i). And hence $x_t T_\alpha = \{x_1, x_2, \dots, x_t\}$ so $[x_t T_\alpha]^c = \{x_{t+1}, \dots, x_s, \dots, x_n\}$, then $x_s T_\alpha \cap [x_t T_\alpha]^c = [\{\{x_1, x_2, \dots, x_t, x_{t+1}, \dots, x_s\} \cap \{x_{t+1}, \dots, x_s, \dots, x_n\}\}, \tau] = [\{x_{t+1}, x_{t+2}, \dots, x_s\}, \tau]$ (ii). from (i) and (ii) $x_s T_\alpha \setminus x_t T_\alpha = x_s T_\alpha \cap [x_t T_\alpha]^c$
- 2- Let $x_m \in (T_\alpha, \tau)$, and $x_m \notin [\{x_{t+1}, x_{t+2}, \dots, x_s\}, \tau]$ when $m \leq t < s$, then $x_m \tau \{x_{t+1}, x_{t+2}, \dots, x_s\} \notin [\{x_{t+1}, x_{t+2}, \dots, x_s\}, \tau]$, and from definition of the stacked-ideals $[\{x_{t+1}, x_{t+2}, \dots, x_s\}, \tau]$ is not stacked-ideal of stacked-semigroup (T_α, τ) .
- 3- $\forall x_a, x_b \in [\{x_{t+1}, x_{t+2}, \dots, x_s\}, \tau^{-1}]$, $x_a \tau^{-1} x_b = (x_a V_t x_b) \in [\{x_{t+1}, x_{t+2}, \dots, x_s\}, \tau^{-1}]$, then τ^{-1} is a binary operation, so: $[\{x_{t+1}, x_{t+2}, \dots, x_s\}, \tau^{-1}] \times [\{x_{t+1}, x_{t+2}, \dots, x_s\}, \tau^{-1}] \rightarrow [\{x_{t+1}, x_{t+2}, \dots, x_s\}, \tau^{-1}]$ (i). $\forall x_a, x_b, x_c \in \{x_{t+1}, x_{t+2}, \dots, x_s\}$, $x_a \tau^{-1} (x_b \tau^{-1} x_c) = x_a V_t (x_b V_t x_c) = (x_a V_t x_b) V_t x_c = (x_a \tau^{-1} x_b) \tau^{-1} x_c \Rightarrow (\{x_{t+1}, x_{t+2}, \dots, x_s\}, \tau^{-1})$ is associative system(ii). From (i) and (ii) $[\{x_{t+1}, x_{t+2}, \dots, x_s\}, \tau^{-1}]$ is a new stacked-semigroup.

3.5.35 Theorem

Let $x_s T_\alpha$ and $x_t T_\alpha$ are tow stacked-ideal of stacked-semigroup (T_α, τ) , if $s \leq t$ then $x_s T_\alpha \setminus x_t T_\alpha = x_s T_\alpha \cap [x_t T_\alpha]^c$, and it is not stacked-ideal on (T_α, τ) , but it is a new stacked-semigroup.

Proof :

- 1- Let $x_s T_\alpha$ and $x_t T_\alpha$ are tow stacked-ideal of stacked-semigroup (T_α, τ) , if $s \leq t$ then $x_s T_\alpha \setminus x_t T_\alpha = x_s T_\alpha - x_t T_\alpha = [\{\{x_n, x_{n-1}, \dots, x_t, x_{t-1}, \dots, x_s\} - \{x_n, x_{n-1}, \dots, x_t\}\}, \tau] = [\{x_{t-1}, x_{t-2}, \dots, x_s\}, \tau]$ (i). And hence $x_t T_\alpha = \{x_n, x_{n-1}, \dots, x_t\}$ so $[x_t T_\alpha]^c = \{x_{t-1}, \dots, x_s, \dots, x_n\}$, then $x_s T_\alpha \cap [x_t T_\alpha]^c = [\{\{x_n, x_{n-1}, \dots, x_t, x_{t-1}, \dots, x_s\} - \{x_{t-1}, x_{t-2}, \dots, x_s, \dots, x_n\}\}, \tau] = [\{x_{t-1}, x_{t-2}, \dots, x_s\}, \tau]$ (ii). from (i) and (ii) $x_s T_\alpha \setminus x_t T_\alpha = x_s T_\alpha \cap [x_t T_\alpha]^c$
- 2- Let $x_m \in (T_\alpha, \tau)$, and $x_m \notin [\{x_{t-1}, x_{t-2}, \dots, x_s\}, \tau]$ when $m \geq t > s$, then $x_m \tau \{x_{t-1}, x_{t-2}, \dots, x_s\} \notin [\{x_{t-1}, x_{t-2}, \dots, x_s\}, \tau]$, and from definition of the stacked-ideals $[\{x_{t-1}, x_{t-2}, \dots, x_s\}, \tau]$ is not stacked-ideal of stacked-semigroup (T_α, τ) .

- 3- $\forall x_a, x_b \in [\{x_{t-1}, x_{t-2}, \dots, x_s\}, \tau^{-1}]$, $x_a \tau^{-1} x_b = (x_a V_t x_b) \in [\{x_{t-1}, x_{t-2}, \dots, x_s\}, \tau^{-1}]$, then τ^{-1} is a binary operation, so: $[\{x_{t-1}, x_{t-2}, \dots, x_s\}, \tau^{-1}] \times [\{x_{t-1}, x_{t-2}, \dots, x_s\}, \tau^{-1}] \rightarrow [\{x_{t-1}, x_{t-2}, \dots, x_s\}, \tau^{-1}]$ (i). $\forall x_a, x_b, x_c \in \{x_{t-1}, x_{t-2}, \dots, x_s\}$, $x_a \tau^{-1} (x_b \tau^{-1} x_c) = x_a V_t (x_b V_t x_c) = (x_a V_t x_b) V_t x_c = (x_a \tau^{-1} x_b) \tau^{-1} x_c \Rightarrow (\{x_{t-1}, x_{t-2}, \dots, x_s\}, \tau^{-1})$ is associative system(ii). From the definition of the semigroups, (i) and (ii) $[\{x_{t-1}, x_{t-2}, \dots, x_s\}, \tau^{-1}]$ is a new stacked-semigroup.

3.5.36 Theorem

Let $x_r T_\alpha$ is stacked-ideal of stacked-semigroup (T_α, τ) then $[x_r T_\alpha]^c = x_r T_\alpha$.

Proof :

Let $x_r T_\alpha$ is stacked-ideal of stacked-semigroup $(T_\alpha, \tau) = [\{x_1, x_2, \dots, x_r, x_{r+1}, \dots, x_n\}, \tau]$, then $x_r T_\alpha = [\{x_1, x_2, \dots, x_r\}, \tau] \Rightarrow [x_r T_\alpha]^c = [\{x_{r+1}, x_{r+2}, \dots, x_n\}, \tau] \Rightarrow [[x_r T_\alpha]^c]^c = [\{x_1, x_2, \dots, x_r\}, \tau] \Rightarrow [[x_r T_\alpha]^c]^c = x_r T_\alpha$.

3.5.37 Theorem

Let $x_r T_\alpha$ is stacked-ideal of stacked-semigroup (T_α, τ) then $[x_r T_\alpha]^c = x_r T_\alpha$.

Proof :

Let $x_r T_\alpha$ is stacked-ideal of stacked-semigroup $(T_\alpha, \tau) = [\{x_1, x_2, \dots, x_r, x_{r+1}, \dots, x_n\}, \tau]$, then $x_r T_\alpha = [\{x_r, x_{r+1}, \dots, x_n\}, \tau] \Rightarrow [x_r T_\alpha]^c = [\{x_1, x_2, \dots, x_{r-1}\}, \tau] \Rightarrow [[x_r T_\alpha]^c]^c = [\{x_r, x_{r+1}, \dots, x_n\}, \tau] \Rightarrow [[x_r T_\alpha]^c]^c = x_r T_\alpha$.

3.5.38 Theorem

Let $x_r T_\alpha, x_s T_\alpha$ and $x_t T_\alpha$ are stacked-ideal of stacked-semigroup (T_α, τ) , if $s \geq t$, then $[x_s T_\alpha \setminus x_t T_\alpha] \cap x_r T_\alpha = [x_s T_\alpha \cap x_r T_\alpha] \setminus [x_t T_\alpha \cap x_r T_\alpha]$.

Proof :

Let $x_r T_\alpha, x_s T_\alpha$ and $x_t T_\alpha$ are stacked-ideal of stacked-semigroup (T_α, τ) , if $s \geq t$ then we have three conditions, (1) $r \leq t$, (2) $t < r < s$, and (3) $r \geq s$.

- (1) If $r \leq t$, then $x_r T_\alpha = [\{x_1, x_2, \dots, x_r\}, \tau]$, $x_s T_\alpha = [\{x_1, x_2, \dots, x_r, \dots, x_t, \dots, x_s\}, \tau]$, and $x_t T_\alpha = [\{x_1, x_2, \dots, x_r, \dots, x_t\}, \tau]$. So $[x_s T_\alpha \setminus x_t T_\alpha] \cap x_r T_\alpha = [x_s T_\alpha - x_t T_\alpha] \cap x_r T_\alpha = [\{\{x_1, x_2, \dots, x_r, \dots, x_t, \dots, x_s\} - \{x_1, x_2, \dots, x_r, \dots, x_t\}\}, \tau] \cap [\{x_1, x_2, \dots, x_r\}, \tau] = \emptyset$ (i).

And $[x_s T_\alpha \cap x_r T_\alpha] \setminus [x_t T_\alpha \cap x_r T_\alpha] = [\{\{x_1, x_2, \dots, x_r, \dots, x_t, \dots, x_s\} \cap \{x_1, x_2, \dots, x_r\}\}, \tau] - [\{\{x_1, x_2, \dots, x_r, \dots, x_t\} \cap \{x_1, x_2, \dots, x_r\}\}, \tau] = [\{x_1, x_2, \dots, x_r\}, \tau] - [\{x_1, x_2, \dots, x_r\}, \tau] = \emptyset$ (ii).

From (i) and (ii): $[x_s T_\alpha \setminus x_t T_\alpha] \cap x_r T_\alpha = [x_s T_\alpha \cap x_r T_\alpha] \setminus [x_t T_\alpha \cap x_r T_\alpha]$.

- (2) If $s < r < t$, then $x_r T_\alpha = [\{x_1, x_2, \dots, x_t, \dots, x_r\}, \tau]$, $x_s T_\alpha = [\{x_1, x_2, \dots, x_t, \dots, x_r, \dots, x_s\}, \tau]$, and $x_t T_\alpha = [\{x_1, x_2, \dots, x_t\}, \tau]$. So $[x_s T_\alpha \setminus x_t T_\alpha] \cap x_r T_\alpha = [x_s T_\alpha - x_t T_\alpha] \cap x_r T_\alpha = [\{\{x_1, x_2, \dots, x_t, \dots, x_r, \dots, x_s\} - \{x_1, x_2, \dots, x_t\}\}, \tau] \cap [\{x_1, x_2, \dots, x_t, \dots, x_r, \dots, x_s\}, \tau] = \emptyset$ (i).

$$x_s \} - \{ x_1, x_2, \dots, x_t \}, \tau \cap [\{ x_1, x_2, \dots, x_t, \dots, x_r \}, \tau] = [\{ x_{t+1}, x_{t+2}, \dots, x_r \}, \tau] \text{ (i)}.$$

And $[x_s T_\alpha \cap x_r T_\alpha] \setminus [x_t T_\alpha \cap x_r T_\alpha] = [\{ x_1, x_2, \dots, x_t, \dots, x_r, \dots, x_s \} \cap \{ x_1, x_2, \dots, x_t, \dots, x_r \}] - [\{ x_1, x_2, \dots, x_t \} \cap \{ x_1, x_2, \dots, x_t, \dots, x_r \}] = [\{ x_1, x_2, \dots, x_t, \dots, x_r \}, \tau] - [\{ x_1, x_2, \dots, x_t \}, \tau] = [\{ x_{t+1}, x_{t+2}, \dots, x_r \}, \tau] \text{ (ii)}.$

From (i) and (ii): $[x_s T_\alpha \setminus x_t T_\alpha] \cap x_r T_\alpha = [x_s T_\alpha \cap x_r T_\alpha] \setminus [x_t T_\alpha \cap x_r T_\alpha]$.

(3) If $r \geq s$, then $x_r T_\alpha = [\{ x_1, x_2, \dots, x_t, \dots, x_s, \dots, x_r \}, \tau]$, $x_s T_\alpha = [\{ x_1, x_2, \dots, x_t, \dots, x_s \}, \tau]$, and $x_t T_\alpha = [\{ x_1, x_2, \dots, x_t \}, \tau]$. So $[x_s T_\alpha \setminus x_t T_\alpha] \cap x_r T_\alpha = [x_s T_\alpha - x_t T_\alpha] \cap x_r T_\alpha = [\{ x_1, x_2, \dots, x_t, \dots, x_s \} - \{ x_1, x_2, \dots, x_t \}, \tau] \cap [\{ x_1, x_2, \dots, x_t, \dots, x_s, \dots, x_r \}, \tau] = [\{ x_{t+1}, x_{t+2}, \dots, x_s \}, \tau] \text{ (i)}.$

And $[x_s T_\alpha \cap x_r T_\alpha] \setminus [x_t T_\alpha \cap x_r T_\alpha] = [\{ x_1, x_2, \dots, x_t, \dots, x_s \} \cap \{ x_1, x_2, \dots, x_t, \dots, x_s, \dots, x_r \}] - [\{ x_1, x_2, \dots, x_t \} \cap \{ x_1, x_2, \dots, x_t, \dots, x_s, \dots, x_r \}] = [\{ x_1, x_2, \dots, x_t, \dots, x_s \}, \tau] - [\{ x_1, x_2, \dots, x_t \}, \tau] = [\{ x_{t+1}, x_{t+2}, \dots, x_s \}, \tau] \text{ (ii)}.$

From (i) and (ii): $[x_s T_\alpha \setminus x_t T_\alpha] \cap x_r T_\alpha = [x_s T_\alpha \cap x_r T_\alpha] \setminus [x_t T_\alpha \cap x_r T_\alpha]$.

3.5.39 Theorem

Let $x_r T_\alpha$, $x_s T_\alpha$ and $x_t T_\alpha$ are stacked-ideal of stacked-semigroup (T_α, τ) , if $s \leq t$, then $[x_s T_\alpha \setminus x_t T_\alpha] \cap x_r T_\alpha = [x_s T_\alpha \cap x_r T_\alpha] \setminus [x_t T_\alpha \cap x_r T_\alpha]$.

Proof :

Let $x_r T_\alpha$, $x_s T_\alpha$ and $x_t T_\alpha$ are stacked-ideal of stacked-semigroup (T_α, τ) , if $s \leq t$ then we have three conditions, (1) $r \geq t$, (2) $t > r > s$, and (3) $r \leq s$.

(1) If $r \geq t$, then $x_r T_\alpha = [\{ x_n, x_{n-1}, \dots, x_r \}, \tau]$, $x_s T_\alpha = [\{ x_n, x_{n-1}, \dots, x_r, \dots, x_t, \dots, x_s \}, \tau]$, and $x_t T_\alpha = [\{ x_n, x_{n-1}, \dots, x_r, \dots, x_t \}, \tau]$. So $[x_s T_\alpha \setminus x_t T_\alpha] \cap x_r T_\alpha = [x_s T_\alpha - x_t T_\alpha] \cap x_r T_\alpha = [\{ x_n, x_{n-1}, \dots, x_r, \dots, x_t, \dots, x_s \} - \{ x_n, x_{n-1}, \dots, x_r, \dots, x_t \}, \tau] \cap [\{ x_n, x_{n-1}, \dots, x_r \}, \tau] = \emptyset \text{ (i)}.$

And $[x_s T_\alpha \cap x_r T_\alpha] \setminus [x_t T_\alpha \cap x_r T_\alpha] = [\{ x_n, x_{n-1}, \dots, x_r, \dots, x_t, \dots, x_s \} \cap \{ x_n, x_{n-1}, \dots, x_r \}] - [\{ x_n, x_{n-1}, \dots, x_r, \dots, x_t \} \cap \{ x_n, x_{n-1}, \dots, x_r \}] = [\{ x_n, x_{n-1}, \dots, x_r \}, \tau] - [\{ x_n, x_{n-1}, \dots, x_r \}, \tau] = \emptyset \text{ (ii)}.$

From (i) and (ii): $[x_s T_\alpha \setminus x_t T_\alpha] \cap x_r T_\alpha = [x_s T_\alpha \cap x_r T_\alpha] \setminus [x_t T_\alpha \cap x_r T_\alpha]$.

(2) If $s \leq r \leq t$, then $x_r T_\alpha = [\{ x_n, x_{n-1}, \dots, x_t, \dots, x_r \}, \tau]$, $x_s T_\alpha = [\{ x_n, x_{n-1}, \dots, x_t, \dots, x_r, \dots, x_s \}, \tau]$, and $x_t T_\alpha = [\{ x_n, x_{n-1}, \dots, x_t \}, \tau]$. So $[x_s T_\alpha \setminus x_t T_\alpha] \cap x_r T_\alpha = [x_s T_\alpha - x_t T_\alpha] \cap x_r T_\alpha = [\{ x_n, x_{n-1}, \dots, x_t, \dots, x_r, \dots, x_s \} - \{ x_n, x_{n-1}, \dots, x_t \}, \tau] \cap [\{ x_n, x_{n-1}, \dots, x_t, \dots, x_r \}, \tau] = [\{ x_{t+1}, x_{t+2}, \dots, x_r \}, \tau] \text{ (i)}.$

And $[x_s T_\alpha \cap x_r T_\alpha] \setminus [x_t T_\alpha \cap x_r T_\alpha] = [\{ x_n, x_{n-1}, \dots, x_t, \dots, x_r, \dots, x_s \} \cap \{ x_n, x_{n-1}, \dots, x_t, \dots, x_r \}] - [\{ x_n, x_{n-1}, \dots, x_t \} \cap \{ x_n, x_{n-1}, \dots, x_t, \dots, x_r \}] = [\{ x_n, x_{n-1}, \dots, x_t, \dots, x_r \}, \tau] - [\{ x_n, x_{n-1}, \dots, x_t \}, \tau] = [\{ x_{t+1}, x_{t+2}, \dots, x_r \}, \tau] \text{ (ii)}.$

From (i) and (ii): $[x_s T_\alpha \setminus x_t T_\alpha] \cap x_r T_\alpha = [x_s T_\alpha \cap x_r T_\alpha] \setminus [x_t T_\alpha \cap x_r T_\alpha]$.

(3) If $r \leq s$, then $x_r T_\alpha = [\{ x_n, x_{n-1}, \dots, x_t, \dots, x_s, \dots, x_r \}, \tau]$, $x_s T_\alpha = [\{ x_n, x_{n-1}, \dots, x_t, \dots, x_s \}, \tau]$, and $x_t T_\alpha = [\{ x_n, x_{n-1}, \dots, x_t \}, \tau]$. So $[x_s T_\alpha \setminus x_t T_\alpha] \cap x_r T_\alpha = [x_s T_\alpha - x_t T_\alpha] \cap x_r T_\alpha = [\{ x_n, x_{n-1}, \dots, x_t, \dots, x_s \} - \{ x_n, x_{n-1}, \dots, x_t \}, \tau] \cap [\{ x_n, x_{n-1}, \dots, x_t, \dots, x_s, \dots, x_r \}, \tau] = [\{ x_{t+1}, x_{t+2}, \dots, x_s \}, \tau] \text{ (i)}.$

And $[x_s T_\alpha \cap x_r T_\alpha] \setminus [x_t T_\alpha \cap x_r T_\alpha] = [\{ x_n, x_{n-1}, \dots, x_t, \dots, x_s \} \cap \{ x_n, x_{n-1}, \dots, x_t, \dots, x_s, \dots, x_r \}] - [\{ x_n, x_{n-1}, \dots, x_t \} \cap \{ x_n, x_{n-1}, \dots, x_t, \dots, x_s, \dots, x_r \}] = [\{ x_n, x_{n-1}, \dots, x_t, \dots, x_s \}, \tau] - [\{ x_n, x_{n-1}, \dots, x_t \}, \tau] = [\{ x_{t+1}, x_{t+2}, \dots, x_s \}, \tau] \text{ (ii)}.$

From (i) and (ii): $[x_s T_\alpha \setminus x_t T_\alpha] \cap x_r T_\alpha = [x_s T_\alpha \cap x_r T_\alpha] \setminus [x_t T_\alpha \cap x_r T_\alpha]$.

3.5.40 Theorem

Let $x_s T_\alpha$ and $x_t T_\alpha$ are tow stacked-ideal of stacked-semigroup (T_α, τ) , and $s \geq t$, then: $[x_s T_\alpha \cap x_t T_\alpha]^c = [x_s T_\alpha]^c \cup [x_t T_\alpha]^c$.

Proof :

Let $x_s T_\alpha$ and $x_t T_\alpha$ are stacked-ideal of stacked-semigroup (T_α, τ) , if $s \geq t$, then $x_s T_\alpha = [\{ x_1, x_2, \dots, x_t, \dots, x_s \}, \tau]$, and $x_t T_\alpha = [\{ x_1, x_2, \dots, x_t \}, \tau]$. And $[x_s T_\alpha \cap x_t T_\alpha]^c = [\{ x_1, x_2, \dots, x_t, \dots, x_s \}, \tau]^c \cap [\{ x_1, x_2, \dots, x_t \}, \tau]^c = [\{ x_1, x_2, \dots, x_t \}, \tau]^c$, so $[x_s T_\alpha \cap x_t T_\alpha]^c = [\{ x_{t+1}, x_{t+2}, \dots, x_s, \dots, x_n \}, \tau]$, it is a new stacked-semigroup (i). Then $[x_s T_\alpha]^c = [\{ x_{s+1}, x_{s+2}, \dots, x_n \}, \tau]$, $[x_t T_\alpha]^c = [\{ x_{t+1}, x_{t+2}, \dots, x_s, \dots, x_n \}, \tau]$, so $[x_s T_\alpha]^c \cup [x_t T_\alpha]^c = [\{ x_{t+1}, x_{t+2}, \dots, x_s, \dots, x_n \}, \tau]$, it is a new stacked-semigroup (ii), from (i) and (ii) $[x_s T_\alpha \cap x_t T_\alpha]^c = [x_s T_\alpha]^c \cup [x_t T_\alpha]^c$.

3.5.41 Theorem

Let $x_s T_\alpha$ and $x_t T_\alpha$ are tow stacked-ideal of stacked-semigroup (T_α, τ) , and $t \geq s$, then: $[x_s T_\alpha \cap x_t T_\alpha]^c = [x_s T_\alpha]^c \cup [x_t T_\alpha]^c$.

Proof :

Let $x_s T_\alpha$ and $x_t T_\alpha$ are stacked-ideal of stacked-semigroup (T_α, τ) , if $t \geq s$, then $x_s T_\alpha = [\{ x_n, x_{n-1}, \dots, x_t, \dots, x_s \}, \tau]$, and $x_t T_\alpha = [\{ x_n, x_{n-1}, \dots, x_t \}, \tau]$. And $[x_s T_\alpha \cap x_t T_\alpha]^c = [\{ x_n, x_{n-1}, \dots, x_t, \dots, x_s \}, \tau]^c \cap [\{ x_n, x_{n-1}, \dots, x_t \}, \tau]^c = [\{ x_{t-1}, x_{t-2}, \dots, x_s, \dots, x_1 \}, \tau]$, it is a new stacked-semigroup (i). And $[x_s T_\alpha]^c = [\{ x_{s-1}, x_{s-2}, \dots, x_1 \}, \tau]$, $[x_t T_\alpha]^c = [\{ x_{t-1}, x_{t-2}, \dots, x_s, \dots, x_1 \}, \tau]$, so $[x_s T_\alpha]^c \cup [x_t T_\alpha]^c = [\{ x_{t-1}, x_{t-2}, \dots, x_s, \dots, x_1 \}, \tau]$, it is a new stacked-semigroup (ii), from (i) and (ii) $[x_s T_\alpha \cap x_t T_\alpha]^c = [x_s T_\alpha]^c \cup [x_t T_\alpha]^c$.

3.5.42 Theorem

Let $x_s T_\alpha$ and $x_t T_\alpha$ are tow stacked-ideal of stacked-semigroup (T_α, τ) , and $s \geq t$, then : $[x_s T_\alpha \cup x_t T_\alpha]^c = [x_s T_\alpha]^c \cap [x_t T_\alpha]^c$.

Proof :

Let $x_s T_\alpha$ and $x_t T_\alpha$ are stacked-ideal of stacked-semigroup (T_α, τ) , if $s \geq t$, then $x_s T_\alpha = [\{ x_1, x_2, \dots, x_t, \dots, x_s \}, \tau]$, and $x_t T_\alpha = [\{ x_1, x_2, \dots, x_t \}, \tau]$. And $[x_s T_\alpha \cup x_t T_\alpha]^c = [\{ x_1, x_2, \dots, x_t, \dots, x_s \}, \tau]^c \cap [\{ x_1, x_2, \dots, x_t \}, \tau]^c = [\{ x_{t+1}, x_{t+2}, \dots, x_s \}, \tau]$.

$\dots, x_s \}, \tau] \cup [\{ x_1, x_2, \dots, x_t \}, \tau] = [\{ x_1, x_2, \dots, x_t, \dots, x_s \}, \tau]$, so $[x_s T_\alpha \cup x_t T_\alpha]^c = [\{ x_{s+1}, x_{s+2}, \dots, x_n \}, \tau]$, it is a new stacked-semigroup (i). And $[x_s T_\alpha]^c = [\{ x_{s+1}, x_{s+2}, \dots, x_n \}, \tau]$, $[x_t T_\alpha]^c = [\{ x_{t+1}, x_{t+2}, \dots, x_s, \dots, x_n \}, \tau]$, so $[x_s T_\alpha]^c \cap [x_t T_\alpha]^c = [\{ x_{s+1}, x_{s+2}, \dots, x_n \}, \tau]$, it is a new stacked-semigroup (ii), from (i) and (ii) $[x_s T_\alpha \cup x_t T_\alpha]^c = [x_s T_\alpha]^c \cap [x_t T_\alpha]^c$.

3.5.43 Theorem

Let $x_s T_\alpha$ and $x_t T_\alpha$ are tow stacked-ideal of stacked-semigroup (T_α, τ) , and $s \geq t$, then :
 $[x_s T_\alpha \cup x_t T_\alpha]^c = [x_s T_\alpha]^c \cap [x_t T_\alpha]^c$.

Proof :

Let $x_s T_\alpha$ and $x_t T_\alpha$ are stacked-ideal of stacked-semigroup (T_α, τ) , if $t \geq s$, then $x_s T_\alpha = [\{ x_n, x_{n-1}, \dots, x_t, \dots, x_s \}, \tau]$, and $x_t T_\alpha = [\{ x_n, x_{n-1}, \dots, x_t \}, \tau]$. And $[x_s T_\alpha \cup x_t T_\alpha] = [\{ x_n, x_{n-1}, \dots, x_t, \dots, x_s \}, \tau] \cup [\{ x_n, x_{n-1}, \dots, x_t \}, \tau] = [\{ x_n, x_{n-1}, \dots, x_t, \dots, x_s \}, \tau]$, so $[x_s T_\alpha \cup x_t T_\alpha]^c = [\{ x_{s-1}, x_{s-2}, \dots, x_1 \}, \tau]$, it is a new stacked-semigroup (i). And $[x_s T_\alpha]^c = [\{ x_{s-1}, x_{s-2}, \dots, x_1 \}, \tau]$, $[x_t T_\alpha]^c = [\{ x_{t-1}, x_{t-2}, \dots, x_s, \dots, x_1 \}, \tau]$, so $[x_s T_\alpha]^c \cap [x_t T_\alpha]^c = [\{ x_{s-1}, x_{s-2}, \dots, x_1 \}, \tau]$, it is a new stacked-semigroup (ii), from (i) and (ii) $[x_s T_\alpha \cup x_t T_\alpha]^c = [x_s T_\alpha]^c \cap [x_t T_\alpha]^c$.

3.6 mapping on stacked-semigroups

3.6.1 Definition

Let T_α and T_η be two stacked-semigroups. A mapping $v : T_\alpha \rightarrow T_\eta$ is a stacked-homomorphism, if

$$\forall x, y \in T_\alpha : v(x \tau y) = v(x) \tau_1 v(y) \in T_\eta .$$

Or

$$\forall x, y \in T_\alpha : \varphi(x \tau y) = \varphi(x) \tau_1 \varphi(y) \in T_\eta .$$

3.6.2 Theorem

Let (T_α, τ) is a stacked-semigroup, then (IT_α, τ) , and (IT_α, τ) are stacked-semigroups .

Proof :

Let (T_α, τ) is a stacked-semigroup, then $T_\alpha = \{ x_1, x_2, \dots, x_n \}$, and $IT_\alpha = \{ 1, 2, \dots, n \} = \{ l(x_1), l(x_2), \dots, l(x_n) \}$. And (T_α, τ) is a stacked-semigroup, then $T_\alpha = \{ x_n, x_{n-1}, \dots, x_1 \}$, and $IT_\alpha = \{ n, n-1, \dots, 1 \} = \{ l(x_n), l(x_{n-1}), \dots, l(x_1) \}$. From definition of the level-staked, we have a corresponding between the elements $(T_\alpha$ and $IT_\alpha)$ and they have a same staking, Then (IT_α, τ) and (IT_α, τ) are stacked-semigroups .

3.6.3 Theorem

Let (T_α, τ) is a stacked-semigroups, and (IT_α, τ_1) is the level stacked-semigroups . A mapping $L : T_\alpha \rightarrow IT_\alpha$ is a stacked-homomorphism .

Proof:

Let $x, y \in T_\alpha$ and $[x] > [y]$, and $[x_y] = [\sum_{i=1}^{\alpha} \frac{|x_{\gamma_i} - t|}{\sum_{i=1}^{\alpha} |x_{\gamma_i} - t|}] / \alpha$
 $\dots, \alpha \in N/0 . L[\max_t(x, y)] = L(x \tau y) = L(x \vee_t y) = L(x) = \max [L(x), L(y)] = L(x) \tau_1 L(y)$, hence $L(x \tau y) = L(x) \tau_1 L(y)$. ($\tau_1 [a, b] = \max[a, b]$), then A mapping $L : T_\alpha \rightarrow IT_\alpha$ is a stacked-homomorphism .

3.6.4 Theorem

Let (T_α, τ) is a stacked-semigroups, and (IT_α, τ_1) is the level stacked-semigroups . A mapping $l : T_\alpha \rightarrow IT_\alpha$ is a stacked-homomorphism .

Proof:

Let $x, y \in T_\alpha$ and $[x] < [y]$, and $[x_y] = [\sum_{i=1}^{\alpha} \frac{|x_{\gamma_i} - t|}{\sum_{i=1}^{\alpha} |x_{\gamma_i} - t|}] / \alpha$
 $\dots, \alpha \in N/0$.

$l[\min_t(x, y)] = l(x \tau y) = l(x \vee_t y) = l(x) = \min [l(x), l(y)] = l(x) \tau_1 l(y)$, hence $l(x \tau y) = l(x) \tau_1 l(y)$. ($\tau_1 [a, b] = \min[a, b]$), then A mapping $l : T_\alpha \rightarrow IT_\alpha$ is a stacked-homomorphism .

3.6.5 Definition

The stacked-homomorphism is an embedding or a monomorphism, denoted $\alpha : T_\alpha \rightarrow T_{\alpha_1}$, if it is injective, that is, if $\beta(x) = \beta(y)$ implies $x = y$.

3.6.6 Theorem

The stacked-homomorphism is denoted $v : T_\alpha \rightarrow IT_\alpha$ or $\varphi : T_\alpha \rightarrow IT_\alpha$ an embedding or a monomorphism if it is type-1 .

Proof :

From the theorem 4.4: if the system is type-1, and $[a_\alpha] = [b_\beta]$, then $a = b$. and from definition above, The stacked-homomorphism is denoted $l : T_\alpha \rightarrow IT_\alpha$ or $L : T_\alpha \rightarrow IT_\alpha$ is injective, so it is an embedding or a monomorphism .

3.6.7 Definition

The stacked-homomorphism is an epimorphism, denoted $\beta : T_\alpha \rightarrow T_{\alpha_1}$, if it is surjective, that is, if for all $y \in T_{\alpha_1}$, there exists $x \in T_\alpha$ with $\alpha(x) = y$.

3.6.8 Theorem

The stacked-homomorphism denoted $l : T_\alpha \rightarrow IT_\alpha$, or $L : T_\alpha \rightarrow IT_\alpha$ is an epimorphism .

Proof :

Let T_α is a stacked-semigroup $\Rightarrow (T_\alpha, \tau) = \{ x_1, x_2, \dots, x_n \}$ or $(T_\alpha, \tau) = \{ x_n, x_{n-1}, \dots, x_1 \}$, and $|T_\alpha| = n$, then the level-staked semigroup $(IT_\alpha, \tau) = \{ l(x_1), l(x_2), \dots, l(x_n) \}$ or $(IT_\alpha, \tau) = \{ L(x_n), L(x_{n-1}), \dots, L(x_1) \}$ and $|IT_\alpha| = n$. and when $l : T_\alpha \rightarrow IT_\alpha$ or $L : T_\alpha \rightarrow IT_\alpha$ so :
 $x_1 \rightarrow l(x_1) = 1$ $x_n \rightarrow L(x_n) = n$
 $x_2 \rightarrow l(x_2) = 2$ $x_{n-1} \rightarrow L(x_{n-1}) = n-1$

$$\begin{matrix} \vdots & \vdots \\ x_n \rightarrow l(x_n) = n & x_1 \rightarrow L(x_1) = 1 \end{matrix}$$

then for all $y \in IT_\alpha$, there exists $x \in T_\alpha$ with $\alpha(x) = y$, so the stacked-homomorphism is surjective, and it is an epimorphism .

3.6.9 Definition

The stacked-homomorphism is an isomorphism , denoted $\alpha : T_\alpha \rightarrow T_{\alpha 1}$, if it is both an embedding and an epimorphism .

3.6.10 Theorem

The stacked-homomorphism denoted $v : T_\alpha \rightarrow IT_\alpha$ or $\varphi : T_\alpha \rightarrow IT_\alpha$ is an isomorphism .

Proof :

From theorem 5.2 , the stacked-homomorphism is denoted $v : T_\alpha \rightarrow IT_\alpha$ or $\varphi : T_\alpha \rightarrow IT_\alpha$ is an embedding or a monomorphism, and from theorem 5.3 , the stacked-homomorphism denoted $v : T_\alpha \rightarrow IT_\alpha$ or $\varphi : T_\alpha \rightarrow IT_\alpha$ is an epimorphism , then The stacked-homomorphism is an isomorphism.

3.6.11 Definition

The stacked-homomorphism, denoted $\alpha : T_\alpha \rightarrow T_{\alpha 1}$ is an endomorphism, if $T_\alpha = T_{\alpha 1}$.

3.6.12 Theorem

The stacked-homomorphism, denoted $v : T_\alpha \rightarrow IT_\alpha$ or $\varphi : T_\alpha \rightarrow IT_\alpha$ is an endomorphism if $T_\alpha = \{ 1, 2, \dots, n \}$.

Proof :

Hence $IT_\alpha = \{ \varphi(x_1), \varphi(x_2), \dots, \varphi(x_n) \} = \{ 1, 2, \dots, n \}$, or $IT_\alpha = \{ v(x_1), v(x_2), \dots, v(x_n) \} = \{ 1, 2, \dots, n \}$ and if $T_\alpha = \{ 1, 2, \dots, n \}$, then $T_\alpha = IT_\alpha$, so it is an endomorphism .

3.6.13 Definition

The stacked-homomorphism, denoted $\alpha : T_\alpha \rightarrow T_{\alpha 1}$ is an automorphism , if it is both an isomorphism and an endomorphism .

3.6.14 Theorem

The stacked-homomorphism, denoted $v : T_\alpha \rightarrow IT_\alpha$ or $\varphi : T_\alpha \rightarrow IT_\alpha$ is an automorphism, if $T_\alpha = \{ 1, 2, \dots, n \}$

Proof :

Hence $IT_\alpha = \{ \varphi(x_1), \varphi(x_2), \dots, \varphi(x_n) \} = \{ 1, 2, \dots, n \}$, or $IT_\alpha = \{ v(x_1), v(x_2), \dots, v(x_n) \} = \{ 1, 2, \dots, n \}$ and if $T_\alpha = \{ 1, 2, \dots, n \}$, then $T_\alpha = IT_\alpha$, so it is an endomorphism (i) From theorem 5.2 , the stacked-homomorphism is denoted $v : T_\alpha \rightarrow IT_\alpha$ or $\varphi : T_\alpha \rightarrow IT_\alpha$ is an embedding or a monomorphism, and from theorem 5.3 , the stacked-homomorphism denoted $v : T_\alpha \rightarrow IT_\alpha$ or $\varphi : T_\alpha \rightarrow IT_\alpha$ is an epimorphism , then The stacked-homomorphism is an isomorphism(ii) Then from (i) and (ii), the stacked-homomorphism, denoted $v : T_\alpha \rightarrow IT_\alpha$ or $\varphi : T_\alpha \rightarrow IT_\alpha$ is an automorphism .

3.6.15 Theorem

Let(T_α, τ) = [$\{ x_1, x_2, \dots, x_n \}, \tau$] is stacked-semigroup , $IT_\alpha(x) = v(x)$, and $IT_\alpha = \{ v(x_1), v(x_2), \dots, v(x_n) \}$, then $v = v^2 = v^3 = \dots$.

Proof :

Let(T_α, τ) = [$\{ x_1, x_2, \dots, x_n \}, \tau$] is stacked-semigroup , $IT_\alpha(x) = v(x)$, and $IT_\alpha = \{ v(x_1), v(x_2), \dots, v(x_n) \}$. Hence : $v(x_1) = 1, v(x_2) = 2, v(x_3) = 3, \dots, v(x_n) = n$. Then $v^2(x_1) = v(v(x_1)) = v(1) = 1$, so :

$$\begin{aligned} v &= \begin{pmatrix} x_1 & x_2 & x_3 & \dots & x_n \\ 1 & 2 & 3 & \dots & n \end{pmatrix} \\ v^2 &= \begin{pmatrix} 1 & 2 & 3 & \dots & n \\ 1 & 2 & 3 & \dots & n \end{pmatrix} \\ v^3 &= \begin{pmatrix} 1 & 2 & 3 & \dots & n \\ 1 & 2 & 3 & \dots & n \end{pmatrix} \\ v^\infty &= \begin{pmatrix} 1 & 2 & 3 & \dots & n \\ 1 & 2 & 3 & \dots & n \end{pmatrix} \end{aligned}$$

Then $v = v^2 = v^3 = \dots$.

3.6.16 Theorem

Let(T_α, τ) = [$\{ x_n, x_{n-1}, \dots, x_1 \}, \tau$] is stacked-semigroup , $IT_\alpha(x) = \varphi(x)$, and $IT_\alpha = \{ \varphi(x_1), \varphi(x_2), \dots, \varphi(x_n) \}$, then $\varphi = \varphi^2 = \varphi^3 = \dots$.

Proof :

Let(T_α, τ) = [$\{ x_n, x_{n-1}, \dots, x_1 \}, \tau$] is stacked-semigroup , $IT_\alpha(x) = \varphi(x)$, and $IT_\alpha = \{ \varphi(x_n), \varphi(x_{n-1}), \dots, \varphi(x_1) \}$. Hence : $\varphi(x_n) = n, \varphi(x_{n-1}) = n-1, \varphi(x_{n-2}) = n-2, \dots, \varphi(x_1) = 1$. Then $\varphi^2(x_n) = \varphi(\varphi(x_n)) = \varphi(n) = n$, so :

$$\begin{aligned} \varphi &= \begin{pmatrix} x_n & x_{n-1} & x_{n-2} & \dots & x_1 \\ n & n-1 & n-2 & \dots & 1 \end{pmatrix} \\ \varphi^2 &= \begin{pmatrix} n & n-1 & n-2 & \dots & 1 \\ n & n-1 & n-2 & \dots & 1 \end{pmatrix} \\ \varphi^3 &= \begin{pmatrix} n & n-1 & n-2 & \dots & 1 \\ n & n-1 & n-2 & \dots & 1 \end{pmatrix} \\ \varphi^\infty &= \begin{pmatrix} n & n-1 & n-2 & \dots & 1 \\ n & n-1 & n-2 & \dots & 1 \end{pmatrix} \end{aligned}$$

Then $\varphi = \varphi^2 = \varphi^3 = \dots$.

3.6.17 Definition

let(T_1, τ_1) , (T_2, τ_2) are stacked-subsemigroup of the stacked-semigroup (T, τ), then $\{ \tau_1, \tau_2 \} \subseteq \tau$

3.6.18 Definition

let(T_1, τ_1) , (T_2, τ_2) are stacked-semigroup , if $T_1 \cap T_2 = T$, then they are tow disjoint-stacked-semigroup . If $T_1 \cap T_2 \neq T$, then they are tow undisjoint-stacked-semigroup .

3.6.19 Definition

Let $T_1 = \{ x_1, x_2, \dots, x_n \}$ and $T_2 = \{ y_1, y_2, \dots, y_m \}$ are stacked-semigroup, then we defined the multiplication between T_1 and T_2 by $T_1 \bullet T_2 = T_1 T_2 = T$. Then T is a new system with a new order set.

And $|T| = |T_1| |T_2|$.

Then $T_1 T_2 = T = \{ x_1 y_1, x_1 y_2, \dots, x_1 y_m, x_2 y_1, x_2 y_2, \dots, x_2 y_m, \dots, x_n y_m \}$

3.6.20 Theorem

Let $T_1 = \{ x_1, x_2, \dots, x_n \}$ and $T_2 = \{ y_1, y_2, \dots, y_m \}$ are stacked-semigroup, then $T_1 T_2 \neq T_2 T_1$.

Proof :

From the definition above let $T_1 = \{ x_1, x_2, \dots, x_n \}$ and $T_2 = \{ y_1, y_2, \dots, y_m \}$, $T_1 T_2 = \{ x_1 y_1, x_1 y_2, \dots, x_1 y_m, x_2 y_1, x_2 y_2, \dots, x_2 y_m, \dots, x_n y_m \}$,

$T_2 T_1 = \{ y_1 x_1, y_1 x_2, \dots, y_1 x_n, y_2 x_1, y_2 x_2, \dots, y_2 x_n, \dots, y_m x_n \}$.

IV. CONCLUSION

Thus can be considered the stacked system is semi-group, and can be applied to data that need to be addressed in the same way, and will follow this paper sheets in the same subject as applications addressing some of the issues in mathematics relevant to this data taken in the form of stacked system.

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Synthesis, Characterization and Biological Activity of Pure and Metal Ions Doped L-Proline Amino Acid

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Abstract- Alkali, Alkaline earth and transition metal ions doped L-proline single crystals were grown by solution growth technique. Due to variation in the nature of dopant, there is a modification in the growth habit, nonlinear optical property and mechanical hardness of the doped crystals. Fourier transform infrared (FTIR) spectra reveal strong absorption bands occur due to the presence of L-proline. UV-visible spectra show an improvement in the optical transmittance while doping on L-proline. The unit cell parameters and cell volume are obtained by powder X-ray diffractometer. Effect of dopant on the crystal defect on the grown crystals was characterized by Optical Microscopy. Anti microbial study of the grown crystals were analyzed using gram positive and gram negative micro organisms.

Index Terms- Solution growth technique, Dopant, Optical Microscopy, Powder X-ray diffractometer.

I. INTRODUCTION

The rapid development in the field of science and technology necessitates the search for newer and efficient nonlinear optical materials. In recent years, much attention has been paid to the research of novel nonlinear optical (NLO) materials, especially semiorganic crystals. Semiorganic compounds illustrate the following features:(1)dipolar structure composed of an electron donating and electron accepting group; (2) the contribution from the delocalized electrons belonging to organic ligand results in high nonlinear optic and electro-optic coefficients in the semi organic crystals also; (3) the organic ligand is ionically bonded to metal ion to impart improved mechanical and thermal properties; (4) exhibit wider transparency range, chemical stabilities and bulk crystal morphologies.

Nonlinear optics is one of the most attractive fields of current research in view of the applications in the areas such as optical modulation, optical switching, optical logic, frequency shifting and optical data storage and for developing technologies in telecommunication and signal processing[1,2]. Investigations were initially focused on purely inorganic materials, which were the first to demonstrate second-order nonlinear optical properties [3]. Attention was later directed towards organic materials due to their low cost, fast and large nonlinear response over a broad frequency range and inherent synthetic flexibility of high optical damage threshold [4]. However, organic materials are poor in thermal stability and mechanical hardness. It is difficult to grow large size and high quality single crystals. Recently, several complexes of proline were reported such as L-proline cadmium

chloride monohydrate and L-proline lithium chloride monohydrate [5].

Organic nonlinear optical materials have large optical susceptibilities, inherent ultrafast response times, and high optical thresholds for laser power as compared with inorganic materials. Amino acids are interesting materials for NLO applications as they contain a proton donor carboxyl acid (-COOH) group and proton acceptor amino (-NH₂) group in them [6]. Amino acids, when added as impurities, have improved material properties [7]. Amino acid, L-proline has formed several complexes, which are promising materials for second harmonic generation [8, 9].

The present study concentrate on the crystal growth of a new NLO crystal of alkali metals, alkaline earth metals and transition metals doped L-Proline by slow evaporation technique and its characterization along with its optical properties is reported. The grown crystals were subjected to powder XRD study to understand the crystal system and space group.

The transparency range of the crystal was estimated from UV-VIS spectrum to find out its optical property. Through etching study the defects that exist due to dopant also found. The antimicrobial study of pure and metal ions doped L-proline was also tested.

II. EXPERIMENTAL

2.1. Solubility study of pure and metal ions doped L-proline single crystals

The solubility of pure and metal ions doped L-proline single crystals were studied for six different temperatures 30, 35, 40, 45, 50 and 60°C as shown in fig.1. Initially, supersaturated solution was prepared at 30°C in an air tight container of 100 ml inside the constant temperature bath maintained with an accuracy of $\pm 0.01^\circ\text{C}$. After achieving the super saturation, the solution was analyzed gravimetrically and the solubility of pure L-proline and metal ions doped L-proline in 100ml of solvent was determined. This procedure was adopted for various temperatures and the solubility curves were drawn. It is observed from the solubility curves that the solubility increases with increasing temperature. The solvent was able to accommodate fairly more solute between the temperature ranges of 45 to 50 °C. Therefore this temperature range was suggested for the growth by temperature lowering method. Equal proportions of L-proline and metal sulphates were taken and were dissolved separately in deionized water. Then the solution of L-proline was poured into the dissolved metal sulphates mixture. The solution thus arrived was filtered twice to remove dust particles and un dissolved materials.

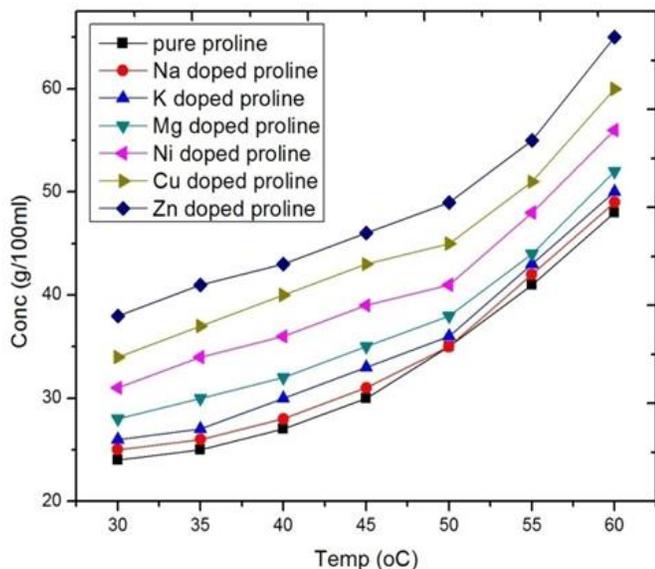


Fig.1 Solubility curve of pure and metal ions doped L-proline single crystals.

2.2 Synthesis of pure L-proline single crystal

The pure L-proline single crystals were grown by dissolving purified L-proline powders in appropriate amount of double distilled water and stirred well using magnetic stirrer for six hours to form a clear solution. Then the solution was kept in a constant temperature bath at 45°C. After a while the temperature had been set to slowdown by 1°C for every 1 hour till to reach 35°C. After reaching 35°C the temperature bath was kept constant at that temperature for about 3 hours. After that the solution was filtered and transferred to crystal growth vessels and crystallization was allowed to take place by slow evaporation under room temperature. Good quality single crystals were obtained after 35 days. The harvested crystals were washed several times with acetone and dried for further study.

2.3 Synthesis of metal ions doped L-proline single crystals

L-proline and metal sulphates (Na^{2+} , K^{2+} , Mg^{2+} , Ni^{2+} , Cu^{2+} , Zn^{2+}) in 1:1 stoichiometric ratio were mixed in deionised water. The reactants were stirred well using a temperature controlled magnetic stirrer for 6hrs to yield a homogeneous solution. Then the same procedure had been adopted as in the previous case. The finally formed solution was filtered using Whatmann filter paper. The filtered solution was then kept in crystal growth vessels followed by slow evaporation at room temperature. Good transparent metal ions doped L-proline crystals were obtained after 45 days. The harvested crystals were washed several times with acetone and dried for further study.

The photographs of the prepared pure and metal ions doped L-proline single crystals are shown in Fig.2

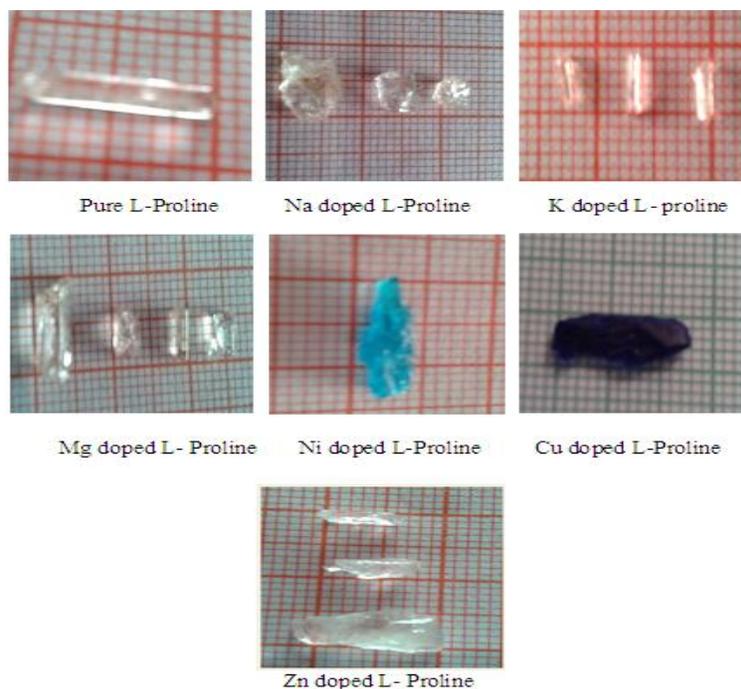


Fig.2 Photographs of grown good quality L-Proline single crystals.

III. RESULTS AND DISCUSSIONS

3.1 FT-IR Spectral analysis of pure and metal ions doped L-proline single crystals

The Fourier Transform infrared spectra were recorded for powdered samples of pure and metal ions doped L-proline crystals using Perkin- Elmer FTIR spectrometer by KBr pellet technique in the range of 400-4000 cm^{-1} . The FTIR spectra of pure and metal ions doped L-proline crystals are shown in fig.3. The effect of dopant on L-proline on the vibrational frequencies of the functional groups of pure L-proline crystal has been identified in the spectra. In the fig 3, the broad band around 3257 cm^{-1} is due to the O-H vibrations of water.

The peak obtained at 3419 cm^{-1} is due to stretching vibration of CH and the peak at 1600 cm^{-1} is due to the stretching vibration of C=O. The bands appeared at 793 cm^{-1} is assigned unambiguously to the wagging of NH_2 modes. The OH stretching vibrations is assigned in the range of 2565 cm^{-1} . The peak at 1398 cm^{-1} is due to the symmetric stretching of COO. These assignments are also supported in the literature.

An additional confirmation for the present assignment is the O-H in-plane-bend vibration at about 1112 cm^{-1} , which is typical for a non-hydrogen bonded carboxylic OH group. Similarly, the absorption maxima of the C=O stretch vibrations around 1780 cm^{-1} are almost identical for the L-proline amino acids.

Larger differences between the spectra are expected for the C-H and C-C stretch and bending vibrations, since among all the other amino acid L-proline is the only imino acid. The nitrogen atom present in the L-proline is secondary in nature. So the nitrogen in it interact with the metal ions change the stretching frequencies of C-H and C-C bonds. However, the spectra can be clearly distinguished in the C-H stretch and even better in the C-C stretch and C-H/N-H bending region. As usual, aromatic C-H

stretch vibrations occur above and aliphatic C–H stretch vibrations below 3000 cm^{-1} .

The splitting of the O–H in-plane-bend vibration of L-proline is due to harmonic couplings with the C–N stretch and C–H bend vibrations of the chiral carbon atom. Even the band shapes of the C–H stretch vibrations and of the C–C stretch and C–H/N–H bending vibrations between 1200 and 1600 cm^{-1} are mainly reproduced. Relative absorption intensities are also in good agreement with experiment.

From the spectra it is clear that, except for L-proline, the symmetric and asymmetric N–H stretch vibrations around at 3393 and 3088 cm^{-1} are barely visible in the simulated spectra. Indeed, we do not observe the N–H stretch vibrations in the present experiment. Only L-proline, where the nitrogen is incorporated in the five membered rings, is predicted to have larger infrared absorption intensity.

A remark to the $\nu(\text{C}=\text{O})$ backbone absorptions of L-proline is unusual compared to the amide absorption of other amino acids. It absorbs at 1618 and 1592 cm^{-1} . Assignments are according to Herlinger and Long (1970), νCN vibration which is assigned as 1409 cm^{-1} and it is sensitive to backbone conformations [10].

The broad band which absorbs at 3393 cm^{-1} corresponds to symmetric and asymmetric vibrations of NH_2^+ group. The band at 1618 cm^{-1} confirms the presence of COO^- group in a molecule. The presence of ring νCH and νCH_2 in the crystal conforms the absorption of band at 1362 cm^{-1} symmetric, 2985 cm^{-1} asymmetric and the bands at $3088, 1150$ and 1455 cm^{-1} both symmetric and asymmetric confirms the νCH_2 functional group present in a molecule. All these assignments show the formation of L-proline crystal in a perfect manner. The influence of dopant such as Na, K, Mg, Ni, Cu and Zn shifts the absorption of NH_2^+ and COO^- functional groups. The absorption bands at 1107 cm^{-1} confirms

the presence of both Na and K in L-proline. The bands at 1176 cm^{-1} as a broad peak and 873 cm^{-1} as a weak peak confirms the presence of Mg doped on L-proline. Again in the case of Ni and Cu the characteristic sharp peak occur at 1083 cm^{-1} and weak band at 1079 cm^{-1} confirms the presence of Ni and band at 1672 cm^{-1} confirms the presence of Cu dopant on L-proline. All the spectral assignments conforms the dopants present in L-proline.

The absorption in the $2744\text{--}2456\text{ cm}^{-1}$ region is resulting from superimposed O–H and NH_2^+ stretching bands. The peak at 1661 cm^{-1} corresponds to the asymmetrical NH_2^+ stretching vibration. The absorption in the $1566\text{--}1457\text{ cm}^{-1}$ region is due to symmetrical NH_2^+ stretching vibration. Ratajczak et al [11] determined that the lack of any strong IR band at 1700 cm^{-1} clearly indicates the existence of the COO^- ion in Zwitter ionic form.

The peaks at 1414 cm^{-1} are assigned to symmetrical COO^- ion group stretching. The other peaks at 1376 and 1329 cm^{-1} are assigned to wagging of CH_2^+ group of the L-proline. The peaks at 1194 cm^{-1} are assigned to twisting NH_2^+ . The wagging vibration of COO^- is observed at 679 cm^{-1} . The peak at 780 cm^{-1} was attributed to the in-plane deformation of COO^- .

The broad band lies in the range $2710\text{--}3400\text{ cm}^{-1}$ in all the doped crystal corresponds to symmetric and asymmetric vibrations of NH_2 group. Very strapping absorption occur around 950 cm^{-1} is owing to sulphate ion. The FTIR spectra of doped crystals show a strong NH absorption peak at about 3200 cm^{-1} . When metal sulphates are doped with L-proline more NH stretch vibrations are pioneer due to doping and as a result the NH absorption peak becomes strapping. So FTIR spectra indirectly ascertain the presence of metal ions on L-proline crystal.

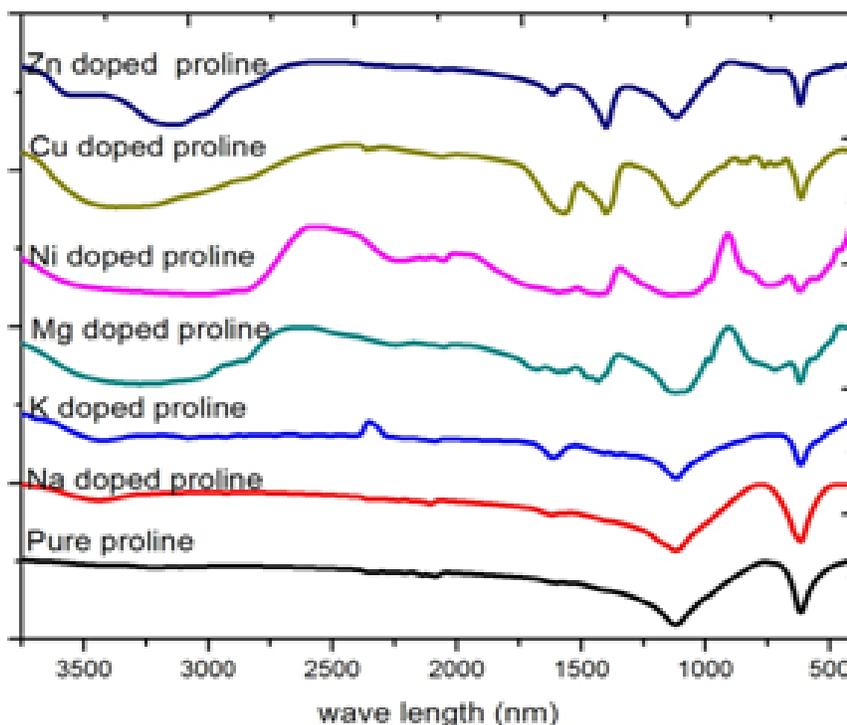


Fig.3 FT-IR Spectra of pure and metal ions doped L-Proline single crystals.

3.2 UV Spectra of pure and metal ions doped L-proline single crystals

The UV-Visible-absorption spectra were recorded using Perkin-Elmer Lambda 35 UV-Visible Spectrometer in the range 190 nm to 800 nm are shown in Fig. 4. From the spectra, it is observed that both the pure and metal ions doped L-proline crystals show good absorption in the UV regions. The pure L-proline single crystal has absorption around 200nm. Thus the addition of metal ions on L-proline has increased the intensity of absorption than pure L-proline. The higher percentage of absorption for Cu doped L-proline when compared to pure and other metal ions doped L-proline suggests the presence of Cu enhance the optical activity of L-proline. The reason for this enhancement may be due to the hole formylation of Cu which when added to L-proline the lone pair electron on N of L-proline may facilitate the electronic transition in a wide manner than the other counterpart. Thus it has maximum absorption with highest intensity. The UV-VIS spectra give restricted information about

the structure of the molecule because the absorption of UV and visible light involves absorption or transmission of the electron from the ground state to higher energy states. From the spectra it is observed that the absorption percentage of metal ions doped L-proline is 15-18 % higher than that of the pure grown crystal. The doped crystal shows a superior absorption in the intact UV region. Good optical absorption and lower cut-off wavelengths are very important properties for NLO crystals. These properties were satisfied by the metal ions doped L-proline. Hence, these crystals may be used for the nonlinear optical applications in the above mentioned wavelength range. So these crystals can be used as NLO crystal properties.

From the spectra (Fig.4), it is evident that above crystal has UV cut off wavelength at 220 nm, which is sufficient for SHG laser radiation or other applications in the blue region. It further indicates that the crystal has wide transparency window between 200 nm and 800nm.

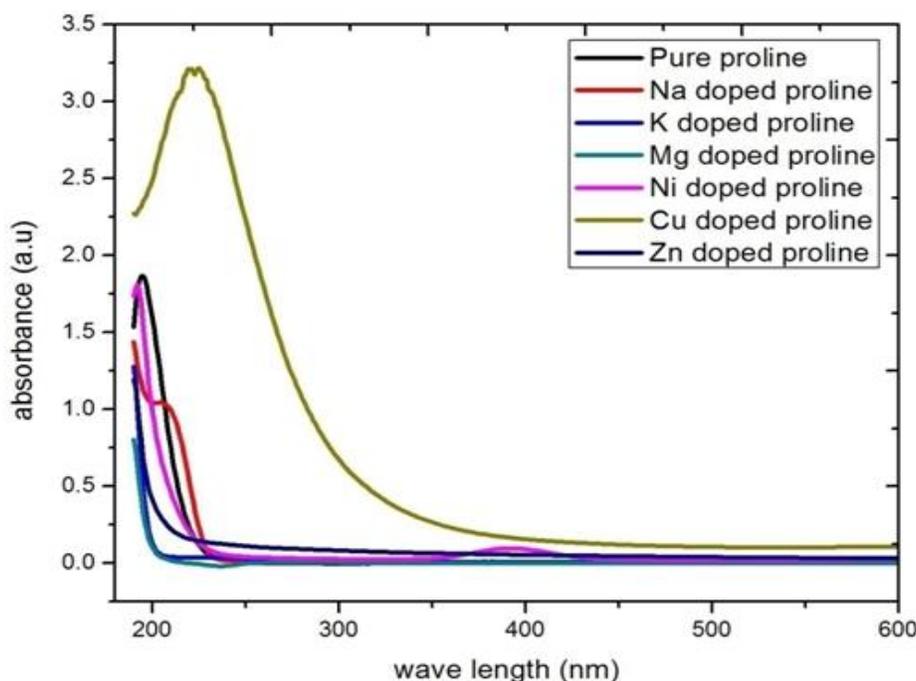


Fig 4 UV Spectra of pure and metal ions doped L-Proline single crystals

3.3 Powder XRD analysis of pure and metal ions doped L-proline single crystals

L-Proline exist in a monoclinic nature having unit cell dimensions of $a= 20.60$, $b= 6.315$ and $c= 5.186$. Using the tetragonal crystallographic equation the lattice parameter of the pure and metal ions doped L-proline crystals were calculated with in an accuracy of ± 0.002 . The crystals were identified by

comparing the interplanar spacing and intensities of the powder pattern with the JCPDS data of L-proline crystals. The variation in lattice parameters and d values for the doped samples can be attributed to the accommodation of impurity in the crystal lattice. The slight shift in the 2θ values of doped crystals suggests that crystal structure were slightly distorted compared to undoped L-proline. (fig-5 and data compiled in table-1).

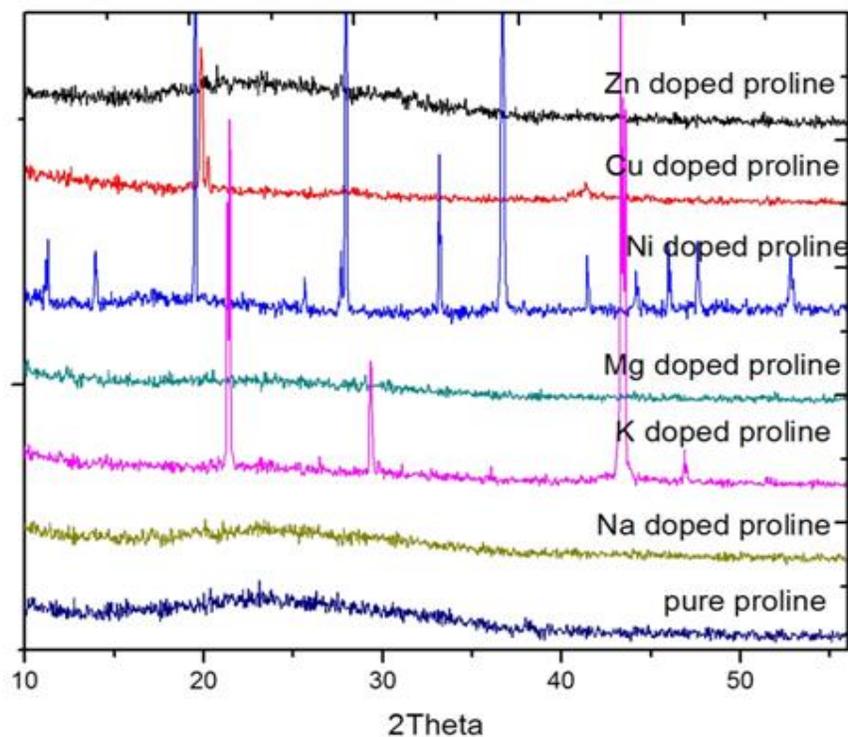


Fig 5 Powder XRD analysis of pure and metal ions doped L-proline single crystals

Table 1: Comparison of unit cell parameters of grown crystals along with pure L-proline

	Pure L-proline	Na doped L-proline	K doped L-proline	Mg doped L-proline	Ni doped L-proline	Cu doped L-proline	Zn doped L-proline
hkl	(310)(311) (-511)(421) (-312)(821)	(020)(201) (211)(231)	(211)(221) (820)(821) (442)(204) (214)(951)	(111)(220) (420)(022) (820)(313) (351)	(110)(-311) (710)(202) (-711)(330) (110)(731)	(111)(020) (731)(710) (910)	(111)(211) (121)(400) (040)(422) (342)
System	Monoclinic	Orthorhombic	Orthorhombic	Orthorhombic	Monoclinic	Monoclinic	Orthorhombic
Space Group	C ₂ (5)	P2 ₁ 2 ₁ 2 ₁ (19)	P2 ₁ 2 ₁ 2 ₁ (19)	P2 ₁ 2 ₁ 2 ₁ (19)	C ₂ (5)	C ₂ (5)	P2 ₁ 2 ₁ 2 ₁ (19)
Cell Parameters (Å)	a=20.60 b=6.315 c=5.186	a=11.64 b=9.037 c=5.620	a=19.59 b=7.839 c=5.619	a=19.59 b=7.839 c=5.619	a=20.60 b=6.315 c=5.186	a=20.60 b=6.315 c=5.186	a=11.64 b=9.037 c=5.620
Interfacial angles	$\alpha = \gamma = 90^\circ$ $\beta = 93.21^\circ$	$\alpha = \beta = \gamma = 90^\circ$	$\alpha = \beta = \gamma = 90^\circ$	$\alpha = \beta = \gamma = 90^\circ$	$\alpha = \gamma = 90^\circ$ $\beta = 93.21^\circ$	$\alpha = \gamma = 90^\circ$ $\beta = 93.21^\circ$	$\alpha = \beta = \gamma = 90^\circ$
JCPDS Card No.	32-1869	21-1805	51-2479	51-2479	32-1869	32-1869	21-1805

3.4 Etching studies of pure and metal ions doped L-proline single crystals

Chemical etching is a very simple and elegant technique to reveal the crystal defects and the crystal growth mechanism. Which is able to develop some features such as growth strains, etch spirals, rectangular etch pits, etc on the crystal surface, Here in the etching studies were carried out on the plane of the as grown single crystals of L-proline for 10-30s. Only some scattered etch pits and short strains were observed for the etching time of 10s. Increasing the etching time to 30s, the size of the etch pits enlarged and some growth strains spread along an axis. The observed etch pits, attributive to layer growth; confirm the

two-dimensional nucleation (2D) mechanism with less dislocations [12].

Figure 6 shows the surface of the L-proline single crystal using water as an etchant at room temperature for 5 and 7s. First, the crystal sample was completely immersed in the etchant and then etched sample was cleaned using a tissue paper and the etch patterns were observed using an optical microscope in the reflection mode. When the crystal was etched for 5 and 7s, the round hole etch were observed. Well defined etch pits were observed while increasing the etching time. The shape of the etch pits may be changed by varying the concentration of the solvent (Sangwal 1992) [13]. Moreover, factors such as temperature of etching, stirring, and adsorption of impurities or reaction

producers, which alters the absolute value of these rates, also lead to the change in the geometry of etch pits (Gilman et al 1957)[14]. The resulting etch patterns are the characteristic distribution of defects and nature of defects in the sample and also confirmed the two-dimensional nucleation growth mechanism. The etch pits produced by etchants are composed from solvents in which a crystal is highly or poorly soluble.

The diamond shaped etches pits obtained for pure L-proline revealed that L-proline has no defects on its own and it confirms the monoclinic nature with perfect crystallinity. The further change of etch pits while doping on L-proline confirms the change in morphology of doped L-proline compared to undoped one.

The beautiful hexagonal forms shown in Mg doped L-proline are those produced by some distortion in the crystal lattice. These etch pits are definitely limited by hexagonal pyramidal faces characteristically symmetrical to six planes of symmetry which accords with all experimental results obtained in this type of doped crystal. The nature of the solvent, then, seems not to affect the final results. Solution phenomena, therefore, are of primary importance when considering the symmetry content and classifications of crystals.

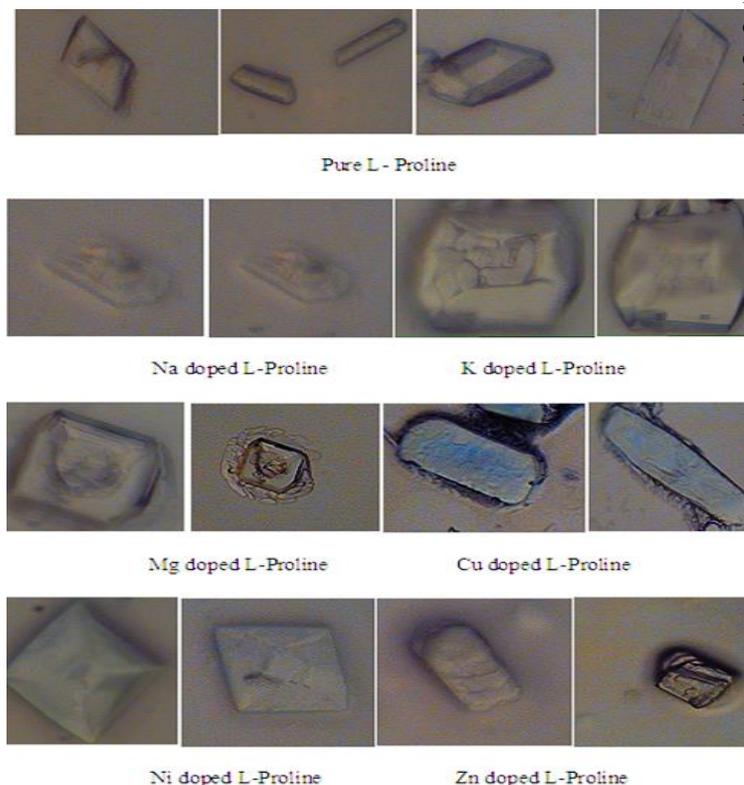


Fig.6 Surface revealing of etched pure and metal ions doped L-proline single crystals

3.5 Antimicrobial activity of pure and metal ions doped L-proline single crystals

The antibacterial activity results of the pure L-proline and their metal ions doped L-proline were given in Fig.7. Antimicrobial results showed that all the synthesized compounds possess biological activity. The activity generally increases with increasing the concentration of the compounds.

The data revealed that the activity of the metal ions doped L-proline enhanced than the undoped L-proline. This enhancement in the activity is rationalized on the basis of the structures of metal ions by possessing an additional electron delocalization of the presence of these metal ions than the pure L-proline. This enhances the trans amination and resamination reactions in biological system. It has also known that the metal ions with nitrogen and oxygen donor systems of L-proline might inhibit enzyme production, since the enzymes which require these groups for their activity appear to be especially more susceptible to deactivation by the metal ions upon bonding with L-proline[15]. On bonding the polarity of the metal ion will be reduced to a greater extent due to overlap of the L-proline nitrogen orbital and partial sharing of positive charges of metal ion with donor groups like L-proline. Further it increases the delocalization of pi electrons over the whole L-proline enhances the lipophilicity of the formed crystal. This again enhances the penetration of metal ions doped L-proline into lipid membrane and blocking the metal bonding sites on enzymes of microorganisms, hence increases the biological activity [16].

Here we noticed that both in bar diagram and in measuring the diameter of zone of inhibition of Cu^{2+} doped L-proline, we found that Cu^{2+} exhibited higher zone of inhabitation than all the other crystals. The reason may be due to greater chance of delocalization of Cu^{2+} (d^9 system) with secondary nitrogen of L-proline. Because of this greater and unique nature of this Cu^{2+} ions exhibit greater inhibition zone than all other counter parts.

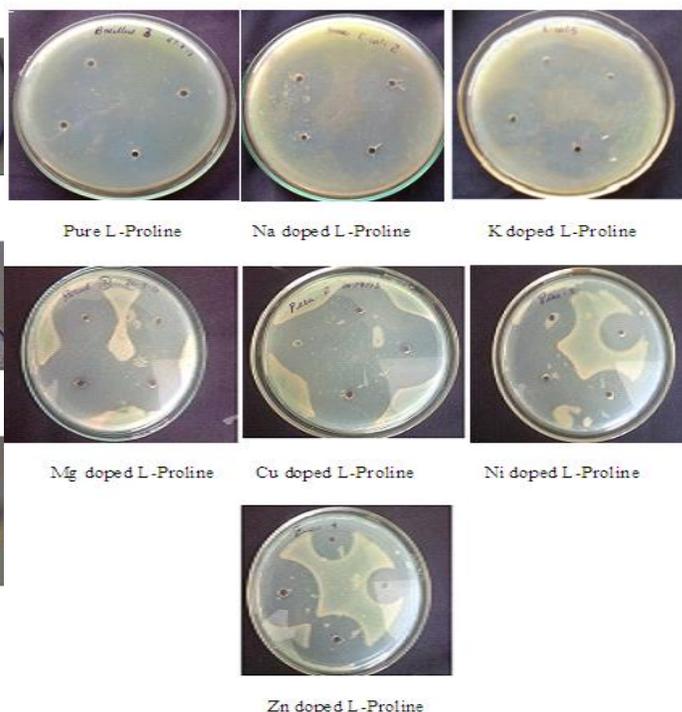


Fig 7 Antimicrobial activity of pure and metal ions L-Proline single crystals

The sensitivity of the microorganisms against the pure and metal ions doped L-proline are represented as bar diagram is shown in Fig 8

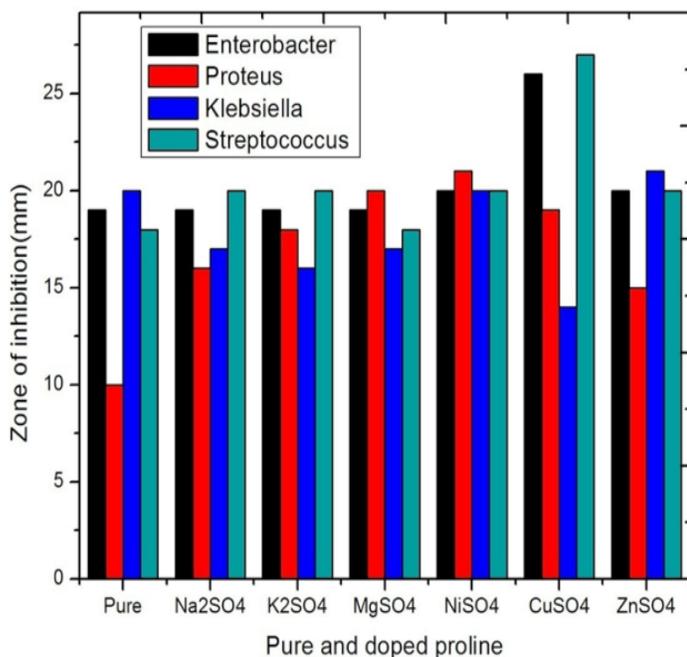


Fig.8 Zone inhibition areas of pure and metal ions doped L-Proline single crystals.

IV. CONCLUSION

The present study deals with growth of L-Proline(essential), amino acid single crystals and alkali, alkaline earth and transition metal ions doped above said amino acid by using conventional slow evaporations solution growth method.

The functional groups present in the grown crystals were identified by recording FTIR spectra. All the recorded FTIR spectra exhibited characteristic peaks corresponding to the nature of the dopant metal ions and other functional groups like amino and carboxylic acid present in amino acids.

The UV Visible absorption of pure L-proline single crystal has absorption around 200 nm and the addition of metal ions on L-proline has increased the intensity of absorption than pure L-proline. The higher percentage of absorption for Cu doped L-proline when compared to pure and other metal ions doped L-proline suggests the presence of Cu enhance the optical activity of L-proline. The reason for this enhancement may be due to the hole formylation of Cu which when added to L-proline the lone pair electron on N of L-proline may facilitate the electronic transition in a wide manner than the other counterpart.

L-Proline exist in a monoclinic nature having unit cell dimensions similar to metal ions doped L-proline. The slight shift in the 2θ values of doped crystals suggests that crystal structure were slightly distorted compared to un doped L-proline.

The diamond shaped etches pits obtained for pure L-proline revealed that L-proline has no defects on its own and it confirms the monoclinic nature with perfect cristanality. The further change of etch pits while doping on L-proline confirms the

change in morphology of doped L-proline compared to undoped one.

All the grown crystals were evaluated in vitro for antibacterial activity by using filter paper disc method against different strains of bacteria viz. *Enterobacter*, *Proteus*, *Klebsiella* and *Streptococcus*. All the crystals along with standard antibacterial Streptomycin were used at 50 and 100 ppm concentrations.

The antimicrobial activity of L-proline and the metal ions doped L-proline revealed that the activity of metal ions doped L-proline is higher than the undoped L-proline. This enhancement in the activity is rationalized on the basis of the structures of metal ions by possessing an additional electron delocalization of the presence of these metal ions than the pure L-proline. This enhances the transamination and resamination reactions in biological system. It has also known that the metal ions with nitrogen and oxygen donor systems of L-proline might inhibit enzyme production, since the enzymes which require these groups for their activity appear to be especially more susceptible to deactivation by the metal ions upon bonding with L-proline.

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A Miniaturized Ultra Wideband (UWB) Antenna Design for Wireless Communications

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Abstract- This paper presents a miniaturized planar circular disc UWB antenna design for wireless communications. Printed on a dielectric substrate and fed by 50Ω microstrip line with truncated ground plane, the proposed antenna has been demonstrated to provide an ultra wide 10dB return loss bandwidth with satisfactory radiation properties. The special structure reduces the spatial volume and it is used to realize the miniaturization of the antenna. Ansoft High Frequency structure Simulator (HFSS) software tool has been employed for obtaining the simulation results. The return loss, voltage standing wave ratio (VSWR), radiation patterns and current distributions of the antenna are discussed.

Index Terms- Ultra wide band (UWB), miniaturization, planar antennas, microstrip line-fed.

I. INTRODUCTION

The development of radio frequency technology and ultra wide band (UWB) equipment, there has been considerable research effort put into UWB antenna. In recent years, monopole antennas are the focus of UWB antenna. Several broadband monopole configurations, such as circular, square, elliptical, pentagonal and hexagonal have been proposed so far [1-4]. However, they are not planar structures as the ground planes are perpendicular to the radiators.

A suitable UWB antenna should be capable of operating over an ultra wide bandwidth as allocated by the Federal Communications Commission. At the same time, reasonable efficiency and satisfactory radiation properties over the entire frequency range are also necessary. Another primary requirement of the UWB antenna is a good time domain performance, i.e., a good impulse response with minimal distortion [5].

In this paper, a miniaturized planar circular disc monopole antenna fed by microstrip line is proposed. The radiator, ground plane and the feeder equipment of the antenna are placed on the same plate. This reduces the spatial volume to great degree. The outline of this paper is as follows. Section II describes the previous work; the design of the proposed antenna is described in section III. Simulation results are presented in Section IV and the conclusions are summarized in Section V.

II. PREVIOUS WORK

Qurratulain, Neela Chatteraj, design a tapered U slot UWB printed monopole microstrip antenna for wireless applications. To miniaturize the UWB antenna, tapering and ground plains are

used. The UWB antenna is etched on $24 \times 36 \text{mm}^2$ FR4 epoxy substrate having relative permittivity of 4.4 and a substrate height of 1.6mm, by 20% reduced size, it has achieved impedance ($S_{11} < -10\text{dB}$) bandwidth over 3.4GHz to 14GHz [7].

Kasi, Ping, Chakrabarty, proposed the design of compact microstrip-fed patch antenna for UWB application. The design is etched on FR4 substrate with the overall size of $28 \text{mm} \times 29 \text{mm}$, dielectric constant of 3.38 and a thickness of 1.6mm. The size of the antenna is reduced by beveling the patch with rectangular slot and partial ground plane. It has achieved impedance ($S_{11} < -10\text{dB}$) bandwidth over 3.8GHz to 12GHz [8].

III. THE PROPOSED ANTENNA DESIGN

Fig.1 illustrates the geometry and configuration of the proposed antenna, which is etched on the Taconic RF-30(tm) substrate with a thickness of 1.6mm and dielectric constant of 3. A 50Ω microstrip line fed on the same side of a dielectric substrate.

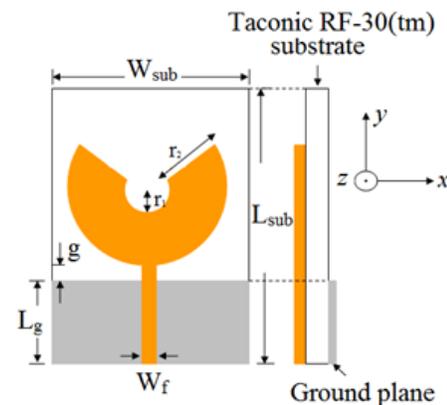


Fig.1 The geometry of the proposed antenna.

W_f is the width of the microstrip feed line that is fixed at 3mm in order to obtain 50Ω impedance. The circular patch is printed on the front surface of the substrate. W_{sub} and L_{sub} represent the width and length of the dielectric substrate, L_g represent the length of ground. The initial parameters of the circular patch before reducing its size are determined from the equations 1 and 2 reported in [2]. To reduce the overall size of the proposed antenna and obtain a good impedance matching

over a broad bandwidth, the circular patch is notched. The optimized parameters are summarized in Table1.

$$f_L (GHz) = \frac{30 \times 0.24}{(l + r) \sqrt{\epsilon_{reff}}} \tag{1}$$

$$\epsilon_{reff} = \frac{\epsilon_r + 1}{2} \tag{2}$$

where,

- f_L = the frequency corresponding to the lower edge of the bandwidth
- l = the height of the cylindrical wire which is the same as that of planar configuration height
- r = the equivalent radius of the cylindrical wire
- ϵ_{reff} = effective relative permittivity of the substrate
- ϵ_r = relative permittivity of the substrate

Table 1 The optimized parameters of the proposed antenna design

Dimension	Length(mm)
W_{sub}	50mm
L_{sub}	50mm
r_1	1.9mm
r_2	13.5mm
L_g	20.2mm
W_f	3mm
g	5.8mm

IV. SIMULATION RESULT AND DISCUSSION

A miniaturized UWB antenna was simulated using Ansoft High Frequency Structure Simulator (HFSS) software [6]. The simulated return loss (S_{11}) of the proposed antenna is shown in Fig.2. It is found that the -10dB return loss bandwidth of the antenna is approximately 6.3GHz (2.7GHz-9.0GHz) and the antenna shows stable behavior over the band. The simulated return loss shows that the antenna is capable of supporting multiple resonance modes, which are distributed across the spectrum. There are three resonance modes formed by the antenna. Their values are 3.2GHz, 6GHz and 8.1GHz respectively. Therefore, the overlapping of these resonance modes leads to the UWB characteristics. It was discovered that the VSWR of the optimized parameters of the proposed design is less than 2, this can be seen in Fig.3. According to Fig.4, The radiation patterns show omnidirectional characteristics at H-plane for 6GHz and 7.2GHz and

changes in shape for 4.5GHz and 9.2GHz. It has been observed that a typical monopole like pattern in E-plane at 6GHz, but it is in distorted in shape at other frequencies. The simulated current distributions of the proposed antenna are shown in Fig.5. It has been observed that, the current is mainly concentrated around the edges of the patch, at the upper part of the ground plane and there is some less intense type of current concentration on the edge of the cutout. This is expected because the cutout edge represents a discontinuity for the surface currents on the patch.

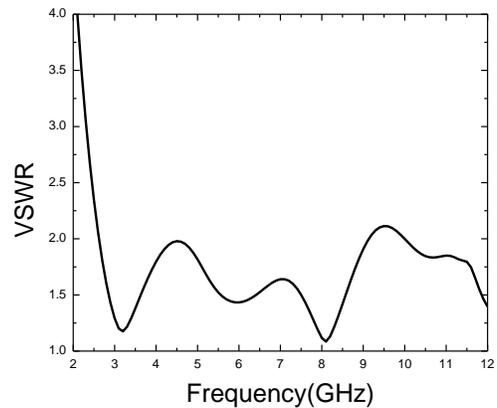
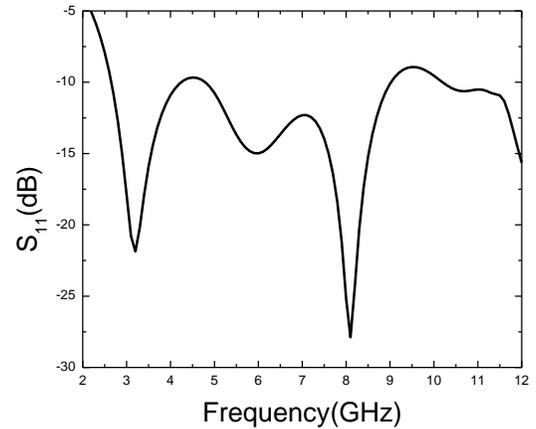
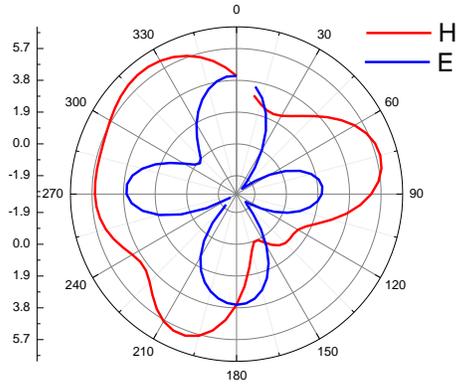
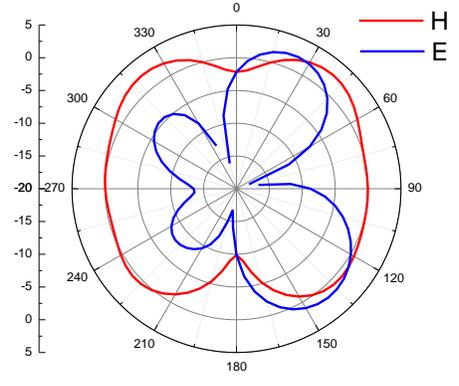


Fig.2 The simulated return loss of the proposed antenna
 Fig.3 The simulated VSWR of the proposed antenna



(a) at 4.5GHz

(b) at 6GHz



(c) at 7.2GHz

(d) at 9.2GHz

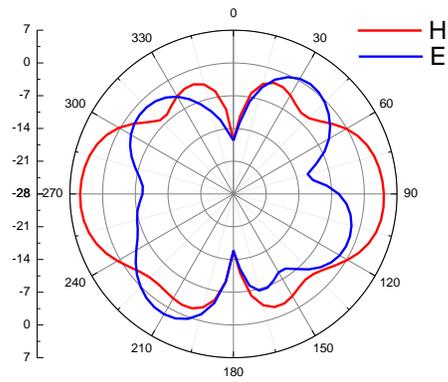


Fig.4 The simulated radiation patterns at E-plane and H-plane of the proposed antenna at (a) 4.5GHz, (b) 6GHz,

7.2GHz and (d) 9.2GHz

(c)

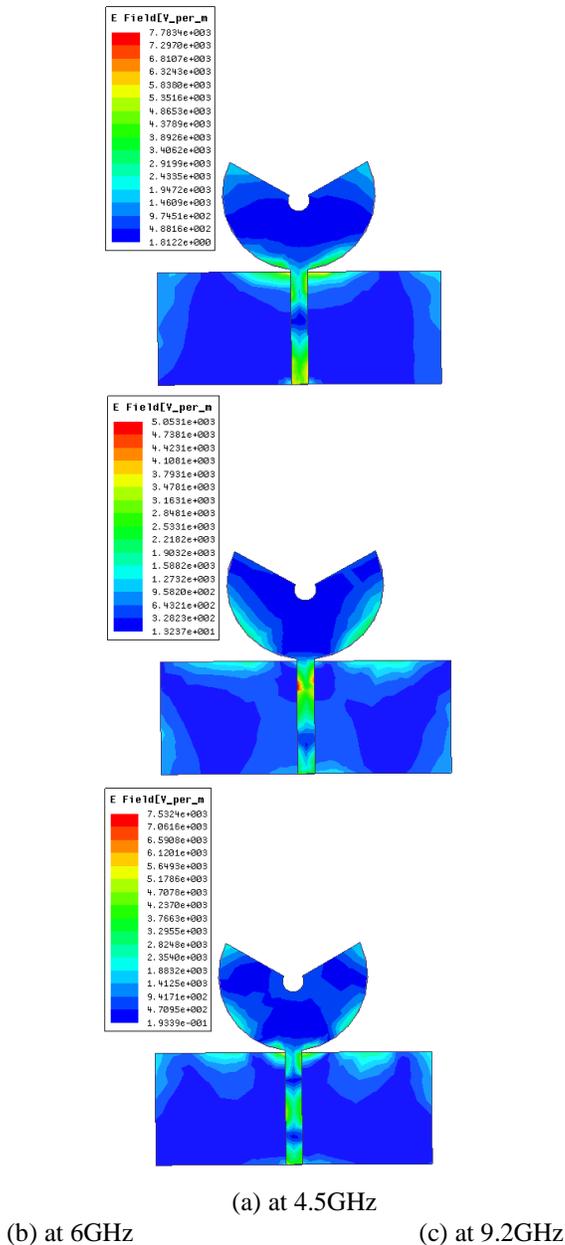


Fig.5 The current distribution of the proposed antenna at (a) 4.5GHz, (b) 6GHz and (c) 9.2GHz

V. CONCLUSION

A miniaturized UWB circular disk antenna design is investigated in this paper. The operating bandwidth ($S_{11} < -10\text{dB}$) achieved was 6.3GHz (2.7GHz-9.0GHz). The proposed antenna is capable of supporting multiple resonance modes, at 3.2GHz, 6GHz and 8.1GHz which are distributed across the spectrum. The antenna exhibited near omnidirectional patterns at H-plane. As a result of notching the patch, the size of the antenna is reduced and has lighter weight, which is very desirable from miniaturization point of view. More degree of freedom in design and possibly less conductor losses are achieved. Due to its very

wide bandwidth, the antenna can be considered as a potential candidate for UWB wireless communication applications.

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Correlated Studies between Growth and Yield Characters of Castor Bean (*Ricinus communis L.*)

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Abstract- A field study was conducted at the Teaching and Research Farm, University of Agriculture, Makurdi, Nigeria in 2008 and 2009 cropping seasons. The objectives were to identify important determiners of yield characters and to determine the correlations between growth characters viz: number of leaves per plant, length of internodes per plant, number of internodes per plant, leaf area index, net assimilation rate, absolute growth rate, plant height; and yield characters namely: panicles per plant, capsules per plant, capsules per panicle, seeds per plant, dry weight of harvestable material, total dry weight per plant, harvest index, seed yield, 100 seed weight and oil yield at 4, 8, 12, 16, 20, 24 and 28 weeks after sowing(WAS). The technique of growth analysis described by Steel and Torrie was adopted for data collection. Growth characters were correlated with yield characters and correlation coefficients were determined. Results showed that, there were positive and significant correlations between number of leaves and all the yield characters at 8 to 28 WAS except capsules per plant; number of internodes and yield characters at 4, 20 and 24 WAS; length of internodes and yield characters at 4 to 28 WAS, except capsules per panicle at 4, 8, 28 WAS, seed yield and 100 seed weight at 4 and 8 WAS, oil yield at 4 WAS. Leaf area index correlated positively and significantly with yield characters at 8 to 28 WAS, except capsules per panicle at 8 and 28 WAS; net assimilation rate with yield characters except capsules per panicle at 24 and 28 WAS, dry weight of harvestable material, harvest index and 100 seed weight at 4 and 8 WAS. Correlations between absolute growth rate and all the yield characters were highly significant and positive except panicle per plant at 8 WAS. There were positive correlations between plant height and all the yield characters at 8 to 28 WAS, which were significant. Each growth character that correlated positively and significantly with a yield character indicates that it is an important determiner of that yield character.

Index Terms- Castor bean, correlated studies, growth characters, yield characters

I. INTRODUCTION

Castor bean (*Ricinus communis L.*) a member of the family Euphorbiaceae is indigenous to Africa (Voss, 1996) and India (Baskin et al, 2000). It is an industrial crop grown for economic seeds exploited mainly for producing oil (Uvah, 1991). Growth, development and yield of crop plants, together with factors affecting them, occupy a position of primary importance in crop production. Growth and yield are physiologically interrelated or correlated (Hudson, 1984). Generally, growth is

an irreversible increase in size (increase in dry weight, length or diameter – Nothman, 2001) with quantitative attributes while yield is the net photosynthetic produce and has quantitative attributes also.

Hudson (1984) reported that growth and yield of crops are products of interplay or correlation between its genetic constitution and the environment. While the genetic make up of a crop is a fixed entity that delimits the extent to which that crop can develop and yield, the actual performance of the crop is regulated by the environment in which it grows.

Proper identification of important determiners of yield (growth characters) in crop plants is a step towards increasing crop yield through manipulation of growth characters by application of growth regulators (Chen, 2001). Mukaila et al. (2005) suggested that in order to obtain a precise knowledge of the factors limiting growth and yield of crops in West Africa, quantitative and correlative analysis of growth and yield of field crops should be made. Variation in weather conditions significantly influenced net assimilation rate, relative growth rate, leaf area and dry matter accumulation of cowpea seedlings in Southern Nigeria (Ezedinma, 1967).

Arkley and Ulrich (1962) reported that of the three factors on which plant growth depends namely; soil, climate and cultural practices, the effect of climate is the most complex. Generally, the degree of association (correlation) between growth and yield characters of crops depends on climatic and genetic factors (Davis, 1978).

In order to obtain a precise knowledge on important determiners of yield of crops, Singh and Chaudhary (1979) suggested that various growth and yield characters be correlated to assert their degree of association. There is dearth of information on correlated studies with respect to growth and yield characters of castor bean. The objective of this study was therefore, to determine the growth characters which are important determiners of yield through correlated studies between growth and yield characters of castor bean.

II. MATERIALS AND METHODS

Four castor bean accessions viz: LAF-4, LAF-11, AKW-5, AKW-7 were used as treatments. Three castor bean seeds were sown per hill on the ridge and spaced 90cm x 50cm with a population density of 22, 222 plants per hectare. Thinning to one seedling per stand was done three weeks after sowing (WAS). The experiment was laid out in Randomized Complete Block Design with three replications. The gross plot size was 8m x 9.9m (79.2m²) with net plot size of 7.2m².

The plots were weeded manually twice, before and after flowering at 30 and 60 days intervals respectively. Basal application of NPK fertilizer (20:10:10) at the rate of 100kgN/ha was done at 40 days after sowing. The plants were sprayed fortnightly with Vetox 85 insecticide at the rate of 1.1kg chemical per 225 litres of water starting from 9 WAS to minimize insect damage by weevils, leaf rollers, grasshoppers and aphids. Growth and yield characters were correlated at 4 to 8WAS to assert their degree of association.

Data on selected growth and yield characters collected from five randomly labelled plants from net plots were recorded at 4, 8, 12, 16, 20, 24 and 28 weeks after sowing and included the following:

Growth Characters:

- (i) Number of leaves per plant
- (ii) Length of internodes per plant (cm)
- (iii) Number of internodes per plant
- (iv) Leaf Area Index (LAI) = $\frac{LA}{GA}$

where:

LA = total leaf area in cm².

GA = area covered on ground in cm².

(v) Net Assimilation Rate (NAR) = $\frac{W_2 - W_1}{A_2 - A_1} \times \frac{\log A_2 - \log A_1}{t_2 - t_1}$ g/m²/day

where:

W₁ and W₂ = total dry weight of plant material (g).

A₂-A₁ = total leaf area (cm²)

t₁ and t₂ = sampling times (weeks after sowing)

(vi) Absolute Growth Rate (AGR) = $\frac{W_2 - W_1}{t_2 - t_1}$ g/m²/day

where:

W₁, W₂ = total dry weight of plant material (g)

A₁, A₂ = total leaf area (cm²)

t₁, t₂ = sampling times (weeks after sowing).

- (vii) Plant height (cm)

Yield Characters:

- (i) Panicles per plant
- (ii) Capsules per plant
- (iii) Capsules per panicle
- (iv) Seeds per plant
- (v) Dry weight of harvestable material (g)
- (vi) Total dry weight per plant (g)
- (vii) Harvest index (HI) = $\frac{W_m}{W}$

where:

W_m = dry weight of marketable material (g)

W = total dry weight of plant material (g)

(viii) Seed yield (kg/ha)

(ix) 100 seed weight (g)

(x) Oil yield (%)

The technique of growth analysis was adopted according to Hunt (1978), and Steel and Torrie (1980).

Statistical Analysis:

All growth characters were correlated with yield characters according to Singh and Chaudhary (1979) at 4, 8, 12, 16, 20, 24 and 28 weeks after sowing to assert their degree of association. GenStat was used.

III. RESULTS

Number of Leaves per Plant

Data on correlation coefficients of number of leaves and yield characters are presented in Table 1. There were positive and highly significant correlations between number of leaves and all the yield characters of castor bean at 8 to 28 WAS, except correlations between number of leaves and capsules per plant which were positive but not significant. Number of leaves was an important determiner of the yield characters evaluated at 8 to 28WAS.

Length of Internodes per Plant

Correlation coefficients of length of internodes per plant and yield characters are summarized in Table 2. Positive and highly significant correlations were obtained between length of internodes and panicles per plant at 4 to 28 WAS; length of internodes and capsules per plant at 4 WAS to 24 WAS; length of internodes and capsules per panicle at 20 and 24 WAS; length of internodes and seeds per plant at 4 to 24 WAS; length of internodes and dry weight of harvestable material at 4 to 28 WAS. Correlations between length of internodes and total dry weight per plant at 12 to 24 WAS; length of internodes and harvest index at 4 to 28 WAS; length of internodes and seed yield at 12 to 28 WAS; length of internodes and 100 seed weight at 12 to 24 WAS; length of internodes and oil yield at 12 to 28 WAS were also positive and highly significant. Therefore, length of internodes importantly determined yield characters at these growth stages.

Number of Internodes per Plant

Table 3 shows that correlations between number of internodes and panicles per plant at 4, 20 and 24 WAS, were positive and highly significant. At 20 and 28 WAS, positive and highly significant correlations between number of internodes and capsules per plant were observed. Number of internodes positively and significantly correlated with capsules per panicle, seeds per plant, dry weight of harvestable material, total dry weight per plant, harvest index and 100 seed weight at 4, 20 and 24 WAS. Correlations between number of internodes and seed yield at 4 and 20 WAS; number of internodes and oil yield at 4 WAS were also positive and highly significant. Number of

internodes was an important determiner of yield characters at 4, 20 and 24WAS.

Leaf Area Index

Results on correlations between leaf area index (LAI) and yield characters are presented in Table 4. Correlations between leaf area index and other yield characters at 8 to 28 WAS were positive and highly significant, except correlations between leaf area index and capsules per plant at 8, 12 and 28 WAS; leaf area index and total dry weight per plant at 8 and 28 WAS; leaf area index and 100 seed weight at 12 and 28 WAS which were positive and significant. This implies that leaf area index importantly determined the yield characters it positively and significantly correlated.

Net Assimilation Rate

Table 5 presents results of correlations between net assimilation rate and yield characters. Net assimilation rate was positively correlated with panicles per plant at 4 to 28 WAS; capsules per plant at 12 to 28 WAS; seeds per plant at 4 to 28 WAS except at 8 WAS; dry weight of harvestable material at 12 to 28 WAS; total dry weight per plant at 8 to 28 WAS and these correlations were highly significant.

Harvest index and seed yield were positively correlated with net assimilation rate at 12 to 28 WAS which were also highly significant. Correlations between 100 seed weight and net assimilation rate at 12 to 20 WAS; oil yield and net assimilation rate at 4 to 16 WAS produced positive and highly significant results. These results showed that, net assimilation rate was also an important determiner of yield characters of castor bean.

Absolute Growth Rate

Correlation results between absolute growth rate (AGR) and yield characters are summarized in Table 6. Correlations between capsules per plant, seeds per plant, dry weight of harvestable material, total dry weight per plant, harvest index, seed yield, 100 seed weight and absolute growth rate at 4 to 28 WAS were positive and highly significant. At 8 WAS, capsules per panicle did not significantly correlate with absolute growth rate. Oil yield positively correlated with absolute growth rate at 4 to 28 WAS and these correlations were highly significant except at 24 WAS. Thus, absolute growth rate determined the yield characters evaluated in this study.

Plant Height

Table 7 shows correlation coefficients for correlations between plant height and yield characters. There were positive

and highly significant correlations between plant height and all the yield characters at most of the growth stages between 4 and 28 WAS. Correlations between capsules per panicle, oil yield and plant height at 28 WAS were not significant, but positive. These results proved plant height to be an important determiner of the yield character.

IV. DISCUSSION

Growth, development and yield of crop plants, together with factors affecting them, occupy a position of primary importance in crop production. Growth and yield are physiologically correlated. Growth characters are functions of dry weight increase or dry matter production per unit time. The dry matter produced (assimilates) were translocated and partitioned to various plant organs (yield characters). The physiological interrelationship or association between growth and yield is evident in the highly positive correlations observed between growth characters and yield characters in this study. Generally, growth according to Hunt (1978) is an irreversible increase in size with quantitative attributes while yield is the net photosynthetic produce or the dry weight of the end product of growth and development and also has quantitative attributes.

Hudson (1984) reported that growth, development and yield of crops are products of interplay between its genetic constitution and the environment. While the genetic make up of a crop is a fixed entity that delimits the extent to which that crop can develop and yield, the actual performance of the crop is regulated by the environment in which it grows.

V. CONCLUSION

Generally, correlation takes place between two types of variables viz: dependent and fixed. Yield of crops depends on the nature and magnitude of growth that has been made. Growth characters are fixed variables while yield characters are dependent variables. The positive nature of these correlations indicates that any decrease or increase in the growth made will translate into proportional decrease or increase in the yield.

Based on results of this study, the selected growth characters correlated positively with yield characters at 4 to 28 WAS, and these correlations were highly significant. This implies that there was high degree of association between the growth and yield characters evaluated. All the growth characters evaluated were therefore important determiners of the yield characters which they positively correlated in this study.

Table 1: Correlations Between Number of Leaves Per Plant and Yield Characters of Castor Bean at Different Times of Sampling in 2006 and 2008 (Combined Data).

Treatments	Weeks After Sowing					
	Week 8	Week 12	Week 16	Week 20	Week 24	Week 28
Panicle per plant	.418**	.554**	.551**	.560**	.571**	.592**
Capsules per plant	.146	.335**	.326**	.352**	.364**	.396**
Capsules per panicle	.530**	.489**	.501**	.498**	.590**	.485*
Seeds per plant	.179**	.365**	.357**	.383**	.395**	.420**
Dry weight of harvestable material	.337**	.386**	.406**	.399**	.400**	.417**
Total dry weight per plant	.459**	.444**	.460**	.455**	.456**	.446**
Harvest Index	.280**	.345**	.362**	.366**	.364**	.388**
Seed yield	.257**	.356**	.349**	.346**	.345**	.367**
100 seed weight	.376**	.401**	.403**	.408**	.371**	.377**
Oil yield	.582**	.554**	.536**	.539**	.536**	.538**

* Significant at P = 0.05

** Significant at P = 0.01

Table2. Correlations Between Length of Internodes Per Plant and Yield Characters of Castor Bean at Different Times of Sampling in 2006 and 2008 (Combined Data).

Treatments	Weeks After Sowing						
	Week_4	Week_8	Week_12	Week_16	Week_20	Week_24	Week_28
Panicle per plant	.534**	.522**	.599**	.657**	.688**	.721**	.499**
Capsules per plant	.661**	.661**	.644**	.629**	.402**	.598**	.263*
Capsules per panicle	.041	.099	.236*	.298*	.289**	.425**	.170
Seeds per plant	.681**	.683**	.669**	.641**	.414**	.618**	.277*
Dry weight of harvestable Material	.396**	.387**	.574**	.722**	.590**	.704**	.347**
Total dry weight per plant	.275*	.278*	.462**	.604**	.523**	.621**	.262*
Harvest Index	.373**	.360**	.555**	.700**	.582**	.682**	.364**
Seed Yield	.225	.222	.405**	.589**	.559**	.659**	.361**
100 Seed weight	.012	.027	.304**	.426**	.474**	.442**	.302*
Oil Yield	.204	.247*	.335**	.288**	.505**	.421**	.457**

* Significant at P = 0.05

** Significant at P = 0.0

Table 3. Correlations Between Number of Internodes Per Plant and Yield Characters of Castor Bean at Different Times of Sampling in 2006 and 2008(Combined Data).

Treatments	Weeks After Sowing						
	Week_4	Week_8	Week_12	Week_16	Week_20	Week_24	Week_28
Panicle per plant	.335**	.055	.125	.158	.398**	.351**	.234*
Capsules per plant	.421**	.259**	.241*	.158	.346**	.251**	.128
Capsules per panicle	.162**	.264*	.254*	.181	.370**	.347**	.185
Seeds per plant	.425**	.261*	.264*	.198	.361**	.284**	.155
Dry weight of harvestable material	.552**	.017*	.075	.090	.379**	.175**	.023
Total dry weight per plant	.358**	.033	.041	.052	.357**	.203**	.040
Harvest index	.514**	.048	.023	.064	.353**	.158**	.008
Seed yield	.429**	.000	.032	.051	.396**	.302*	.173
100 seed weight	.223**	.045	.063*	.100	.307**	.315**	.222
Oil yield	.061**	.079	.071	.052	.040	.169	.239*

* Significant at P = 0.05

** Significant at P = 0.01

Table 4. Correlations Between Leaf Area Index Per Plant And Yield Characters of Castor Bean at Different Times of Sampling in 2006 and 2008 (Combined Data).

Treatments	Weeks After Sowing					
	Week_8	Week_12	Week_16	Week_20	Week_24	Week_28
Panicle per plant	.528**	.739**	.634**	.675**	.650**	.447**
Capsules per plant	.327**	.507**	.326**	.555**	.548**	.508**
Capsules per panicle	.225	.182*	.449**	.339**	.151**	.230
Seeds per plant	.333**	.509**	.353**	.584**	.575**	.535**
Dry weight of harvestable Material	.485**	.602**	.616**	.751**	.478**	.480**
Total dry weight per plant	.392*	.431**	.685**	.632**	.304**	.327*
Harvest index	.482**	.590**	.575**	.721**	.492**	.476**
Seed yield	.571**	.590**	.449**	.582**	.458**	.372**
100 seed weight	.347**	.157	.334**	.375**	.113**	.197*
Oil yield	.421**	.447**	.313**	.389**	.413**	.421**

* Significant at P = 0.05

** Significant at P = 0.01

Table 5. Correlations Between Net Assimilation Rate (G/M²/Day) Per Plant and Yield Characters of Castor Bean at Different Times of Sampling in 2006 and 2008(Combined Data).

Treatments	Weeks After Sowing						
	Week_4	Week_8	Week_12	Week_16	Week_20	Week_24	Week_28
Panicle per plant	.520**	.389**	.735**	.594**	.467**	.466**	.403**
Capsules per plant	.255*	.175	.561**	.380**	.470**	.644**	.311**
Capsules per panicle	.270*	.287*	.245*	.252*	.176	.001	.210
Seeds per plant	.256**	.176	.568**	.389**	.489**	.646**	.350**
Dry weight of harvestable Material	.100	.073	.616**	.415**	.486**	.512**	.373**
Total dry weight per plant	.064	.050**	.468**	.319**	.355**	.332**	.279*
Harvest Index	.078	.053	.606**	.399**	.455**	.480**	.379**
Seed Yield	.295*	.301*	.559**	.465**	.463**	.487**	.387**
100 Seed weight	.171	.079	.316**	.314**	.390**	.203	.292*
Oil Yield	.515**	.552**	.462**	.589**	.215	.136	.215

* Significant at P = 0.05

** Significant at P = 0.01

Table 6. Correlations Between Absolute Growth Rate (G/M²/Day) Per Plant and Yield Characters of Castor Bean at Different Times of Sampling in 2006 and 2008 (Combined Data).

Treatments	Weeks After Sowing						
	Week_4	Week_8	Week_12	Week_16	Week_20	Week_24	Week_28
Panicle per plant	.276*	.156	.413**	.440**	.340**	.304**	.373**
Capsules per plant	.428**	.321**	.522**	.555**	.408**	.449**	.431**
Capsules per panicle	.270*	.162	.303**	.293*	.296*	.345**	.337**
Seeds per Plant	.423**	.316**	.514**	.548**	.405**	.441**	.418**
Dry weight of harvestable Material	.548**	.372**	.602**	.633**	.511**	.446**	.398**
Total dry weight per plant	.649**	.457**	.683**	.837**	.636**	.553**	.586**
Harvest Index	.480**	.322**	.521**	.524**	.430**	.374**	.309**
Seed Yield	.709**	.548**	.665**	.748**	.514**	.478**	.514**
100 Seed weight	.816**	.710**	.672**	.615**	.522**	.526	.637**
Oil Yield	.345**	.373**	.418**	.358**	.354**	.304	.389**

* Significant at P = 0.05

** Significant at P = 0.01

Table 7. Correlations Between Plant Height (Cm) and Yield Characters of Castor Bean at Different Times of Sampling in 2006 and 2008 (Combined Data).

Weeks After Sowing	Treatments	Week_4	Week_8	Week_12	Week_16	Week_20	Week_24	Week_28
	Panicle per plant	.606*	.603**	.618**	.518**	.518**	.590**	.152
	Capsules per plant	.515**	.511**	.496**	.219**	.451**	.479**	.406**
	Capsules per panicle	.203*	.261*	.398**	.507*	.377**	.460**	.073
	Seeds per plant	.532**	.528**	.529**	.243**	.472**	.508**	.416**
	Dry weight of harvestable Material	.774**	.782**	.654**	.324**	.668**	.659**	.449**
	Total dry weight per plant	.649**	.710**	.633**	.411**	.642**	.663**	.268*
	Harvest Index	.749**	.751**	.627**	.299**	.637**	.623**	.483**
	Seed Yield	.624*	.595**	.522**	.368**	.561**	.533**	.460**
	100 Seed weight	.302*	.342**	.361**	.373**	.512**	.489**	.256*
	Oil Yield	.159**	.195**	.295**	.533**	.259**	.287*	.039

* Significant at P = 0.05

** Significant at P = 0.01

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Mechanical Testing of Hybrid Composite Material (Sisal and Coir)

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Abstract- The global demand for wood as a building material is steadily growing, while the availability of this natural resource is diminishing. This situation has led to the development of alternative materials. Of the various synthetic materials that have been explored and advocated, polymer composites claim a major participation as building materials. There has been a growing interest in utilizing natural fibres as reinforcement in polymer composite for making low cost construction materials in recent years. Natural fibres are prospective reinforcing materials and their use until now has been more traditional than technical. Among this paper concern Evaluation of mechanical properties such as tensile strength, flexural strength and impact strength for different fibre length and fibre volume fraction Specimen1 [3mm] Sisal (25%) - coir (15%), Specimen 2 [3mm] Sisal (20%) - coir (20%), Specimen 3[5mm] Sisal (20%) - coir (20%). Sisal and coir fibers used as reinforcement materials with matrix of Epoxy resin to manufacturing of composite plate by hand lay-up process and cut into that as per ASTM for testing the materials.

Index Terms- fiber, sisal, coir, tensile, flexural, impact

I. INTRODUCTION

Natural fibres are economical less weight and environmentally superior alternatives to synthetic fibres. The specific properties of the natural fibre composites were in some cases better than synthetic fibres. This suggests that natural fibre composites have a potential to replace in many applications like automobile and aircraft industry. The artificial fibres possess twice the weight of natural fibres and more cost, cause damage to human beings and energy for extraction is more compared to natural fibres. In this connection the sisal and coir fibre are a natural fibre that used to prepare the reinforced composite with suitable matrix of Epoxy. The composites are prepared by various fibre length and volume fraction. The mechanical properties are analyzed and find the optimum fibre parameter.

II. METHODOLOGY

- To find out the new class of less-weight material for automotive and house holding applications (sisal and coir)
- Fabrication of sisal and coir fibre reinforced polymer based composites.
- Evaluation of mechanical properties such as tensile strength and modulus flexural strength and modulus,

compressive strength, machining parameters for different fibre volume length and fibre volume fraction.

- Besides the above objectives is to develop new class of composite by incorporating fibre reinforcing phases into a polymeric resin.

III. MOULD PREPARATION

For the sample preparation the first and foremost step is the preparation of the mould which ensures the dimension of 300×300×30 mm the composite to be prepared. We have to prepare moulds for the preparation of 20% sisal and 20% coir and another 25% sisal and 15% coir fibre of the composite having 3mm and 5mm fibre length. A clean smooth surfaced wooden board is taken and washed thoroughly. The Steel plate (as shown in figure 3.1) was covered with a mould release sheet



Figure 3.1 Moulds for Making Composite Plates

3.1 SISAL AND COIR CHOPPED FIBRE REINFORCED COMPOSITE

In this Reinforced composite the different volume fraction of composite plate such as 20% of sisal and 20% of coir as shown in Figure 3.2 (a) and 25% of sisal and 15% of coir as shown in Figure 3.2 (b) in 3mm fibre length and the same proportion is carried with 5mm fibre length as shown in Figure 3.2 (c) and Figure 3.2 (d) Calculated the amount of epoxy resin and hardener (ratio of 4:1 by weight) was thoroughly mixed with gentle stirring to minimize air entrapment. For quick and easy removal of composite sheets, mould release sheet was put over and below the mould cavity and wax was applied at the inner surface of the mould. After keeping the mould on a glass sheet a thin layer (≈ 1 mm thickness) of and matrix (4:1) were poured into the mould. The bundles of short continuous fibres were arranged random direction into the mould. Then again the matrix was poured above the fibres and care was taken to avoid formation of air bubbles. Pressure was then applied from the top and the mould was allowed to cure at room temperature for 24 hrs. After 24 hrs the samples were taken out of the mould, cut

into different sizes as per the ASTM D standards and kept in air tight container for further experimentation.



Fig 3.2.1(a)



Fig 3.2.1(b)

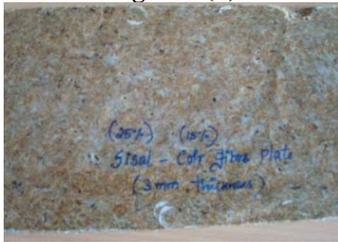


Fig 3.2.1(c)



Fig 3.2.1(d)

IV. MECHANICAL TESTING

After fabrication the test specimens were subjected to various mechanical tests as per ASTM standards. The mechanical tests that we carried out are tensile test, impact test and flexural test. The specimen size and shape for corresponding tests are as shown in table 4.1

Sl.no	Test	ASTM Standard	Specimen size (mm)
1	Tensile test	D638-03	250 X 25 X 3
2	Flexural properties	D790	154 X 13 X 3

3	Impact testing	D256	64 X 12.7 X 3
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Table 4.1 ASTM Standard for Specimen Preparation

4.1 TENSILE TEST

After the fibres reinforced composite was dried, it was cut using a saw cutter to get the dimension of specimen for mechanical testing. The tensile test specimen was prepared (Figure 4.1.1 and 4.1.2) according to ASTM D3039; the most common specimen for ASTM D3039 has a constant rectangular cross section, 25 mm (1 in) wide and 250 mm (10 in) long. The specimen was mounted in the grips of the Instron universal tester with 10 mm gauge length. The stress strain curve was plotted during the test for the determination of ultimate tensile strength and elastic modulus. All the test results were taken from the average of two tests.



Figure 4.1.1 Specimen plate with 25% of sisal and 15% of coir



Figure 4.1.2 Specimen plate with 20% of sisal and 20% of coir

4.2 FLEXURAL TEST

Flexural test were using the 3-point bending method according to ASTM D7264. Flexural test was conducted to study the behavior and ability of material under bending load. The load was applied to the specimen until it is totally break. The flexural test was conducted for different types of fibres length and volume fractions of composite (as shown in figure 4.2.1).



Figure 4.2.1 Specimen for flexural test

4.3 IMPACT TEST

Impact is a single point test that measures a materials resistance to impact from a swinging pendulum. Impact is defined as the kinetic energy needed to initiate fracture and continue the fracture until the specimen is broken. This test can be used as a quick and easy quality control check to determine if a material meets specific impact properties or to compare materials for general toughness. The standard specimen for ASTM is 64 x 12.7 x 3 mm .The most common specimen thickness is 3 mm, because it is not as likely to bend or crush (as shown in figure 4.3.1)



Figure 4.3.1 Specimen for impact test

V. RESULTS AND DISCUSSION

5.1 TENSILE TEST RESULTS

Tensile test was carried out the sisal and coir reinforced hybrid fibre epoxy composites by applying tensile load on the specimen which was mounted in an Electronic Tensometer as shown in figure 5.1(a). The test was conducted by varying the volume fraction of the composite. A set of twenty five readings were from the volume fraction of composites and the average values were obtained. The Table 5.1 shows parameters were observed at the time tensile testing of composite.

- i) Maximum stress (N/mm²)
- ii) Maximum strain
- iii) Maximum load (N)
- iv) Maximum displacement (mm)



Figure 5.1(a) Specimen in Tensometer



Figure 5.1(b) Tested Tensile Specimen

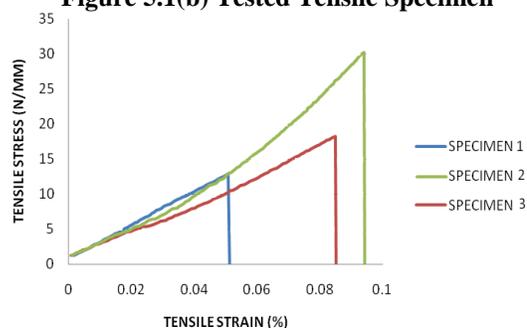


Figure 5.2 Graph Showing Tensile Stress Versus Tensile Strain

Material	Maximum Stress (N/mm ²)	Maximum Strain	Maximum Load (N)	Maximum Displacement (mm)
Specimen1 [3mm] Sisal (25%) - coir (15%)	13.20	0.0536	676.48	2.986
Specimen 2 [3mm] Sisal (20%) - coir (20%)	30.00	0.0965	1610.28	5.812
Specimen 3 [5mm] Sisal (20%) - coir (20%)	19.30	0.0825	935.00	4.782

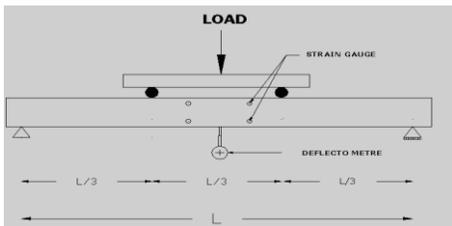
Table 5.1 Tensile properties of Sisal fibre reinforced composites

The random directional alkali treated 20% of sisal and 20% of coir with 3mm fibre length has higher tensile strength compared than other volume fraction of sisal and coir fibre with different fibre length and also untreated composite fibre. The random directional alkali treated composite is increased by 25.08%. Here we carried on alkali treatment of 5% NaOH.

5.2 FLEXURAL TEST RESULT

Flexural properties such as flexural strength and modulus are determined by ASTM Test method D790. In this test composite beam specimen of rectangular cross section is loaded in three-point bending mode. We calculated for three specimens as shown in figure 5.4 In that specimen had a highest breaking load point compared with others it has a higher strength. It will illustrated in the Table 5.2. Tests were carried out at room temperature and as per the Indian standards. Structural properties are ascertained by conducting middle third loading test. The testing arrangement is shown in Fig.5.2.1. Four point bending was applied on reinforced concrete beams of beam span 1.8 m through hydraulic jack of capacity 100kN. The specimens were placed on a simply supported arrangement of 100 T Loading frame. The beams were suitably instrumented for measuring deflections at several locations including the midspan deflection with dial gauges and LVDTs. To avoid the excessive deformation at the support locations, additional dial gauges 45 were placed at the top and bottom faces of ends. DEMEC (Demondable mechanical strain gauge) was used to measure the concrete strain readings at top as well as the bottom fibre on mid section of the beam.

Fig. 5.2.1 For a rectangular sample under a load in a three-



point bending setup

$$\sigma = \frac{3FL}{2bd^2}$$

- *F* is the load (force) at the fracture point
- *L* is the length of the support span
- *b* is width
- *d* is thickness

Material	Ultimate Breaking load (N)	Actual deflection (mm)	Flexural Strength (Mpa)	Flexural Strength (Mpa)
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Specimen 1	68.67	10.7	81.705	22.25
Specimen 2	83.38	10.56	92.599	36.26
Specimen 3	73.57	7.06	87.158	27.68

Table 5.2 Flexural Test Result

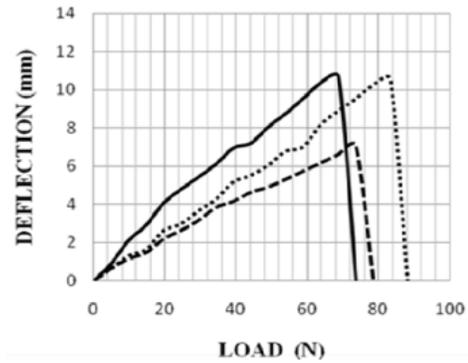


Figure 5.2.2 Graph showing Flexural Load Vs Deflection Graph

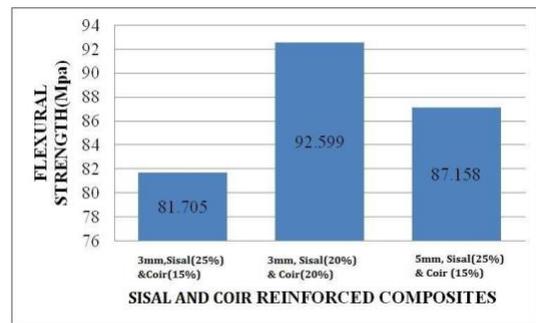


Figure 5.2.3 Graph showing Flexural Strength Graph

The random directional alkali treated 20% of sisal and 20% of coir with 3mm fibre length has higher flexural strength compared than other volume fraction of sisal and coir fibre with different fibre length and also untreated composite fibre. The random directional alkali treated composite is increased by approximately 10%. This indicates the maximum bending strength available in that composite.

5.3 IMPACT TEST RESULT

Izod impact test are performed on commercially available machines in which a pendulum hammer is released from a suitable height to contact beam specimen with a kinetic energy. Whereas vertical cantilever beam specimen is used in the Izod test.

The energy absorbed in the breaking specimen. Usually indicated by the position of a pointer on a calibrated dial attached to the testing machine equal to the difference between the energy of the pendulum hammer at the instant of impacting that three ratios of specimen 40%wt of sisal and coir fibre obtained the withstanding capacity of 6.8 joules compared with others it is high as shown in figure 5.3(a) and 5.3(b)

(A) FORMULA USED

Impact strength = [(Energy absorbed) / (Area of the cross section)] KJ/cm²

(B) SPECIFICATION OF THE COMPOSITE SPECIMEN

- Length of the bar = 64mm
- Breadth of the bar = 12.7mm
- Thickness of the bar = 3.2 mm
- Area of the cross section of bar = 40.64 mm²



Figure 5.3(a) Specimen after Impact Test

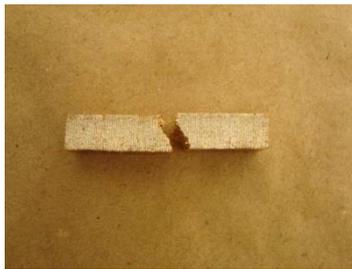


Figure 5.3(b) Specimen after Impact Test

Sl.no	Material	Energy absorbed force (a) KJ	Energy spend to break the specimen (b) KJ	Energy absorbed by the specimen (a-b) KJ	Impact strength KJ/cm ²
1	Specimen 1	16	14.8	1.2	2.95
2	Specimen 2	16	14.2	1.8	4.42
3	Specimen 3	16	14.6	1.4	3.44

Table 5.3 Impact Test Result

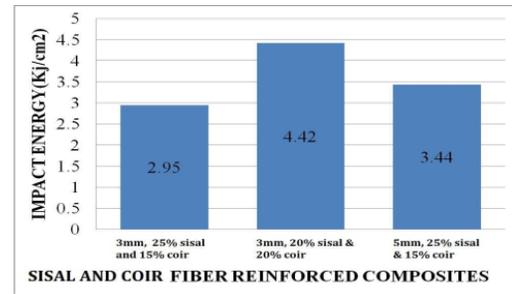


Figure 5.3(c) Graph showing Impact Strength Graph

The random directional alkali treated 20% of sisal and 20% of coir with 3mm fibre length has higher impact strength compared than other volume fraction of sisal and coir fibre with different fibre length and also untreated composite fibre. The random directional alkali treated composite is increased by approximately 32%. This indicates the maximum energy absorbed at the time of load acting and withstands the maximum possible strength available in that composite.

VI. CONCLUSION

The mechanical properties of sisal and coir natural fibre composites were prepared by epoxy resin matrix. The composite were prepared with different volume fractions. The following conclusions are made from the results and discussion.

- The tensile strength of the discontinuous fibre composite is higher at 20% sisal and 20% coir having 3mm fibre length of composites.
- The tensile strength of the random directional composite higher at 20% sisal and 20% coir having 3mm fibre length, the maximum strength was obtained at 5% NaOH alkali treatment.
- The flexural strength & impact strength of the composite is higher at 20% sisal and 20% coir having 3mm fibre length of composites and their modulus also.

It has been found that at the 20% sisal and 20% coir having 3mm fibre length in a composite produce optimum tensile strength and modulus, flexural strength and modulus and also impact strength. Mechanical properties of the composite depend upon the fibre volume fraction of the composite.

The results obtained from this study conclude that 20% sisal and 20% coir having 3mm fibre length is suitable for light weight and low load applications. Composite properties further improved by fibre surface treatment, which enhances adhesion between fibre and matrix.

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Earthworm's gut as reactor in vermicomposting process: A mini review

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Abstract- This review investigates earthworms as reactors towards the development of designer earthworms for the decomposition of complex polymeric structures. Unit operation aspects pertaining to vermicomposting is least addressed or cited in literature, while a lack of models employing worms as composting agents recognizable as biological reactors is quite apparent. The process of isolation of complex macromolecular structures such as protein is also cumbersome and presents inaccuracies. This could be done by studying the effect of various feed sources in different ratios based on the adherence to reactor kinetics and vermicast nutrient compositions. Experimental data would reveal if reactor kinetics are applicable to the earthworms by assessing effect of various food sources and food source mixes at various ratios on vermicast nutrient compositions. Outcome will include extension of reactor kinetics in predicting vermicompostability, which is potentially beneficial to botanists, agriculturalists, environmentalists and biologists by reducing research time and increasing research success rates via relationships derived.

Index Terms- reactor, earthworm gut, vermicomposting, vermicast

I. INTRODUCTION

Vermicomposting is defined as a bio-oxidative process in which detritivorous earthworms interact with microorganisms and other fauna within the decomposer community, accelerating the stabilisation of organic matter and greatly modifying its physical and biochemical properties [1]. Vermitechnology refers to methods, processes and designs that relate to vermicomposting. It's an anaerobic process of organic materials which involves wastes, microbes, moisture, oxygen and many environmental factors. When the moisture content and oxygen concentration are brought to a suitable level, microbial activity increases. In addition to oxygen and water, microorganisms require a source of carbon, macronutrients such as N, P, and K, micronutrients, and certain amounts of trace elements for their normal growth and reproduction. These requirements are provided by the organic waste materials. By using the organic matter as a food source the microorganisms reproduce rapidly and release carbon dioxide, water, some organic products, and energy. Some of this energy produced is consumed during the metabolism processes with the remainder released as heat. Although microorganisms are responsible for the biochemical degradation of organic matter in the vermicomposting process, earthworms are important in conditioning the substrate and promoting microbial activity.

Generally, the unit operation aspect pertaining to the technology is least addressed or cited in literature, while a lack of models employing worms as composting agents recognizable as biological reactors is quite apparent. Difficulties in extracting proteins from substrates poses yet another constraint to researchers who intend to study the effects of various forms of these macromolecular structures and their effect on vermicomposting or absorption potentials in worm cast. Most studies on composting using earthworms are typically small-scaled, with reactors centered on containers that contain suitable beddings (mostly waste mixtures) and [2]. Organic wastes from sewage sludge, paper industry waste, urban residues, food and animal waste, and horticultural residues from cultivars have been successfully managed by vermicomposting producing vermicomposts that contain nutrients that are readily taken by plants [1]. The emphasis is rarely on the worm as a reactor. Earthworms are considered as natural reactors since they redesign the physical structure of the soil environment by ingesting litter and soil particles by depositing casts on the soil surface [3]. The benefits of earthworm usage to aid composting are many; their activity determine and are a consequence of soil or substrate characteristics, formation and development via physical, chemical and biological effects [4], [5]. Their casts have tremendous potential and applications, including as ruminant feed modifiers [6] and fish pond fertilizers [7].

Earthworms are capable of disengaging barriers that conventionally immobilize organic matter, including complex proteins and phenolics [5]; they further stimulate and increase biological activity by fragmentation and ingestion of organic matter; this increases the surface area exposed to microorganisms [5]. Lack of understanding of digestive kinetics may, however, lead to poor cast management which result in adverse effects; earthworms have been shown to drive greenhouse gasses via vermicasts, particularly nitrous oxide (N₂O) [8]. Therefore, a thorough comprehension of the worm itself as a reactor and aspects pertaining to the kinetics need addressing to properly assess their effectiveness. The quality of ingested of food, that may include leaf litter, manure, soil organic matter, live or dead roots and root exudates, leachates, organisms, etc., together with various biotic and abiotic factors, affect earthworms and will ascertain the structure of earthworm communities and media they inhabit [5]. The passage of food resources, or substrates, through the worm gut is an important consideration. This involves mechanical action and begins with the process of

ingestion at the anterior end, followed by its conveyance via the worm gut right on to the posterior end. The process consummates with egestion of worm-casts, and involves the secretion of various enzymes and mucus within the worm gut and the decomposition and digestion of ingested substrates either directly or with the aid of either resident or ingested microorganisms, [9], [10], [5].

II. CHEMICAL REACTORS AND ITS TYPES

Chemical reactors, which are the containers in which chemical reactions occur, are chiefly characterized by (a) the time variation of the reactant input and (b) the mixing pattern of reactants within the reactor. Based on the time variation of the reactant input, reactors can be classified as batch, semi-batch or continuous-flow types. Continuous-Flow Reactors can further be classified into Continuous Stirred-Tank Reactors and Plug-flow Reactors based on the mixing pattern of the reactants within the reactor [11]. In a Batch reactor, reactants are processed in batches and the contents are perfectly mixed. The concentration of any reactant is spatially uniform but changes with time. This process produces high conversions (digestibilities) if the reactant is left in the reactor for long periods of time. But, because the production process is discontinuous and an idle period exists between each batch processing, the overall efficiency is low. In Continuous-Stirred Tank Reactor (CSTR), reactants are continuously introduced and the products and unreacted reactants continuously removed. The contents are perfectly mixed. The concentration of any reactant does not vary either in space or time. Conversion rate is the lowest among the flow reactors. But, in a Plug-flow Reactor (PFR), the reactants are continuously introduced and the products and unreacted reactants continuously removed. There is no mixing of the contents in the axial direction through the reactor. The concentration of any reactant changes in both space and time. Conversion rate is the highest among all the flow reactors.

III. MODELLING ANIMAL GUT AS REACTOR

Chemical reactor models of the digestive system and its components have provided an important framework to quantitatively study physiological processes involved in food processing. Penry and Jumars [12] have presented elaborate reaction kinetics, mass balance and rate equations by assuming animal guts to be either one of three reactor types; batch reactor, PFR or continuous-flow stirred-tank reactor (CFSTR). Accordingly, the gut should function as a plug-flow reactor when dealing solely with regular digestion kinetics catalyzed by enzymes secreted by the animal. Microorganism mediated fermentation or decomposition in animals, coupled with reasonably short throughput time indicate a CSTR/PFR series in gut behaviour. Later researches [13] indicated that tubular guts are morphological expressions of plug flow, and are common among deposit feeders, allowing relatively rapid ingestion rates and short throughput times. Reactor design models can be successfully employed to model the guts of variety of animals. According to Horn & Messer [13], Stomach of an animal can be predicted as a batch or CSTR, the intestine as a PFR and hindgut caecum as a CSTR. Tubular guts predominate among multicellular animals and the flow of digesta through tubular guts can be described quite reasonable by the PFR model. Gut reactor models are more successful than compartmental models in describing the flow patterns of digesta. In modelling an animal gut as reactor, Gut architecture, gut capacity, intake level, diet composition, digesta passage rate and digestion rate (Operating variables) are all the factors affecting digestibility of materials [14]. Throughput time is the ratio of gut volume to volumetric throughput rate, conversion increases as gut volume increases relative to throughput time or as throughput time decreases relative to gut volume. Throughput rates are smaller in foregut fermenters (CSTR-PFR) than in hindgut fermenters (PFR-CSTR) of similar size. Large body size, longest throughput times and highest conversion efficiencies, foregut fermentation may be accomplished efficiently by PFR.

Digestion begins when the food is consumed. Carbohydrates, fats, and protein are broken down in parts of the gut into simpler compounds like sugars, alcohols and fatty acids, and amino acids. These can then be absorbed (or assimilated) across the gut wall into the animal's circulatory system where they are distributed to the organism's energy budget to carry out basic organism activities: maintenance and respiration, reproduction, growth or production, and storage. In most of the organisms, Carbon (C), Phosphorous (P) and Nitrogen (N) are the vital nutrients which affect growth, metabolism and the maintenance of homeostasis. These nutrients represents as an index of food quality. An elemental approach can also complement an experimental program where basic chemical elements (C, N, and P) of the food, the organism, and the egesta can be measured. J.D. Logan *et al* [15] showed how modulation works in three nutrient (C, N and P) systems and developed a model that controls consumer homeostasis through dynamic differential assimilation. A static, two nutrient (C and P) case was studied by Sterner R.W [16] and Frost *et al* [17]. Woods H.A and Kingsolver J.G [18] developed a chemical reactor model of the caterpillar midgut, and used the model as a framework for generating hypotheses about the relationship between feeding responses to variable protein and the physical and biochemical events in the midgut and body. Application of such ideas to digestion processes in simple organism provides a quantitative framework for addressing many complex questions about digestion processes in both vertebrates and invertebrates up and down the complexity scale [19].

IV. EARTHWORM'S GUT

The activity of the earthworm gut is like miniature composting tube that mixes, conditions and inoculates the residues. Moisture, pH, enzymes and microbial populations in the gut are favorably maintained for a synergistic relationship, and then a terrific by-product.

When the organic materials pass through the earthworm gut, the resulting vermicast is rich in microbial activity, plant growth regulators and pest repellents [20]. Earthworm's gut is an effective tubular reactor, which maintains a suitable temperature through novel temperature regulatory mechanisms, thus accelerating the rates of the bioprocesses and preventing enzyme inactivation caused by high temperatures [21].

According to Edwards & Bohlen [22], the earthworm gut is a straight tube which extends from mouth to anus. The food enters through the mouth and gets sucked in by pharynx. Food particle moves to crop which acts as temporary storage and is mixed together. After leaving crop, partially mixed food particles enter gizzard where the actual digestive process begins. The powerful muscles of the gizzard churn and mix the mass of food and dirt. The mixture is reduced to a thick paste once the churning and mixture is complete. Glands in the walls of the gizzard add enzymes, which aid in the chemical breakdown of the organic material. The mixture is then sent to the intestine. The intestine has friendly bacteria that act on the food mixture. While the mixture is being eaten it releases various vitamins, minerals, carbohydrates, and proteins from the organic matter; this supply everything the worm needs in order to absorb it into its body. Most of the worm's body length is intestine. It is lined with thousands of finger-like projections that are filled with small blood vessels. The blood vessels help to absorb the liquefied food. Finally at the end of the intestine, the soil particles and undigested organic matter pass out of the worm's body through the anus. The waste is deposited in a form called a worm cast. The worm cast is mostly just ground up soil. By the time it comes out of the worm it has become enriched, acid neutralized, and revitalized.

V. EARTHWORM'S GUT ENZYMES

According to Lakshmi & Indira [21], Earthworms are physically aerators, crushers and mixers; chemically degraders and biologically stimulators in decomposer system. These worms have in-house supply of enzymes such as amylase, cellulose, nitrate reductase, acid and alkaline phosphatases. These enzymes degrade the complex biomolecules into simple compounds and responsible for the decomposition and humification of organic matter. These enzymes are active at a very narrow pH range and efficiently maintain the highly non-linear pH parameters. Amylase, cellulose, acid phosphatase, alkaline phosphatase and nitrate reductase were secreted in the gut of the earthworms due to the increased presence of microorganisms in it.

Cellulase activity is maximal in the posterior region of the gut of the worms supports the view that microorganisms present in the fore and mid gut might be helping in the partial digestion and processing of the complex plant remains which contains cellulose, xylan, manna, pectin etc [23]. Earthworm produces an enormous amount of intestinal mucus composed of gluco-proteins and small glucosidic and proteic molecules [20]. Naturally occurring plant-remains ingested by worms are very complex, consisting of starch, cellulose, xylan, galactine and protein substances. These complex organic molecules are digested through a mutualistic earthworm microflora-digestion system. Amylase, cellulose, xylanase, endoglucanase, cellobiase, acid phosphatase, alkaline phosphatase and nitrate reductase produced by jointly earthworms and gut microflora are supposed to play a central role in the process of digestion and humification of soil organic matter [21]. The intestine of earthworm contains microorganisms and gut enzymes. Similar to the occurrence of greater number of microbes in the gut of earthworms, the cast also contains more microorganisms [24].

VI. EARTHWORM'S GUT MICROFLORA

Enzymes are produced jointly by worms and gut microflora plays a central role in the process of digestion and humification of soil organic matter. The gut of earthworm is continuously exposed to numerous microorganisms ingested from the external environment [25]. The biochemical decomposition of organic matter is primarily accomplished by the microbes; however, earthworms are crucial drivers of the process by fragmenting and conditioning the substrate, and by increasing the surface area of organic matter available for microbial attack after comminution [26]. Essentially epigeic earthworms directly affect the decomposition of organic matter through gut-associated processes, via the effects of ingestion, digestion and casting [27], [28].

According to Sruthy *et al* [24], the gut of the earthworm constitutes a unique microenvironment in soils. Microorganisms constitute an important diet (Microbivorous). Qualitative and quantitative surveys of microbial flora of various earthworms are still warranted. It was observed that there are variations in the population of microorganisms in the foregut, midgut and hindgut of earthworm. The variation in the microbial populations in the earthworm gut may be because of their nutritional needs and digesting ability of the earthworms. The selective digestion of microbes in the gut influences the type of nutrients that are available for subsequent assimilation by both the earthworm and members of the gut microflora. The survival of microbes in the earthworm gut depends on their capacity to resist to digestive enzymes of microbial or earthworm origins, intestinal mucus, calcium carbonate or to bacteriostatic and microbial substances. The predominant microorganisms found in the foregut, midgut and hindgut were bacteria, actinomycetes and fungi. The bacteria in the foregut helps to digest the food particles, actinomycetes in the midgut helps to destroy the pathogens by antagonistic activity, and the fungi help to bind the waste particles as castings in the hindgut. The microbes entering the worm guts consume mucus, which mainly increase their activity, which in turn enables them to contribute enzymes to the digestive processes of the earthworms. These enzymes come with the ejected materials of earthworms. The increase in the counts of bacteria and yeasts along the gut of earthworm is due to increase in availability of nutrients in the gut [20]. An increasing appreciation of the synergistic

interactions between earthworm and microorganisms is observed [29]. Despite of the studies so far, the real existence of symbionts in the earthworm gut is still controversial [30]. However some other studies show some evidence of earthworm gut symbionts. It was found that some microorganisms in the earthworm intestine that are absent in the surrounding soil and important changes in the fatty acid concentration and composition in the gut of earthworm, *L. terrestris*.

VII. EARTHWORM'S GUT AS REACTOR

In treating the worm (tubular gut) as a reactor, various aspects require consideration, such as the rate of reactant passage via the worm gut, which invariably determines the type of reactor kinetics involved. Enzymatic kinetics need to be considered as well; this would enable the chance of determining the effectiveness of employing nitrogen content as a viable substitute for protein content, while relationship constants can be used to ascertain cast stability. Digestion in earthworm guts occur via metabolic pathways that involve enzymatic conversions of complex carbohydrates and proteins to intermediate products such as peptides, free amino acids and monosaccharide sugars [31]. Michaelis-Menten kinetics deal with the catalytic action of enzymes on substrates, with the assumptions that there is the formation of an enzyme-substrate complex, the complex attains rapid equilibrium with free enzyme and that the breakdown of the complex into products is the rate determining step [32]. The general scheme for the enzyme catalyzed reaction under steady state conditions results in the dual nature of the kinetic equation, i.e., the reaction rate exhibits both zeroth and first order dependence towards S. A plot of the initial reaction velocity against the concentration of S gives the characteristic rectangular hyperbola, with the maximum velocity asymptotically ascertained from the plateau range of the curve; the Lineweaver-Burk method plots reciprocals of the said variables [33]. For purposes of accuracy, linear transformations of the equation require to be tested as the velocity is subject to experimental error, although the substrate concentration can be controlled by the investigator [34].

CONCLUSION

Several researchers model animal guts as reactors, although not many discuss earthworms specifically [12], [13], [35]. To date, most studies dealing with the role of the earthworm species in waste management have focussed on the changes before and after vermicomposting [28], [36], [37], rather than those occur throughout the process. There is as yet research that correlates the earthworm gut to concepts of a Plug Flow Reactor (PFR). That is to say, we're not sure if fluids are completely mixed in any given cross section throughout the gut length, while contiguous cross sections or unit volumes do not exchange mass with each other in a worm, as with in PFR's. Research on various worm feed sources include biosolids [38], fruit and vegetable waste [39], newspaper and cafeteria waste [40], as well as dung [41] have not cited the effects of feed types on worm digestion kinetics or vermicast nutrient compositions. There is lack of research on the effects of various feed source mixes on the vermicast nutrient compositions as well.

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Table 1: Recent works considering animal guts as reactors

Year	Researchers	Animals
19867	Penry & Jumars	Deposit feeders. (e.g., Polychaete annelids). Mammalian foregut fermenters. (e.g., Kangaroos, cows, sheep). Hindgut fermenters. (e.g., Horses, rabbits).
1988	Carlson & Alice	Deposit feeders. (e.g., Vampire bat, Sea anemone, Starfish) Foregut fermenters. (e.g., Hippopotamus) Hindgut fermenters. (e.g., Koala bear, Manatee)
1989	Hume I.D	Mammalian Herbivores.
1990	Martinez del Rio et al	Nectar and fruit eating birds.
1992	Horn & Messer	Marine herbivorous fishes.
1993	Yuelong yang	Insect herbivore, Grasshopper.

1996	Simpson & Raubenheimer	Locust, Caterpillar.
1999	Woods H.A & J.G. Kingsolver	Caterpillars
2002	Hume I.D	Mammalian carnivores. (e.g., Dogs, Cats) Mammalian omnivore. (e.g., Rats) Mammalian foregut fermenters. (e.g., Sheep, Kangaroo) Hindgut fermenters. (e.g., Pony, Rabbit)
2005	Wolesensky & David Logan	Herbivore consumers, Grasshoppers.
2010	Rodney Van Bentum <i>et al</i>	Passage of food through animal stomach.

Source: [11], [12], [13], [19],[42], [43], [44], [45], [46], [47].

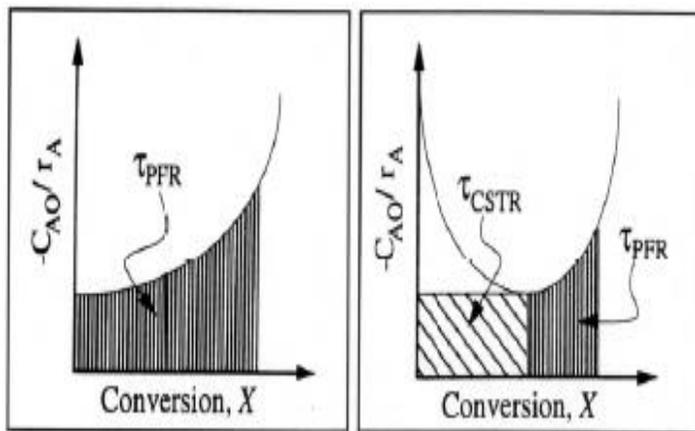


Fig 1: Graphical design equation for PFR and CSTR Source: [42]

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Performance Comparison of Ejector Expansion Refrigeration Cycle with Throttled Expansion Cycle Using R-170 as Refrigerant

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Abstract- Since long time, it has been noticed that refrigerators are the devices which work almost 365 days round the clock; hence objective of energy efficiency improvement attracts much. There are several ways of improving the performance of a vapor compression refrigeration cycle. Use of an ejector as expansion device is one of the alternative way. The advent of new component 'Ejector' into refrigeration system opened the new era of research. The vital component, which decides the effective operation of the ejector expansion refrigeration system, is the ejector. Hence, design of an ejector and analyses of its physical and operational parameters have drawn special attention. The thermodynamic analysis of natural refrigerant (R 170) based vapour compression refrigeration cycles is presented in this article using a constant pressure mixing ejector as an expansion device. Using ejector as an expansion device, R 170 yields a maximum COP improvement of 24.12 percent.

Index Terms- Coefficient of performance, Comparison, Ejector expansion cycle, R 170, Vapour compression cycle.

I. INTRODUCTION

The throttling device in a refrigeration system normally serves two purposes. One of the thermodynamics function is expanding the liquid refrigerant from the condenser pressure to the evaporator pressure. The other one is the control function which may involve the supply of the liquid to the evaporator at the rate at which it is evaporated. Irreversibility associated with throttling is major issue in vapour compression refrigeration cycle. There are different ways to reduce the throttling losses in the refrigeration cycles. Use of ejector as an expansion device by replacing the throttling valve in the conventional vapor compression refrigeration cycle is a promising alternative to reduce the throttling losses or the expansion irreversibility in the refrigeration. Because of its simple structure, ease of manufacturing, no moving parts, low cost and low maintenance requirements, the use of two- phase ejector has become an important cycle modification recently. Ejector reduces the compressor work by raising the suction pressure to a level higher than that of which in turn improves COP of the system. It also enables to reduce size of the evaporator.

In 1990, an analysis is performed by Kornhouser [1] on the Ejector Expansion refrigeration cycle to investigate the performance improvement on vapor compression refrigeration

(VCRC). Eight refrigerants were used, R11, R12, R113, R114, R500, R502, R22 and R717. According to this paper, refrigerant R502 has given the highest coefficient of performance improvement and the COP improvement using R12 was 21% over the basic cycle. In 1995, according to Domanski [2] the theoretical COP of the ejector-expansion refrigeration cycle was very much sensitive to the ejector efficiency. In 1998, Nakagawa and Takeuchi [3] research was concluding that the longer divergent part provides a longer period of time for the two-phase flow to achieve equilibrium. With this result, using longer length of the divergent part of the motive nozzle, higher motive nozzle efficiency was determined. In 2007, based on the second law of thermodynamics Yari and Siriousazar [4] worked on performance of transcritical CO₂ refrigeration cycle with ejector-expansion. They found ejector is improving the optimum second-law efficiency by 24.8% as compared to conventional system and 16% as compared to internal heat exchanger system. In 2007, an analysis is given by Deng et al. [5] on a transcritical CO₂ ejector-expansion refrigeration cycle that uses an ejector as the main expansion device instead of an expansion valve. He concluded for the given working conditions, the ejector was improving the maximum COP by 18.6% compared to the internal heat exchanger system and 22% compared to the conventional system. In 2007 according to simulation work by Nehdi et al. [6] on performance of the vapour compression cycle using ejector as an expander, it has been found that the geometric parameters of the ejector design have noticeable effects on the system performance. He achieved the maximum COP for Optimum geometric area ratio around 10. For the given operating conditions of evaporator temperature, 5°C and condenser temperature, 40 °C, In 2008, Yari, M. [7] conducted Exergetic analysis of the vapour compression refrigeration cycle using ejector as an expander, in this research the effects of evaporating temperature and condensing temperature on the COP, second law efficiency and exergy destruction in various component were calculated, and also summarized that the COP and second law efficiency of the ejector-compression is about 16% greater than that for the vapour compression cycle and total exergy destruction of the vapour compression cycle was about 24 % higher than that for the ejector-compression cycle. According to J Sarkar [8] - [9] research on the performance improvement with three natural refrigerants namely, ammonia, propane and isobutene, it has been determined that maximum performance improvement using ejector can be achieved in the case of isobutane, whereas ammonia giving minimum performance

improvement. In 2012, J Sarkar [10] provided a detailed literature review on two-phase ejectors and their applications in vapor compression refrigeration and heat pump systems. In this paper he described wide theory on characteristics of both subcritical and transcritical vapor compression systems with various cycle configurations.

II. DESCRIPTION OF THE SYSTEM

The layout of the ejector expansion vapour compression refrigeration cycle in figure 1 and the corresponding Pressure–Enthalpy diagram is shown in figure 2.

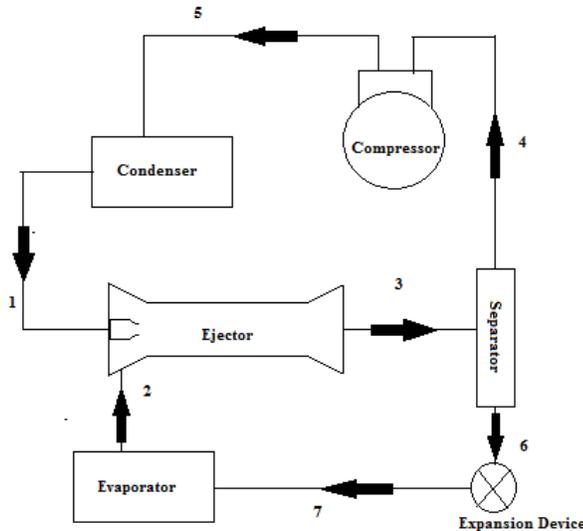


Figure1. Ejector Expansion Vapour Compression Refrigeration Cycle

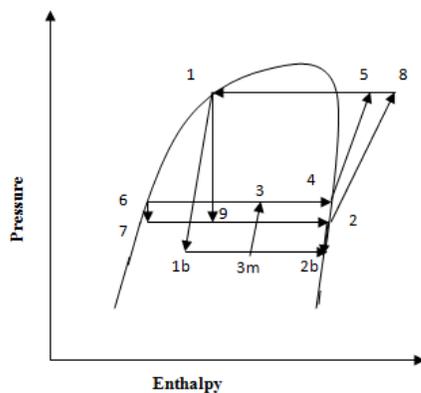


Figure2. Pressure Enthalpy Diagram

The primary flow from the condenser (state 1) and the secondary flow from the evaporator (state 2) are expanding through primary and secondary nozzles, respectively (1–1b and 2–2b) to mixing chamber pressure, mixing at constant pressure (1b, 2b–3m). The mixed flow is discharged through the diffuser (3m–3) of the ejector and then separated in forms of vapour (state 4) and liquid (state 6) so that this ratio matched with the inlet ratio of primary and secondary flows. Then the liquid circulates through the

expansion valve (6–7) and evaporator (7–2), whereas the vapour flows into the compressor (4–5) and the condenser (5–1). There are three ejector parameters, entrainment ratio (secondary mass flow to primary mass flow), PLR (diffuser exit pressure to secondary nozzle inlet pressure), and geometric area ratio (total nozzle exit area to primary nozzle exit area), which greatly affect the system performance.

III. ANALYSIS OF THE SYSTEM

The ejector expansion vapour compression refrigeration cycle has been modeled based on following conservation laws and equations:

- Conservation of mass,
- Conservation of momentum,
- Conservation of energy

The following assumptions have been used to simplify the theoretical model and set up the equations per unit total ejector flow,

1. The refrigerant will be at all times in thermodynamic quasi-equilibrium.
2. There is negligible Pressure Drop
3. No wall Friction.
4. Steady state one-dimensional model.
5. Thermodynamic processes in compressor, expansion valve and ejector area assumed to be adiabatic
6. No heat transfer with the surrounding for the system except in the condenser.
7. The flow across the throttle valve is isenthalpic.
8. The refrigerant condition at the evaporator outlet is saturated vapour and condenser outlet is saturated liquid.
9. The vapour condition from the separator is saturated vapour and the liquid coming from the separator is saturated liquid.

A. Nomenclature

A	cross-sectional area (m ²)
V	fluid velocity (m/s)
COP	coefficient of performance
h	specific enthalpy (kJ/kg)
P	pressure (kPa)
PLR	pressure lift ratio
qe	specific cooling effect (kJ/kg)
t	temperature (°C)
wc	specific work (kJ/kg)
x	vapour quality
η	isentropic efficiency
μ	entrainment ratio
Φ	ejector area ratio

B. Subscripts

B	basic cycle
c	compressor
ej	ejector

C. Equations

Using above assumptions, following equations are set up

$$h_1 = h_{1b} + V_{1b}^2/2 \quad (1)$$

$$h_2 = h_{2b} + V_{2b}^2/2 \quad (2)$$

Nozzle outlet enthalpies are given by

$$h_{1b} = h_1 - \eta_n [h_1 - h(P_{2b}, s_1)] \quad (3)$$

$$h_{2b} = h_2 - \eta_n [h_2 - h(P_{2b}, s_2)] \quad (4)$$

Primary and secondary nozzle exit area is given by

$$A_{1b} = 1/(1 + \mu)\rho_{1b} V_{1b} \quad (5)$$

$$A_{2b} = 1/(1 + \mu)\rho_{2b} V_{2b} \quad (6)$$

The ejector area ratio of this system is given by

$$\Phi = (A_{1b} + A_{2b}) / A_{1b} \quad (7)$$

Velocity and enthalpy at the outlet of the constant pressure mixing section of the ejector are given by

$$V_{3m} = (1/(1 + \mu)) V_{1b} + (\mu/(1 + \mu)) V_{2b} \quad (8)$$

$$h_{3m} = (1/(1 + \mu))(h_{1b} + V_{1b}^2/2) + \frac{\mu}{1 + \mu} (h_{2b} + V_{2b}^2/2) - V_{3m}^2/2 \quad (9)$$

For the diffuser section

$$h_{3m} + V_{3m}^2/2 = h_3 \quad (10)$$

Whereas diffuser exit enthalpy can be found by

$$h_3 = h_{3m} + [h(P_4, s_{3m}) - h_{3m}]/\eta_d \quad (11)$$

The Ejector overall energy balance is given by

$$\frac{1}{1 + \mu} h_1 + \frac{\mu}{1 + \mu} h_2 = h_3 \quad (12)$$

The specific compressor work can be found by

$$w_{c,ej} = \frac{1}{1 + \mu} (h_5 - h_4) \quad (13)$$

Cooling effect can be found by

$$q_{e,ej} = \left(\frac{\mu}{1 + \mu}\right)(h_2 - h_7) \quad (14)$$

The COP of the ejector expansion cycle can be determined by

$$COP = \frac{q_{e,ej}}{w_{c,ej}} \quad (15)$$

The COP of the corresponding basic vapour compression cycle is given by

$$COP_B = \frac{h_2 - h_1}{h_g - h_2} \quad (16)$$

And the COP improvement is given by

$$\Delta COP = \frac{COP - COP_B}{COP_B} \quad (17)$$

IV. COMPUTATIONAL METHOD

A computer MODEL is developed to solve the above equations using MATLAB SIMULINK. The model takes following input data type of refrigerant, evaporation temperature, condensation temperature, and refrigerant properties. Refrigerant (R 170) is used as a working fluid into the system. The simulation procedure is as follows;

1. First of all calculating thermodynamic properties at state points 1 and 2. For the given motive and suction efficiencies Specific enthalpies and specific volume at states 1b and 2b are calculated. Velocities of refrigerant stream at the corresponding states are calculated by using (1) and (2).
2. Starting calculation with assuming an iterative value of entrainment ratio ($1 > \mu > 0$) than fluid velocity and specific enthalpy at the exit of constant pressure mixing section (state 3m) are calculated using (8) and (9).
3. Using (10) to (12) and known diffuser efficiency, specific enthalpy, pressure vapour quality at state 3 are calculated by applying effective iteration technique, other properties are also calculated.
4. If the condition $(1 + \mu) \times 3 \cong 1$ is not satisfied then steps 8–9 will be repeated by feeding a new value of μ until the condition is satisfied.
5. Calculate thermodynamic properties at states 4, 6, and 7. Also by using known compressor isentropic efficiency the properties of state 5 are calculated
6. The various performance parameters like $w_{c,ej}$, $q_{e,ej}$, COP, COPB and ΔCOP are calculated Using (14) to (17).

V. RESULTS

Using ejector as an expansion device, R 170 yields a maximum COP improvement of 24.12 percent. For given evaporator temperature 208K, condenser temperature 242K and Refrigerant, calculations were performed to observe effect of mixing temperature. It was found that, mixing temperature is attributed to change in entrainment ratio which in turn affects Coefficient of performance (COP). With increase in mixing temperature Coefficient of performance (COP) first increases as entrainment ratio increases, after certain optimum value it decreases as entrainment ratio decreases. Mixing temperature is

also attributed to ejector area ratio, so by changing ejector areas we can select corresponding mixing temperature.

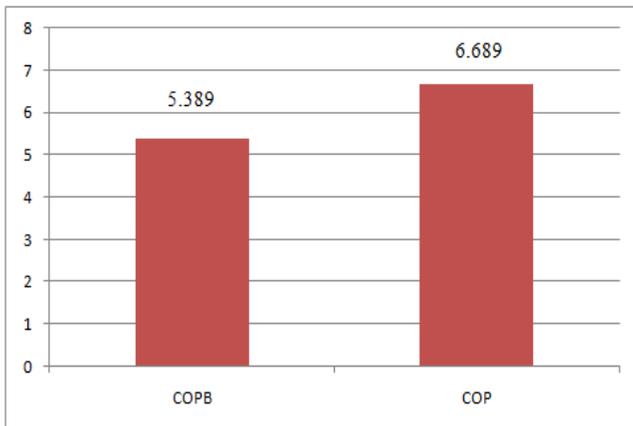


Figure3. Performance Comparison of Ejector Expansion Cycle with Throttled Expansion Cycle

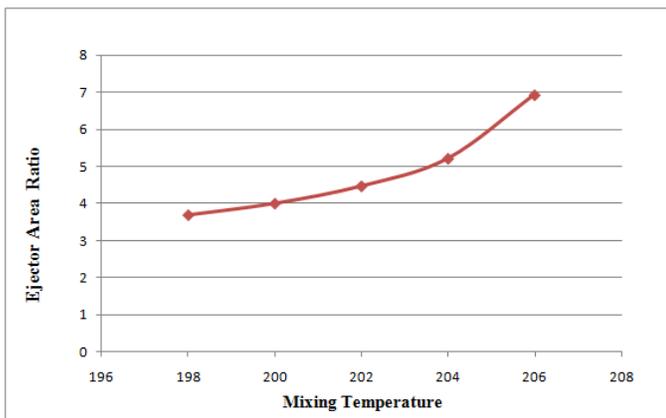


Figure4. Mixing Temperature v/s Ejector Area Ratio

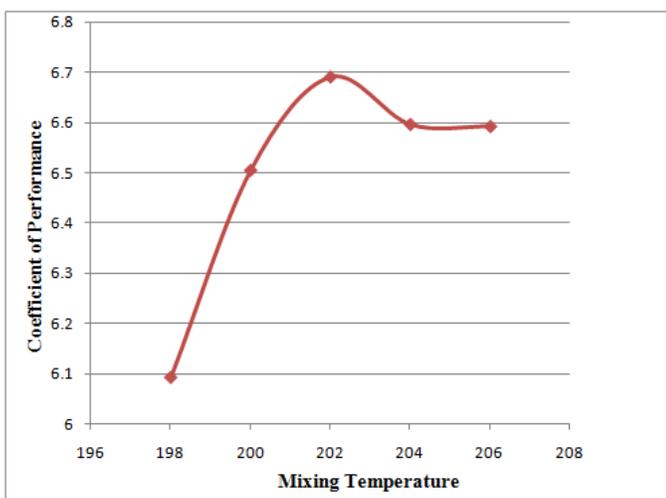


Figure5. Mixing Temperature v/s Coefficient of Performance

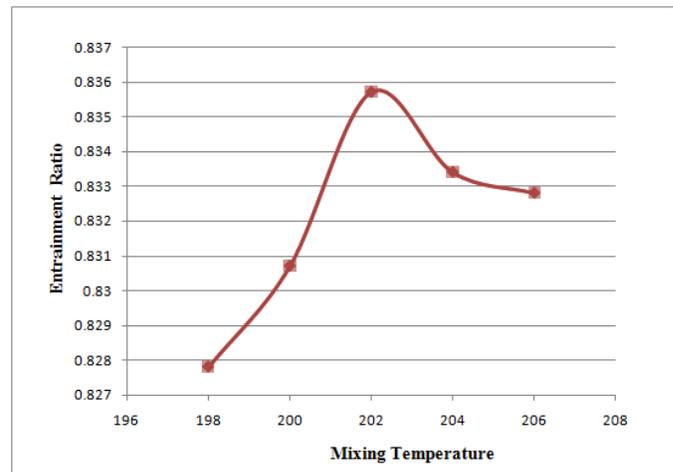


Figure6. Mixing Temperature v/s Entrainment Ratio

VI. CONCLUSION

On the basis of above analysis it has been found that an ejector refrigeration system is suitable for experimental studies, since it requires a simple component that significantly improves system performance. By keeping same evaporator temperature and condenser temperature the ejector expansion refrigeration cycle provides increased coefficient of performance, decreased compressor displacement, and decreased compression ratio, reduced evaporator size as compared with a standard vapor compression cycle. This may open new era of the search for non CFC, refrigerants. Deeper scrutiny is required for understanding of various processes within the two-phase ejector. Implementations of the ejector expansion cycle for practical uses have not yet been worked out. Further research is required in this field.

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Design and Simulation of Speed Control of DC Motor by Fuzzy Logic Technique with Matlab/Simulink

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Abstract- The design of intelligent control systems has become an area of intense research interest. A promising direction in the design of intelligent systems involves the use of Fuzzy logic controller to discover the abilities of intelligent control systems in utilizing experience via rule-based knowledge.

The most commonly used controller in the industry field is the proportional plus- integral-plus- derivative (PID). PID controller requires a mathematical model of the system while Fuzzy logic controller (FLC) provides an alternative to PID controller, especially when data are not available or partly available for the system.

For comparison purpose, three controllers PI, PID and FLC have been designed and implemented in the MATLAB/Simulink model to examine the performance of DC motor with different loads. The results show that the FLC give better response compared to PI &PID controller.

Index Terms- PI, PID, Fuzzy logic controller, DC Motor,

I. INTRODUCTION

Direct current (DC) motors have variable characteristics and are used extensively in variable-speed drives. DC motor can provide a high starting torque and it is also possible to obtain speed control over wide range. Why do we need a speed motor controller? For example, if we have a DC motor in a robot and we just apply a constant power to each motor on a robot, then the poor robot will never be able to maintain a steady speed. It will go slower over carpet, faster over smooth flooring, slower up hill, faster downhill, etc. So, it is important to make a controller to control the speed of DC motor in desired manner.

DC motor plays a significant role in modern industrial. These are several types of applications where the load on the DC motor varies over a speed range. These applications may demand high-speed control accuracy and good dynamic responses.

[11] DC Motor model

The resistance of the field winding and its inductance of the motor used in this study are represented by R_f and L_f , respectively. The resistance of the armature and its inductance are shown by R_a and L_a respectively in dynamic model. Armature reactions effects are ignored in the description of the motor. This negligence is justifiable to minimize the effects of armature reaction since the motor used has either interlopes or compensating winding. The fixed voltage V_f is applied to the field and the field current settles down to a constant value. A

linear model of a simple DC motor consists of a mechanical equation and electrical equation as determined in the following equations:

$$J_m \frac{d\omega}{dt} = K_m \cdot \phi \cdot I_a - b \cdot \omega - M_{load}$$

$$L_a \frac{dI}{dt} = V_a - R_a \cdot I_a - K_b \cdot \phi \cdot \omega$$

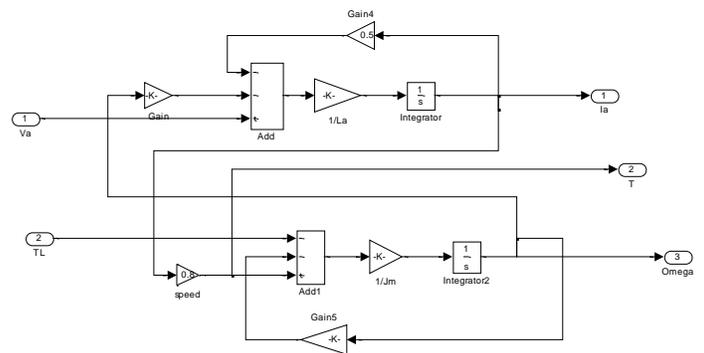


Fig 1 Simulink model of separately excited dc motor

Speed Response of DC Motor without any controller is shown below:

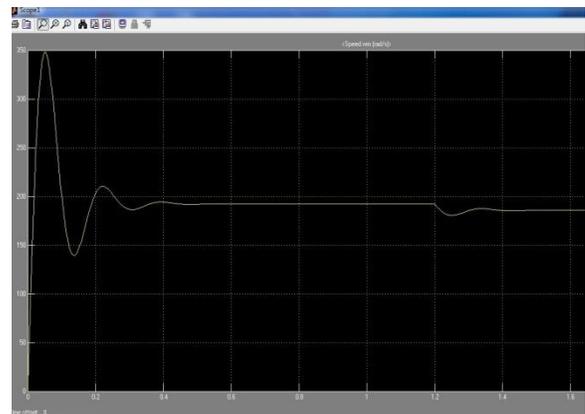


Fig 2. Speed Response of DC Motor without any controller

The Peak Overshoot and number of oscillations obtained in above curve are much more and hence undesirable. These

parameters are controlled by using different controllers discussed below.

II. PROPORTIONAL PLUS - INTEGRAL (PI) CONTROLLER

Since most of the process cannot work with an offset, they must be controlled at their set points and in order to achieve this, extra intelligence must be added to proportional controller and this is achieved by providing an integral action to the original proportional controller. So the controller becomes proportional integral controller.

- ❖ Under PI Controller as long as error is present the controller keeps changing its output and once the error is zero or it disappears the controller does not change its output.
- ❖ Integration is the mode that removes the offset or the error but sometimes it may make transient response worse.
- ❖ In PI Controller the output of the controller is changed proportional to the integral of the error.

The mathematical expression of the PI Controller is:

$$y = K_p \cdot e + K_i \int e \cdot dt$$

Where, K_i = Integral gain of the PI controller.

PI Controller has the following disadvantages:

- ❖ The response is sluggish at the high value of the integral time.
- ❖ The control loop may oscillate at the small value of integral time.

III. PROPORTIONAL-INTEGRAL-DERIVATIVE (PID) CONTROLLER

PID Controller includes all the three control actions i.e. proportional, integral and derivative.

- ❖ A PID controller calculates and outputs a corrective action, which corrects the error between the process output and the desired set point that adjusts the process accordingly and rapidly.

The output of the controller or the manipulated variable is obtained by adding P, I and D components and their associated coefficient.

The mathematical expression of the PID Controller is:

$$y = K_p \cdot e + K_i \int e \cdot dt + K_d \frac{de}{dt}$$

IV. FUZZY LOGIC CONTROLLER

Fuzzy logic has two different meanings, in a narrow sense, fuzzy logic is a logical system, which is an extension of multivolume's logic, and however, in a wider sense fuzzy logic is

almost synonymous with the theory of fuzzy sets, a theory which relates to classes of objects with un-sharp boundaries in which membership is a matter of degree. In this perspective fuzzy logic in its more narrow definition, fuzzy logic differs both in concept and substance from traditional multi-valued logical system. Fuzzy logic is a convenient way to map input space to an output space. Mapping input to output is the starting point for everything.

FLC have some advantages compared to other classical controller such as simplicity of control, low cost and the possibility to design without knowing the exact mathematical model of the process. Fuzzy logic incorporates an alternative way of thinking which allows modeling complex systems using higher level of abstraction originating from the knowledge and experience. Fuzzy logic can be described simply as "computing words rather than numbers" or "control with sentence rather than equations."

V. STRUCTURE OF FUZZY LOGIC

There are specific components characteristic of a fuzzy controller to support a design procedure. Figure 3 shows the controller between the preprocessing block and post processing block.

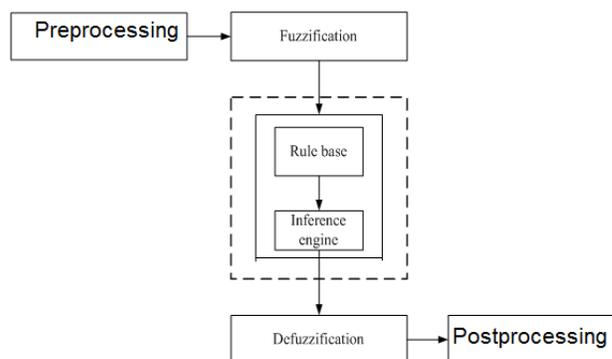


Fig. 3. Structure of fuzzy logic controller

Fuzzification

The first block inside the controller is fuzzification which converts each piece of input data to degrees of membership by a lookup in one or several membership functions. The fuzzification block matches the input data with the conditions of the rules to determine. There is degree of membership for each linguistic term that applies to the input variable. The first step in designing a fuzzy controller is to decide which state variables represent the system dynamic performance must be taken as the input signal to the controller. Fuzzy logic uses linguistic variables instead of numerical variables. The process of converting a numerical variable (real number or crisp variables) into a linguistic variable (fuzzy number) is called Fuzzification. System variables, which are usually used as the fuzzy controller inputs includes states error, state error derivative, state error integral or etc.

The membership function is a graphical representation of the magnitude of participation of each input. There are different memberships functions associated with each input and output response. In this study, we use the trapezoidal membership

function for input and output variables. The number of membership function determines the quality of control which can be achieved using fuzzy controller. As the number of membership function increases, the quality of control improves. As the number of linguistic variables increases, the computational time and required memory increases. Therefore, a compromise between the quality of control and computational time is needed to choose the number of linguistic variables. For the speed control of DC motor study, five linguistic variables for each of the input and output variables are used to describe them.

Rule Base

The collection of rules is called a rule base. The rules are in “If Then” format and formally the *If side* is called the *conditions* and the *Then side* is called the *conclusion*. The computer is able to execute the rules and compute a control signal depending on the measured inputs *error* (e) and *change in error* (dE). In a rule based controller the control strategy is stored in a more or less natural language. A rule base controller is easy to understand and easy to maintain for a non- specialist end user and an equivalent controller could be implemented using conventional techniques.

Defuzzification

Defuzzification is when all the actions that have been activated are combined and converted into a single non-fuzzy output signal which is the control signal of the system. The output levels are depending on the rules that the systems have and the positions depending on the non-linearities existing to the systems. To achieve the result, develop the control curve of the system representing the I/O relation of the systems and based on the information; define the output degree of the membership function with the aim to minimize the effect of the non-linearity. The reverse of Fuzzification is called Defuzzification. The use of Fuzzy Logic Controller (FLC) produces required output in a linguistic variable (fuzzy number). According to real world requirements, the linguistic variables have to be transformed to crisp output.

It obtains the center of area occupied by the fuzzy set. It is given by the expression.

$$X = \frac{\int \mu(x)xdx}{\int \mu(x)dx}$$

Where, X=crisp value;x = support value at which the membership function reaches the maximum value; $\mu(x)$ = maximum value of membership function corresponding to the quantization level.

Post processing

The post processing block often contains an output gain that can be tuned and also become as an integrator.

VI. CONTROLLER DESIGN

DC MOTOR SPEED CONTROL USING PI CONTROLLER:

The Figure 4 shows the model of PI controller for DC motor. The model is simulated with speed vs time of the DC motor with the fixed load and also with varying load.

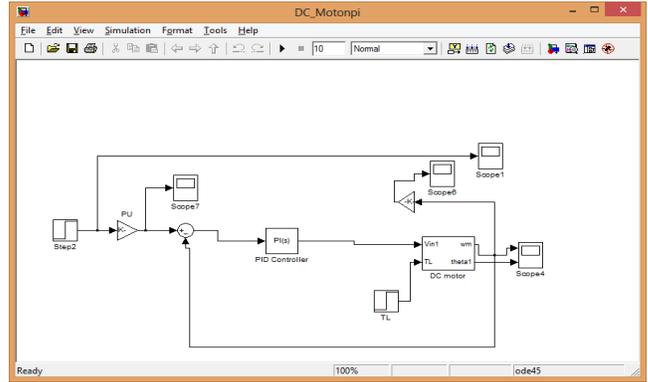


Fig 4. Mat Lab/Simulink model for DC motor using PI Controller

DC MOTOR SPEED CONTROL USING PID CONTROLLER:

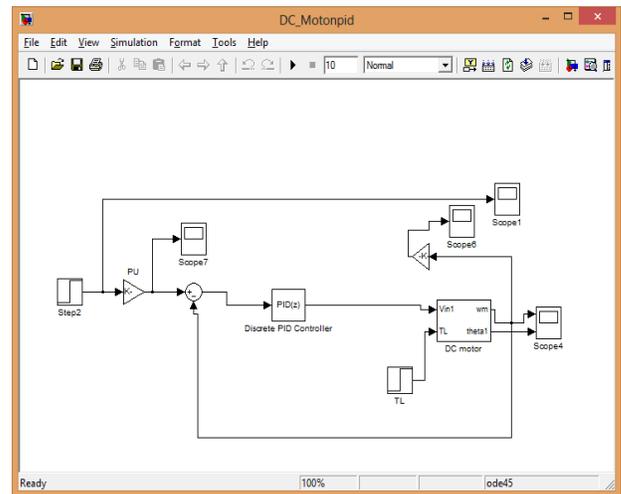


Fig 5. Mat Lab/Simulink model for DC motor using PID Controller.

The figure 5 shows the MatLab/Simulink model for 11 speed control of DC motor using PID controller.

DC MOTOR SPEED CONTROL USING FUZZY LOGIC CONTROLLER (FLC)

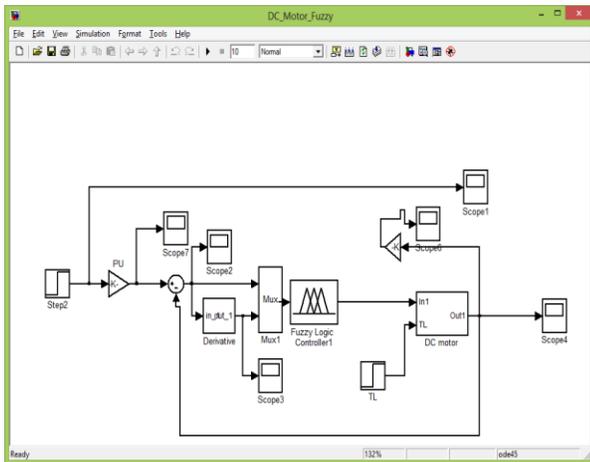


Figure 6 MatLab/Simulink model for DC motor using Fuzzy Controller.

The figure 6 gives the MatLab/Simulink model for control of speed of DC motor using fuzzy logic controller.

VII. RESULT AND DISCUSSION

Simulation result of DC motor without using any controller is shown in fig 1. That fig may be compared with fig 7 for speed control.

COMPARISON OF SPEED CONTROL USING PI, PID AND FUZZY LOGIC CONTROLLER:

All these controllers are simulated on MATLAB and their *Speed Vs Time* characteristic is studied. The Characteristic is shown below:

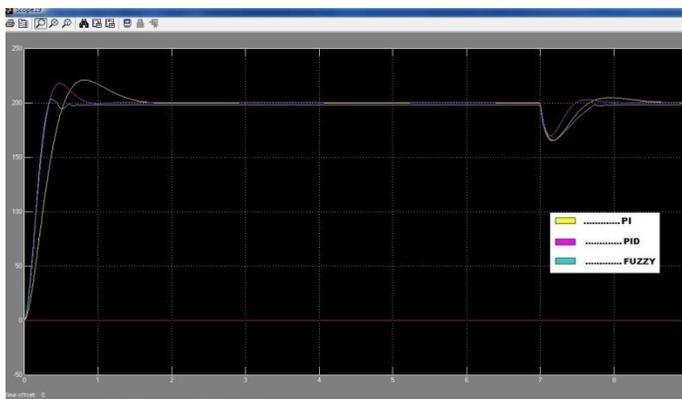


Fig 7. Simulation Result for DC motor using PI, PID and Fuzzy Logic Controller.

VIII. CONCLUSION

From Simulation results it may be concluded as:

- FLC have better performance by reducing, e_{ss} (Steady state error), M_p (maximum overshoot), T_r (rise time) and T_s (settling time).

- FLC have more sensitive responses against load disturbances to classical PI & PID controller.
- FLC is better than conventional PI & PID controller.

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Laboratory Diagnostic Link to Infections: An Update

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Abstract- This review article highlights the various organs affected due to infection by a host of microorganisms resulting in the elevation of Liver Function Tests particularly liver enzymes due to infections by falciparum malaria, parasites, viral infections, dengue, measles, tuberculosis, anaplasmosis etc. Kidney function progressively decrease in infections due to measles, tetanus, staphylococcus, malaria, MRSA viruses and cardiac function tests are elevated in pneumonia. In bacterial meningitis CSF analytes are altered, while HIV, HCV, HbsAG infections are said to affect every organ. We have used recent reach findings during the last 13 years and hence this review article will certainly serve as a platform for exploring new avenues for research in this interesting field.

Index Terms- Malaria, LFT, HIV, AST, ALT, CKD, CSF.

I. INTRODUCTION

Microorganism are excellent models for understanding cell function in higher organisms including humans and the six features associated with living organisms are metabolism, reproduction, differentiation, communication, involvement and evolution. All these above are associated with chemical reactions and microbes change the clinical and physical properties of their habitats. Harmful microorganisms cause infection which in turn affect chemical reactions. Although microbiology tests identify the type of infections but it does not pinpoint the alterations in biochemical analytes and the organs which are affected. This paper is therefore an attempt to identify the alterations in biochemical analytes organ wise and the role of measured blood analytes to the degree of infection. This will help to evaluate the incubation period of microorganism infections in humans, its survival rate based on analytes change there by bringing biochemical investigation to assess the infectious status.

Malaria

The mean level of most of the biochemical liver function test parameters were below the normal reference ranges, and a highly significant difference was observed between pregnant women with malaria, and their controls, in the level of aspartate aminotransferase (AST), Alanine transaminase (ALT), total protein, albumin and globulin, but not in the levels of bilirubin fractions.⁽¹⁾ Hepatic dysfunction in acute Plasmodium falciparum malaria ranged from mild elevation of liver enzymes to acute

hepatitis (ALT>10 times of normal level). It indicates severe illness with high frequency of complication and mortality rates.⁽²⁾ Children with cerebral malaria had a higher rate and more severe course of acute renal failure than children with mild malaria. Today, there is no evidence of a dominant role of steroid-resistant and chronic "malarial glomerulopathies" in children with a nephrotic syndrome in Africa. Acute Renal Failure (ARF) was a frequent and serious complication of falciparum malaria in non-immune adults. However, recently it has been reported more often in semi-immune African children with associated morbidity and mortality.⁽³⁾

Exchange transfusion is helpful in patients with heavy parasitemia, those with severe jaundice, and those with the Systemic Inflammatory Response syndrome with an overall reduction of mortality by 20%. Apheresis has been reported to successfully support anuric patients with cerebral and pulmonary complications.⁽⁴⁾ Falciparum malaria associated with ARF is a life threatening condition, but early presentation and intervention with appropriate anti-malarial and dialysis therapy is associated with improved survival and recovery of renal function. Early dialysis treatment in patients with severe falciparum malaria and signs of deteriorating renal function is recommended.⁽⁵⁾ P. vivax malaria can cause ARF, which occurs more commonly in P. falciparum malaria. Renal ischemia is the dominant pathogenic mechanism that results in acute tubular necrosis. The prognosis of ARF in P. vivax malaria is favorable.⁽⁶⁾ Malaria is associated with ARF, which occurs most commonly in plasmodium falciparum infected patients. Early diagnosis and prompt dialysis with supportive management can reduce mortality and enhance recovery of renal function.⁽⁷⁾

Parasite levels had a significant influence on metabolic acidosis but not on CI. Alterations related to cardiac function, hemoglobin levels and metabolic acidosis were most prominent in children younger than 2 years.⁽⁸⁾ Hypovolemia is as a major underlying cause of lactic acidosis and hypoglycemia in African children with severe falciparum malaria. These deleterious metabolic conditions contribute to myocardial affection which was evident but not predictive per se of fatal outcome. Suggesting impaired cardiac function contributing to clinical manifestations in P. falciparum malaria.⁽⁹⁾ Findings may be relevant for fluid management and should be further explored in endemic regions.⁽¹⁰⁾ Increased CI reflecting high output status is associated with low hemoglobin levels while metabolic acidosis is linked to parasite levels.⁽¹¹⁾ Cardiovascular manifestations in severe falciparum malaria include mainly hypotension and acute pulmonary oedema. In addition to severe falciparum parasitaemia

and sequestration, secondary infections, severe anaemia, hyperpyrexia, dehydration/fluid overload, metabolic acidosis, hypoxia, and disseminated intravascular coagulation can also contribute to the cardiovascular problems in malaria. Malaria can also complicate pre-existing cardiac decompensation and may even prove fatal for patients with compromised heart.⁽¹²⁾

Liver enzymes increase in malaria parasitaemia to a level dependent on the degree of parasitaemia and also suggest that the liver is involved in the pathophysiology of malaria.⁽¹³⁾

Patients with *Plasmodium falciparum* malaria have high incidence of subclinical haemorrhological disorders which do not amount to overt DIC but adversely affect renal function contributing to acute renal failure.⁽¹⁴⁾ There is strong evidence of hepatocyte dysfunction and hepatic encephalopathy in some of these patients, with no obvious non-malarial explanation. Current guidelines may need to be revised.⁽¹⁵⁾ Liver enzymes AST, ALT and ALP significantly increases in malaria patients as compared to control subjects. Therefore these enzymes may be useful in diagnosis of malaria subjects.⁽¹⁶⁾

Viral Infections

There was a reverse correlation between liver enzyme levels and renal allograft function when analysed with univariate and linear regression analyses. This correlation increased over time. There was also a significant relation between cyclosporine blood levels and liver enzyme values in the univariate analysis. However, this relationship was attenuated over time. Elevated liver enzymes also correlated with anemia. The Liver enzyme elevation is a common finding among kidney transplant recipients. Serial monitoring of aminotransferases, particularly ALT, should be performed in all patients after kidney transplantation.⁽¹⁷⁾

In clinical practice of rheumatoid arthritis (RA), various kinds of laboratory tests are required for diagnosis, assessment of the disease activity, assessment of complications and risk factors before starting therapy, and assessment of adverse effects during the therapy. Anemia, thrombocytosis, and leukocytosis are common in active RA. Reactivation of hepatitis B virus (HBV) after immunosuppressive therapies is a potentially serious complication. HBc and/or HBs antibodies should be measured before starting the therapies even if HBs antigen is negative, and appropriate interventions including measurement of HBV-DNA and starting prophylaxis (entecavir is recommended) should be performed.⁽¹⁸⁾ HBV infection with elevated ALT, rather than HBV infection alone, was associated with reduced renal function.⁽¹⁹⁾

Reduced eGFR and albuminuria are associated with increased risk for infection-related mortality. Efforts are needed to reduce its incidence and mitigate the effects of infections among individuals with CKD.⁽²⁰⁾ The risk of hospitalization and death with pneumonia is greater at lower eGFRs, especially in younger adults. This association may contribute to excess mortality in people with CKD. Creatinine peak was inversely correlated to GA in preterm infants born less than 32 weeks of gestational age. Neonatal rather than maternal morbidity affected Creatinine peak. In hspDA, creatinine increase preceded ibuprofen administration.⁽²¹⁾ Using more sensitive and specific markers of myocardial injury, the prevalence of myocarditis during acute influenza infection is

substantially lower than previously thought, whereas skeletal muscle injury is relatively common and it seems likely that this complication is rare.⁽²²⁾ Patients with SARS are prone to have mild non-specific hepatitis. It seldom causes the typical symptoms of hepatitis and it is easy to be ignored in clinic.⁽²³⁾

FPG on admission could be an independent predictor for the severity of H1N1 pneumonia. Elevated FPG induced by H1N1 pneumonia is not a result of direct damage to pancreatic β -cells, but arises from various factors' combinations caused by H1N1 virus infection.⁽²⁴⁾ Myocarditis can be a rare but severe complication of infectious disease and should be considered as a diagnosis in patients presenting with chest pain and elevated cardiac enzymes in the absence of underlying coronary disease. It can lead to cardiomyopathy and congestive heart failure. There are only a few reported cases of myocarditis associated with *Campylobacter* infection.⁽²⁵⁾

Dengue

Thrombocytopenia and elevated transaminases were observed in patients with classic dengue fever. The main laboratory abnormalities found in dengue hemorrhagic fever were thrombocytopenia, hemoconcentration and elevated transaminases, similar to severe dengue with the exception of hemoconcentration. Most laboratory abnormalities started on the 3rd day but were more evident on the 5th day with restoration of values by the 11th day; this was more prominent in under 15-year-olds and with the more severe clinical forms. These results are relevant in assessing the disease because they can be used as markers for more severe forms and can help by enabling the adaptation of the therapeutic conduct to the needs of individual patients.⁽²⁶⁾

Marmosets are susceptible to dengue virus (DENV) infection. However, blood parameter data and clinical signs of DENV-infected marmosets are limited. Five DENV-inoculated marmosets demonstrated thrombocytopenia, nine demonstrated leucopenia, and five demonstrated an increase in the levels of AST, ALT, LDH, and BUN. Additionally, seven DENV-inoculated marmosets demonstrated clinical signs including fever and decreases in activity. None of the four mock-inoculated marmosets demonstrated changes in either hematological or biochemical parameters. Marmosets inoculated with DENV exhibited clinical signs and changes in hematological and biochemical parameters. The results suggest that blood parameter data and clinical signs could potentially be useful markers for understanding the progress of DENV infection in studies using marmosets.⁽²⁷⁾ There is no specific treatment for dengue-associated fulminant liver failure. After administration of intravenous N-acetylcysteine, a rapid decrease in liver transaminases and normalization of coagulation profile was observed followed by clinical improvement and favourable outcome despite factors associated with poor prognosis. The use of intravenous N-acetylcysteine is safe and efficient in the treatment of dengue-associated fulminant liver failure, especially in centres when liver transplantation is not readily available.⁽²⁸⁾

Transaminase levels increased in virtually all dengue patients and correlated with other markers of disease severity. However, peak enzyme values usually occurred later than other complications. Clinically severe liver involvement was infrequent and idiosyncratic, but usually resulted in severe bleeding. Chronic co-

infection with hepatitis B was associated with modestly but significantly increased levels of ALT, but did not otherwise impact the clinical picture.⁽²⁹⁾ The frequency of dual dengue and malaria infection was 23.21%. The serology of the dengue and malaria showed negative results in 30.35%. The diagnosis of dual infections could be made on the basis of history, clinical examination supported by hematological results. It is recommended that all the patients suspected for dual infections should be treated concomitantly for dengue and malaria in malaria endemic areas.⁽³⁰⁾

The clinical and biochemical profile of dengue haemorrhagic fever (DHF) varies from epidemic to epidemic. Clinical features of DHF varied from the previous epidemic. Hepatic dysfunction with increased levels of liver enzymes was common in DHF.⁽³¹⁾ Liver damage is a common complication of dengue infection and aminotransferase levels are a valuable marker for monitoring these cases.⁽³²⁾ The incidence of dengue fever (DF) is estimated to have increased 30-fold in the past 50 years.⁽³³⁾ Dengue viruses were shown to cause cardiac disease with clinical manifestations ranging from mild elevation of biomarkers to myocarditis and/or pericarditis.⁽³⁴⁾ Patients with severe dengue had worse cardiac function compared with dengue in the form of left ventricular systolic dysfunction with increased left myocardial performance. Septal myocardial systolic velocities were reduced as well as right ventricular systolic. Patients with severe dengue have evidence of systolic and diastolic cardiac impairment with septal and right ventricular wall being predominantly affected.⁽³⁵⁾

Measels a & Tetanus

Tetanus is a disease caused by *Clostridium tetani*. Acute renal failure (ARF) can occur in patients with tetanus and a number of mechanisms may contribute to this, including rhabdomyolysis and autonomic nervous system overactivity. ARF is an important complication of tetanus, which was not associated with death. Hyperglycemia, hyperkalemia, and thrombocytopenia seem to increase mortality.⁽³⁶⁾

Staphylococcus

Complete eradication of MRSA is necessary to treat MRSA-associated glomerulonephritis, and if this is not attained, a permanent loss of renal function occurs.⁽³⁷⁾

Tuberculosis

Urea breath testing may provide a useful diagnostic and biomarker assay for tuberculosis and for treatment response. Future work will test specificity for *M. tuberculosis* using lung-targeted dry powder inhalation formulations, combined with co-administering oral urease inhibitors together with a saturating oral dose of unlabeled urea, which would prevent the delta signal from urease-positive gastrointestinal organisms and the rate of LFT abnormalities was higher when patients were exposed to INH, and significant abnormalities were more frequent than reported in the INH literature. It is prudent to closely follow the LFTs of these patients. The results have shown the importance of estimating some LFT parameters, prior to the start of Antitubercular Drugs (ATD) and Antiretroviral Therapy (ART) in these cases. Hence, a mandatory performance of LFT is recommended, as it is simple and cost effective. TNF-alpha and

IL-1 released from activated Kupffer cells (KCs) were involved in BCG plus LPS induced liver injury. FR167653 significantly attenuated hepatocyte injury via inhibition of TNF-alpha and IL-1 released from activated KCs.^(39,40,41,42)

Meningitis

Increased CSF lactate is a useful post neurological bacterial meningitis (PNBM) marker, with better predictive value than CSF hypoglycorrhachia or pleocytosis. Lactate levels ≥ 4 mmol/L showed 97% sensitivity and 78% specificity, with a 97% negative predictive value.⁽⁴³⁾ There have been relatively few attempts to focus on poor prognostic markers associated with AIDS related Cryptococcal meningitis in Asian patients. Simple bedside clinical tools like ophthalmoscopy and CSF manometry can help in risk stratification in this group of patients.⁽⁴⁴⁾ A logistic regression analysis, taking into account age, gender, length of hospital days, sepsis definition, presence of meningitis, creatine kinase MB isoenzymes, and cTnI serum levels, demonstrated that severity of septic disease was the only variable significantly associated with the death. Evaluation of serum levels of cTnI within the first 24 hrs of diagnosis of sepsis or septic shock in children was not better than creatine kinase MB isoenzyme or clinical evaluation, to predict the outcome (death or discharge from hospital) of septic process.⁽⁴⁵⁾ The mean CSF and serum cortisol levels were higher in patients with bacterial meningitis than patients with aseptic meningitis and control group and the difference was highly statistically significant. Also, there was positive correlation between CSF cortisol level and severity of bacterial meningitis using Glasgow outcome score. Serum and CSF cortisol levels were elevated in patients with meningitis and can be used as a marker for differentiating bacterial from aseptic meningitis.⁽⁴⁶⁾

HIV

Tenofovir is associated with greater effect on decline in renal function and a higher risk of proximal tubular dysfunction in antiretroviral naïve patients initiating antiretroviral therapy (ART).⁽⁴⁷⁾ PLHIV are at increased risk of renal disease, with greater risk at later stages of infection and at older ages. ART prolongs survival and decreases the risk of renal disease. However, less reduction in renal disease risk occurs for Tenofovir-containing ART than for other regimens.⁽⁴⁸⁾ The risk of kidney disease associated with the widely used agent tenofovir continues to be studied, although its incidence in reported clinical trials and observational studies remains quite low. Future studies about the relationship between black race and kidney disease, as well as strategies for early detection and intervention of kidney disease, hold promise for meaningful reductions in morbidity and mortality associated with kidney disease.⁽⁴⁹⁾

Galactose elimination capacity as a parameter of cytosolic liver function and indocyanine green clearance as a parameter of liver perfusion were not affected by ART.⁽⁵⁰⁾ Antiretroviral drugs may have significant effect on liver function. It is therefore recommended that liver function of HIV patients on ART should be determined regularly to monitor progress of ART therapy.⁽⁵¹⁾ Liver biopsy accompanied by liver function test provides a clearer picture of necroinflammation. Such co-infected individuals also face increased risk of hepatotoxicity from ART. Individuals with HIV-HBV coinfection should have both the

infections completely assessed in order to decide on the best therapeutic option for both viruses.⁽⁵²⁾ HAART has a duration and drug dependent effects on the liver cells integrity and functions. This effect is lesser with NRTIs as compared with NNRTIs and PIs. It is therefore recommended that routine liver function tests be instituted in HIV patients on HAART regimen.⁽⁵³⁾ There was a small but statistically significant elevation in ALT and SAP at 2 weeks and AST at 6 weeks after ART initiation. The proportion of patients with rate-limiting toxicity of liver enzymes was small. None had treatment terminated because of hepatotoxicity.⁽⁵⁴⁾

A significant lipid profile change occurs in AIDS patients compared to HIV infection and healthy subjects. There were no significant differences in total TT4 concentrations among the AIDS patients when compared to HIV infection and normal healthy subjects. A measured FT4 concentration was slightly but significantly decreased in HIV /AIDS patients. Total T3 concentrations were normal in HIV infected patients, but slightly decreased in AIDS; more important, T3 level was decreased in AIDS patients. The level of FT3 concentration was slightly but significantly increased in HIV infected and significantly decreased in AIDS patients. Thyroid dysfunction is frequent in HIV infection and with progression of disease there is a primary hypothyroid like stage that occurs in patients with HIV infection. TT3, FT3, FT4 and serum TSH can be used as a surrogate marker of the progression of the disease.⁽⁵⁵⁾ Although 1 in 10 patients on raltegravir therapy developed significant creatine kinase elevation as defined, symptoms were uncommon, not severe and occurred in patients with easily identifiable risk factors.⁽⁵⁶⁾ Virucidal agents designed for topical vaginal use block HIV infection of genital tissue. Such agents have major implications for world health, as they will provide women with a mechanism of personal and covert protection from HIV infection.⁽⁵⁷⁾

HBs Ag and HCV

Adefovir dipivoxil (ADV) is an independent predictor for significant deterioration of renal function. Patients on ADV should be monitored, especially patients who are older, have baseline renal insufficiency, or have hypertension and/or diabetes mellitus.⁽⁵⁸⁾ Recent studies with extended follow-up of renal transplant recipients suggest that HCV infection may affect patient and graft survival during the second decade. Further studies are required to identify the mechanisms of infection of patients with end-stage renal disease and to define better treatment strategies for these patients before and after kidney transplantation and all patients with CRF should be immunized against hepatitis B as early as possible in the development of their disease, to ensure maximum response, and to minimize the effects of elevated serum creatinine and increasing age.⁽⁵⁹⁾ A significant number of patients have been infected with hepatitis B and C viruses; laboratory analysis in patients with a chronic course did not always correlate with the evolution of the disease; the clinical course is mostly mild.⁽⁶⁰⁾ Total antioxidant activity was significantly decreased in both hepatitis B and C. Among the enzymes analyzed, ALP, ALT, LDH and AST were all significantly increased in both patients with hepatitis B and C whereas CK was significantly decreased in patients with hepatitis B and remained unchanged in patients with hepatitis C.⁽⁶¹⁾

Liver function test parameters were elevated compared with control subjects ($P < 0.001$). The increase in serum alpha-fetoprotein was higher ($P < 0.001$) in HCV than HBsAg positive patients. Serum alpha-fetoprotein level was highest in HCV compared to HBsAg positive and hepatitis negative patients with CLD.⁽⁶²⁾ HRW significantly attenuates oxidative stress in CHB patients, but further study with long-term treatment is required to confirm the effect of HRW on liver function and HBV DNA level.⁽⁶³⁾ More than 170 million people worldwide are chronically infected with the HCV, which is responsible for over 1 million deaths from cirrhosis and primary liver cancers. Beside chronic liver disease, relevant extrahepatic manifestations of HCV infection include cryoglobulinemia, lymphoproliferative disorders, and renal diseases.⁽⁶⁴⁾ hs-CRP and fibrinogen may be considered as a CHC progression prognostic factor, Evidence indicates that HCV have a key role in coronary heart disease.⁽⁶⁵⁾ Hepatic transaminase tests such as ALT and AST often are part of standard laboratory panels in asymptomatic outpatients, similar to screening tests for blood donors and for life insurance applicants. The evaluation of an abnormal ALT or AST level in an asymptomatic patient therefore is a common challenge encountered by primary care physicians.⁽⁶⁶⁾

The Red Cell Distribution Width(RDW) was elevated in chronic hepatitis B (CHB) patients and patients with HBV related liver cirrhosis and was positively correlated with the severity of HBV-related liver cirrhosis. RDW is a potential index to assess the severity of HBV-related liver diseases.⁽⁶⁷⁾ Independent of IL-28B polymorphisms, blood IP-10 is a promising biomarker for predicting therapy response in chronic hepatitis C virus HCV infection. Urine IP-10 has been proposed as a biomarker in tuberculosis, but to date, no urine biomarkers for HCV infection have been evaluated. IP-10 is detected and increased in the urine of HCV-viremic patients compared to healthy donors and cured-HCV subjects.⁽⁶⁸⁾ Recent studies on liposomal formulation of chemotherapeutic and bioactive agents and their targeted delivery show liposomal antibiotics potential in the treatment of microbial infections.⁽⁶⁹⁾ The frequency of anti-HCV treatment approximately doubled between 1995 and 2001. Although adherence to consensus recommendations regarding pre-therapeutic evaluation is not ideal, a substantial improvement has occurred since 1995. Nevertheless, means of increasing the availability of antiviral therapies, particularly for patients with HIV co-infection or injecting drug use, require further study.⁽⁷⁰⁾

Bacterial Infection

Procalcitonin (PCT) levels are not significantly affected by loss of renal function, immunosuppressive agents or autoimmune disorders. Thus, significantly elevated PCT concentrations offer good sensitivity and specificity for the early diagnosis of systemic bacterial infection in patients with CRF or patients with ESRD treated by HD. CRP concentration may be an useful indicator for inflammation in patients with renal diseases, but have low specificity for the diagnosis of bacterial infection.⁽⁷¹⁾ The absolute number of WBCs or red blood cells in the urine and the presence of casts, proteinuria, and leukocyte esterase were not associated with positive culture or urinary tract infection. Neither pyuria nor a positive culture was related to temperature, systemic WBC count, or serum albumin, urea, or creatinine.⁽⁷²⁾

Differences in the average plasma glucose values, urea, creatinine, bilirubin and ALT between the patients diagnosed with bacteraemia and sepsis are not statistically significant. The results have showed that even in the course of a bacteraemia, there is a significant increase in the non-specific inflammatory parameters indicating the gravity of bacteraemia as well, with a constant risk of developing sepsis and septic shock. The importance of running and following-up the laboratory parameters herewith is emphasised for the purpose of detecting sepsis in a timely manner and administering an adequate therapy.⁽⁷³⁾

Severity of liver dysfunction and severity of renal dysfunction are both important determinants of short-term mortality among liver cirrhosis patients with bacteremia and spontaneous bacterial peritonitis in Japan.⁽⁷⁴⁾ *Helicobacter pylori* infection in gastric mucosa may cause systemic inflammatory reaction. Study did not demonstrate nutritional benefits after *H. pylori* eradication treatment, as the level of nutritional markers reduced. This relationship needs to be confirmed by further prospective studies.⁽⁷⁵⁾ Aggressive fluid rehydration remains the cornerstone of management of cholera. Instead of presenting with a classical BUN/Creatinine ratio of >20:1, patients with pre-renal failure in cholera may present with a BUN/Creatinine ratio of <15:1.⁽⁷⁶⁾ Infection with cytotoxin associated gene A (Cag-A) positive *H. pylori* strain may play a role as a risk factor in development of ischemic heart diseases through provocation of high inflammatory response or through other mechanism. Therefore eradication of this infection is important as it is much less expensive than long term treatment of the other risk factors.⁽⁷⁷⁾

During cardiac surgery (mitral valve replacement) Prostaglandin E1 (PGE1) may suppressed the production of IL-6, IL-8 but not IL-10, which may be related to its myocardial protection effect.⁽⁷⁸⁾ Abnormalities in liver enzyme levels are frequent during severe enterocolitis due to *S. enteritidis* in adult patients. These abnormalities are moderate and self-limited.⁽⁷⁹⁾ Hyperbilirubinemia and liver enzyme abnormalities are commonly observed in sepsis. However, the frequency in premature neonates and the specific relation to gram-negative bacteria are not known. Gram-negative bacteremia is commonly associated with cholestasis in premature neonates. Liver enzyme abnormalities are more common than elevated conjugated bilirubin, not all gram-negative bacteria have the same effect and the lack of enteral feeding seems to play a more significant role than the administration of parenteral nutrition.⁽⁸⁰⁾

Anaplasmosis

A significant increase in WBC is observed as a result of significant increase and decrease in lymphocytes and neutrophils, respectively. The biochemical changes revealed significant increase in AST, ALT, total bilirubin, BUN and icteric index, however significant decrease in total protein values were encountered in infected camels.⁽⁸¹⁾

Human T Lymphotropic Virus

Markers of Human T Lymphotropic Virus infection (infection status, antibody titer, and provirus load) are associated with hematologic and biochemical alterations, such as

lymphocyte abnormalities, anemia, decreased eosinophils, and elevated LDH levels.⁽⁸²⁾

Babesiosis

Results indicated that the percentage of the infection with Babesiosis was 15.42% and the percentage of parasitemia ranged between 3.5-10.4% with a mean 6.95%, infected goats showed signs of loss of appetite, weakness, pale mucous membranes, jaundice, fever, coughing, nasal discharge, recumbency, diarrhea and haemoglobinuria. A statistically significant decrease were recorded in total RBC, Hb, PCV and platelets counts.⁽⁸³⁾ A gradual decrease in Hb value was observed at various stages of parasitaemia and there was a sharp fall when parasitaemia reached more than 50%. Examination of blood smears showed phagocytosis of both healthy and infected erythrocytes.⁽⁸⁴⁾ Chronic canine babesiosis caused by *B. gibsoni* is highly pathogenic associated with anaemia and haematobiochemical alterations.⁽⁸⁵⁾ A significant reduction was observed in the number of RBC, Hb concentration and PCV values ($p < 0.05$). In histopathological examination, hepatocellular degeneration and necrosis, fibrosis, mucus gland and biliary hyperplasia, mild lymphocytic hepatitis, granuloma and telangiectasis were observed. It seems that the increased and reduction of significant blood parameters, may be due to liver failure and pathological changes following larval migration and stimulating of immune responses.⁽⁸⁶⁾ In *Trypanosoma evansi* infection the main changes in the erythrocytes were macrocytes, hypochromic cells, Howell-Jolly bodies, target cells, stomatocytes and burr cells. Serum chemistry revealed hypoproteinemia, hypocholesterolaemia, hypoglycemia, hyperbilirubinemia, elevated creatinine, BUN, increased AST and ALT.⁽⁸⁷⁾ *T. annulata* infection in cattle is associated with hematological and biochemical, and ECG changes.⁽⁸⁸⁾

There was parasite resistance to ivermectin. Famacha data showed negative correlation with packed cell volume, leukocytes, hemoglobin, albumin, total protein, globulin and albumin/globulin ratio. The packed cell volume showed a strong and positive correlation with hemoglobin, albumin and total protein. Treatment with ivermectin and closantel were not responsible for considerable changes in hematological and biochemical parameters evaluated.⁽⁸⁹⁾ The average activity of the enzymes studied in chagasic patients, except LDH and CPK, are significantly altered ($p < 0.05$) in the majority of the arterial and venous blood samples. The finding of released AST, ALT, ALP, acid maltase and alpha-HBDH in groups IA and IB is an indication of early myocardial damage in chronic chagasic patients without clinical evidence of cardiac disease. It is suggested that the possible evaluative pattern for myocardial damage could be established by the increment in coronary sinus blood of the enzymes AST, acid maltase and alpha-HBDH.⁽⁹⁰⁾

Leishmaniasis

Animals with the clinical form of the disease demonstrate hematological and biochemical changes consistent with anemia, uremia, hyperproteinemia, and hyperglobulinemia, which present themselves as strong clinical markers of visceral leishmaniasis associated with the signs previously reported.⁽⁹¹⁾

II. CONCLUSION

This review article has given an update of all possible human infections and the organs and the associated analytes which are affected. It has highlighted the biochemical changes in main organs of humans such as liver, heart and kidney. Persistent infections may lead to damage to the above organs. Based on all the updates given in this paper, reach activities may be focussed on the role biochemistry in infectious diseases as a broad research topic and selecting a particular organ which are prone to infections and studying the changes in analytes concentration. This will make biochemistry as an integral part of clinical microbiology.

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Feasible Application of Modern Eco-Friendly Treatment of Wool Fabric before Coloration

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Abstract- Preparation is a fundamental factor for any textile material in order to produce the substrate with accurate chemical and physical properties to ensure persuasive colouration and finishing. Pre-treatment plays a significant role for the successful coloration of any kind of natural textile fibre like wool. This paper overview the influence of different types of contemporary preparation techniques applied on wool fibre before coloration such as scouring, carbonising and bleaching. However, traditional wool pre-treatment utilize different chemicals those generate pollution in the effluents; a few of them are erosive which could damage the equipment and the fabric as well. Hence, it also focuses on the recently introduced eco-friendly enzyme based biological application and plasma treatment on wool fibre preparation.

Index Terms- Wool Pre-treatment, Bio-scouring, Plasma, Carbonising, Bleaching, Enzymes.

I. INTRODUCTION

Raw wool is a really impure component which generally contaminated with 40% to 70% of superfluous matter[5]. Wool fibre undergoes various types of treatments before dyeing and finishing. The executing of these treatments successfully is crucial, because without appropriate pretreatment it is impossible to produce a quality dyed substrate. Moreover, 60-70% of downstream processing complications are related to poor preparation of the textile material. So, the preparation process requires to “deliver” a fabric where uniform colouration can be attained.

Wool fibre has to undergo different preparation treatments such as scouring, carbonising and bleaching. In order to reduce

extensive fibre damage, save energy consumption as well as time and to construct the process more environmentally friendly researchers and industries are now trying to implement enzyme based bio-scouring, bio-bleaching and bio-carbonising. Moreover, application of plasma treatment can perform a pivotal role in scouring process.

II. WOOL SCOURING

The technique of scouring raw wool fibre is one of the most vital steps in the preparation of wool fibre. Bird (1972)[1] mentioned the following three types of impurities are available in raw wool fibre:

- 40% Wool grease or wax, which generally consists of sterols in alliance with long chain C14-C22 fatty acids, fatty alcohols, cholesterol esters, hydrocarbons and lanolin.
- 5 to 20% is Suint which is extremely complex mixture including potassium salts of fatty acids, proteins, amino acids and mineral sand.
- The remainder is mechanically adhering constituents such as dirt, sand, burrs and vegetable matter.

A. ALKALINE AQUEOUS SCOURING SYSTEMS

In alkaline aqueous scouring procedure, sodium carbonate is utilised as a builder to improve grease removal and avert redeposition. Sodium carbonate neutralise free fatty acids and aids in emulsifying wool grease therefore promoting grease removal of the wool fibre. Saponification of wool grease proceeds several hours at the boil in caustic alkali[10]. In order to avert degradation of wool, the temperature should not be enabled to rise above 60°C and the value of pH should not exceed 10[15].

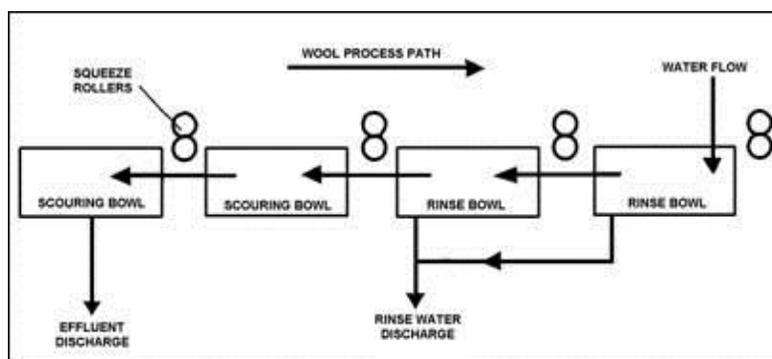


Figure 1: Conventional wool scouring arrangement[18].

Table 1: Initial concentration for wool scouring[15].

Bowl	Synthetic detergent%	Sodium carbonate%	Common Salt %	pH	Temperature °C
First bowl	0.25	0.25	-	9.0	54
Second bowl	0.2	0.2	0.4	10-10.5	52
Third bowl	0.12	0.02	0.5	10	49
Forth bowl	0-0.01	0	0	-	46

B. SOLVENT SCOURING

Preservation of water and abatement of effluent pollutants have encouraged the development of solvent scouring. In continuous solvent scouring system, the preferred solvent is perchloro ethylene. The scouring portion includes a vaned paddle contributing some mechanical action which assists in the removal of particulate dirt[15]. In a contemporary method established by CSIRO, raw wool is conveyed over perforated drums underneath jets ejecting solvents under substantial pressure to abolish extracted grease and dirt[3].

C. BIO-SCOURING OF WOOL

In an aqueous-scouring treatment, the high scouring temperature (60–90°C) wasted excessive heat energy and there was too much organic solvent to demolition in the solvent-scouring waste water[14]. In order to resolve above complications, enzymatic bio-scouring treatment is a recent evaluation in wool pre-treatment process.

The enzyme with acceptable bio-scouring effect was a combination of *Bacillus subtilis* and *Candida lipolytica*, and the ratio these two was 1:4[17].

Table 2 : Process parameters of bio-scouring[17].

Enzyme consumption	pH	Batch Ratio	Temperature(°C)	Time(hrs)
6%	7.0	1:33.28	40.44°C	18.11

Under the above mentioned condition, the fat content of bio-scoured wool was only 0.75%, which is reduced to 0.31% compared to that of traditional scouring. Moreover, the lanolin was reclaimed as a valuable material in industry by

centrifugation from wastewater. In addition, the residual lanolin, perspiration, chaffy, short wool and silt were utilized to make ecological organic fertilizer by compost treating[17].

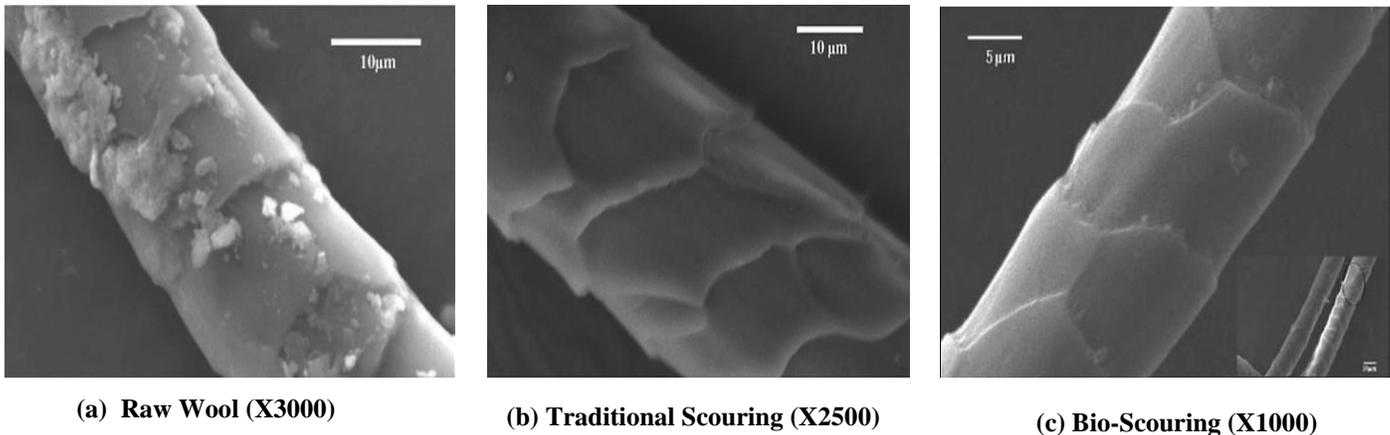


Figure 2: SEM Comparison of Wool Fibre[17].

According to scanning electronic microscope (SEM) photographs, it could be observed that the bio-scoured surface with enzyme was very clean and smooth in comparison with that scoured with traditional process[17].

D. LOW TEMPERATURE PLASMA TREATMENT ON WOOL SCOURING

In order to enhance the effectiveness of scouring process, plasma treatment as environmentally friendly technique have employed in wool fabric nowadays. A Europlasma CD600 machine at a radio frequency of 13.56 MHz and O₂ is applied there as plasma gas. The conditions of plasma treatment are represented in the following table[13].

Table 3: Plasma treatment parameters[13].

Gas	Power(Watt)	Gas flow rate (Standard litre per minute)	Treatment time (Minute)
O ₂	300	0.3	3

The following figure exhibits outcomes of the scouring of O₂ plasma treated wool fabrics at distinctive time interval. The results in table disclose that 8.86% of the oils, fat, and wax were abolished after O₂ plasma treatment of wool. This is executed as the topmost of the layer of fabric is stripped off by engraving of the O₂ plasma operation[13].

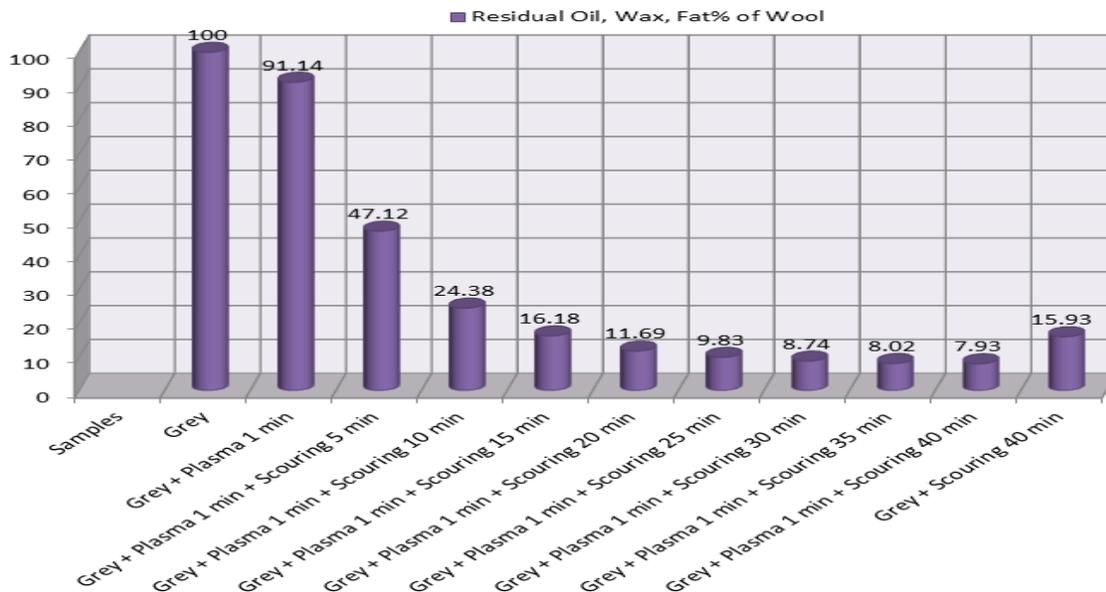
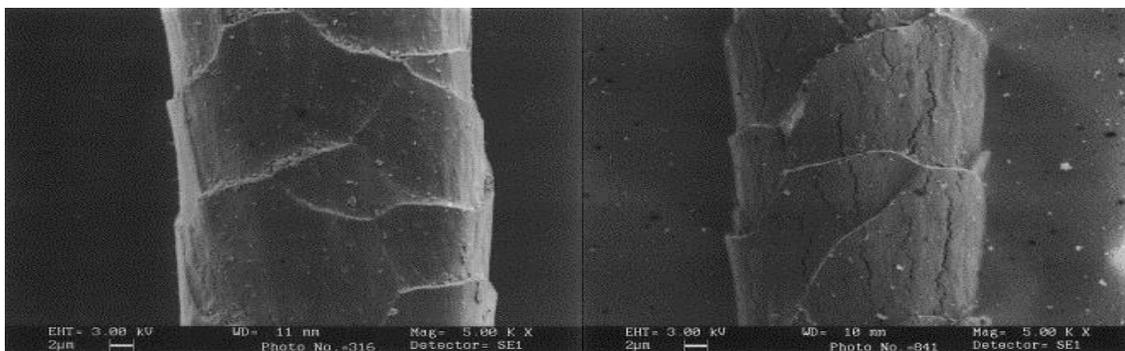


Figure 3: Residual oil, fat, and waxes of plasma treated and untreated wool samples[13].

On the contrary to 40 minutes needed for traditional scouring, 20 minutes and 25 minutes of scouring can be applied for plasma treated wool fabric. This process is environmentally friendly. The most substantial aspect is that surface properties of

fabric change significantly after short plasma treatment without altering bulk characteristics and the exploitation of chemical is very less due to physical method[13].



(a) Untreated specimen(mag. 5000X) (b) Plasma treated specimen(mag. 5000X)

Figure 4 : SEM photographs of wool fibre[6].

It is observed that holes are evident on the O₂ plasma treated wool fabric surfaces, which results by the ablation effect of nonpolymerizing reactive plasma gas. These holes can contribute dye molecules to penetrate the fibre surface and accelerate rate of dyeing[13].

III. CARBONISING

The object of carbonizing is the removal of cellulosic impurities such as burrs and vegetable fibres from wool. Carbonizing means treating cellulose with strong acid at a high temperature in order to obtain degradation products (including hydrocellulose), which are brittle and can be removed conveniently from the fabric by virtue of an appropriate mechanical treatment[2].

A. TRADITIONAL CARBONISING

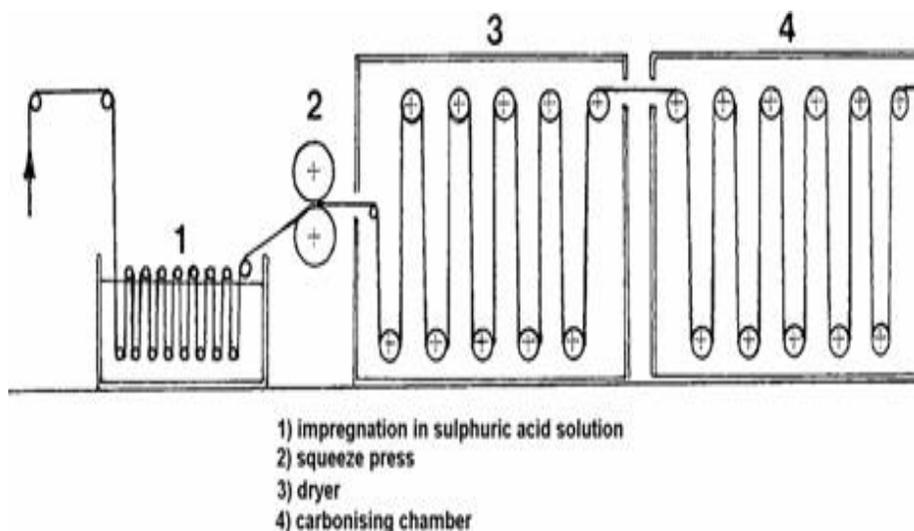


Figure 5: Representation of a conventional carbonising installation plant[18].

The scoured wool fabric is padded, immersed in 5 % (wt. vol.) H_2SO_4 until thoroughly saturated, squeezed, dried slowly and uniformly in open width at $60^{\circ}-70^{\circ}C$ and then backed at $110^{\circ}C$ for about 5 min. The charred vegetable material is brittle and is removed in a crushing machine processing iron rollers[1]. Carbonized wool is then rinsed and neutralised with sodium carbonate or ammonia at pH of about 6[2].

A. ENZYMATIC BIO-CARBONIZING

The tensile strength of carbonized fibre decreased by about 25.7% relative to raw wool; due to partial peptide bond hydrolysis during treatment with sulphuric acid[11]. This also results in extensive fibre damage in the subsequent process. For

this reason, replacement of chemical carbonisation by enzymes, such as, cellulase and xylanase, has been practiced nowadays in order to reduce wool fibre damage, effluent load and energy consumption[4].

B. METHODS OF BIO-CARBONIZING

Removal of vegetable impurities (i.e. Cellulose, Pectin or Lignin) is carried out using cellulase, pectin and lignin digesting enzymes[4]. Scoured wool fibre is treated separately with the acid cellulase, acid pectinase and xylanase enzymes and then in combination of them (1:1:1) utilizing the process condition represented in the following tables.

Table 4: Process parameters of single enzyme bio-carbonising[4].

Enzyme Concentration	pH	Material : Liquor	Temperature($^{\circ}C$)	Time(mins)
1-20ml/L	5.0	1:25	50 $^{\circ}C$	60-210

Table 5: Process parameters of mixed enzyme bio-carbonising[4].

Enzyme Concentration	Enzyme ratio	pH	Material : Liquor	Temperature($^{\circ}C$)	Time(mins)
20ml/L	1:1:1	5.0	1:30	50 $^{\circ}C$	120

C. EFFECT OF SINGLE ENZYME TREATMENT

Treatment of raw scoured wool fabric with acid cellulase, acid pectinase or Xylanase enzyme removes the vegetable content of wool fibre to various extents.

The amount of remaining vegetable matter(1.05%) is about 25% of the total impurity content of raw wool in case of using commercial acid cellulase[4].

Table 6: Effect of treatment of raw wool with single enzymes on its properties[4].

Treatment	Enzyme conc (mL/L)	Impurities Content (%)
Untreated	-	4.00
Carbonised	-	0.10
Acid Cellulase	1	2.02
	2.5	1.82
	5	1.44
	10	1.09
	20	1.05
Acid Pectinase	1	2.48
	2.5	2.32
	5	2.05
	10	1.77
	20	1.20
Xylanase	1	2.61
	2.5	2.46
	5	2.31
	10	2.12
	20	1.73

Acid cellulase degrades cellulose and hemicellulose, acid pectinase hydrolyses pectin and xylanase remove lignin. However, limited increase of tensile strength is monitored when wool fibre treated with high concentrated (5-20mL/L) cellulase or pectinase enzyme[4].

D. EFFECT OF MIX ENZYME TREATMENT
 The synergetic action of three enzymes in one bath is found to be much more effective in removing the vegetable matters from raw wool rather than using individual enzyme[4].

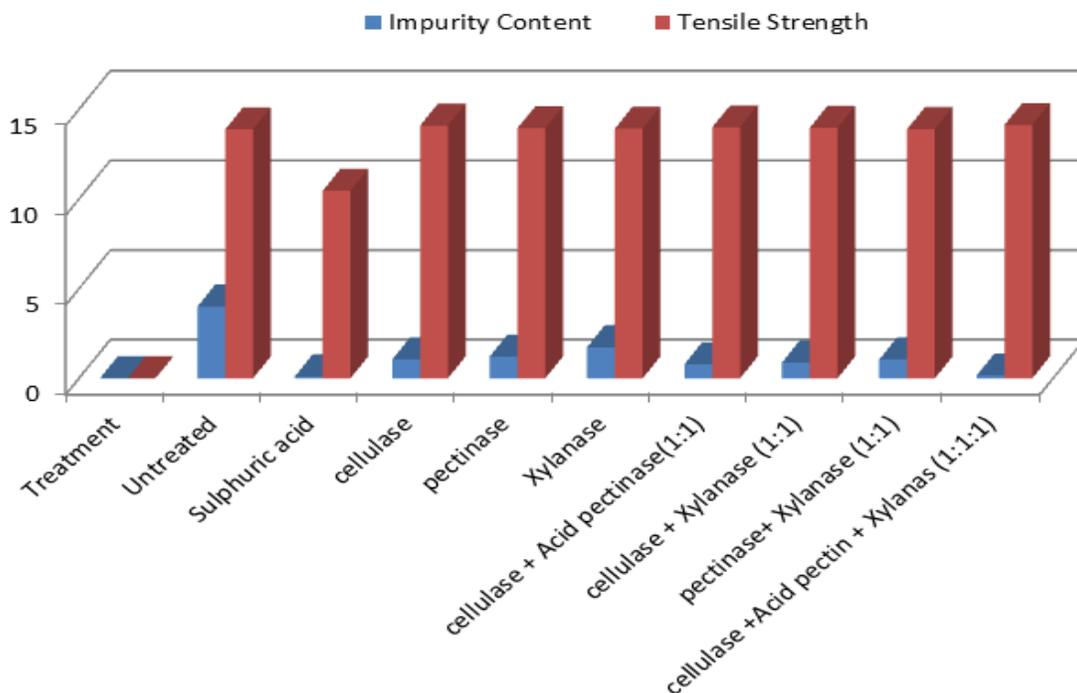


Figure 6: Residual oil, fat, and waxes of plasma treated and untreated wool samples[4].

The percent of vegetable matter in raw wool is reduced from 4 in case of raw wool to 0.16 when wool fibres treated with the mixture of these three enzymes.

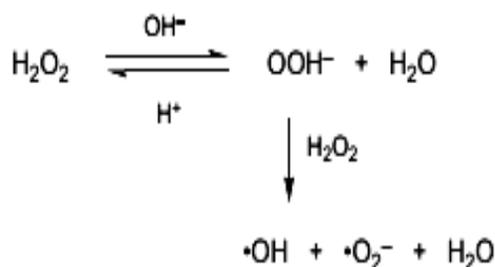
This may be attributed to the ability of each enzyme to remove a definite part of the vegetable matter that contaminates raw wool fabric[4].

IV. WOOL BLEACHING

The purpose of bleaching is to remove as far as possible the natural cream colour of wool, either for the production of white goods or when it is desired to produce bright pale colours[1]. Approximately 10% of the entire world production of wool is bleached[10].

A. PEROXIDE BLEACHING IN ALKALINE CONDITION

Hydrogen peroxide gives a permanent bleaching effect on wool. The active bleaching agent is the perhydroxy anion, $-OOH$, despite current work has strongly implicated the superoxide radical anion, $\cdot O_2^-$ [10].



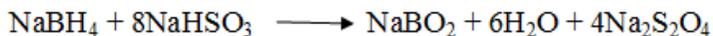
For wool bleaching, the stabiliser is generally tetra sodium pyrophosphate or sodium tri-polyphosphate. Wool is generally oxidatively bleached at pH 8.5–9 for one hour at 50–60 °C in presence of these phosphates. Furthermore, silicate based stabilizers over phosphates in effluents from textile treatment using efficiently these days[10].

B. PEROXIDE BLEACHING IN ACIDIC CONDITION

Wool is processed with a solution of hydrogen peroxide containing formic acid (2.5g/L) at pH 4-4.5 in room temperature. The processed wool is then squeezed to eliminate excess water and passed into a dryer. The chemical degeneration of wool fabric is less and rinsing after washing is not mandatory in this process[7].

C. BLEACHING WITH SODIUM BOROHYDRIDE

This is comparatively recent reductive bleaching technology for wool. It applies the reaction between Sodium borohydride and Sodium bisulphite to produce the active bleaching agent Sodium dithionite.



Damage of wool fibre is significantly less in Sodium Borohydride bleaching compare to peroxide. However, whiteness degree is quite similar to peroxide[16].

D. ENZYME EMBELLISHED BLEACHING OF WOOL

The improvement of whiteness caused by protease in wool bleaching is effected by a number of enzymes applied under both oxidising and reducing conditions. It is generally a two-step process, where an initial etching effect makes the wool more susceptible to subsequent bleaching. The addition of the protease enzyme to a peroxide bath shortens the bleaching time by half for the same whiteness[9].

Table 7: Bleaching of woven cloth with and without protease[9].

Fabric	Enzyme ^b % o.w.f.	Peroxide Bleaching	Combination bleaching ^a
		Whiteness, W	Whiteness, W
1	0.5	27.8	43.1
	0	21.0	32.5
	0.5	33.3	51.0
	0	21.2	33.0
2	0.5	31.8	45.0
	0	26.1	33.0
	0.5	36.2	47.9
	0	26.2	33.5
3	0.5	33.4	46.5
	0	27.2	36.0
	0.5	43.2	58.1
	0	28.	36.6
4	0.5	37.3	49.0
	0	29.4	41.0
	0.5	40.4	58.5
	0	30.7	

*a After peroxide bleaching, cloth was further bleached with Arostit BLN

*b Esperase 8.OL

Table 8: Reductive bleaching together with protease[9].

Enzyme % o.w.f.	Reducing agent%(o.w.f.)	pH	W ^a
Papain	Bisulphite(20) ^b	6.7	11
		6.7	22
		6.7	29
		6.7	20
		6.7	14
0	Dithionite(15)	6.7	13
		6.7	16
		6.7	21
		6.7	29
		6.7	44
Esperase8.OL	Dithionite(15)	7.0	17
		7.0	24
	Sulphite(20)	8.3	16
		8.3	18
	0	Sulphite(20)	8.3	1

*a Initial wool whiteness -10

*b Bisulphite is sodium meta bisulphite together with sulphite so as to provide pH 6.7

Reductive bleaching with bisulphite at pH 6.5-6.9 in the existence of papain is probably a fairly cheap and expeditious technique compared with peroxide bleaching, but necessitates modification. In both oxidative and reductive method the minimum weight loss is 3% which is exorbitant for wool because of its higher expanse [9].

V. CONCLUSION

It is obvious that preparation performs a significant role for the successful completion of dyeing and finishing of wool fabric. Without proper pre-treatment it is impossible to accomplish a high quality wool fabric coloration operation. However, due to some drawbacks such as excessive fibre damage, loss of tensile strength, higher amount of effluents in the wastewater and to reduce energy consumption and time, industries are now trying to upgrade the methods of eco-friendly enzyme based biological scouring, bleaching and carbonizing as well as implementation of plasma treatment in wool scouring. This definitely has creating a momentous influence for the textile industry.

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Socio Economic Impact of Pilgrimage Tourism: A Geographical Enquiry of Matavashino Devi

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Abstract- Pilgrimage as a form of journey provide an opportunity for the people to visit sacred places and is a feature common to more or less all societies. The land of Jammu is blessed with the holy stay of many great saints and spiritual souls. Mata Vaishno Devi being one of them is the most popular shrine located in the lap of Tirkuta Hills of Jammu region. Every year lacs of devotees from every nook and corner of the country as well as from different parts of the world pay the obeisance at shrine. The present work is an attempt to study the socio-economic impacts of pilgrimage tourism at Katra and its surrounding areas and also study the share of this pilgrimage centre in the state economy.

Index Terms- Vaishno Devi, Tirkuta Hills, Katra, Pilgrim.

during the period when Goddess was busy in destroying the various Asuras, one day her three main manifestations viz. Mata Maha Kali, Mata Maha Lakshmi and Mata Maha Saraswati got together and pooled their collective spiritual strength. A stunning bright light emanated from the place where the supernatural forces of the three manifestations coalesced and a beautiful young girl emerged out of this *Tejas* (Supernatural forces).

The holy Shrine of Mata Vaishno Devi, situated in the lap of Trikuta Hills of Lesser Himalayas near Katra at an altitude of 2500 feet above the mean sea level, is a unique natural gift. Located at 32°59'N latitude and 74°55'E longitude, Katra is a famous base camp for onward journey to the holy Shrine. The total track from Katra to Bhawan is 14.5 Km. Table 1 elaborates in detail the elevation and distance of different stations from the base camp at Katra to Bhawan.

I. INTRODUCTION

Mata Vaishno Devi is one of most well-known shrines since time immemorial. The Hindu mythology claims that

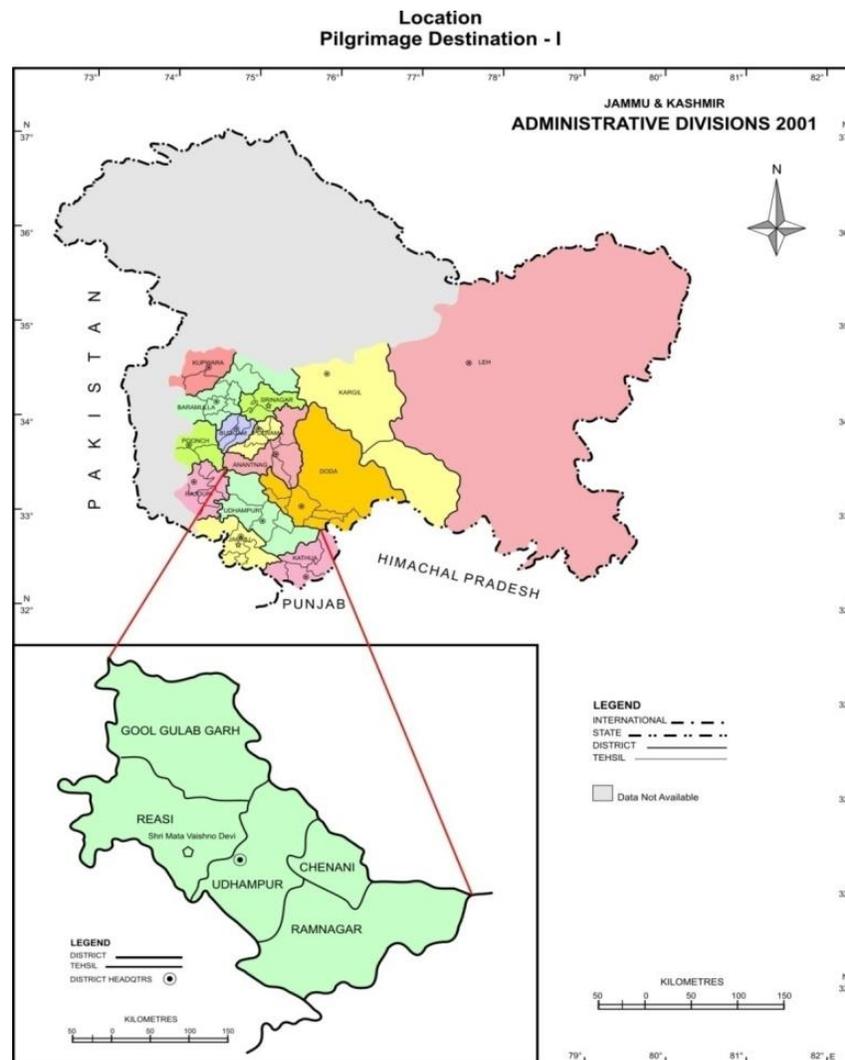
Table 1: Distance with altitude (feet) above sea level of different Pilgrim spots from Katra to Bhavan

S. No.	From	To (Spot)	Distance (Kms)	Altitude (ft.)
1.	Katra	Darshani Darwaza	1.0	2700
2.	Darshani Darwaza	Ban Ganga	1.0	2800
3.	Ban Ganga	Charan Paduka	1.5	3380
4.	Charan Paduka	Adhkuwari	4.5	4280
5.	Adhkuwari	Hathi Matha	2.5	6500
6.	Hathi Matha	Sanjichatt	2.0	6200
7.	Sanjhi Chatt	Bhairo-Mandir	1.5	6583
8.	Sanjhi Chatt	Bhavan	2.5	5200

Source: Mawa, S. "Pilgrimage Tourism Marketing Strategy with special reference to Mata Vaishno Devi Shrine

The whole holy shrine is situated on a plateau which is about 2.6km long and about 1.25 kms wide and composed mostly of limestone fissure rocks, dolomite and river deposits of recent origin. The entire journey from Katra to holy shrine of Mata

Vaishno Devi owing to scenic beauty attracts large numbers of tourists. The location of Shri Mata Vaishno Devi Shrine is shown in map 1.



Map 1

Objectives

The main aim of the study is to ascertain the socio Economic impact of pilgrimage tourism of Mata Vaishno Devi on the economy of Jammu and Kashmir. In order to achieve this, the following objectives have been set.

1. To provide a coherent and credible set of pilgrimage tourism account of Mata Vaishno Devi.
2. To examine the influx of Pilgrims tourists of Mata Vaishno Devi.
3. To assess the impact of pilgrimage tourism on the socio-economic status of the local residents.
4. To analyze the impact of pilgrimage tourism (Vaishno Devi) on the economy of the state.

Methodology

An empirical research is a cumulative product of primary and secondary sources of data. The secondary data sources in the form of government and non- government publications have been

extensively used to develop the conceptual frame work. The micro level analysis has been made by using primary sources. Primary survey of Mata Vaishno Devi has been conducted for the collections of information on various aspects of pilgrims as well as local inhabitants of the regions. This information has been collected with the help of questionnaires. In order to analyze the socio-economic impacts on the region various aspects like growth of pilgrims in number as well as in percentage, expenditure on different sectors of tourism, like accommodation, food, transportation, offering and shopping and miscellaneous activities has been taken into consideration. Further, the data has been analyzed by applying appropriate statistical and cartographic techniques. Besides, efforts have also been made to show tourism Multiplier and income effects in the study.

II. SOCIAL IMPACT OF PILGRIMAGE TOURISM- KATRA.

Social assets are one of the most important motivating and influencing factors in determining the tourist destinations and also awakening the desire of a tourist to see new areas and visualizing them to be different from their own. For a moment they want to mingle themselves in to a new world. This whole process causes a social change to come in the society. Appreciation of social impact of tourism has been neglected; however, Sir George Young logically highlighted the importance of considering social impact of tourism along with its economic impact. The social consequences of the economic activity are to be taken into consideration at some stage during growth of that activity in a universal manner. Tourism involves the trafficking of people, because it personifies contacts with the rich and the poor nations of the world. A major part of its very existence is social intercourse, because it is an industry that is very sensitive to non-economic influence, tourism requires the establishments of careful balance between economic and social benefits, in tourism there is personal confrontation, affluence and poverty. Tourism indeed is not all economics it is a host-guest relationship. Tourism expands the social and cultural frontiers through the interaction of various cultures and also due to enhanced educational ability which equips the humanity with new ideas, new skills and new cultures thereby acting as a powerful instrument of socio-economic transformation. Social impacts of tourism refer to the change in the quality of life of residents of tourist destinations as a result of development of tourism in that region. Katra, is a hub of pilgrimage tourism in

Jammu region. Due to the development of tourism a great change has been noticed among the young generation than the older people. There is no doubt that this destination has experienced a vital social change in the past three decades. The change in society is very natural but advent of tourism along with modern mass media has accelerated the process of change. Sometimes the change is viewed as undesirable and unhealthy.

No doubt with the spread of information and communication revolution, the world is shrinking towards a global village. In the study area, this process has been further accelerated due to tourism. The cultural setup, lifestyle, food habits, dress, language, dance, drama, music, literature, value system, rituals and customs everything has witnessed tremendous change as a result of tourism in the study area. Sometime the change is desirable but in most of the cases it is a dilution of socio-cultural framework of the host region. The social changes/impacts can be study under the following heading:

1.1 Demographic change – Katra

Katra is known the world over, for its great religious sanctity and supreme reverence. The growth rate of population in Katra shows a remarkable change since 1911 to 2011 (Table 2). The earlier settlement of Katra was known as Thath, which was renamed later on as Katra by Maharaja Gulab Singh in 1981. As evident from the population figures of year 1911, there were only 828 persons living in the settlement of Katra during the period of Dogra rule. The whole hillock of Mata Vaishno Devi Ji belonged to the Dharmath Trust, which was looking after the management of Holy cave and the route along the Dharamshallas.

Table 2: Growth of Population since 1911-2011 – Katra

Census Year	Population	Decadal Growth (%)
1911	828	
1921	868	4.83
1931	950	9.44
1941	1005	5.78
1951	1267	26.06
1961	1529	20.62
1971	3315	116.80
1981	4573	38.00
1991	NA	NA
2001	8303	81.56
2011	9008	8.49

Source: Census of India 2011.

The table further reveals that the population of Katra Town has increased to 3315 in 1971 and 9008 in 2011 A.D. respectively. But with an increase in pilgrim flow the resident population also grew to 116.8 percent during 1961-71 decade. It is only, because of this growth in population that the Government of Jammu and Kashmir state has to notify the settlement of Katra under the provisions of Jammu and Kashmir State Municipal Act, making Katra as an urban town with constitution of a Notified Area Committee. Besides, the increase in resident population, the floating population has also increased by i.e. 81.56 percent from 1981 to 2001, especially after the constitution of Shri Mata Vaishno Devi Shrine Board in 1986. In the recent decade the growth of population at katra town is 8.49 percent

which is very low as compare to the previous decadal growth rate.

1.2 Occupational structure – Katra

As per the Census records of previous four decade, i.e. 1961, 1971, 1981 and 2001 an analysis has been made that reflects a drastic change in the occupational pattern in the decade of 1961-71. It is observed that cultivators’ percentage has decreased from 10.2 percent (1961) to 2.6 percent (1971) and 1.4 percent in 1981. A further decline of 0.2 percent in the year 2001 has been recorded. Being a pilgrimage centre substantial increase has been made noticed in the territory sector, where labourer category and other services has increased from 10.9 percent (1961) to 17.7 percent (1971) to 19.20 percent (1981) and 34.0 percent (2001).

Similarly, the decrease in non-worker dependent on pilgrims has been found declined from 70.3 percent (1961) to 65.7 percent (1981) and 63.1 percent (2001). The table reveals that the

economic base of the town has considerably strengthened in secondary and tertiary sector, but has dwindled in primary sector because of increased urbanization.

Table 3: Occupational Structure (percentage) – Katra

S. No.	Occupation	1961	1971	1981	2001
1	Cultivators	10.2	2.6	1.4	0.2
2	Household Industries	1.8	0.5	3.2	0.1
3	Trader and Commerce	7.5	7.6	10.5	2.6
4	Labour and other services	10.9	17.7	19.2	34.0
5	Non-workers Dependent on Yatrics	70.3	71.6	65.7	63.1
	Total Workers	100.0	100.0	100.0	100.0

Source: Master Plan Katra 2021 A.D.

1.3 Changing land use – Katra

The Tourism with its excessive concern for aesthetic economic development, lays greater stress on the part of land resources. It is the tourism only when compared to other urbanizing agents, has involved in higher rate of conversion of agricultural land to non-agricultural one mainly for tourist landscaping and meeting the recreation needs of the tourists. The extent of conversion however varies from one resort to another depending upon the type of tourism being promoted, the nature of tourist arrivals and the most important of all is the type of tourism promotional agency.

The land use scenario of Katra town has witnessed a tremendous change during the last few decades. Since Katra town receives countless pilgrims per year thus for the management of the town, the State Government has initiated Town Planning Scheme for developing the town in an organized manner. For this the State Govt. brought Katra town under the provisions of the State Town Planning Act, 1963 and constituted a Development Board for the preparation of a town planning

scheme for 410.58 acres of lands out of which only 82.58 acres of land has been developed for various uses, as given in table 4.

During the year 1975 the residential area was restricted to 26 acres out of which 5 acres was devoted to commercial activities, 7.5 acres for public/semi public utilities, 0.6 acres for socio-cultural activities, 7.0 acres for recreational activities, 2.0 acres for religious and archaeological usage, 16 acres for circulation, 3 acres for industrial purpose. Land measuring 328 acres was under open area. But this has been transformed in to various land uses like residential, Pilgrims accommodation, commercial, Govt. Offices, Hotel, Guest Houses, Circulation and industries. As a result of this open area has decreased. The town Planners has proposed different proportion of land under different land use plan, given in table 4, which shows increase in land use over the year under different plans. Thus Katra has gradually sprawled towards the surrounding villages. It demands control over the future development in and around this expanding town, so as to achieve a sustainable urban development and provide better infra-structure to the pilgrims and local population in near future.

Table 4: Proportion of Land under different categories – Katra

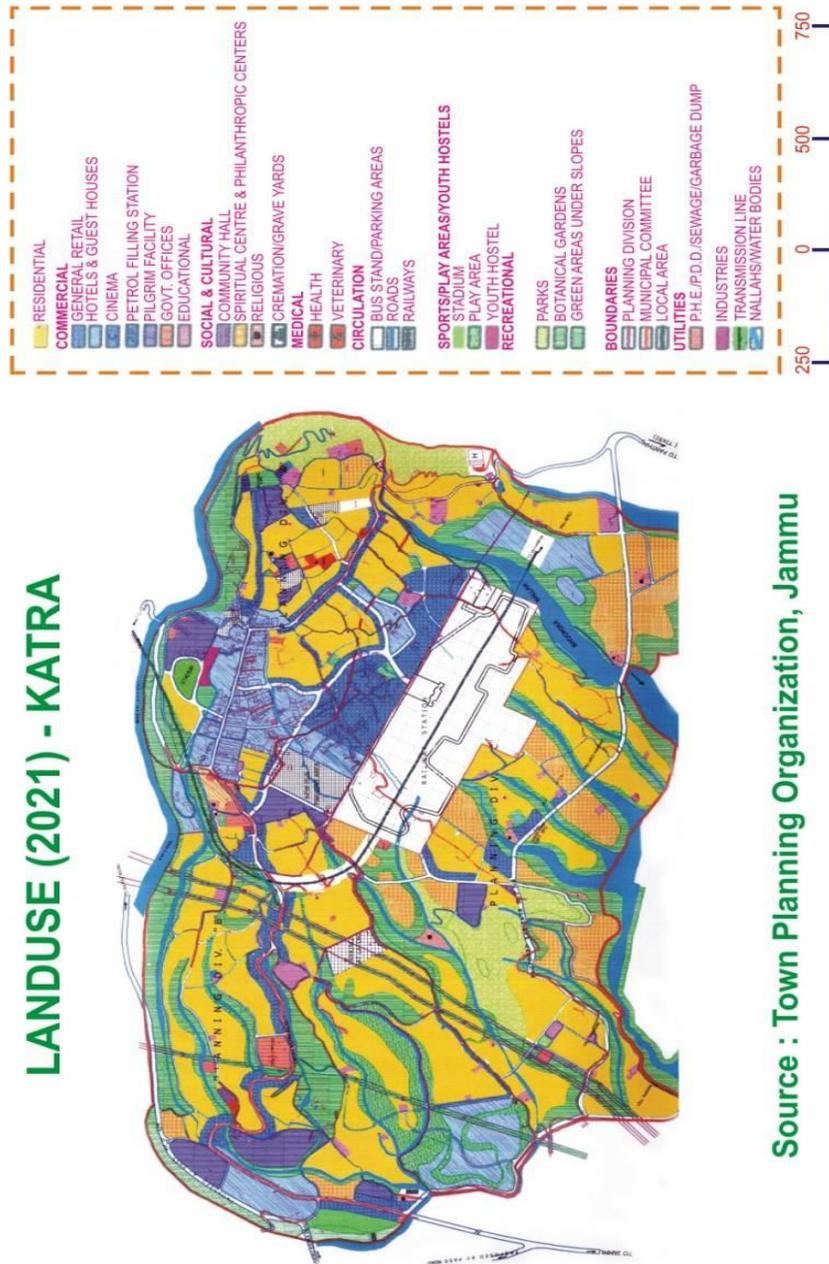
S. No.	Land use	As on. 18.8.1975	As on 13.9.1986	As on Feb. 2002
		Area	Area	Area
1.	Residential	26.00	107.26	238.00
2.	Pilgrim accommodation in dormitory use	9.00	27.80	27.80
3.	Commercial			
	a. General Business	3.00	4.22	12.65
	b. Hotels	2.00	8.22	16.73
	c. Guest House	-	-	16.87
	d. Cinema	-	0.50	0.50
4.	Public/Semi Public			
	a. Educational Institutes	2.30	4.02	6.26
	b. Medical Institutes	0.60	1.06	1.06
	c. Govt. offices	3.10	8.69	10.00
	d. Labour Sarai	0.30	0.50	0.50
5.	Public utilities	1.20	1.84	2.00
6.	Social cultural	0.60	3.61	8.34
7.	Recreational:			
	a. Parks, open spaces etc.	7.00	8.00	10.00
8.	Religious and Archaeological	2.00	5.28	10.25

9.	Circulation:			
	a. Road/lanes	16.00	32.03	71.82
	b. Terminal Parking	-	6.50	6.50
	c. Air strip	6.48	6.48	8.45
	d. Industrial	3.00	1.87	1.00
11	Open Area	328.00	1094.79	2252.84
	Total	410.58	1322.67	2701.57

Source: Master Plan – Katra 2021 A.D. prepared by town planning organization Jammu, p.15

1.4 Proposed Land Use

The growth of Katra town got a fillip since 1975. It is mainly due to the growth of pilgrimage tourism at Mata Vaishno Devi. Katra is serving as the most important nucleus for pilgrimage to the Darbar of Mata Vaishno Devi and hence lots of efforts have been made by both the state authorities and Shrine Board Authorities in providing facilities to the pilgrims in Katra and along the route to the holy cave. Moreover, in view of the ongoing disturbance in the state security is the prime priority. The movement of vehicles, their parking, the movement of pilgrims, their stay and their shopping etc. demand proper attention among other day to day problems in Katra. Therefore, the state Government proposed land use plan 2021 A.D. for Katra so as to achieve sustainable urban development and provide adequate infrastructure to the local population and pilgrims in near future. A detail of land use plan is shown in map 2. This proposed land use plan, covering about 2699.60 acres of land, has been divided into three planning divisions (Table 5), in order to effectively implement the proposals envisaged in Master Plan.



MAP 2

Table5: Planning Divisions – Katra.

Planning Division	Area in Acres	Location
A.	794.00	Village Katra from Banganga on North to Railway land boundary on South, Shankaracharya hills on East to Railway live on west.

B.	673.60	Village on west of railway line on north upto Banganga Nallah, on South upto Nomain check post and on east upto Latori road.
C.	1232.00	Village Arlihansali on west upto Kotla Bajala on east upto Purana Droor and on south upto Nilapamota and Sarli
Total	2699.60Acres	

Source: Master plan – Katra 2021 A.D. Town Planning Organization, Jammu. P. 51-53.

The allocation of the area under various land uses has been made as per national level planning norms (Table 6).

Table 6: Proposed Land use 2021 (Area in Acres) – Katra

S. No.	Land Use	Area	Percentage
1	Recreational	1100.75	40.77
2	Pilgrim facilities	64.90	2.40
3	Commercial	285.55	10.58
4	Government offices	16.10	0.60
5	a) Educational b) Medical Hospital	37.79	1.40
6	Social and Cultural	209.97	7.78
7	Circulation a) Bus stand parking b) Roads c) Parking	495.52	18.36
8	Sports area/ Youth Hostel	9.85	0.36
9	Utilities	21.7	0.80
10	Recreational	133.93	4.96
11	Green area under transmission lines	31.50	1.17
12	Green area under Slope	118.14	4.38
13	Green Belt	81.02	3.00
14	Nallahs / Water Bodies	92.88	3.44
	Total	2699.60	100.00

Source: Master plan – Katra 2021 A.D. Town Planning Organization, Jammu. P. 55.

1.5 Growth of Urban System of Katra

Katra was just a village about 50 years ago where the residential structures were around a linear pedestrian bazaar. It witnessed a very slow growth, as evident from the census records of 1911 upto 1961 A.D. Katra town with its urban limits of 1.62 sq. kms (410.58 acres) expand tremendously and thus got notified in 1971. Presently it is one of the fastest growing towns of Jammu and Kashmir. A Town Planning Scheme for 410.58 acres land was prepared by Town Planning Organization Jammu which was approved by the state Govt. vide SRO 334 dated 2.7.1980. Thereafter, it was again notified vide SRO 579 dated 13.09.1986 under the provisions of Jammu and Kashmir State Development Act, 1971 comprising a local area spread over 1322.67 acres of land. But during this period Government of India approved a project for bringing Katra Town on the railway map connecting Katra with rest of country by rail. As such the Railway Department acquired 2000 Kanals of land in Katra in village Kundrorian, Arli, Hansali and Sarli. It was then felt that the town is likely to grow towards its South side and as such 1272.33 acres of land area was added to the previous local area

and a new local area with a total area of 2595 acres was constituted vide SRO 64 dated 7.2.2002.

Presently, the town of Katra (within its NAC of 1971) consists of Chinta Mani Mohalla, Upper Bazar Mohalla, Bhimmi Mohalla, Keshar Nagar, Tootwala Mohalla, Tea Garden Housing Colony and Kalka Nagar. Villages of Kundorian, Kotli Bajala, Purana Daroor, Nilay Pamote & Sarli Hansoli now form a part of the local area notified vide SRO 64 dated 07.02.2002.

1.6 Temporal variation in registered labourers in katra.

In terms of the registered labourers, Muslims dominate the working class at Katra by providing more than 75 percent of labour force throughout the study period (Table 7). In the year 2001-02 highest percentage 80.02 percent of registered labourers were Muslims which decreased in the subsequent years and stand at 79 percent in 2008-09. From 2001-02 onward upto 2008-09, highest percentage of 82.61 percent of labourer recorded in the year of 2006-07. Similarly the percentage of Hindu labourers ranged between 17.6 percent 2006-07 to 24.01percent in 2003-04. The variation in registration of labourers belonging to Hindu and Muslim communities has been associated with economic backwardness and social unemployment of each community.

Table 7: Temporal variations in registered labourers (percentage) – Katra

S. No	Year	Hindu	Muslim
1.	2001-02	19.98	80.02
2	2002-03	21.98	78.01
3	2003-04	24.01	75.99
4	2004-05	23.00	77.00
5	2005-06	21.03	78.97
6	2006-07	17.39	82.61
7	2007-08	22.98	77.02
8	2008-09	21.00	79.00

Source: Municipal Office, Katra

1.7 Type of establishment and workers- Katra

Among all the tourist establishment hotel industry along with shops and allied enterprise constitutes 35.99 of the total establishment in 1990-91. Guest house and Dharamshalas along with transport captures 12 percent of total establishment in the same year. However Government employees and palanquin carrier registered only 2.4 percent and 1.6 percent respectively in 1990-91 (Table 10). In the year 2005 the number of each

segment have been fluctuating but hotel, industry and shop again occupied the highest position though with minor decrease. However the pony attendant and pithu attendant captures 9.4 percent and 8.4 percent establishment in 2005. Palanquin carrier Government employees are the only sector which have recorded an increase and stand at 1.6 percent and 2.6 percent in 2005 and 2006 respectively.

Table 8: Type of establishment and workers at Mata Vaishno Devi shrine (Katra)

S. No.	Nature of establishment	1990-91	2005-06
1.	a. Hotel industry	35.99	28.14
	b. Guest House and Dharmshallas	12.00	10.05
	c. Shops and allied establishment	35.99	30.15
	d. Transport	12.00	9.38
2.	Pony Attendant	N.A.	9.49
3.	Pithu attendant (Porter)	N.A.	8.44
4.	Government Employees	2.40	2.68
5.	Palanquin Carrier	1.62	1.67
	Total	100	100

Source: Municipal Office, Katra.

1.8 Distribution of labourers by destinations and community wise

The labourer force serving at Shri Mata Vaishno Devi belongs to both Muslim and Hindu community which as per the number of labourer share a ratio of 80:20 (Table 9). Perusal of the table further reveals that among the pony wala hundred percent Muslims are from Poonch district followed by 90.5 percent from Udhampur district and 80 percent from Rajouri district. Similarly the Hindu pony wala recorded the highest percentage from Ramban which is to the tune of 41.18 percent very closely followed by 28.57 percent from Doda district.

However the pithuwala registered the interesting pattern where in 100 percent services are provided by Hindus from Samba district and 60 percent from Kathua district, 37.17 percent from Ramban district, 35.48 percent from Doda district and 33.33 percent from Jammu district. However the Muslims from Rajouri district constitute 91.55 percent, Poonch district 88.79 percent, Udhampur district 81.83 percent and Jammu district manage to provide the service of 66.67 percent pithu wala. The variation in the percentage of services provided by both the communities clearly indicates the socio-economic and politico-cultural harmony between the communities.

Table 9: Percentage distribution of labourers by destinations (percentage) – Katra

S.No	Destinations	Pony Wala		Pithu Walas	
		Hindu	Muslim	Hindu	Muslim
1.	Doda	28.57	71.43	35.48	64.52
2.	Ramban	41.18	58.82	37.17	62.83
3.	Rajouri	20.00	80.00	8.45	91.55
4.	Reasi	26.72	73.28	30.59	69.41
5.	Udhampur	9.46	90.54	18.17	81.83
6.	Poonch	-	100	11.21	88.79

7.	Jammu	-	-	33.33	66.67
8.	Kathua	-	-	60.00	40.00
9.	Samba	-	-	100.00	-
	Total	20.00	80.00	19.99	80.01

Source: Municipal Office, Katra

1.9 Distribution of Respondent by Occupation

Different sectors of tourist industry work in union to enhance the revenue generated by pilgrimage tourism. Table 10 provides a detail of the varied establishments which boast of tourism and generate employment henceforth. Perusal of the table clearly indicates that of all the establishments; Tour and travel agencies (Rs 48236.6/person/month) earn much more than any business

center followed by Palanquin wala (Rs 14831.7/person/month), Professional photo-graphers (Rs 14547.1/person/month), Hotels and Restaurants (Rs 11691.0/person/ month), Poney wala (Rs 10645.8/person/month), Pithu wala (Rs 6995.8/person/ month) and Tea stalls and other allied business activities (Rs 2485.0/person/ month).

Table 10: Percentage distribution of Respondent by Occupation – Katra

S. No.	Nature of Establishment	No. of Establishment	No. of Worker	Income/ unit/day (Rs)	Total income of all units /year (lacs)	Income/ person/ month (RS)
1	Tea stall and other allied business activities	37.0	70.0	1545.7	208.74	2485.0
2	Tours and Travel	14.0	29.0	3285.0	167.86	48236.6
3	Poney Owner	25.0	25.0	350.0	31.93	10645.8
4	Pithu (porter Service)	20.0	20.0	230.0	16.79	6995.8
5	Palanquin Service	16.0	84.0	2560.0	149.50	14831.7
6	Professional Photographer	4.0	23.0	2750.0	40.15	14547.1
7	Hotels and Restaurants	28.0	440.0	6040.0	617.28	11691.0
	Total	144.0	691.0	16760.7	1232.25	109433.0

Source: Primary survey – 2005

1.10 Classification of tourist establishment by infrastructure and income

Classification of tourist establishments has been done on the basis of infrastructure and rate of accommodation. Perusal of table 11 reveals that the hotels and restaurants providing accommodation at the rate of Rs 2000-Rs 3000 earned

maximum revenue to the tune of Rs 4.75 lacs per month followed by the hotels (Rs 3.25 lacs/month) providing rooms at the rate of Rs >3000 , Rs 1000-2000 and 500-1000 per day. The total revenue generated by all the hotels and restaurants stands to the tune of Rs 11.61 lacs per month. From the table 11 it is clear that most of the pilgrims have sound financial background.

Table 11: Classification of tourist establishment by infrastructure and income – Katra

S. No.	Room Rent	No. of Hotel and Restaurant	Nature of Accommodation	No. of Rooms	Total Income/ Month (Lacs)
1	<500	14.0	Hotel	200.0	0.86
2	500-1000	12.0	Hotel	125.0	1.25
3	1000-2000	15.0	Hotel and restaurant	182.0	1.50
4	2000-3000	13.0	Hotel and restaurant	185.0	4.75
5	>3000	15.0	Hotel and restaurant	75.0	3.25
	Total	69		767	11.61

Source: Association of Hotels, Restaurants & Travel Agents Katra (Mata Vaishno Devi)

III. ECONOMIC IMPACT OF PILGRIMAGE TOURISM – KATRA

The expenses incurred by the tourists are an important aspect to study the economic impacts on a tourist resort. The structure of tourist expenditure is crucial and of economic importance, since there is an expenditure and national income, tourist expenditure and employment, tourist expenditure and tax revenue. Katra, the base camp for the pilgrimage tourism of Mata Vaishno Devi, is experiencing the impact of heavy inflow of pilgrims which besides generating employment and revenue also add to the market value of the goods and services offered by the

residents or stakeholders of the pilgrimage tourism. For better analysis and understanding of the economy of the area, some aspects viz growth in the number of pilgrims, other activities related with tourism services, estimated expenditure per pilgrim in Katra, income effect, multiplier effect, employment effects and residents perception are assessed.

2.1 Growth of pilgrim to Shri Mata Vaishno Devi – Katra

The determination of growth in the number of pilgrims is an important component of tourist impact analysis. The growth rates of pilgrims have been calculated and documented in the table 12.

Table 12: Growth of Pilgrim to Shri Mata Vaishno Devi – Katra

S. No.	Year	No. of Tourists	Growth rate
1.	1980	12.13	-----
2.	1985	14.86	22.50
3.	1990	21.69	45.96
4.	1995	40.12	84.97
5.	2000	51.92	29.41
6.	2005	62.52	20.42
7.	2007	72.22	15.51
8.	2008	65.76	-8.94
9.	2009	82.35	25.23
10.	2010	87.49	6.24
11.	2011	101.15	15.61
12.	2012	101.54	0.39

Source: 1. Digest of Statistics 2011-12. Directorate of Economic and Statistics, Govt. of Jammu and Kashmir.
2. JKTDC, Office Jammu.

The critical analysis of table 12 reveals that the number of tourists visiting Shri Mata Vaishno Devi Shrine always bare an upward trend throughout the study period. Documenting the facts and figures, the table clearly indicates that in the year 1980, 12.13 lacs persons visited the shrine followed by 40.12 lacs in 1995, 51.52 lacs in 2000, 62.52 lacs in 2005, 87.49 lacs in 2010, and 101.54 lacs in 2012,

Further analysis of the table shows that the highest growth of pilgrims at Mata Vaishno Devi has been recorded in the year 1990 was 45.96 percent and lowest growth rate has been recorded in the year 2008. This decrease in the growth rate could be attributed to the political upheaval and Amarnath land dispute that almost divided the state on communal lines.

Table 13: Year wise growth of Local and Non-Local Pilgrim (percentage)–Katra.

S. No.	Year	Locals	Non-Locals	Ratio
1.	1980	16.90	83.10	17:83
2.	1985	12.09	87.91	12:88
3.	1990	18.21	81.79	18:82
4.	1995	13.69	86.31	14:86
5.	2000	12.49	86.51	13:87
6.	2005	12.30	87.70	12:88
7.	2008	10.25	89.75	10:90
8.	2009	11.30	88.70	11:89
9.	2010	12.44	87.66	12:88
10.	2011	12.10	87.90	12:88
11.	2012	10.90	89.10	11:89

Source: 1. Shrine Board Central Office, Katra
2. JKTDC Office, Jammu

As a matter of fact, the ratio of local and non-local pilgrims visiting the area and paying obeisance to Shri Mata Vaishno Devi

has been found to be 1:7 (Table 13). It has been found that pilgrims from outside the state constitute more than 80 percent of

total pilgrims which range between 81.7 percent in 1990 to 89.10 percent in 2012. Similarly the local pilgrims range between 10.90 percent in 2012 to 18.2 percent in 1990. The higher percentage of non-local is a healthy indicative of economic development of the region.

Table 14: Proportion of Pilgrims from different states of India – Katra

S. No	Destinations	M	F	Total
1.	Uttar Pradesh	8.40	16.99	14.27
2.	Delhi	6.30	14.64	12.00
3.	Maharashtra	12.61	7.81	9.33
4.	Jammu & Kashmir	7.15	3.91	4.93
5.	Karnataka	7.15	4.49	5.33
6.	Punjab	8.40	6.05	6.80
7.	Madhya Pradesh	5.88	8.98	8.00
8.	West Bengal	4.20	4.69	4.53
9.	Bihar	14.28	9.77	11.20
10.	Rajasthan	3.36	3.91	3.73
11.	Andhra Pradesh	2.10	1.76	1.87
12.	Haryana	1.68	1.76	1.73
13.	Gujarat	2.10	2.34	2.27
14.	Assam	0.84	0.98	0.93
15.	Manipur	0.84	0.59	0.67
16.	Sikkim	0.42	0.39	0.40
17.	Orissa	0.84	0.39	0.54
18.	Tamil Nadu	0.84	0.78	0.80
19.	Goa	1.26	0.39	0.67
20.	Chattisgarh	7.15	6.45	6.67
21.	Uttranchal	4.20	2.93	3.33
	Total	100	100	100

Source : Primary survey – 2005-08

The table number 14 tells the Proportion of Pilgrims from different states of India to the holy shrine of Mata Vashino Devi at Katra. The table is quite lucid and self explanatory.

Table 15: Respondents duration of stay – Katra (N=2589)

S. No	Stay Duration	Percentage
1	<-3	51.20
2	3-6	41.47
3	6-9	6.93
4	>-9	0.40
	Total	100

Source : Field Survey conducted by the Researcher
Average duration of stay: $2589/750 = 3.5$ day.

The table number 15 shows that the duration of stay of different pilgrims universally proportional to percentage which can be best judge by the fact that 5.2 percent pilgrims stay for less 3 day followed 41.4 percent which prefer to stay for 3 to 6 days. However 6.9 percent pilgrims stay for 6 to 9 days and only lowest of 0.4 percent pilgrims stay for more than 9 days. Taking these values into consideration it can be said that the average duration of stay of a pilgrims stands at 3.5 days.

Table 16: Expenditure of Pilgrims during stay per head – Katra

S. No.	Break up of Income Head	Average Expenditure	Percentage	Total expenditure (Rupees)
1.	Boarding and Lodging	597.10	42.81	447825.00

2	Internal Transport	116.50	8.35	87375.00
3	Offering	205.25	14.71	153937.50
4	Shopping	385.50	27.63	289125.00
5	Miscellaneous	90.75	6.50	68062.50
	Total	1395.10	100	1046325.00

Source: Primary survey – 2005-08

Average duration of Stay = 3.5 days

Therefore the per day expenditure of a Pilgrim as $1395.10/3.5 = \text{Rs.}398.60$

The relevant data on the expenditure pattern of tourist, based on the field survey is presented in Table 16. It is observed from this table that per head per day expenditure of a pilgrim at Katra is Rs. 398.60. Taking a grand figure 679223 of tourist who visited the holy Shrine Mata Vaishno Devi in 2008, tourist expenditure is around Rs. 947.58 crore.

The table further indicates that 85.15 percent of the expenditure of pilgrims is incurred on boarding and lodging; shopping and offering; the remaining expenditure is incurred on internal transport and miscellaneous activities. It may also be pointed out that the boarding and lodging account for highest proportion of pilgrims expenditure followed by the spending on shopping and offering.

Table 17: Temporal variations in expenditure of pilgrims – Katra

Years	No. of Pilgrim	Per Capita Expenditure per head per day (Rs)	Average Duration of Stay (Days)	Total Expenditure (Rs crore)
2005	6109895	398.60	3.5	852.1
2006	6251998	398.60	3.5	8722.1
2007	6950573	398.60	3.5	9696.7
2008	6792223	398.60	3.5	9475.8
2009	8235064	398.60	3.5	11488.7
2010	8749000	398.60	3.5	12205.7
2011	10115232	398.60	3.5	14111.7
2012	101 54 401	398.60	3.5	14166.4

Source: 1. Compiled from tables 15 & 16

2. JKTDC, Jammu

On the basis of average expenditure of a pilgrim per head per day (Rs. 398.60) and duration of stay (3.5 days) per head expenditure of pilgrim is estimated Rs. 1395.10 on various services. The gross receipts from pilgrimage tourism at Katra is estimated and presented in Table 17.

It thus followed from table 17 that pilgrim incurred an expenditure estimated at Rs. 852.39 crore in 2005 but it reach Rs. 14166.4 crore in 2012. It is only due to increase in influx of pilgrims.

IV. TOURISM MULTIPLIER EFFECT - KATRA

Tourism multiplier is in fact an attempt to go behind the tourist receipts and find out the expenditure profile of the tourist, nature of his preferences, volume of their transactions, direction of economic dissemination and the share which goes to various segments of economic activity. The expenditure by the tourist can have beneficial effects on all the economic sectors by diversification of industrial and other economic activities, since this money circulates as it changes hands and is spent and respent a number of times. Tourism multiplier thus indicates the cumulative force of each currency unit entering the economy. There is a chain reaction of spending, triggered off by the injection of tourist money into destination economy.

A multiplier is the ratio of direct, indirect and induced changes within an economic system to direct a causal change itself. The expenditure of the tourists gets converted to the income or savings of those working in the tourism sector. This has been called the “Primary effect”, when a part of income spent and respent, it gives rise to the “Secondary effect”. For instance, the primary effects of a hotel owner which he receives in the form of hotel bills from the tourists gets converted to secondary effects when he make payment for electricity, furniture, food and other services, which he provides to the tourists. Therefore, the expenditure of tourists not only supports the tourist industry directly but also helps many other sectors of the economy to grow. The income occurring to the economy from tourist expenditure will be received by the factors of production in terms of wages, rent, interest and profit, will be receipt or saved for further turnover effects. For the purposes of estimation of total aggregate national income generated in the economy by Tourism sector the total receipts are multiplied by multiplier co-efficient. Tourism multiplies is based upon some unrealistic assumption like constant ratios of propensity to import and consume, taxation to income and factor income shares a national income. In addition, the chains effects are measured only up to first or second round of expenditure, while decreasing the economic effects of Tourism Thon Bryden says, It is upon the multiplier effects that most studies to tourism in the developing countries to

date have concentrated". Peter (1969), Checchi (1961), Zinder Report (1969) and Tripartite Survey (1969) being the examples. An exception is Mitchell's work in East Africa, 1969 wherein he calculates only the first round expenditure effects.

In India an attempt has been made for the first time by NCAER (National Council of Applied Economic Research) in 1969 to calculate the economic benefit of tourism through multiplier analysis. In their Techno-Economic Survey of Jammu and Kashmir State, a tourism multiplier coefficient of 3.2 has been assumed for the state. In fact Techno Economic Survey did not yielded significantly unexpected results as some of the goods and services on which the tourists spend have to be imported from outside the state and consequently leakages in economic output reduce the total revenue generation.

The tourism department of Jammu and Kashmir in formulating its 5th plan proposals for development of tourism has

assumed a multiplier coefficient of 3.5. The NCAER proceeds with two alternative assumptions about the multiplier coefficient of 3.2 and 3.6. The NCAER observed that the contribution of tourism to overall Indian economy could be calculated with the same multiplier coefficient which was suggested for Jammu and Kashmir and reported that for the purpose of estimating the total aggregate national income generated in the economy due to foreign tourism in India, it will be in the range with a low of 3.2 and high 3.6 multiplier coefficient times the initially injected direct income derived from foreign tourist expenditure."

In the light of these observations an attempt has been made to estimate the multiplier effect of tourism activity in the destination (Katra).

Table 18: Average Expenditure of Pilgrim under different heads – Katra

Year	No. of Pilgrims	Average Spending per head (crore)									
		B &L	TE	T	TE	O	TE	SH	TE	MS	TE
2005	6109895	597.1	364.82	116.5	711.80	205.25	125.41	385.5	235.54	90.75	55.45
2006	6251998	597.1	373.30	116.5	728.36	205.25	128.32	385.5	241.01	90.75	56.74
2007	6950573	597.1	415.01	116.5	809.74	205.25	142.66	385.5	267.45	90.75	63.08
2008	6792223	597.1	405.56	116.5	791.29	205.25	139.41	385.5	261.84	90.75	61.64
2009	8235064	597.1	491.71	116.5	959.38	205.25	169.02	385.5	317.46	90.75	74.73
2010	8749000	597.1	522.40	116.5	1019.26	205.25	179.57	385.5	337.27	90.75	79.39
2011	10115232	597.1	603.98	116.5	1178.42	205.25	207.61	385.5	389.94	90.75	91.79
2102	10154401	597.1	606.22	116.5	1182.99	205.25	208.42	385.5	390.94	90.75	95.67
Total	53203985		3783		7381.24		1300.42		2441.45		578.49

Note : B&L- Boarding and lodging, TE – total expenditure, T – transport, O- offerings, SH- shopping, Ms- Miscellaneous

Source: Compiled from Table 16 & 17

The breakup of Pilgrim expenditure on various services is summed up in Table 18 and 19. Analysis of table18 indicates that boarding and lodging; shopping and offering; Transport industries are biggest beneficiaries of tourism activity in the state. However boarding and lodging garners approximately Rs. 364.82 crore in 2005 and Rs. 606.22 crore in 2012, out the total receipts from tourism calculated at Rs. 1642.98 crore and Rs. 2484.24 crore in 2005 and 2012 respectively. When we compare

gross receipt of the year 2007 and 2008 i.e. Rs. 1697.94 crore and 1659.74 crores, it is observed that the gross income of 2008 is less than the 2007, which may be due to the political instability in Jammu and Kashmir and the issue of Amarnath land dispute. A summary of this table is presented in table 19. The information contained in this table clearly reflects the share of different sectors of tourism industry in the pilgrim gross receipt at Katra.

Table 19: Gross Receipt from Tourism Item-Wise (in Crore) – Katra

Income Head	Receipt per Item (Crore Rupees) year Wise							
	2005	2006	2007	2008	2009	2010	2011	21012
Boarding and Lodging	364.82	373.30	415.01	405.56	491.71	522.40	603.98	606.22

Transportation	711.80	728.36	809.74	791.29	959.38	1019.26	1178.42	1182.99
Offering	125.41	128.32	142.66	139.41	169.02	179.57	207.61	208.42
Shopping	385.50	241.01	267.45	261.84	317.46	337.27	389.94	390.94
Miscellaneous	55.45	56.74	63.08	61.64	74.73	79.39	91.79	95.67
Total	1642.98	1527.73	1697.94	1659.74	2012.3	2137.89	2471.74	2484.24

Source: Compiled from tables 18

Gross income generated by Pilgrimage tourism (Mata Vaishno Devi) on the basis of data given in table 20 as collected by the Researcher with multiplier values of 3.2 and 3.6 has been estimated for the year 2005 to 2012. The gross income created in different components of tourism industry year wise is put into table 20.

Table 20: Gross Income in different sectors of Tourism industry (in Crore) – Katra

Income Head	Gross Income with Multiplier value of															
	3.2								3.6							
	2005	2006	2007	2008	2009	2010	2011	2012	2005	2006	2007	2008	2009	2010	2011	2012
Boarding and Lodging	1167.4	1194.6	1328.1	1297.8	1573.5	1671.7	1972.7	1939.0	1313.4	1343.9	1494.1	1460.0	1770.2	1880.4	2174.3	2182.4
Transportation	227.8	233.1	259.1	253.22	3070.0	3261.6	3770.9	3785.6	256.3	262.2	291.5	284.9	3453.8	3669.3	4242.3	4258.8
Offering	401.3	410.6	456.5	446.11	540.9	574.6	664.4	666.9	451.5	462.0	513.6	501.9	608.5	646.5	747.4	750.3
Shopping	753.7	771.2	857.4	837.89	1015.9	1079.3	1274.8	991.8	847.9	867.6	964.7	942.6	1142.9	1214.2	1403.8	1407.4
Miscellaneous	177.4	181.6	201.8	197.25	239.1	254.0	293.7	306.1	199.6	204.3	227.1	221.9	269.0	285.8	330.4	344.4
Total	2727.6	2791.1	3102.9	3032.3	6439.4	6841.2	7976.5	7689.4	3068.7	3140.00	3491.0	3411.3	7244.4	7696.2	8898.2	8943.3

Source: compiled from table No 19

The table 20 shows that the income generated by pilgrimage tourism (Mata Vaishno Devi) with multiplier co-efficient 3.2 and 3.6, constituted range between 10 percent to 23 percent and between 13 percent to 27 percent of Gross Net State Domestic Product advance estimate at Rs. 23292.21; Rs. 36918.83 crore

(Digest of Statistics 2011-12) in the year 2004-05 and 2011-12 respectively. This table also shows that the boarding and lodging stand top position of the total income generated by pilgrimage tourism at Katra followed by the shopping and offering during the study period.

3.1 Temporal variations in gross income of pilgrimage tourism at Vashino Devi

The temporal variation in the total income from the pilgrimage tourism has been calculated and documented (Table 21) on the basis of field survey.

Table: 21. Temporal variations in Gross Income (Rs. Crore) of pilgrimage tourism- Katra

S.No	Years	Gross Income (Rs. in crore)
1	2005	1642.98
2	2006	1527.73
3	2007	1697.94
4	2008	1659.74
5	2009	2012.30

6	2010	2137.89
7	2011	2471.74
8	2012	2484.24
	Total	15634.56

Source: Compiled from tables Number: 18.

A brief look of table 21 demonstrates the temporal variation in the gross income from the pilgrimage tourism in crores for the years 2005-2012. The table further reveals that Mata Vaishno Devi earned Rs 15634.56 crores since 2005 to 2012. The table further reveals the year-wise income variation from the study area.

3.2 Share of pilgrimage tourism of Mata Vashino Devi in the economy of Jammu and Kashmir

Tourism is the backbone of the Jammu and Kashmir economy, because the state Jammu and Kashmir is bestowed with countless God gifted features and Pilgrimage is one of them, the land of Jammu and Kashmir is known as land of Walis (Saints). So the pilgrimage tourism plays a vital role in the development of economy of Jammu and Kashmir. The given data collected by the researcher from field survey and presented in the table 22 gives a full account of share of pilgrimage tourism in the economy of the state.

Table 22. Share of Pilgrimage tourism in the Economy of Jammu and Kashmir

Years	Gross Receipt (Rs in crore)	Net state Domestic Product (Rs in crore)	Share (in % age)
2004-05	1642.98	23292.21	7.05
2005-06	1527.73	24371.09	6.70
2006-07	1697.94	25794.32	6.58
2007-08	1659.74	27387.31	6.06
2008-09	2012.30	29102.03	6.91
2009-10	2137.89	30513.15	7.01
2010-11	2471.74	32507.00	7.60
2011-12	2484.24	34491.69	7.20

Source: 1. Compiled from table 21
2. Digest of Statistics 2011-12.

A study of table 22 shows the share of pilgrimage tourism in the economy of Jammu and Kashmir in percentage. The study reveals that out of the Net State Domestic Product (NSDP) Rs 23292.21 crores and the gross receipt from the Holy shrine of Mata Vashino Devi is about Rs 1642.98 crores respectively which account for 7.05 percent in the economy of Jammu and Kashmir in the year 2005. The table further reveals that there is a fluctuating trend in the percentage share of pilgrimage tourism from the years 2005-2012. But overall picture shows a different trend that is Net State Domestic Product is increasing from Rs 23292.21 crores in the 2004-05 to Rs 34491.69 crores in the year 2011-12. The gross receipt Vashino Devi is showing rising trend during the whole study period. This area has a great potential for the more development tourism related activities like development of tourist circuits, amusement parks in the surrounding of Katra Town which will attract the tourist for a longer stay in Jammu region.

V. CONCLUSION AND SUGGESTIONS

The research firmly signifies that the pilgrimage tourism is the life line of Jammu region particularly at the holy shrine of Mata Vashino Devi which is an out most pilgrimage destination. Katra town is a transit camp for the pilgrims to Mata Vashino Devi. The town reflects a great change in respect of its land use pattern, demographic setup, cultural milieu and the overall economic scenario. The result of the study also shows that the income generated by pilgrimage tourism (Mata Vaishno Devi) with multiplier co-efficient 3.2 and 3.6, constituted range between 10 percent to 23 percent and between 13 percent to 27 percent of Gross Net State Domestic Product advance estimate at Rs. 23292.21; Rs. 36918.83 crore (Digest of Statistics 2011-12) in the year 2004-05 and 2011-12 respectively. The share of holy shrine in the economy of state ranges from 6 percent to 9 percent per financial year. This share may be increased many fold if the government encourage the pilgrims to stay longer in Jammu by fully exploring and utilizing the tourism potential in the area. It

can be achieved by developing alternative religious tourist circuits like Shiv Khori- Machail; Kailash Parvat in Bhaderwah and Pingla Devi in Ramnagar; Agar Jatu, Sarthal Baba. Also some extra recreational activities like to start the Cable Car facility, development of parks, improving the condition of the roads, regular state transport buses, better helicopter services and budget hotel would be useful interventions.

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Hiding Methods for Preventing Jamming Attacks on Wireless Networks

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Abstract- Wireless mediums open nature are capable for intentional interference attacks referred as jamming. This attacks paved a way for denial-of-service attacks on wireless networks. The intruder with immense knowledge of protocol specifications and network secrets can create low-effort jamming attacks that are difficult to detect and counter. In these attacks, the intruder is active only for a short period of time, selectively targeting messages of high importance. However, selective jamming attacks can be launched by performing real-time packet classification at the physical layer. To prevent these attacks, three schemes are developed to avoid real-time packet classification by combining cryptographic primitives with physical-layer attributes. Here, the security of the proposed methods is analyzed.

Index Terms- Selective Jamming , denial-of-service, wireless networks, packet classification

I. INTRODUCTION

Wireless networks rely on the uninterrupted availability of the wireless medium to interconnect participating nodes. However, its open nature vulnerable to multiple security threats. Anyone with a transceiver can eavesdrop on wireless transmissions, inject spurious messages or jam legitimate ones, while eavesdropping and message injection can be prevented using cryptographic methods, jamming attacks are harder to counter. They leads to severe denial-of-service (DoS) attacks against wireless networks [1], [5], [6], [7]. In the simplest form, the adversary interferes with the reception of messages by transmitting a continuous jamming signal [5] or several short jamming pulses [7].

The effects of jamming at the physical layer resonate through the protocol stack, providing an effective denial-of-service (DoS) attack on end-to-end data communication. The simplest methods to defend a network against jamming attacks comprise physical layer solutions such as spread-spectrum or beam forming, forcing the jammers to expend a greater resource to reach the same goal. However, intelligent jammers can incorporate cross layer protocol information into jamming attacks, reducing resource expenditure by several orders of magnitude by targeting certain link layer and MAC implementations as well as link layer error detection and correction protocols. The majority of anti-jamming techniques make use of diversity. For example, anti-jamming protocols may employ multiple frequency bands, different MAC channels, or multiple routing paths. Such diversity techniques help to curb the effects of the jamming attack by requiring the jammer to act on multiple resources simultaneously. Using

multiple-path variants of source routing protocols such as Dynamic Source Routing (DSR) or Ad-Hoc On-Demand Distance Vector (AODV) , for example the MP-DSR protocol source node can request several routing paths to the destination node for concurrent use. To make effective use of this routing diversity, however, each source node must be able to make an intelligent allocation of traffic across the available paths while considering the potential effect of jamming on the resulting data throughput.

In order to capture the non-deterministic and dynamic effects of the jamming attack, model the packet error rate at each network node as a random process. At a given time, the randomness in the packet error rate is due to the uncertainty in the jamming parameters, while the time-variability in the packet error rate is due to the jamming dynamics and mobility. Since the effect of jamming at each node is probabilistic, the end-to-end throughput achieved by each source-destination pair will also be non-deterministic and, hence, must be studied using a stochastic framework. In this article, I thus investigate the ability of network nodes to characterize the jamming impact and the ability of multiple source nodes to compensate for jamming in the allocation of traffic across multiple routing paths. Our contributions to this problem are as follow: I formulate the problem of allocating traffic across multiple routing paths in the presence of jamming as a lossy network and formulate the centralized traffic allocation problem for multiple source nodes as a convex optimization

II. PROBLEM STATEMENT

Consider the scenario in fig.1(a) Nodes A and B communicate via a wireless link. Within the communication range of both A and B, there is a jamming node J, when A transmits a packet m to B, J classifies m by receiving only few bytes of m . J then corrupts m beyond recover by interfering with its reception at B. we address the problem of preventing jamming node from classifying m in real time. Our goal is to transform a selective jammer to a random one.

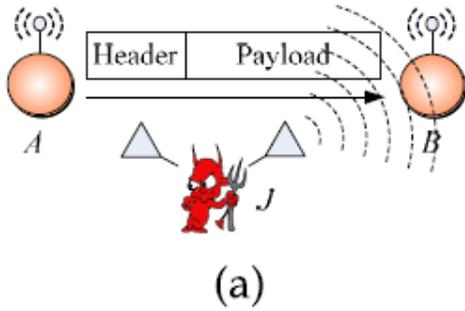


Fig.1(a) Realization of Selective Jamming attack

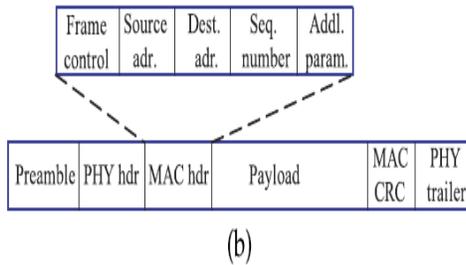


Fig.1(b) Generic frame format of a wireless network

1 Real-Time Packet Classification:

At the Physical layer, a packet m is encoded, interleaved, and modulated before it is transmitted over the wireless channel. At the receiver, the signal is demodulated, deinterleaved and decoded to recover the original packet m . Nodes A and B communicate via a wireless link. Within the communication range of both A and B there is a jamming node J. When A transmits a packet m to B, node J classifies m by receiving only the first few bytes of m . J then corrupts m beyond recovery by interfering with its reception at B.

2 A Strong Hiding Commitment Scheme

A strong hiding commitment scheme (SHCS), which is based on symmetric cryptography. Assume that the sender has a packet for Receiver. First, S constructs $commit(message)$ the commitment function is an off-the-shelf symmetric encryption algorithm is a publicly known permutation, and k is a randomly selected key of some desired key length s (the length of k is a security parameter). Upon reception of d , any receiver R computes.

3 Cryptographic Puzzle Hiding Scheme

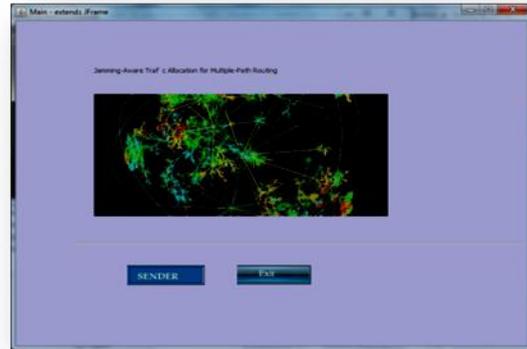
A sender S have a packet m for transmission. The sender selects a random key k , of a desired length. S generates a puzzle (key, time), where $puzzle()$ denotes the puzzle generator function, and tp denotes the time required for the solution of the puzzle. Parameter is measured in units of time, and it is directly dependent on the assumed computational capability of the adversary, denoted by N and measured in computational operations per second. After generating the puzzle P , the sender broadcasts (C, P) . At the receiver side, any receiver R solves the received puzzle to recover key and then computes.

4 Hiding based on All-Or-Nothing Transformations

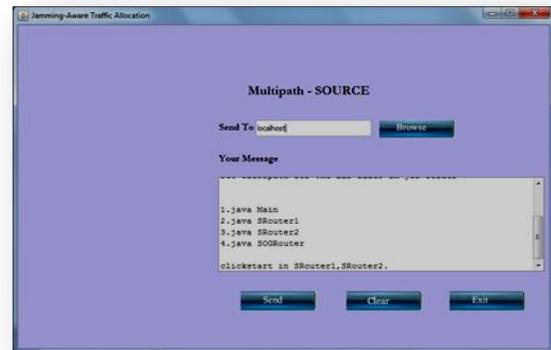
The packets are pre-processed by an AONT before transmission but remain unencrypted. The jammer cannot

perform packet classification until all pseudo-messages corresponding to the original packet have been received and the inverse transformation has been applied.

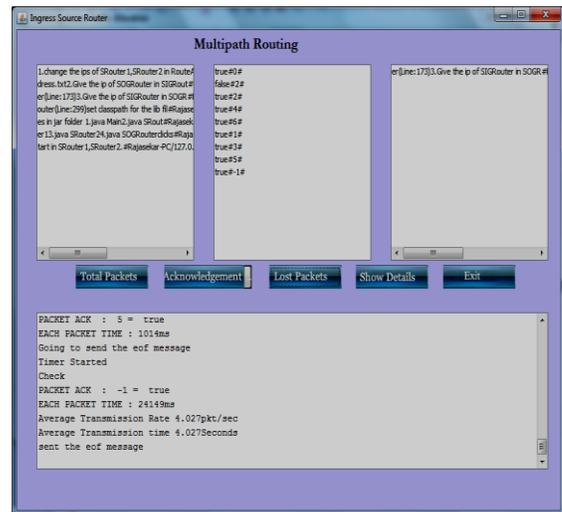
III. EXPERIMENT RESULT -SCREEN SHOTS



This is the main page for the sender to send their message.

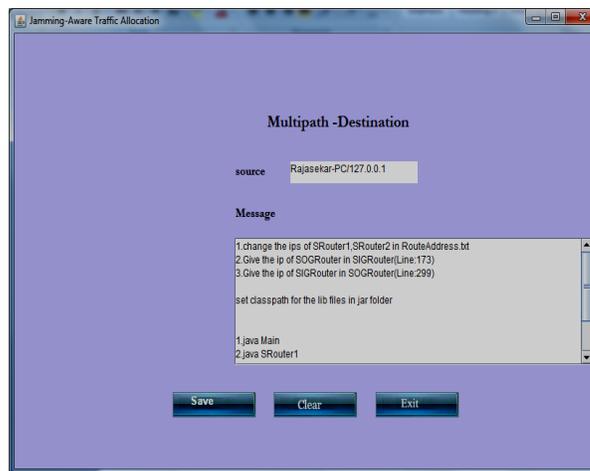
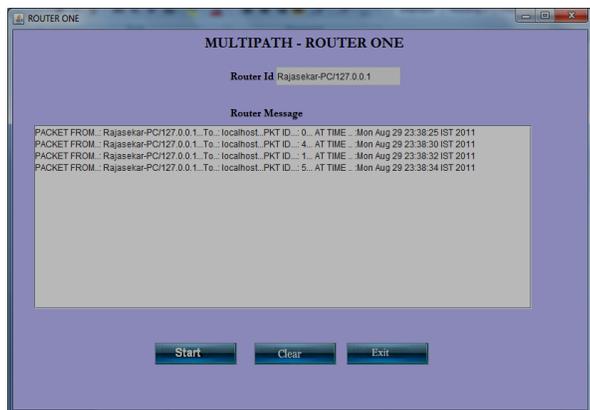


In the above screen illustrates the sender part, sender select the message to send to destination.



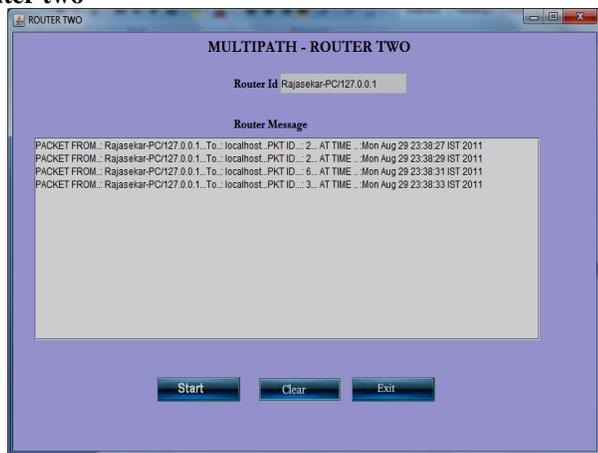
This shows the ingress router to receive all user data before it sends to jammer. If any packet losses is happen it will be view here itself.

Routing-router one



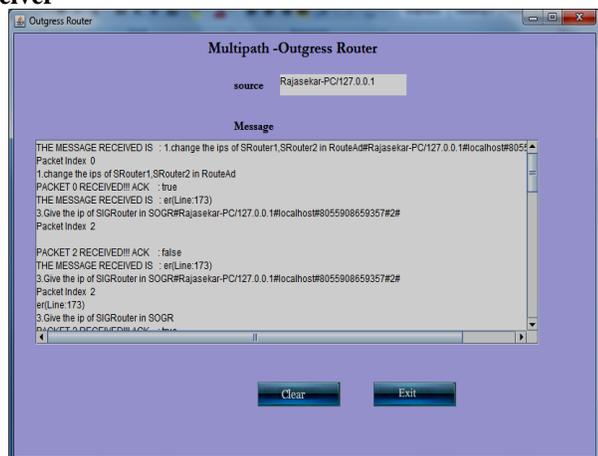
Receiver can receive the data from sender through in which the outruss router. The outruss router directly connected with receiver.

Router two



In this screen is the Receiver or Router two that is available node in the network.

Receiver



Outgress router get data from the connected node in the networks

IV. CONCLUSION

The problem of traffic allocation in multiple-path routing algorithms in the presence of jammers whose effect can only be characterized statistically for each network node to probabilistically characterize the local impact of a dynamic jamming attack and for data sources to incorporate this information into the routing algorithm. I formulated multiple-path traffic allocation in multi-source networks as a lossy network flow optimization problem using an objective function based on portfolio selection theory from finance. I showed that this centralized optimization problem can be solved using a distributed algorithm based on decomposition in network utility maximization (NUM) presented simulation results to illustrate the impact of jamming dynamics and mobility on network throughput. I have thus shown that multiple path source routing algorithms can optimize the throughput performance by effectively incorporating the empirical jamming impact into the allocation of traffic to the set of paths.

FUTURE ENHANCEMENT

I developed Jamming Aware Traffic allocation ,but lack of packet retransmitting while packets getting jamming ,so I extended this model with packet retransmitting.

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Design and Simulation of Speed Control of DC Motor by Artificial Neural Network Technique

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Abstract- This paper proposes the artificial neural network based controller for speed control of a separately excited DC motor. The Artificial Neural Network controller allows controlling both type of systems i.e. linear and non-linear system by training the network. So it is a novel approach to study and a broad research area.

In this paper three controllers “PI, PID, ANC” have been designed and implemented in the MATLAB /Simulink model to examine the performance of DC motor with different loads. The results show that the ANC give better response compared to PI & PID controller.

Index Terms- PI, PID, ANN, Artificial Neural controller (ANC), DC Motor.

I. INTRODUCTION

Direct current (DC) motors have variable characteristics and are used extensively in variable-speed drives. DC motor can provide a high starting torque and it is also possible to obtain speed control over wide range. Why do we need a speed motor controller? For example, if we have a DC motor in a robot and we just apply a constant power to each motor on a robot, then the poor robot will never be able to maintain a steady speed. It will go slower over carpet, faster over smooth flooring, slower up hill, faster downhill, etc. So, it is important to make a controller to control the speed of DC motor in desired speed.

DC motor plays a significant role in modern industrial. These are several types of applications where the load on the DC motor varies over a speed range. These applications may demand high-speed control accuracy and good dynamic responses.

II. DC MOTOR MODEL

The resistance of the field winding and its inductance of the motor used in this study are represented by R_f and L_f , respectively. The resistance of the armature and its inductance are shown by R_a and L_a respectively in dynamic model. Armature reactions effects are ignored in the description of the motor. This negligence is justifiable to minimize the effects of armature reaction since the motor used has either interlopes or compensating winding. The fixed voltage V_f is applied to the field and the field current settles down to a constant value. A linear model of a simple DC motor consists of a mechanical equation and electrical equation as determined in the following equations:

$$J_m \frac{d\omega}{dt} = K_m \cdot \phi \cdot I_a - b \cdot \omega - M_{load}$$

$$L_a \frac{dI}{dt} = V_a - R_a \cdot I_a - K_b \cdot \phi \cdot \omega$$

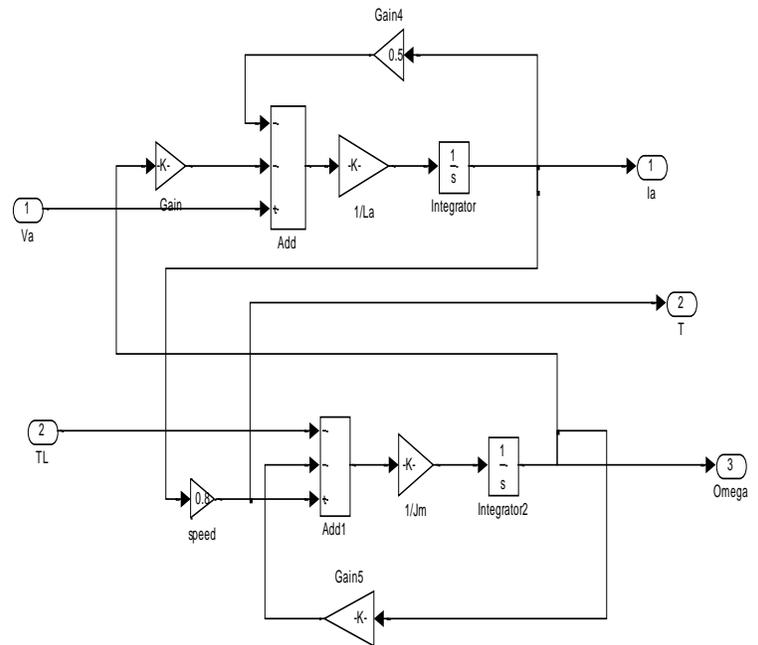


Fig 1. Simulink model of separately excited dc motor

Speed Response of DC Motor without any controller is shown below:

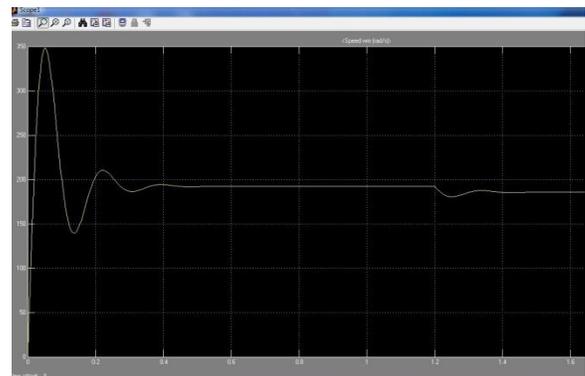


Fig 2. Speed Response of DC Motor without any controller

The Peak Overshoot and number of oscillations obtained in above curve are much more and hence undesirable. These parameters are controlled by using different controllers discussed below.

III. PROPORTIONAL PLUS- INTEGRAL (PI) CONTROLLER

Since most of the process cannot work with an offset, they must be controlled at their set points and in order to achieve this, extra intelligence must be added to proportional controller and this is achieved by providing an integral action to the original proportional controller. So the controller becomes proportional – Integral controller.

- ❖ Under PI Controller as long as error is present the controller keeps changing its output and once the error is zero or it disappears the controller does not change its output.
- ❖ Integration is the mode that removes the offset or the error but sometimes it may make transient response worse.
- ❖ In PI Controller the output of the controller is changed proportional to the integral of the error.

The mathematical expression of the PI Controller is:

$$y = K_p \cdot e + K_i \int e \cdot dt$$

Where, K_i = Integral gain of the PI controller.

PI Controller has the following disadvantages:

- ❖ The response is sluggish at the high value of the integral time T_n .
- ❖ The control loop may oscillate at the small value of integral time T_n .

IV. PROPORTIONAL-INTEGRAL-DERIVATIVE (PID) CONTROLLER

PID Controller includes all the three control actions i.e. proportional, integral and derivative.

- ❖ A PID controller calculates and outputs a corrective action, which corrects the error between the process output and the desired set point that adjusts the process accordingly and rapidly.
- ❖ The output of the controller or the manipulated variable is obtained by adding P, I and D components and their associated coefficient.

The mathematical expression of the PID Controller is:

$$y = K_p \cdot e + K_i \int e \cdot dt + K_d \frac{de}{dt}$$

V. NEURAL NETWORK CONTROLLER

Neural networks are wonderful tools, which permit the development of quantitative expressions without compromising the known complexity of the problem. This makes them ideal in

circumstances where simplification of the problem, in order to make it mathematically tractable, would lead to an unacceptable loss of information. As pointed out by Ziman, there is a fine balance between over-idealizing the initial hypothesis in order to make it amenable to mathematical analysis, and abandoning reality.

Neural networks resemble the human brain in the following two ways:

1. A neural network acquires knowledge through learning.
2. A neural network's knowledge is stored within inter-neuron connection strengths known as synaptic weights.

An Artificial Neural Network (ANN) is an information processing paradigm that is inspired by the way biological nervous systems, such as the brain, process information. The key element of this paradigm is the novel structure of the information processing system. It is composed of a large number of highly interconnected processing elements (neurons) working in unison to solve specific problems. ANNs, like people, learn by example. An ANN is configured for a specific application, such as pattern recognition or data classification, through a learning process. Learning in biological systems involves adjustments to the synaptic connections that exist between the neurons. This is true of ANNs as well.

The true power and advantage of neural networks lies in their ability to represent both linear and non-linear relationships and in their ability to learn these relationships directly from the data being modeled. Traditional linear models are simply inadequate when it comes to modeling data that contains non-linear characteristics.

The neural network consists of junctions which are connected with LINKS, also called processing units. For each junction a number is ordered, this number is called weight. The weights are the tools for the long distance information storing in the neural network, the learning process occurring with the appropriate modification of weights. These weights are modified so that the network input/output behavior is in consonance with the environment, which provide the input data.

The calculation algorithm consists of Calculation of the output of the network, with inputs and weights and modification of weights.

A single input neuron consists of a scalar input 'p' multiplied by the scalar weight 'w' to form 'wp' which is fed to the summer along with bias 'b' multiplied by '1'.

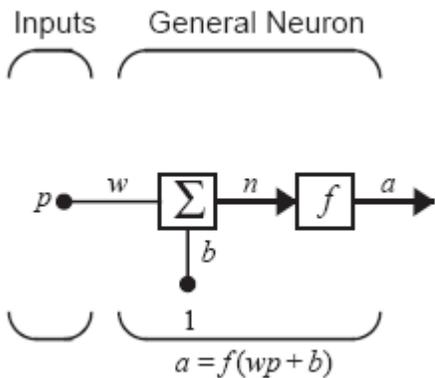


Figure 3: Basic Neural Network

The net input is $wp+b$ and the output a is;
 $a=f(WP+b)$;
 f- Transfer function
 W & b can be adjusted by learning rule.

TRANSFER FUNCTION:

- LINEAR TF:

$a = \text{purelin}(n)$

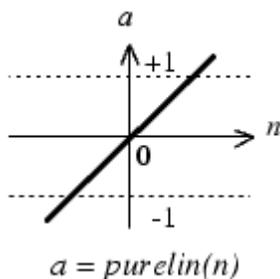


Figure 4: Linear Transfer Function

VI. CONTROLLER DESIGN

DC MOTOR SPEED CONTROL USING PI CONTROLLER:

The Figure 5 shows the model of PI controller for DC motor. The model is simulated with speed vs time of the DC motor with the fixed load and also with varying load.

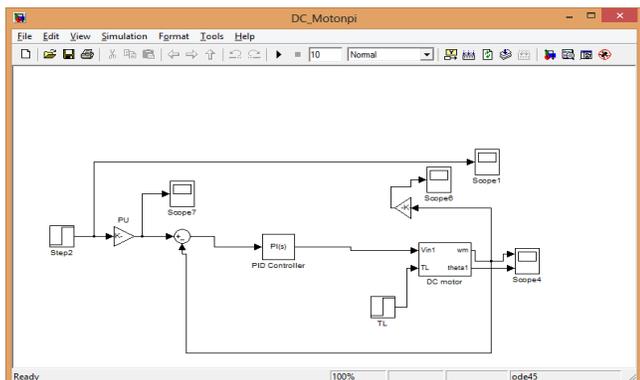


Figure 5. Mat Lab/Simulink model for DC motor using PI Controller

DC MOTOR SPEED CONTROL USING PID CONTROLLER:

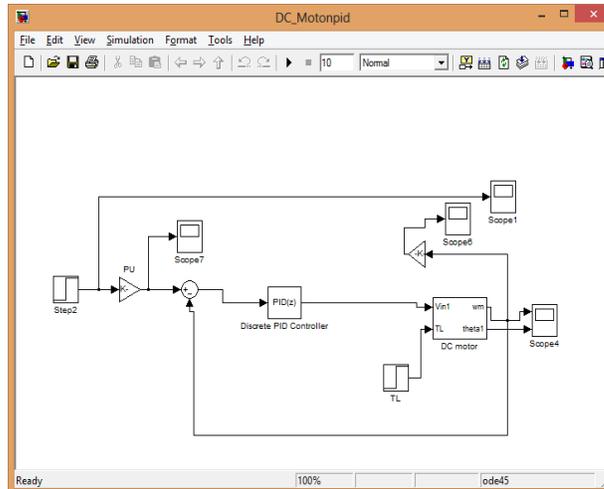


Figure 6 Mat Lab/Simulink model for DC motor using PID Controller.

The figure 6 shows the MatLab Simulink model for speed control of DC motor using PID controller.

ARCHITECTURE OF NEURAL NETWORK CONTROLLER

The Figure 7 shows the model of Artificial Neural Network controller (ANC) for DC motor. The model is simulated with speed vs time of the DC motor with the fixed load and also with varying load.

The ANC model is shown below:

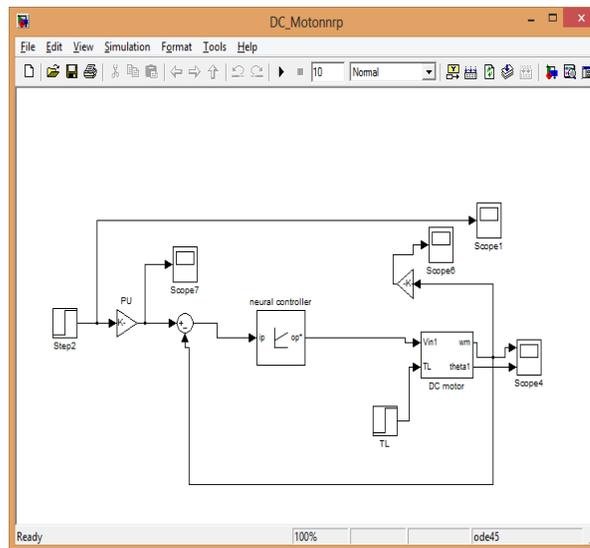


Figure 7. Simulink model of Artificial Neural Network Controller

VII. RESULT AND DISCUSSION

Simulation result of DC motor without using any controller is shown in fig 1. That fig may be compared with fig 8 for speed control.

COMPARISON OF SPEED CONTROL USING PI, PID, ARTIFICIAL NEURAL NETWORK CONTROLLER:

All the controllers are simulated on MATLAB and their *Speed Vs Time* characteristic is studied. The Characteristic is shown below:



Fig 8. Simulation Result for DC motor using PI, PID and Artificial Neural Network Controller.

VIII. CONCLUSION

Simulation results show that:

- ANC have better performance by reducing, e_{ss} (Steady state error), M_p (maximum overshoot), T_r (rise time) and T_s (settling time).
- ANC have more sensitive responses against load disturbances to classical PI & PID controller.
- ANC is better than conventional PI & PID controller.

Biggest disadvantage of ANC is its more rise time.

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A Study on Analyzing the Trend of NPA Level in Private Sector Banks and Public Sector Banks

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Abstract- A healthy and a sound banking system are very essential for an economy in order to grow and remain in this competitive environment. RBI and other regulatory bodies have taken several policies in the light of developing the functioning of the banking sector. The best indicator for the health of the banking industry in a country is its level of Non-performing assets (NPAs). It reflects the performance of banks. NPAs in the Indian banking sector have become a major concern for the Indian economy. NPA has a direct impact on the profitability, liquidity and solvency position of the bank. Higher NPA indicates inefficiency of the bank and lower NPA indicate better performance and management of funds. To improve the efficiency and profitability of banks the NPA need to be reduced and controlled. This paper basically deals with the trends of NPA in banking industry, the factors that mainly contribute to NPA raising in the banking industry and also provides some suggestions how to overcome this burden of NPA on banking industry.

Index Terms- Public sector Banks, Private sector Banks, Non-Performing Asset

I. INTRODUCTION

The Banking system remains, as always the most dominant segment of the financial sector. Without a sound and effective Banking system in India it cannot have a healthy economy. The Banking system of India should not only be hassle free but it should be able to meet new challenges posed by the technology or any other external and internal factors. Indian Banks continue to build on their strength under the regulators watchful eye and hence has emerged stronger. For the past three decades India's Banking system has several outstanding achievements to its credit. The most striking is its extensive reach. It is no longer confined to only metropolitans or cosmopolitans in India. In fact, Indian Banking system has reached even to the remote corners of the country. This is one of the main reasons of India's growth process. The government's regular policy for Indian Bank since 1969 has paid rich dividends with the nationalization of 14 major private Banks of India. Not long ago, an account holder had to wait for hours at the Bank counters for getting a draft or for withdrawing his own money. Today, he has a choice. Gone are days when the most efficient

Bank transferred money from one branch to other in two days. Now it is simple as instant messaging or dials a pizza. Money has become the order of the day. The first Bank in India, though conservative, was established in 1786. From 1786 till today, the journey of Indian Banking System can be segregated into three distinct phases.

- Phase I-Early phase from 1786 to 1969 of Indian Banks;
- Phase II-Nationalization of Indian Banks and up to 1991 prior to Indian Banking sector Reforms;

Phase III-New phase of Indian Banking System with the advent of Indian Financial & Banking Sector Reforms after 1991.

NPA AND BANKS

NPAs are an inevitable burden on the banking industry. Banks need to monitor their standard asset regularly in order to prevent any account becoming an NPA. Today the success of the bank depends upon the proper management of NPAs and keeping them within the tolerance level.

EWS-Early Warning Signals are those which clearly indicate or show some signals of credit deterioration in the loan account. They indicate the problems involved in the account so that remedial action can be taken immediately. Most banks have EWS system.

The RBI has issued guidelines to banks for classification of assets into four categories.

- (i) Standard Asset
- (ii) Doubtful Asset
- (iii) Sub-standard Asset
- (iv) Loss Asset

Standard Asset: Standard asset are those which are not NPA. These are regular and performing and there are no adverse features. They do not disclose any credit problem.

Doubtful Asset: They are NPA which remain as such for a period exceeding two years.

Sub-standard Asset: They are those which are NPAs for a period not exceeding two years.

Loss Asset: Are those NPAs where 100% loss has been identified and it is not yet written off in the books of accounts.

Table I: PROVISIONAL NORMS

Asset Classification	Provision requirements
Standard assets	a) direct advances to agricultural & SME sectors at 0.25 per cent; (b) residential housing loans beyond Rs. 20 lakh at 1 per cent; (c) advances to specific sectors, i.e., personal loans (including credit card receivables), loans and advances qualifying as Capital Market exposures, Commercial Real Estate loans etc. at 2 per cent (d) all other advances not included in (a), (b) and (c) above, at 0.40 percent
Substandard Assets	10 per cent of the total out standings for substandard
Doubtful assets (i)Doubtful upto 1 yr(NPA more than 2 yrs but upto 3 yrs) (ii)Doubtful for more than 1 yr but upto 3 yrs(NPA more than 3 yrs but upto 5 yrs) (iii)Doubtful for more than 3 yr(NPA more than 5 yrs)	100% to the extend of deficit (deficit=advance- security) 20% of tangible security available. 30% of tangible security available. 50% of tangible security available.
Loss assets	100% of the outstanding

RESEARCH DESIGN

Objectives of the study:

- 1 .To find out trend in NPA level
2. To find out the factors that contributes to NPA.
3. To suggest the various measures for proper management of NPA in banks.

Scope of the Study:

The present study is descriptive in nature. This study was mainly planned to evaluate the NPA level of public sector and private sector Bank. This research study surely will provide a parameter particular for a better understanding of NPA level in banking sector. This attempt covers the extensive research work on NPA structure of the Indian Banking sector. The findings of

study present a comparison between selected variables for the past six years.

Review of Literature:

1. Kajal Chaudhary and Monika Sharma (2011), they studied about the performance of private and public sector banks and how they manage their NPA. They have taken few of the private and public sector banks under the study. The study has shown Performance level in each sector. The study has also given some recommendations regarding how the bank should improve their performance and also managing NPA.
2. DR. Partap Singh (2012), in this paper attempts have been made to analyze trends in NPAs, Causes and Impact of NPAs. Nonperforming assets indicate the

credit risk of the banks. This paper deals with the comparative analysis of advances and non performing assets in public and private sector banks in the light of mounting competitive scenario in the banking sector. The study shows improvement in the management of NPA.

3. G.V.Bhavani Prasad, D.Veena (2011), NPAs Reduction Strategies for Commercial Banks in India. This paper also deals with the concept of NPA, how an account turns into NPA and some measures to manage NPA.
4. Management of Non-Performing Assets in Indian Public Sector Banks with special reference to Jharkhand: This study was basically confined to management of NPA in Public sector banks in Jharkhand. The study outlines the reasons for NPAs through figures and graphs and few recommendations to improve NPA.
5. Dr. Mohan Kumar, Govind Singh (2012) Mounting NPAs in Indian Commercial Banks: Causes and Consequences of NPAs in Banks using tables and few suggestions for improvement of NPA level.

Purpose of the Study:

The basic purpose the study is to understand and analyze the NPA level of private and public sector Banks by considering few public and private sector Banks. To understand what are the factors that contribute to NPA. To suggest some measures in order to reduce the level of NPA. This study would also in turn influence the Banks to identify the problems pertaining to the account and to avoid the occurrence of any account turning into NPA.

Statement of the Problem:

The substance of the Banks will be threatened depending upon the level of NPA. If banks have many accounts that are turning out to NPA, the existence of the bank would be difficult. The banks which have higher NPA can lose the confidence of the customer and also it would affect the liquidity, profitability and solvency position of the bank.

Limitations:

- The study is limited to the extent of the availability of data.
- The period of the study is limited for six years.

Research Methodology:

The study is planned to be carried out with the help of secondary data for the purpose to and understand the NPA level of private and public sector Banks.

Data Collection:

The present study is mainly based on secondary data. The required data were collected from the annual reports of the Banks through their websites.

Sources of Data:

Secondary data was collected from the reports, articles, journals, documents, printed literatures, certain web sites and other online data bases etc.

Factors contributing to NPA

According to the recent study conducted by RBI, the factors contributing to NPA are divided into 2 segments

- (i) Internal factors
- (ii) External factors
- (iii) Other factors

Internal factors

- a) Diversion of fund for expansion, diversification, modernization or for taking up new projects.
- b) Diversion of fund for assisting or promoting associate concerns.
- c) Time or cost overrun during the project implementation stage.
- d) Business failure due to product failure, failure in marketing etc.
- e) In efficiency in bank management.
- f) Slackness in credit management and monitoring.
- g) In appropriate technology or problems related to modern technology.

External factors

- a) Recession in the economy as a whole.
- b) Input or power shortage.
- c) Price escalation of inputs.
- d) Exchange rate fluctuations
- e) Change in government policies

Other factors

- a) Liberalization of the economy and the consequent pressures from liberalization like several competitions, reduction of tariffs etc.
- b) Poor monitoring of credits and failure to recognize early warning signals shown by standard assets.
- c) Sudden crashing of capital market and inability to raise adequate funds.
- d) Mismatching of funds i.e. using loan granted for short term for long term transactions.
- e) Granting of loans to certain sectors of the economy on the basis of government directives rather than commercial imperatives.

II. DATA ANALYSIS AND INTERPRETATION

Table II: CLASSIFICATION OF LOAN ASSETS OF PUBLIC SECTOR BANKS - 2008 TO 2013

Bank group/Year	Standard advances		Sub-Standard Advances		Doubtful Advances	
	Amount	Percent	Amount	Percent	Amount	Percent
Public Sector Banks						
2008	16,564.51	97.67	168.46	0.99	190.83	1.13
2009	20,546.01	97.90	195.21	0.93	207.08	0.99
2010	24,551.47	97.72	276.85	1.10	246.79	0.98
2011	29,888.72	97.68	336.12	1.10	319.55	1.04
2012	34,379.00	96.83	603.76	1.70	470.75	1.33
2013	38,999.85	96.16	765.89	1.89	734.85	1.81

Source: <http://www.rbi.org.in/>

The above table shows classification of loan assets of the Public sector banks. Over the years we can see fluctuation of NPAs among the banks both increase and decrease. In case of standard asset there was a constant increase from 2008 to 2011

and then a slight decrease from 2012. In case of sub standard asset, for public sector banks it kept on increasing. In case of doubtful asset, public sector banks there were a constant increase.

Table III: CLASSIFICATION OF LOAN ASSETS OF PRIVATE SECTOR BANKS - 2008 TO 2013

Bank group/Year	Standard advances		Sub-Standard Advances		Doubtful Advances	
	Amount	Percent	Amount	Percent	Amount	Percent
Private Sector Banks						
2008	4,597.22	97.25	72.81	1.54	44.53	0.94
2009	5,031.87	96.75	105.27	2.02	50.18	0.96
2010	5,677.23	97.03	86.78	1.48	65.43	1.12
2011	7,149.78	97.55	44.00	0.60	107.36	1.46
2012	8,628.96	97.92	51.33	0.58	103.16	1.17
2013	10,266.73	98.09	58.54	0.56	110.69	1.06

Source: <http://www.rbi.org.in/>

The above table shows classification of loan assets of the Private sector banks. Over the years we can see fluctuation of NPAs among the banks both increase and decrease. In case of standard asset there was a constant increase from 2010 to 2013. In case of sub standard asset, for private sector banks it kept on decreasing except in 2009. In case of doubtful asset, private sector banks there were a constant increase from 2008 to 2011 and gradually decreased in 2012 and 2013.

Compared to Private sector banks, Public sector banks NPAs level is more in case of sub standard asset and doubtful asset. But in case of standard asset private sector banks remain high which shows a good position of private sector banks and also it show that they have adopted all necessary measures in order to avoid any account becoming NPAs. Public sector banks need to be more cautions while granting loan and also to avoid the occurrence of NPA in public sector banks.

Table IV: COMPOSITION OF NPAs OF NATIONALIZED BANKS - 2008 TO 2013

Bank group / Years	Priority Sector		Non-priority Sector		Public Sector		Total
	Amount	Percent Share	Amount	Percent Share	Amount	Percent Share	Amount
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Nationalized Banks							
2008	163.85	67.21	77.9	31.96	2.02	0.83	243.80
2009	157.21	60.10	101.4	38.76	2.97	1.13	261.58
2010	199.06	56.13	152.7	43.08	2.80	0.79	354.62
2011	257.21	59.90	169.4	39.47	2.73	0.64	429.40
2012	322.90	48.34	343.1	51.37	1.92	0.29	667.95
2013	404.86	42.21	553.5	57.71	0.78	0.08	959.22

Source: <http://www.rbi.org.in/>

The above table depicts the total amount of NPAs at Nationalized banks in India as on 31st march from 2008 to 2013. And also the above table depicts the composition of NPAs of different sector at nationalized banks. During 2008, priority sector share was 67.21%, Non-priority sector 31.96% and public sector share was 0.83%. In the year 2009 priority sector, Non-priority sector and public sector share was 60.10%, 38.76% and 1.13% respectively in the NPAs. In the year 2010 priority sector share was 56.13%, Non-priority sector share was 43.08 and public sector share was 0.97% in NPAs, during year 2011 priority sector, Non-priority sector and public sector share was 59.90%, 39.47% and 0.64% respectively. In the year 2012

priority sector share was 48.34%, Non-priority sector share was 51.37% and public sector share was 0.29% and in the year 2013 priority sector was 42.21%, Non-priority sector share was 57.71% and public sector share was 0.08% in the amount of NPAs of Nationalized banks in India.

It can be inferred that during 2012 and 2013 Non-priority sector share in the amount of NPAs of Nationalized banks is more as compared to priority and public sector and during 2008,2009, and 2010 .Priority sector share in the amount of NPAs of Nationalized banks is more as compared to public sector share and non-priority sector.

Table V: COMPOSITION OF NPAs OF SBI Group- 2008 TO 2013

SBI Group	Priority Sector		Non-priority Sector		Public Sector		Total
	Amount	Percent	Amount	Percent	Amount	Percent	Amount
2008	89.02	58.49	62.22	40.8	0.97	0.63	152.20
2009	84.47	47.26	92.50	51.7	1.77	0.99	178.74
2010	109.40	50.11	106.46	48.7	2.44	1.12	218.31
2011	155.67	55.32	125.67	44.6	0.06	0.02	281.40
2012	239.11	52.33	217.59	47.6	0.25	0.05	456.94
2013	264.42	44.09	334.94	55.8	0.31	0.05	599.67

Source: <http://www.rbi.org.in/>

The above table depicts total amount of NPAs at SBI Group banks in India as on 31st March from 2008 to 2013. The above table also depicts the sector wise share in the amount of NPAs of SBI Group in India. From the above table it is observed that, In the year 2008 priority sector, Non-priority sector and public sector share was 58.49%, 40.88% and 0.63% respectively. In the year 2009 priority sector, Non-priority sector and public sector share was 47.26%, 51.75% and 0.99% respectively. During 2010

priority sector share was 50.11%, Non-priority sector share was 48.77% and public sector share was 1.12% in the amount of NPAs of SBI Group banks. In the year 2011 priority sector, Non-priority sector and public sector share was 55.32%, 44.66% and 0.02% respectively. During the year 2012 priority sector, Non-priority sector and public sector share was 52.33%, 47.62% and 0.05% respectively. During 2013 priority sector share in the amount of NPAs of SBI Group banks was 44.09%, Non-priority

sector share was 55.85% and Public sector share was 0.05% only.

The above table depicts the total amount of NPAs at SBI Group Banks in India as on 31st march from 2008 to 2013. And also the above table depicts the composition of NPAs of different sector at SBI Group Banks. From the above table it can be

inferred that during 2008 to 2012 Priority sector share was high in generation of amount of NPAs in the SBI Group banks, during the year 2013 Non-priority share was high in the creation of amount of NPAs in the SBI Group banks. It can be concluded that Priority sector is the troubling sector for SBI Group banks in the amount of NPAs.

Table VI: COMPOSITION OF NPAs OF PUBLIC SECTOR BANKS - 2008 TO 2013

Bank group / Years	Priority Sector		Non-priority Sector		Public Sector		Total
Public Sector Banks	Amount	Percent	Amount	Percent	Amount	Percent	Amount
2008	252.87	63.85	140.15	35.3	2.99	0.75	396.00
2009	241.68	54.89	193.90	44.0	4.74	1.08	440.32
2010	308.46	53.84	259.23	45.2	5.24	0.91	572.93
2011	412.87	58.09	295.15	41.5	2.78	0.39	710.80
2012	562.01	49.96	560.71	49.8	2.17	0.19	1124.89
2013	669.28	42.93	888.53	57.0	1.08	0.07	1558.90

Source: <http://www.rbi.org.in/>

The above table depicts the total amount of NPAs at Public sector banks in India. And different sectors contribution to the total NPAs. During the year 2008 priority sector share was 63.85%, Non-priority sector share was 35.39% and Public sector share 0.75 for the total NPAs of 396.05 billion. In the year 2009 priority sector, Non-priority sector and public sector share was 54.89%, 44.04% and 1.08% respectively. During the year 2010 priority sector, Non-priority sector and public sector share was 53.84%, 45.25% and 0.91% respectively. In the year 2011 priority sector, Non-priority sector and public sector share was 58.09%, 41.52% and 0.39% for the total amount of NPAs of 710.80 billion. During the year 2012 priority sector, Non-priority sector and public sector share was 49.96%, 49.85% and 0.19%

for the total amount of NPAs of 1124.89 billion. In the year 2013 priority sector, Non-priority sector and public sector share was 42.93%, 57.00% and 0.07% for the total amount of NPAs of 1558.90 billion.

It is depicting priority sector, Non-priority sector and public sector share for the amount of NPAs from 2008 to as on 31st march 2013. From the above table it can be inferred that during 2008 to till 2011 priority sector share was high in the NPAs as compared to Non-priority and public sector. During 2011 priority and non-priority sector share was almost equal in the creation of NPAs for public sector banks. During 2013 Non-priority share was high in creation of NPAs in public sector banks as compared to priority and public sector.

Table VII: BANKS GROUP-WISE GROSS NON-PERFORMING ASSETS, GROSS ADVANCES AND GROSS NPA RATIO OF PUBLIC SECTOR BANKS-2013

Banks	Gross NPAs (1)	Gross Advances (2)	Gross NPAs to Gross advances
Public Sector Banks			
SBI and its Associates	627784	14188827	4.42
Nationalized Banks \$	1016834	31412861	3.24
Public Sector Banks	1644618	45601688	3.61

Source: <http://www.rbi.org.in/>

Table VIII: BANKS GROUP-WISE GROSS NON-PERFORMING ASSETS, GROSS ADVANCES AND GROSS NPA RATIO OF PRIVATE SECTOR BANKS-2013

Banks	Gross NPAs	Gross Advances	Gross NPAs to Gross Advances Ratio (%)
	(1)	(2)	(3)
Private Sector Banks			
Old Private Sector Banks	52098	2731197	1.91
New Private Sector Banks	155525	8860233	1.76
Private Sector Banks	207623	11591430	1.79

Source: <http://www.rbi.org.in/>

Gross NPA is an advance which is considered irrecoverable, for bank has made provisions, and which is still held in banks' books of account. Compared to private sector banks (207623), Public sector banks have more gross NPA (1644618).Gross advances Compared to private sector banks (45601688), Public sector banks have more gross advances (11591430).The ratio of Gross NPA to gross advances in case of public sector is more compared to private sector (3.6 public sector to 1.79 private sector), which need to be reduced by adopting the necessary measures.

III. SUGGESTIONS TO REDUCE NPAs IN BANKS

These are some of the legal measures in order to recover NPAs.

1. Debt Recovery Tribunals (DRTs): Narasimham Committee Report I (1991) recommended the setting up of Special Tribunals to reduce the time required for settling cases. There are 22 DRTs and 5 Debt Recovery Appellate Tribunals. This is insufficient to solve the problem all over the country (India).

2. Securitisation Act 2002: Securitisation and Reconstruction of Financial Assets and Enforcement of Security Interest Act 2002 is popularly known as Securitisation Act. This act enables the banks to issue notices to defaulters who have to pay the debts within 60 days. Once the notice is issued the borrower cannot sell or dispose the assets without the consent of the lender. The Securitisation Act further empowers the banks to take over the possession of the assets and management of the company. The lenders can recover the dues by selling the assets or changing the management of the firm. The Act also enables the establishment of Asset Reconstruction Companies for acquiring NPA. According to the provisions of the Act, Asset Reconstruction Company of India Ltd. with eight shareholders and an initial capital of Rs. 10 crores has been set up. The eight shareholders are HDFC, HDFC Bank, IDBI, IDBI Bank, SBI, ICICI, Federal Bank and South Indian Bank.

3. Lok Adalats: Lok Adalats have been found suitable for the recovery of small loans. According to RBI guidelines issued in 2001. They cover NPA up to Rs. 5 lakhs, both suit filed and non-suit filed are covered. Lok Adalats avoid the legal process. The

Public Sector Banks had recovered Rs. 40 Crores by September 2001.

4. Compromise Settlement: Compromise Settlement Scheme provides a simple mechanism for recovery of NPA. Compromise Settlement Scheme is applied to advances below Rs. 10 Crores. It covers suit filed cases and cases pending with courts and DRTs (Debt Recovery Tribunals). Cases of Willful default and fraud were excluded.

5. Credit Information Bureau: A good information system is required to prevent loans from turning into a NPA. If a borrower is a defaulter to one bank, this information should be available to all banks so that they may avoid lending to him. A Credit Information Bureau can help by maintaining a data bank which can be assessed by all lending institutions.

Corporate Governance: A Consultative Group under the chairmanship of Dr. A.S. Ganguly was set up by the Reserve Bank to review the supervisory role of Boards of banks and financial institutions and to obtain feedback on the functioning of the Boards vis-à-vis compliance, transparency, disclosures, audit committees etc. and make recommendations for making the role of Board of Directors more effective with a view to minimizing risks and over-exposure. The Group is finalizing its recommendations shortly and may come out with guidelines for effective control and supervision by bank boards over credit management and NPA prevention measures.

Other factors to reduce NPAs

Credit Appraisal and Monitoring:

- Banks should have the well defined policies in respect of their loan portfolio and those policies should be communicated to the staff at the service points clearly and any lacunae in this area will jeopardize the interests of the bank to a great extent in the sense, that the staff servicing the loan accounts on account of lack of knowledge will not be in a position to adhere to the terms and conditions stipulated for the loan portfolio
- Credit appraisal has to be done branch officials without any bias taking into consideration the well defined policies framed for the loan portfolio

- All loan accounts are to be reviewed at periodical intervals and they should be renewed in time wherever required
- Borrowers are to be contacted at periodical intervals and the managers should be in a position to ascertain the financial position of the borrowers at each stage
- The managers should have profound knowledge about the market conditions and towards enriching his knowledge in this direction, he should be capable of updating his knowledge through various means like newspapers, media, internet etc
- Weakness in credit appraisal and credit monitoring can be overcome by proper training, human resource management and support to use acquired knowledge boldly by the operating staff.

Inspection and Credit:

Inspection and credit audit finds on credit irregularities/deficiency should be given the weightage and necessary compliance carried out promptly to prevent non performing assets. By strengthening security and improving activity level, non performing accounts can turn the corner

Risk Management:

Adherence to documented risk management policy, proper risk architecture, independent credit risk evaluation, centralized data base, credit management information system and credit modeling can help prevent non performing assets to a great extent. Credit modeling, in particular can predict impending sickness. For example Reserve Bank of India has devised a model i.e. Compatible Index of Lead Indicator (CILI) to predict movements in the manufacturing sector by about two quarters in advance. Similarly ICRA has got a risk assessment software model.

Asset Management Companies:

The Sarfaesi act 2002 provides for formation and operation of Asset Reconstruction Company/Securitisation Company. There should be concerted efforts in all quarters to make the AMC/ARC take off effectively. This concept has been fairly working in certain Asian countries like Japan, South Korea, China, Thailand, Malaysia and Indonesia.

NPAs Impact on profitability of Banks

The definition of banking is that acceptance of deposits and lending of loan. Whereas they pay interest at different rates for the deposits they are accepting from the customers called depositors, they have to collect interest for the advances they lend to the customers called borrowers. They keep a certain margin between the interest charged and interest paid. The margin should be in such a way that the banks can afford to pay all expenses in conducting the banking activities. The balance amount after payment of all expenses and charges will be the profit for the banks and the profit is shared between the shareholders

In case, the banks are not able to recover the amount lent to their borrowers, the level of profits comes down. All loan accounts are classified as performing assets or non performing assets. In classifying the non performing assets, the availability

of security or net worth of the borrower/guarantor is not considered for such classification.

Non performing assets impact on the bank's profitability in several ways as indicated below:

- They reduce the net interest income as the interest is not charged to these accounts.
- All non performing assets need to be prudentially provided for. This will again lead to reduced profitability.
- Servicing NPAs becomes costly in terms of time, money and manpower. They reduce employee productivity and overall profitability.
- Non performing assets affect recycling of bank credit as lendable resources shrink and adversely impact profitability. Higher time value of money can be ensured only by faster recycling of money lent.
- Non performing assets affect the liquidity position of the bank, create assets and liability mismatch and force the bank to raise resources at high cost.
- They affect the service to good customers, as their needs may not be met. This leads to loss of business and reduction in profit.
- Banks which makes low profits, have lower capital adequacy ratio and lower the capital adequacy ratio limits further asset creation. Such banks face difficulties in their growth, expansion/diversification plans, as they do not have the wherewithal to march boldly on these fronts. In the absence of vibrant growth and dynamic expansion, the only consequences are stagnation and negative growth.
- High non performing assets shadow the image of the banks in both domestic and international markets. This leads to business contraction and low profitability.
- NPAs lead to adverse selection because in their efforts to increase the income from lending, such banks lend at higher interest rates to low rated borrowers.
- High non performing assets, low profitability, riskier business and high NPAs work in a vicious circle against the bank and may jeopardize the very survival of the bank

IV. CONCLUSION

NPAs are draining the capital of the banks and weakening their financial strength. It is also as much a political and a financial issue. The banks and financial institutions should be more proactive to adopt a pragmatic and structured non performing assets management policy where prevention of non performance assets receives priority. Compared to private sector banks, public sector bank is more in the NPA level. Public sector bank must take more care in avoiding any account becoming NPA by taking proper preventive measures in an efficient manner.

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Benefits and Issues Surrounding Data Mining and its Application in the Retail Industry

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Abstract- Today with the advent of technology data has expanded to the size of millions of terabytes. For retail industries, customer's data works as tracks for analysing their buying behaviour. How this data is maintained and used for an effective decision making in retail industry is discussed in this paper. This not only increases profit for companies but also poses a challenge in the field of data mining about how probably "Recommended for You" items are chosen by the customers and how likable is the platform or store according to the customer preferences. Clustering algorithm is used to segregate customer profiles. Business Intelligence and analytics work to bring best decision routes for marketing.

Index Terms- data mining, business intelligence and analytics, retail industry, tesco, decision making, customer behaviour.

I. INTRODUCTION

Business Intelligence and Analytics (BI&A) is now recognized and understood as a very significant factor that can enhance organizational performance through intelligently taken decisions and meticulous ideas and perspectives (Chen et al. 2012; Davenport 2006). The evolution of modern day BI&A systems is largely attributable to Decision Support Systems (DSS). Business Intelligence and Analytics systems allow for the collation and transformation of data into information that can act as valuable inputs in the process of business decision-making. These systems allow the organization to emphasize on their decision routes, that is, the format through which decisions are arrived at in a company in order to enhance performance. By integrating data with the decision routes, BI&A systems provide for improved end decisions that in turn imply organizational success.

II. DATA MINING

History of Data Mining

Data mining is also known as the knowledge that is discovered from databases. A probable definition of data mining is – a process of extracting previously unknown, implicit, and useful information from the data found from databases. Data mining has come to become as a recognized field of research in the recent past. The Gartner Group had predicted in the year 1998 that almost half of the companies from Fortune-500 would be using technologies based on data mining within the year 2000 (Webster & Watson, 2002). However, most of the techniques are anything but new in the arena since they have been used for ages in statistics.

Database technology was developed in the 1960s which allowed the storage and utilization of data in a systematic manner. These advantages resulted in being not too useful for business since it required a lot of programming in order to generate simple reports. To add to it, computers were slow and expensive during those days.

During the 1970s advances in computer systems and their database, were going through further advances. These proceedings culminated into OLTP or the Online Transaction Processing in the 1980s, which allowed transactions to be put under codes and captured without the intervention of human (Rajagopalan et al, 1993). A new and more significant source of data was introduced with the invention of personal computer (PC). Gradually computer became a tool for everyday use for every employee. Marketers were especially benefited with the spreadsheet software for undergoing data analysis. As a result they discovered how powerful data is for aiding decision making capabilities. On the hand, statistics and artificial intelligence were two other streams of data mining where researches were taking place. Researchers were developing techniques for detection of automatic relationship and data visualization.

In the beginning of the 1990s the above mentioned technologies started to be highly developed. A large amount of database was now accessible to users who had their PCs and a local area network, along with server/client technology (Forgionne, 1999). The statistical and database software was proving to be user-friendly and thus several end users were able to generate their own reports and perform analyses on their own as well. Technologies became more powerful and this resulted in businesses organizing systems for storage of special data in order to provide structured and useful data throughout the company. The data stores, also known as the warehouses for data, provide the required raw material for data mining on a large scale.

Data Mining and Business Intelligence

Software solutions are instrumental to utilizing business applications. Risk management and enterprise decision-making now cannot be separated from mining tools. Business Intelligence (BI) is acquired by using mining. Use of data warehousing and Information Systems (IS) have made it possible for enterprise datasets to grow rapidly. Credit card companies generally log millions of transactions in any given year. Mobile operators and telecommunications companies usually generate largest data sets. User accounts exceed 100 million which generate billions of data per year. Against such numbers, OLAP or other analytical processing and manual operation do not have any chance to stand up. BI, on the other hand, makes the task possible.

According to Gartner Group “Data mining and artificial intelligence are at the top five key technology areas that will clearly have a major impact across a wide range of industries within the next three to five years”. This conclusion was arrived at in a 1997 report (Jun Lee & Siau, 2001). Another Gartner group report that came out in 2008 (Godbole & Roy, 2008), says that 80% of information systems data is unstructured and an increase of double the size was envisaged every three months. Decision support systems had taken up BI in a big way. BI’s domination was most visible in insurance, retail and banking. To cite a success story, The First American Corporation has effectively improved investment climate and customers’ loyalty by using BI. Employees in the categories of knowledge workers, middle management, executives, analysts and operational management benefited from BI.

BI is acquired by data in today’s environment. Mining tools are used to implement BI. Rivals are left behind, business operations are better managed, risk management and survivability are given a fillip by the data mined by the mining tools. Customer Relationship Management (CRM) is enabled through mining customers churn, their habits and patterns.

Customer churn happens when a certain percentage of customers leave the enterprise, perhaps to take advantage of their perceived and real better climate at a rival enterprise to keep the customers satisfied. Discovering alpha consumers who play ambassadors for the product and make the product a success is made possible by mining tools. Customers’ segmentation depending upon their habits and trends is necessary to target these alpha consumers. Advertising agencies and Catalogue marketing cannot do without mining tools. Mining tools can also provide market analysis from which information regarding the products that are usually bought together can be put together. DM is especially good at it.

III. DATA MINING IN THE RETAIL SECTOR: CASE STUDIES

Data mining involves risks and returns in equal proportions. The following discussion shall analyze two organizations, Tesco and Amazon, with respect to their data mining operations, to understand in practical light, whether or not data mining results in improved performance for retail organizations.

C. Tesco

Tesco Plc, a globally recognized and rated retail chain deals in grocery as well as general products. Its headquarters are in Hertfordshire (Chestnut) and is presently the largest supermarket in the United Kingdom. It also has the highest recruitment rate in the whole of UK. According to its 2009 annual report, Tesco had a whopping 320000 employee strength globally with 2320 running stores spread over the 7 continents. Tesco touched the Asian markets only at the start of this decade with setting up stores in Malaysia, Taiwan and China (to name a few). It was in 1995 that Tesco succeeded in overtaking its rival Sainsbury’s to become the highest UK superstore. This achievement made their market shares take a huge leap from 15.4% in 1995 to 29% in 2004. Tesco also managed to acquire the famous retail superstore T & S Plc which is stated to have had 90 stores around the UK (Bandura, 1986). Specifically the last decade has been of growth

and progress. They ventured into newer verticals like e-commerce, major diversification and increase in the variety of products and services which they have been offering (Also including diversifying into garments brand etc).

Tesco is at present UK’s leader in the grocery market sector and enjoys a 30% chunk of the grocery business. Also it is noteworthy that Tesco has presence in 13 different countries worldwide. Tesco is believed to have followed Ian McLaurin’s achievements and the CEO dreamt of an organization whose prime motive would customer satisfaction. They also play on their idea of extending “every little helps” that the organization can. This policy was adopted during the transformation of Tesco. Under the leadership of Leahy, Tesco has tasted great heights in the business history map and is only behind 2 other superstore chains worldwide. (America’s Wal-Mart and France’s Carrefour).

Presently, Tesco has comprehensive consumer data and profiles on approximately 145 million Americans – which accounts for more than 65% of its adult population. This information consists of their search history, browsing routes, products viewed, purchase records, location information, unique identification codes for customers and their devices and information about their computer/device systems (Davenport, 2006). Through the in-store Wi-Fi available at all Tesco stores, it is able to maintain records of customer movements which are applied to enhance layouts and product placements. Besides the use of the traditional cookies, which track user browsing preferences for the use of the online advertising industry, Tesco uses unique identifiers to maintain exhaustive profiles of its customers. Tesco also capitalizes on the rich information left behind by smartphone users. Data mining is conducted on smartphone data to obtain the unique MAC address, which is device-specific (Arnott & Pervan, 2008).

Tesco also uses advanced video software’s and cameras to track in-store movements of customers. Mining of such data reveals significant information on the number of adults and children, number of cash counters idle/overloaded, parts of the store that are more crowded and popular, facial expressions of the customers in response to the products, etc. It is also reported to be developing a store-only social network, where buyers can interact to discuss, recommend or provide their opinion on different products, services, special schemes, offers, etc. Tesco’s extensive investment in its exhaustive data mining practices, and the continuing success they have have resulted in, is ample evidence of the fact that if carried out smartly and efficiently, data mining can turn out to be extremely profitable for a retail organization.

D. Amazon

Amazon is amongst the largest and the most profitable e-commerce giants in the world today. Although the internet offers lucrative avenues for the use of data mining, Amazon does not have a formally developed, in-house data mining programme in place to track and understand the rich data trail left behind by its users (Kannungo, 2009). While it is most common to cite Amazon’s “Recommended For You” feature when discussing real-life examples of data mining, the truth is that Amazon’s reliance on data mining techniques is extremely restricted, especially when compared to competitor e-commerce

organizations operating on the same scale. Amazon does not track the behavior of buyers who eventually delete items from their cart before their final purchase, it does not mine data on buyers who add items to the cart and do not make a purchase and it also does not attempt to study data on interruptions in browsing experiences and why they occurred (Benbasat & Nault,1990). Rather than following a research and data-backed approach to enhance the experience they provide to users, they follow an intuitive approach to accomplish that goal. In the process, the organization side-steps opportunities to enhance their services. Whenever the supermarket wars take place, the bullets fly thickest where the loyalty background is. In this regard the grocer who is considered to have the most potent weapon of loyalty is Tesco. Yet, the immense mystery belonging to the data world remains how the customer insights brought about from Tesco Clubcard data mountain help to make it to the UK's biggest grocery chain.

Six years post the launch of Clubcard, in early 2001, Tesco had bought a shares in majority in dunnhumby which is its data analysis supplier. People in the data land were aware that something big was waiting in the future. It was proved so. Until 2001 dunnhumby and Tesco had restricted analysis of customer samples typically to about 10%. This was done in order to control the expenses of transmission and data storage. The huge changes came with lower costs of technology and the growing desire by Tesco to go deeper into data regarding consumer insights. They had taken it as a challenge to decipher the 104 billion rows of data that was stored at one point of time.

Tesco Lifestyle happened to be a result; a modeling system and segmentation based on the customer shopping behavior. Lifestyles ultimately dealt with understanding of the factors which affect shopping behavior, for instance, promotions, price, healthy eating, along with measurement of the share Tesco's hold from a customer's wallet. Their aim was to make people spend more and nudge them towards buying products from Tesco that they would have bought from elsewhere.

Their campaigns included the famous - "What is in the basket?". Dunnhumby started to look for products in the shopping baskets of random customers to find out certain ones that are predictive of a lifestyle or a need - for example, weight-watching goods. Thereafter, the data was mined to find out which other products were related to this and how much of it is used by customers regularly. The analysis found out 25 different dimensions of shopping or typologies - these include factors like how 'green', family oriented, and healthy a certain product was. These areas were such where traditional methods of calculation could hardly help, so there was a need to devise people's own approaches to collect data. Most of the 40K products that Tesco stocks were given a thumbs up or down across these dimensions. data and methodology

In this section, Tesco grocery section would be surveyed before and after the use of data mining techniques would be surveyed in detail. The Grocery section of Tesco was chosen because it was the busiest section which attracted the maximum number of consumers.

E. Survey and Data

Customer woes continue to plague the executives and managers who stare at unresolved questions that beg their

attention day in and day out. In a revelation of a kind, discussions between the Retail Food Industry Center's (TRFIC) Board of Advisors and Walmart, it was realized that there is a disconnect between consumers who refuse payment for things the retailers had assumed that the former would want and the retailers themselves. (Wolfson,2000). This initiated a research in order to find out the motivations that drove consumers' purchases. The questions asked were:

1. What makes the shoppers to choose a particular store to buy groceries?
2. What goes into making the decision about the stores?
3. Are all the shopping trips undertaken to the same shops for different purchases?

A nationwide telephone survey with 900 households as respondents (and in Atlanta, 300 households), was taken as a first step in the summer of 1999. The primary shopper for food was interviewed and the age group covered was between 18 and 75 years. Four different shopping aspects were covered: ready-to-eat/take out, stock up, fill-in and special occasion. The respondents had to rate a store on a scale from 10 (very Important) to 1 (not important) in correspondence with 30 factors given in the survey. The method of cluster analysis was employed to figure out the shoppers' preferences for a shopping trip for stock up. For the purpose, six types of grocery shoppers were chosen.

F. Analysis

Cluster analysis is a technique to employ in data mining. The original data containing preferences was applied to arrive at a conclusion about the shoppers' individual preferences. Market segmentation based on clusters has been put to use since the beginning of 1970s increasingly (Green 1995, Wind 1978). Customers were profiled based on hierarchical as well as non-hierarchical techniques. Segment of large data sets come across during marketing was carried out by k-means, a non-hierarchical method towards the end of 80s (k denotes the number of clusters).

Something that may be called "path dependence" may impact hierarchical approach and so non-hierarchical clustering techniques are being used. Path dependence involves the tendency of the objects grouped to stay together as in the beginning even if one does not concur with cluster average. In the event, the increase in group homogeneity can be rearranged by k-means.

IV. RESULTS AND DISCUSSION

Different customer profiles were segregated by making use of three (Arnott & Pervan, 2008) clustering algorithms. The results were reviewed carefully and they were instrumental in identifying different groups. The six consumer profiles have been described with the Minitab results as reference point.

Cleanliness along with sanitation has emerged as the most important aspect of shopping when consumers go for stock-up shopping. Quality or fresh farm products or meat are the second most important point. Price does not seem to matter too much in anybody's case. About 60% of all the shoppers rank price a little above mid-point. Even for people who did give a thought to

price, the price did not reach a score of much more than fifth or sixth. If you were to look beyond this, consumers do not seem to agree much on most things. In fact, they display marked differences.

V. CONCLUSION

Through the preceding analysis, it is evident that data mining has wide and varied applications for retail organizations, especially those that function on a large scale and those that have a well-developed web presence. While it does involve substantial expenditure, if implemented with care and after a thorough cost-benefit analysis, it is bound to show results. Any organization that operates in the dynamic markets of present times cannot afford to neglect the value of data mining in creating personalized shopping experiences for its customers and in optimizing its supply chain, operations and products – and thus, in enhancing organization performance.

Retail industries make profits out of efficiency from their supply chain managements. BI tools help in supporting their supply chain management which makes enterprises have better management over the supplies. When integrated in IMS or WMS, BI tools help in finding patterns, possible over production, shortages, and underproductions and so on; but in most cases quick response towards demand spike which are very important to catch. Originally, models that are complexly mathematical were used for logistical problems and supply chain management. Logistics are capable of affecting inventories specially to lack of precise forecasting and spikes in demands from slow response.

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2 Novel Approaches for Speed Control of DC Motor: Fuzzy Logic and Artificial Neural Network Techniques

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Abstract- The design of intelligent control systems has become an area of intense research interest. A promising direction in the design of intelligent systems involves the use of Fuzzy Logic Controller (FLC) and Artificial Neural controller (ANC) to discover the abilities of intelligent control systems in utilizing experience via rule-based knowledge.

This paper presents the FLC and ANC. Both controllers are designed, implemented and compared in the MATLAB/Simulink model to examine the performance of DC motor with different loads.

Index Terms- DC Motor, Fuzzy Logic Controller (FLC), ANN, Artificial Neural controller (ANC).

I. INTRODUCTION

Direct current (DC) motors have variable characteristics and are used extensively in variable-speed drives. DC motor can provide a high starting torque and it is also possible to obtain speed control over wide range. Why do we need a speed motor controller? For example, if we have a DC motor in a robot, if we just apply a constant power to each motor on a robot, then the poor robot will never be able to maintain a steady speed. It will go slower over carpet, faster over smooth flooring, slower up hill, faster downhill, etc. So, it is important to make a controller to control the speed of DC motor in desired speed.

DC motor plays a significant role in modern industrial. These are several types of applications where the load on the DC motor varies over a speed range. These applications may demand high-speed control accuracy and good dynamic responses.

DC Motor model

The resistance of the field winding and its inductance of the motor used in this study are represented by R_f and L_f , respectively. The resistance of the armature and its inductance are shown by R_a and L_a respectively in dynamic model. Armature reactions effects are ignored in the description of the motor. This negligence is justifiable to minimize the effects of armature reaction since the motor used has either interlopes or compensating winding. The fixed voltage V_f is applied to the field and the field current settles down to a constant value. A linear model of a simple DC motor consists of a mechanical equation and electrical equation as determined in the following equations:

$$J_m \frac{d\omega}{dt} = K_m \cdot \phi \cdot I_a - b \cdot \omega - M_{load}$$

$$L_a \frac{dI}{dt} = V_a - R_a \cdot I_a - K_b \cdot \phi$$

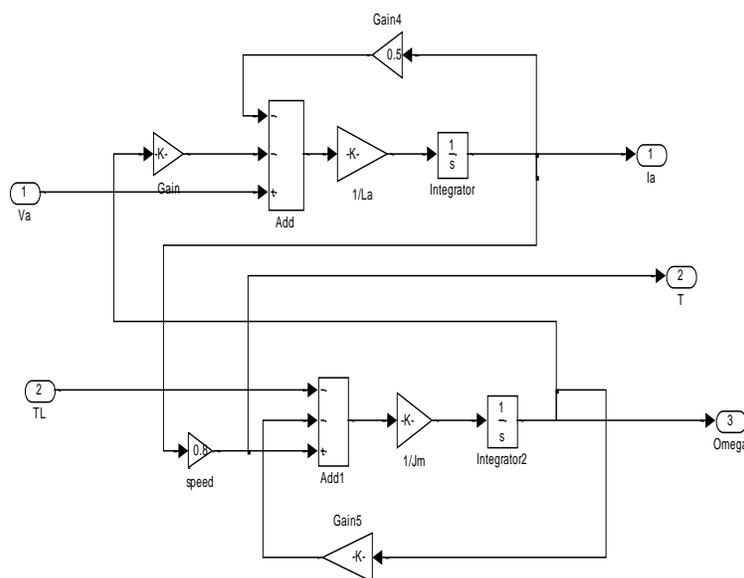


Fig 1. Simulink model of separately excited dc motor

Speed Response of DC Motor without any controller is shown below:

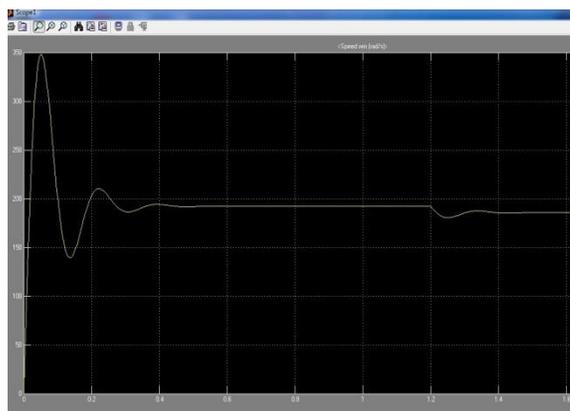


Fig 2. Speed Response of DC Motor without any controller

The Peak Overshoot and number of oscillations obtained in above curve are much more and hence undesirable. These parameters are controlled by using ANC and FLC discussed below.

II. FUZZY LOGIC CONTROLLER

Fuzzy logic has two different meanings, in a narrow sense, fuzzy logic is a logical system, which is an extension of multivolume’s logic, and however, in a wider sense fuzzy logic is almost synonymous with the theory of fuzzy sets, a theory which relates to classes of objects with un-sharp boundaries in which membership is a matter of degree. In this perspective fuzzy logic in its more narrow definition, fuzzy logic differs both in concept and substance from traditional multi-valued logical system. Fuzzy logic is a convenient way to map input space to an output space. Mapping input to output is the starting point for everything.

FLC have some advantages compared to other classical controller such as simplicity of control, low cost and the possibility to design without knowing the exact mathematical model of the process. Fuzzy logic incorporates an alternative way of thinking which allows modeling complex systems using higher level of abstraction originating from the knowledge and experience. Fuzzy logic can be described simply as “computing words rather than numbers” or “control with sentence rather than equations.”

III. STRUCTURE OF FUZZY LOGIC

There are specific components characteristic of a fuzzy controller to support a design procedure. Figure 3 shows the controller between the preprocessing block and post processing block.

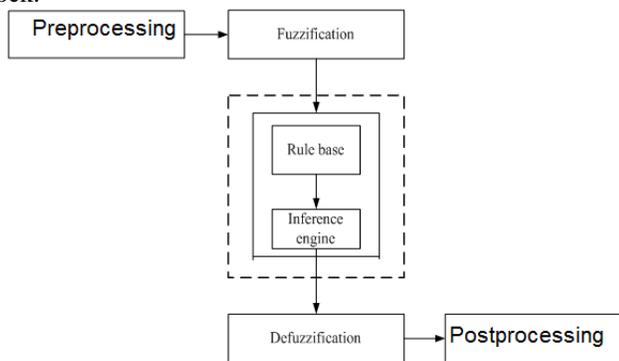


Fig. 3 Structure of fuzzy logic controller

Fuzzification

The first block inside the controller is fuzzification which converts each piece of input data to degrees of membership by a lookup in one or several membership functions. The fuzzification block matches the input data with the conditions of the rules to determine. There is degree of membership for each linguistic term that applies to the input variable. The first step in designing

a fuzzy controller is to decide which state variables represent the system dynamic performance must be taken as the input signal to the controller. Fuzzy logic uses linguistic variables instead of numerical variables. The process of converting a numerical variable (real number or crisp variables) into a linguistic variable (fuzzy number) is called Fuzzification. System variables, which are usually used as the fuzzy controller inputs includes states error, state error derivative, state error integral or etc.

The membership function is a graphical representation of the magnitude of participation of each input. There are different memberships functions associated with each input and output response. In this study, we use the trapezoidal membership function for input and output variables. The number of membership function determines the quality of control which can be achieved using fuzzy controller. As the number of membership function increases, the quality of control improves. As the number of linguistic variables increases, the computational time and required memory increases. Therefore, a compromise between the quality of control and computational time is needed to choose the number of linguistic variables. For the speed control of DC motor study, five linguistic variables for each of the input and output variables are used to describe them.

Rule Base

The collection of rules is called a rule base. The rules are in “If Then” format and formally the *If side* is called the *conditions* and the *Then side* is called the *conclusion*. The computer is able to execute the rules and compute a control signal depending on the measured inputs *error* (e) and *change in error* (dE). In a rule based controller the control strategy is stored in a more or less natural language. A rule base controller is easy to understand and easy to maintain for a non- specialist end user and an equivalent controller could be implemented using conventional techniques.

Defuzzification

Defuzzification is when all the actions that have been activated are combined and converted into a single non-fuzzy output signal which is the control signal of the system. The output levels are depending on the rules that the systems have and the positions depending on the non-linearities existing to the systems. To achieve the result, develop the control curve of the system representing the I/O relation of the systems and based on the information; define the output degree of the membership function with the aim to minimize the effect of the non-linearity. The reverse of Fuzzification is called Defuzzification. The use of Fuzzy Logic Controller (FLC) produces required output in a linguistic variable (fuzzy number). According to real world requirements, the linguistic variables have to be transformed to crisp output.

It obtains the center of area occupied by the fuzzy set. It is given by the expression.

$$X = \frac{\int \mu(x)x dx}{\int \mu(x) dx}$$

Where, X=crisp value;x = support value at which the membership function reaches the maximum value; μ(x)=

maximum value of membership function corresponding to the quantization level.

Post processing

The post processing block often contains an output gain that can be tuned and also become as an integrator.

IV. NEURAL NETWORK CONTROLLER

Neural networks are wonderful tools, which permit the development of quantitative expressions without compromising the known complexity of the problem. This makes them ideal in circumstances where simplification of the problem, in order to make it mathematically tractable, would lead to an unacceptable loss of information. As pointed out by Ziman, there is a fine balance between over-idealizing the initial hypothesis in order to make it amenable to mathematical analysis, and abandoning reality.

Neural networks resemble the human brain in the following two ways:

1. A neural network acquires knowledge through learning.
2. A neural network's knowledge is stored within inter-neuron connection strengths known as synaptic weights.

An Artificial Neural Network (ANN) is an information processing paradigm that is inspired by the way biological nervous systems, such as the brain, process information. The key element of this paradigm is the novel structure of the information processing system. It is composed of a large number of highly interconnected processing elements (neurons) working in unison to solve specific problems. ANNs, like people, learn by example. An ANN is configured for a specific application, such as pattern recognition or data classification, through a learning process. Learning in biological systems involves adjustments to the synaptic connections that exist between the neurons. This is true of ANNs as well.

The true power and advantage of neural networks lies in their ability to represent both linear and non-linear relationships and in their ability to learn these relationships directly from the data being modeled. Traditional linear models are simply inadequate when it comes to modeling data that contains non-linear characteristics.

The neural network consists of junctions which are connected with LINKS, also called processing units. For each junction a number is ordered, this number is called weight. The weights are the tools for the long distance information storing in the neural network, the learning process occurring with the appropriate modification of weights. These weights are modified so that the network input/output behavior is in consonance with the environment, which provide the input data.

The calculation algorithm consists of Calculation of the output of the network, with inputs and weights and modification of weights.

A single input neuron consists of a scalar input 'p' multiplied by the scalar weight 'w' to form 'wp' which is fed to the summer along with bias 'b' multiplied by '1'.

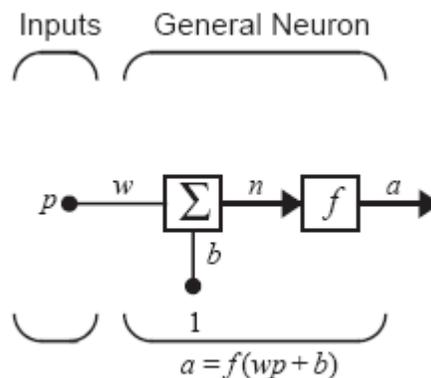


Figure 4: Basic Neural Network

The net input is $wp+b$ and the output a is;
 $a=f(WP+b)$;
 f- Transfer function
 W & b can be adjusted by learning rule.

TRANSFER FUNCTION:

- LINEAR TF:

$a = \text{purelin}(n)$

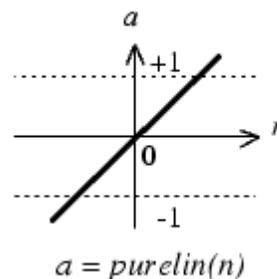


Figure 5: Linear Transfer Function

V. CONTROLLER DESIGN

DC MOTOR SPEED CONTROL USING FUZZY LOGIC CONTROLLER (FLC)

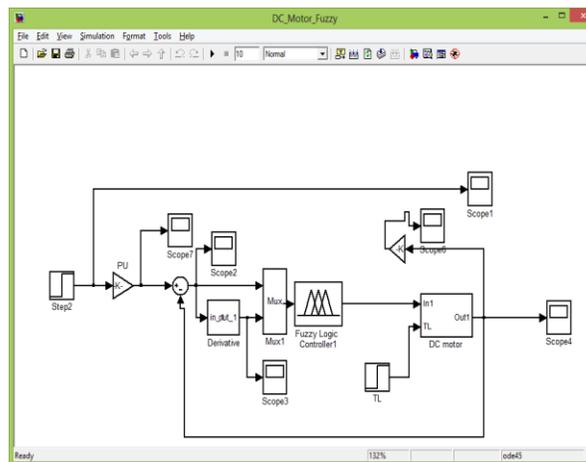


Figure 6 MatLab/Simulink model for DC motor using Fuzzy Controller.

The figure 6 gives the MatLab/Simulink model for control of speed of DC motor using fuzzy logic controller.

ARCHITECTURE OF NEURAL NETWORK CONTROLLER

The Figure 7 shows the model of Artificial Neural Network controller (ANC) for DC motor. The model is simulated with speed vs time of the DC motor with the fixed load and also with varying load.

The ANC model is shown below:

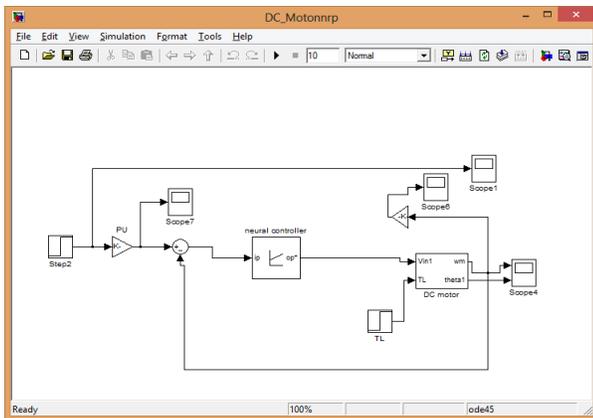


Fig 7. Simulink model of Artificial Neural Network Controller

VI. RESULT AND DISCUSSION

Simulation result of DC motor without using any controller is shown in fig 1. That fig may be compared with fig 7 for speed control.

COMPARISON OF SPEED CONTROL USING FUZZY LOGIC CONTROLLER AND ARTIFICIAL NEURAL CONTROLLER:

All the controllers are simulated on MATLAB and their *Speed Vs Time* characteristic is studied. The Characteristic is shown below:



Fig 7. Simulation results of FLC and ANC.

VII. CONCLUSION

From the simulation results it may be concluded that:

- ANC has better performance by reducing, e_{ss} (Steady state error), M_p (maximum overshoot) and T_s (settling time).
- But FLC has small rise time (T_r) as compared to Artificial Neural Network controller.
- Biggest disadvantage of ANC is its more rise time (T_r).

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Effects of Natural Fillers on Some Properties of Polystyrene

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Abstract- The effects of some animal materials, viz feather, hide and hoof, as fillers for polystyrene were investigated. Composites of varying weight percentages of fillers in fixed weight of the polymer resins were produced for each filler type by the injection moulding technique. The physico-mechanical and thermal properties of the composites prepared showed variations in the properties such as, tensile strength, elongation at break, compressive strength, flexural strength, surface hardness and melting and crystallization temperatures. These materials of animal origin can be used as fillers and mainly as biodegradable fillers for polymer resins and form bio-plastics.

Index Terms- Feather, hide, hoof, mechanical properties and polystyrene.

I. INTRODUCTION

The ever increasing rise of thermoplastics has led to the production of many viable goods that can serve man in several ways. In fact, people have used polymers for far longer than metals; from the earliest times, wood, leather, wool and cotton have been in use for various purposes [1]. This is because of their inherent properties which include corrosion resistance; resistance to water and chemicals, high dielectric constant, toughness, high strength, enhanced abrasion resistance, flex and moderate-to-high creep resistance and moderate temperature moulding characteristics. Most materials of commerce though identified as single materials by their generic names are actually not mono-materials. Many additives are usually incorporated to impart desired physico-mechanical/chemical properties on the finished products. These additives (compounding agents) are carefully selected based on the desired performance target [2].

Fillers are additives widely used for thermoplastics, thermosets and elastomers. They may be inert materials that serve to reduce resin cost and, to a lesser extent, improve processability [3]. Fillers are used in polymers for a variety of reasons; cost reduction, improved processing, density control, optical effects, thermal conductivity, control of thermal expansion, electrical properties, magnetic properties, flame-retardancy and improved mechanical properties such as hardness and tear resistance [4]. Thus, some animal materials such as feather, hide and hoof were used as fillers and incorporated into the polymer resins of common utility. These animal materials like feather and hide are naturally fibrous, tough and light due to high keratin content. Hoof, from physical observation, is tough and coarse. They are used to enhance the mechanical properties

of polystyrene and also to see produce green composites of polystyrene.

Polymer Matrix

This is the base polymer which may be either thermoplastic or thermoset. Virtually all polymers have at one time or the other served as matrix for some form of composites because of their low strength and usual ductility or toughness in comparison with the reinforcing materials which are strong, stiff and brittle and with low density [5]. Polymer matrix supports the fillers and transfers the external loading to them by shear of the filler/matrix interface. In addition, matrix provides protection for the filler surface and minimizes diffusion of species such as oxygen or moisture which can degrade the mechanical properties of filler during manufacturing or service life of the composites. It prevents the propagation of cracks in the filler and usually provides the major control of electrical, chemical and thermal properties of the composites.

II. MATERIALS AND METHOD

Materials

General purpose polystyrene was used. Polystyrene is a thermoplastic and aromatic polymer made from the aromatic monomer styrene, a liquid hydrocarbon that is commercially manufactured from petroleum by the chemical industry. It has many desirable properties and one of the most widely used kind of plastic. Polystyrene is outstandingly easy to process. Its stability and flow makes it an ideal polymer for injection moulding technique.

The samples feather, hide and hoof from chicken and cow respectively, were used as the fillers. They were collected, washed and dried for two weeks. The dried samples were sieved and mesh sizes of 200µm were used.

Method

i.) Polymer Composite Production

Pellets of polystyrene resins were mixed with each of the fillers at varying percentages. These were extruded as strands and made into small granules. This was done to ensure a homogenous mixing of the fillers and the polymer resins. Later, each composition was fed into the hopper of an injection moulding machine (TL-120-8.50 Model, Made in China), fixed with a rectangular shaped die (with the dimensions of 146mm in length, 40mm in width and 5mm in thickness). After melting and compounding, the mixture was injected into the rectangular die and rectangular polymer composite test bars were produced.

ii.) Mechanical Properties Measurement of the polymer composites

The tensile properties of the filled polymer composites of polystyrene were measured using the Instron Universal Testing Machine. The compressive and flexural strengths were also measured using the Compressive Strength Testing machine of Model Cat G 43/2 and Flexural Strength testing machine of Model Cat L 18/D and Make Controls, Mikano, Italy, respectively. The readings were automatically recorded and the values computed.

The surface hardness of the polymer composites were determined by means of the Avery Hardness Testing machine, Type 6406, Number E65226, manufactured by Avery Birmingham, England.

iii) Determination of the thermal properties of the composites

The thermal properties of the polymer composites were determined by the means of the Differential Scanning Calorimeter, (DSC), of Model DSC Jade and Make Perkin Elmer.

The melting and crystallization behaviour of polymer composites were examined by differential scanning calorimeter

(DSC). This method is suitable for the determination of the melting and crystallization temperature of plastics (PE, PP and PS). By heating the samples in a DSC at a constant heating rate, cooling at constant rate and reheating at a constant heating rate, the melting and crystallization temperatures with their corresponding enthalpies of reactions were determined separately and recorded.

III. RESULTS AND DISCUSSIONS

3.1. Mechanical Properties Tests

i) Analysis of Tensile Strength

This is the stress at which the specimen breaks or ruptures, as measured in MPa. This stress at failure is called the ‘ultimate stress’. It results from large and irreversible deformation, which is a sample rather than material property and is strongly influenced by sample defects and processing history. Tensile strength is the most common of the mechanical properties of polymers [6].

Table 1: Values of tensile strength of PS composites

Polymer Composites	Tensile strength (MPa)	Elongation (mm)	Elongation (%)	Break load (KN)
0% PS	4	10.55	6.35	0.81
1% Feather	5	7.14	4.79	0.99
5% Feather	4	11.79	7.86	0.65
1% Hide	8	14.87	9.98	1.53
5% Hide	7	51.97	35.6	0.27
1% Hoof	3	16.44	10.96	0.47
5% Hoof	2	0.86	0.57	0.46

The two fillers, feather and hide, enhanced the tensile strength of the polystyrene composites while hoof filler decreased it below the value of the unfilled specimen. Hide filled composite has the highest value, followed by feather and they decreased their effects as the filler loading increased to 5%.

Hide, it should be recalled that is, elastic, fibrous and collagenous, while feather is fibrous and very rich in keratin (98%) and hoof rich in calcium and coarse in nature.

The variations in the values of the tensile strength of the composites observed may be linked with the degree of adherence of the fillers to the polymer matrix as explained by Bueche [7] and Flemmert [8]. These authors believe that the filler particles

tie polymer chain bundles together by filling interstitial voids, thereby restricting molecular slippage on application of tensile force. At the same time, the filler particles assist in distributing any induced stress more equitably. This also reduces the chances of “break or craze ” to propagate along the molecular chain, leading to mechanical failure. By the same mechanism, elongation should be hindered, especially with increasing filler loading [9]. This fact was also confirmed from this work and some other works [10, 11], as elongation at break decreased with increased filler loading in all the polymer composites characterized.

Table 2: Values of compressive strength of PS composites

Polymer Composites	Test force (KN)	Compressive strength (N/mm ²)
0% PS	152.40	47.60
1% Feather	270.20	84.40
5% Feather	218.70	68.40
1% hide	240.80	75.30
5% Hide	254.80	79.60
1% Hoof	246.10	76.90
5% Hoof	275.80	86.20

The addition of these fillers into polystyrene matrix increased the compressive strengths. This tremendous increase in the compressive strengths of polystyrene composites could be attributed to better polymer-filler interaction and adhesion which results in the stiffening of the polystyrene chain and thus exhibited a resistance to compression under applied strain. These

fillers hoof and hide can be used to enhance the compressive strength of polystyrene.

The keratin content of feather and hoof filled composites proved their increased strengths to the composites, while hide filler depicted an improvement on the compressive strength of polystyrene.

Table 3: Values of flexural strength of PS composites

Polymer Composites	Test force (KN)	Flexural strength (N/mm ²)
0% PS	0.30	1.06
1% Feather	0.39	1.37
5% Feather	0.18	0.63
1% hide	0.13	0.46
5% Hide	0.28	0.98
1% Hoof	0.16	0.56
5% Hoof	0.36	1.27

Polystyrene composites filled with feather at 1% and hoof at 5% filler loading respectively increased the flexural strength above that of the unfilled polystyrene Table 3. Feather and hoof fillers interacted well with polystyrene matrix, thereby improving its flexural strength. Hoof filler, in this case increased the flexural strength as the filler loading increased meaning that hoof

exhibited good polymer-filler phase interaction and adhesion, thus offering good strength to the polystyrene resin, while feather filled composites decreased the strength as the filler loading increased.

Table 4: Readings of surface hardness of PS composites

S/No	Specimen	Diameter of indenter (2mm)	Load (5Kg)	Diameter of indentation (mm)	BHN (N/mm ²)
1	PS 0% Filler	2mm	5kg	0.5	4.1722
2	PS 1% Feather	2mm	5kg	0.5	4.1139
3	PS 5% Feather	2mm	5kg	0.6	4.2332
4	PS 1% Hide	2mm	5kg	0.5	4.1722
5	PS 5% Hide	2mm	5kg	0.5	4.1722
6	PS 1% Hoof	2mm	5kg	0.4	4.1139
7	PS 5% Hoof	2mm	5kg	0.5	4.1722

The same similar irregular trend was observed among the three fillers incorporated into polystyrene composites as shown in Table 4. This could be attributed to the fact that the addition of these fillers to the polymer matrices affected the adhesion strength between the polymer and fillers. This can be explained by means of an analysis of polymer-filler interactions. The presence of electrons in the fillers and polymers may have caused repulsion that affected the surface hardness, since there was no

donor or acceptor of electrons, thereby reducing crosslinking density and consequently, there was no additional physical crosslinks within the polymer network, Thus, the surface hardness was meaningless [12] or it could mean that the fillers were evenly distributed on the polymer matrix, thereby showing slight surface resistance.

Table 5: DSC Readings for PS composites

Polymer	Filler	T _m (°C)	DT _m (°C)	ΔHM(J/g)	ΔH _m (J/g)	T _c (°C)	DT _c (°C)	ΔH _c (J/g)	DΔH _c (J/g)
PS	0%	90.59	-	0.59	-	90.24	-	0.88	-
	2% Feather	92.93	2.34	0.47	-0.12	92.95	2.71	1.89	1.01
	2% Hide	91.94	1.35	0.71	0.12	91.51	1.30	1.75	0.87
	2% Hoof	91.90	1.31	0.89	0.31	94.31	4.07	2.84	1.96

In the case of polystyrene composites, the fillers increased both the melting and crystallization temperatures, when compared with the unfilled polymer specimen and unlike its counterparts where an increase in melting temperature and a decrease in crystallization temperature for polyethylene composites and vice versa for polypropylene composites as depicted in Table 5.

This resulting increase for polystyrene composites may be due to the nature of these fillers, polymer-filler phase interaction, strength of the intermolecular forces and sensitivity of the DSC method. The variations in the crystallization temperature, (T_c), as shown by Chemistry, may be due to the interactions of the fillers with the polymer matrix and these depend on the nature of the fillers, time, pressure and purity of the fillers[13].

IV. CONCLUSION

The use of feather, hide and hoof as fillers have embedded some significant properties that are advantageous to polystyrene. Hide filler exhibited better reinforcing performance on the polymer resins, followed by feather and lastly hoof. This could be attributed to the nature of hide and also confirms the good and durable leather product made from hide. The qualities also revealed by feathers showed an interesting value for feathers. This may be due to its high keratin content and other desirable qualities, leading to its increasing demand by researchers to convert feathers into bio-plastics resins and carbon fibers. These fillers are proteinous materials that can decompose and degrade. So the need to use them as biodegradable fillers incorporated into polymers (plastics which litter the environment and seen at landfills) is strong, to help in keeping the environment clean. Also, they can be used to form bio-plastics due to the mechanical strength property, they displayed; thereby reducing dependence on the polymer resins produced from petrol.

Therefore, it is pertinent to channel these fillers into use as fillers for thermoplastic resins and more especially the feathers which are not being used but mainly seen and disposed.

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Defeating the Poverty Cycle in Nigeria through Innovation and Industrial Revolution

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Abstract- Local and global realities compel a rethink of the economic priorities and strategies in Nigeria. The economy is struggling to leverage the country's vast wealth in fossil fuels in order to displace the crushing poverty that affects about 54 percent of its population. Economist experts refer to the coexistence of vast wealth in natural resources and extreme personal poverty in developing countries like Nigeria as the "resource curse". Nigeria's exports of oil and natural gas at a time of peak prices have enabled the country to post merchandise trade and current account surpluses in recent years but still harbors a good percentage of people living below the poverty line.

This article enumerates the Nigerian economy, with a question of what went wrong even with the abundance of natural resources. The analysis is therefore an authentic answer to the need of an industrial revolution and innovation which perhaps is the topic of discourse.

Index Terms- Poverty cycle, Innovation Industry, Revolution

I. INTRODUCTION

Over the years, the Nigerian Federation has been battling for a transition to a market economy, a wide range of macroeconomic and social indicators have also ranked her economy to resume full stature comparable to countries of the Organization for Economic Co-operation and Development (OECD); its integration into global chains of production and new ideas has become more reliable cemented and has deepened along with the country's economic and social changes which has taken Nigeria to the leading position of African economies surpassing the famous South Africa. Been a country of absurd economic realities, Nigeria is at present the world 13th largest producer of crude oil and the largest economy in Africa earning an estimated \$2.5 million a day in oil revenue. Despite this development, it's GDP per capita which rose from \$1,700 to \$2,400 still ranked the country among the lowest in the African continent and 54 per cent of its 170 million people live on less than \$1.25 per day which is the official poverty line suggested by the World Bank.

These figures are unimaginable shocking because of her abundance of natural resources primarily oil and natural gas in conjunction with the massive agricultural potentials based on its fertile soil, climate and the significant rural and urban population. Human development data for Nigeria has remained persistently bleak despite a considerable upturn in the country's economic fortunes from the year 2000. Surprisingly, Nigeria was

ranked 80th by UNDP in a poverty survey sampling 108 developing nations that focused on severe deprivation. The agency placed Nigeria on a Human Poverty Index of 37.3, which interpretation is below more impoverished African neighbors with far smaller economies like Rwanda and Malawi. Significantly, the study and statistics also accounted not only by income destitution, but also at other basic aspects including education, access to health care, standard of living and life-expectancy.

Other internal survey reveals that more than 60 million Nigerians are docketed as poor according to standard definitions, while 35 percent of the total population lives in extreme poverty. These recent trends are especially worrying because they parallel a significant but contradictory improvement in performance. Before this present global financial crisis set in, the capital seat of the federation Abuja had been a success in wielding substantial positive change in its overall balance sheets through a process of re-prioritization and economic reform since the inception of the 4th republic (1999). A slew of measures, including the privatization of several steel, petrochemical, mining and port entities helped develop the non-oil sector, lowering inflation which boosts international currency reserves and also successfully negotiated with the London and Paris clubs to do away with a large part of its foreign debt.

However, World Bank research confirms that even during periods of relative prosperity, poverty levels remained unabated in the broadest sense, and actually worsened during successive positive growth periods. Between 1972 and 1980, for instance, the Nigerian per capita income shot up from \$1,300 to \$2,900 based on rapidly escalating oil prices. A subsequent decline in global oil revenues will drag down the per capita income, consumption and expenditure to critical levels.

II. THE POVERTY CYCLE AND ITS CAUSES

The neglect on investment in human development projects had continued to pump borrowed finances into capital-intensive industries. The fallout was that the dramatic rise in national fortunes bypassed the majority of Nigerians as witnessed from the negligible rise in per capita consumption figures for the same period. The differential effect on poverty levels in rural and urban areas for the coinciding period is equally startling. Because of a simultaneous worsening of income distribution, rural poverty declined slightly while the number of urban poor gained.

Notwithstanding, the worst-of it were also the highest losers, as the population living in extreme poverty across Nigeria swelled up from 7 million to 11 million. The obvious explanation

behind this is that policy makers sorely failed to share the increase in wealth equitably, thereby calling for the practice of small and medium industries to close the gap between the poor and the rich. Although experts note that small businesses have some detrimental characteristics that made them require private and public support, meaning the government must have to give full support to small industries if it's ready to pull out from these crises that may likely collapse the economy in the future. It is a testimony that apart from limited managerial capabilities, which include lack of economies of scale, lack of collective voice and influence on policy, frequent cases of market failures and their biases against small and medium scale businesses, is a barrier to any economy. Others include weak financial capacity to undertake research and development or procure other costly support services such as Business Development Services, and huge knowledge gaps, as most small business promoters don't know what they need to know but which they don't know.

III. CONCLUSION

After discussing the numerous problems encountered by the Nigerian nation even with the vast resources and manpower, one will conclude that a drastic step is needed to address the situation and put them in proper control. This article has suggested innovation and industrial revolution to curtail the feathers of this ugly monster in view of the above listed problems currently plaguing the country.

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Efficient FP Growth using Hadoop - (Improved Parallel FP-Growth)

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Abstract- As an important part of discovering association rules, frequent itemsets mining plays a key role in mining associations, correlations, causality and other important data mining tasks. Since some traditional frequent itemsets mining algorithms are unable to handle massive small files datasets effectively, such as high memory cost, high I/O overhead, and low computing performance, an improved Parallel FP-Growth (IPFP) algorithm and discuss its applications in this paper. In particular, a small files processing strategy for massive small files datasets to compensate defects of low read/write speed and low processing efficiency in Hadoop. Moreover, use of MapReduce to implement the parallelization of FP-Growth algorithm, thereby improving the overall performance of frequent itemsets mining. The experimental results show that the IPFP algorithm is feasible and valid with a good speedup and a higher mining efficiency, and can meet the rapidly growing needs of frequent itemsets mining for massive small files datasets.

Index Terms- Frequent itemsets mining, Hadoop MapReduce, Parallel FP-Growth, Small files problem

I. INTRODUCTION

As data management and analysis are facing new challenges in the age of big data, the rationality and timeliness of the data processing methods are becoming the research hotspot of big data statistical analysis, and big data association analysis greatly increases the profits of enterprises.

As one of the important research directions of data mining, frequent itemsets mining plays an essential role in mining associations, correlations, causality and other important data mining tasks [1] which is a strong impetus to the applications of association rules in markets selection, decision analysis and business management [5]. The existing classical frequent itemsets mining algorithms are breadth-first algorithm Apriori proposed by Agrawal et al. in 1994 and depth-priority algorithm FP-Growth presented by Han et al. in 2000. In order to improve the efficiency of frequent itemsets mining, many researchers have proposed several methods to optimize classical algorithms [11]; [10]. Meanwhile, to address the bottleneck of mining performance and reduce memory consumption and computation cost of the machine in the single machine environment, parallel and distributed algorithms are proposed methods [2], the applications of corresponding algorithms for frequent itemsets mining in the large-scale datasets will easily cause high CPU consumption, high memory cost, high I/O overhead, low computing performance and other issues.

As typical methods of Hadoop Distributed File System (HDFS) and MapReduce parallel programming model provide a new idea for handling big data. In the frequent itemsets mining for large-scale data, a MapReduce approach of parallel FP-Growth (PFP) algorithm is proposed in [8], and the performance of PFP algorithm is enhanced by adding load balancing features in [20], but these methods ignore frequent

Itemsets mining for massive small files datasets in Hadoop.

With the arrival of big data era, massive data are growing rapidly. However, in reality, most of the large-scale data are composed of massive small files. Small files usually refer to those file sizes, which are less than 64 MB. According to a study in 2007 at the National Energy Research Scientific Computing Center, 43% of the over 13 million files on a shared parallel file system are under 64 KB and 99% are under 64 MB (Petascale Data Storage

Institute (2007)), and more scientific applications consist of a large number of small files are depicted in [4]. Nevertheless, in the face of massive small files datasets, the constructed FP-tree in Parallel FP-Growth (PFP) algorithm cannot fit into the memory, which often causes problems such as memory overflow and huge communication overhead. Meanwhile, the computing efficiency of the Hadoop platform largely depends on the performance of HDFS and MapReduce [17], and Hadoop was, at first, designed specifically to handle streaming large files, so when dealing with massive small files, there are significant limitations. Massive small files will reduce the performance of Hadoop, which is mainly shown in the following two aspects:

- (1) The access efficiency of HDFS is decreased.
- (2) The additional overhead of MapReduce is increased. [21]

II. IPFP ALGORITHM DESCRIPTION

IPFP algorithm for mining frequent itemsets in massive small files datasets in detail.

(1) Write a small files processing program—*Sequence File*. The *Sequence File* is used to merge all massive small files, which are composed of a large amount of transaction datasets stored in HDFS, into a large transaction data file (transaction database).[21]

(2) Equally divide the transaction database into several sub-transaction databases and then assign them to different nodes in Hadoop cluster. This step is automatically operated by HDFS, when necessary we can use the balance command enabling its file system to achieve load balancing. [21]

(3) Compute *support* count of each item in the transaction database by MapReduce, and then obtain the set of *I_list* from *support* count in descending order.[17]

(4) Divide *I_list* into *M* groups, denoted as *Group_list* (abbreviated as *G_list*), and assign *group_id* for each group sequentially and each *G_list* contains a set of items.[3]

(5) Complete the parallel computing of FP-Growth algorithm by MapReduce. The *Map* function compares the item of each transaction in the sub-transaction database with the item in *G_list*. If they are same, then distribute the corresponding transaction to the machine associated with *G_list*. Otherwise, compares with the next item in *G_list*. Eventually, the independent sub-transaction databases corresponded to *G_list* will be produced. The *Reduce* function recursively computes the independent sub-transaction databases generated in step , and then constructs the FP-tree. This step is similar to the process of traditional FP-tree generation, but the difference is a size *K* max-heap *HP* which stores frequent pattern of each item.[21]

(6) Aggregate the local frequent itemsets generated from each node in the cluster by MapReduce, and finally get the global frequent itemsets.

III. IPFP ALGORITHM IMPLEMENTATION STEPS

Implement the IPFP algorithm, which is mainly composed of four steps as described in the following.[21]

Step 1: Merge massive small files. *Sequence File* is composed of a series of <key, value>, where the key is the name of small files and the value is the content of small files before merging. *Sequence File* exploits three classes—*WholeFileInputFormat*, *WholeFileRecordReader* and *SmallFilesToSequenceFileConverter*, to merge the massive small files into a large file.

(1) *WholeFileInputFormat* class:

1) The *isSplittable* () method reloads and returns the value of false, and the purpose is to maintain the input file not to be divided into slices.

2) The *getRecordReader* () method returns a customized *RecordReader*.

(2) *WholeFileRecordReader* class: the *FileSplit* is converted into a record, where the *key* of the record is the filename and the *value* is the content of this file.

(3) *SmallFilesToSequenceFileConverter* class: Massive small files are merged into a sequential file, and this class contains the *Map* () and the *Reduce* (). The input format of data is *WholeFileInputFormat*, while the output format is *SequenceFileOutputFormat*.

Step 2: Compute *I_list*. The complexity of time and space is $O(TDBsize/P)$, (*TDBsize*: the size of transaction database, *P*: the number of parallel MapReduce programs).

Step 3: Generate *G_list* from *I_list*, and complete parallel computing of FP-Growth algorithm. *Map* () judges which *G_list* the item of transactions in the machine belongs to, and then sends this transaction to the corresponding *G_list* machine. In order to avoid sending duplicate transaction, we delete the duplicate entries in the hash table. Each *Reduce* () handles the independent sub-transaction database associated with *G_list*, which creates heap *HP* with a size of *K* for each item in *G_list*.

Step 4: Aggregate local frequent itemsets generated in the previous step from each node, and then we get global frequent itemsets.

IV. EXPERIMENTS AND RESULTS

In this section, we show the study results from different sources that the feasibility, speedup, validity and efficiency of IPFP algorithm by two experiments. The experimental Hadoop cluster is composed of one Master machine and four Slave machines with Intel Pentium® Dual-Core E5700 3.00GHz CPU and 2.00GB RAM.

All the experiments are performed on Ubuntu 12.04 OS with Hadoop 0.20.2, Jdk 1.6.0 and Eclipse 3.7.1. The real data from the Frequent Itemset Mining Dataset Repository are used as the experimental data, which are processed into three groups of different sizes datasets. The feasibility, validity, speedup and efficiency are used to evaluate the overall performance of IPFP algorithm and compare it with the PFP algorithm in the same environment.[21]

V. APPLICATIONS

In this section, we apply the IPFP algorithm to a car database which consist different attributes of car such as, car model number, mileage, etc. The IPFP algorithm is used to analyze the difference between the time taken to run a regular fp growth to IPFP algorithm.

The IPFP algorithm shows better processing performance and a higher mining efficiency than PFP algorithm.

VI. CONCLUSIONS

In this paper, it is described that the small files processing strategy, the IPFP algorithm can reduce memory cost greatly and improve the efficiency of data access, thus avoids memory overflow and reduces I/O overhead. Meanwhile, the IPFP algorithm is migrated to the MapReduce environment, which can complete frequent itemsets mining efficiently and thus enhance the overall performance of FP-Growth algorithm. The experimental results show that IPFP algorithm can make a breakthrough where PFP algorithm has its defects in handling massive small files datasets, and has a good speedup and a higher mining efficiency.

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Growth and Instability in Agricultural Production in Haryana: A District level Analysis

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Abstract- Indian agriculture history is witness of the new agriculture arrangement which took place in India has changed the overall traditional cropping pattern in India as well as in Haryana. There are many agriculture reforms such as land reforms, green revolution, minimum support price, and new economic reforms have adopted in Indian agriculture. All these reforms have directly affected the agriculture sector in overall India. Even these reforms are favourable in terms of productivity and production of all the crops but they have inadequately affected in terms of crop stability. Only a few crops such as rice and wheat are going to more stable but the coarse cereals and pulses are going to highest instable in area and production in Haryana.

Index Terms- Growth, Instability Area, Production, Agriculture

I. INTRODUCTION

Haryana is the state which has large amount of fertile land, in India. It is doing well in industrial as well as agricultural sectors. About 70% of the population is engaged in agriculture, directly or indirectly. Haryana has achieved a remarkable growth in its agricultural sector, which not only has made it self-sufficient in foodgrains production but also has elevated it to the second largest contributor to India's central pool of food grains¹. On the question the relationship between growth and instability, in the cases of some crops; the modern technology reduced variation while other believe that it is bound to increase. The modern technology do help to reduce variability in yields and production only a few crops (Mehra Shakuntala 1981). There are many studies on instability conducted during 1980s concluded that agriculture production had become more unstable after the introduction of new agricultural technology (Mehra 1981; Hazell 1982; Dev 1987; and Ray et al 1988). Sharma et al 2006 estimated crop wise and state wise variability in production and yield for two time periods, namely 1981/82 - 1990/91 and 1991/92 - 2000/01, and the study find out that production of food grains became more stable during 1990s compared with 1980s at all India levels and in most of the states.

Instability, in agricultural sector, which measures the range of variation in different dimensions; it may be in area of cultivation, yield or production. Here it has been shown, the range of instability in production among different crops in Haryana. In other word, this study intends to measure the extent of instability in the production of major crops in this state. The

paper is divided in two sections. It begins with an examination of growth in area of cultivation and production of major crops in Haryana. And, secondly it measures the instability in crop production. There are many studies such as Rao (1975), Dharm Narain (1976), Mehra (1981), Hazell (1982), Rao et al (1988), etc, have pointed out that the new strategy of agri-cultural production based on high-yield varieties (HYV) seed-fertiliser technology has contributed to the growth in production and productivity. At the same time they have also pointed out that this growth has been accompanied with the increase in the output/yield variability (B P Vani and Vinod Vyasulu 1996). There are many reasons which create new agriculture arrangement in India. Among these the green reevaluation is favourable only a few crops; it enhance the productivity, but only for a few crops, Minimum Support Price (MSP) and government policy are favourable only for a few specific crops. These entire factors collectively change the traditional cropping pattern in Haryana as well as in India. Thus the change in the variability and instability with the adoption of green revolution becomes an important issue (B P Vani et al 1996). It highly reduces the instability in a few crops, while it increases high instability in coarse cereals and diversifies the resource in mono-crop culture in Haryana. Instability declined progressively in some states (Punjab, Haryana, Assam, Himachal Pradesh, MP, Rajasthan and UP) whereas in some other states (Orissa, West Bengal, Thmil Nadu) it became progressively un-stable (S Mahendradev 1987).

The agricultural instability can be measured by different methods, such as the coefficient of variation (CV), dispersion, Cuddy Della Valle Index (CDI), etc. The present study applies the Cuddy Della Valle Index for measuring the instability. This Index first de-trends the given series and gives a clear direction about the instability. The use of coefficient of variation as a measure to show the instability in any time series data has some limitation. If the time series data exhibit any trend the variation measured by CV can be over-estimated, i.e. the region which has growing production are at constant rate will score high in instability of production if CV is applied for measuring instability. As against that Cuddy-Della Valle index attempts de-trend the CV by using coefficient of determination (R^2). Thus it is a better measure to capture instability in agricultural production. A low value of this index indicates the low instability in farm production and vice-versa. To calculate instability of crop production Cuddy-Della Valle index has been used in the present study.

¹ Economics survey of Haryana, 2007-08

$$\text{Cuddy-Della valle index}^2 = C.V. * (1 - R^2)^{0.5}$$

Where C.V. = Coefficient of Variation

R^2 = ESS/TSS i.e. ratio of explained variation to total variation.

ESS = Variation explained by explanatory variable.

TSS = Total Variation.

Variation can be measured by C.V. But due to presences of trend with variation in production with passes of time. Here C.V. adjusts with R^2 to de-trend the production series, because it is statistically sound. The present study divides the CDI value into three categories, which represent the different range of instability.

The ranges of instability are as follows:

- Low instability = between 0 to 15
- Median instability = greater than 15 and lower than 30
- High instability = greater than 30

Data Sources The study is based on secondary data, the data sources are Statistical Abstract of Haryana (Different Issues), Economics Survey of Haryana and India (Different Issues)

Districts Covered - This Study is based on the analysis of district-wise data pertaining of the 12 major district namely Ambala, Kurukshetra, Karnal Sonapat, Rohtak Faridabad, Gurgaon, Mahendergarh, Bhiwani, Jind Hisar and Sirsa. There were 12 districts in 1980-81 in Haryana and this study is begun from 1980-81 so that to analysis easily those districts are separated from the particularly districts are combing them. The districts are Yamunanagar and Panchkula are clubbed in Ambala, Kaithal is added in Kurukshetra, Panipat is added in Karnal, Jhajjar is added in Rohtak, Rewari is added in Mahendergarh, Fatehabad is clubbed in Hisar, and Mewat in Gurgaon district

II. AGRICULTURE GROWTH IN HARYANA

The agricultural production increased in almost the al kind of crops during the 1980s except maize, barley and massar. Gram which registered 3.1 percent of total growth from 1980-81 to 1990-91 thereafter, it registered a sharp declining trend during nineties and during 2000-01 to 2006-07 by (-82.9%) and (-12.5%) percent, respectively.

² The cuddy- Della Valle index takes in to account the time trend in a variable, which is not captured in the coefficient of variation the index is applied when a variable shows some trend which may be linear or non linear and such case Cuddy-Della Valle index is used as an appropriate measure of variability.

Table 2.1 Total Percentage growth in production

Crops	% increase in Production		
	1980-81 to1990-91	1990-91 to 2000-01	2000-01to 06-07
Rice	45.7	46.9	25.08
Wheat	84.5	50.1	3.99
Jowar	35.4	-64.6	4.35
Bajra	8.7	24.7	3.51
Maize	-41.0	-30.6	9.68
Barley	-40.9	10.3	-35.59
Gram	3.1	-82.9	-12.50
Moong	81.3	-69.0	238.89
Masoor	-6.9	-54.6	-12.24
Foodgrains	58.37	39.08	11.04
Oilseeds	239.36	-11.76	48.31
Total cotton*	79.63	19.74	31.16
Sugarcane	67.4	4.7	0.12

Data Source: Statistical Abstract of Haryana (Different Issue) *Thousand of bales of 170 k.g.

One point is to be noticed here that the production of almost all the crops increased during eighties except maize, barley and massar but during nineties there were many crops like jowar, maize, gram, moong, massar and oilseeds which showed negative growth in their production. Overall the production of total foodgrains and total cotton registered a remarkable growth over the periods. (See table no 2.1)

increasing continuously, in case of pluses it is declining. The production of total pulses was 502.3 thousand tonnes in 1980-81; it increased 686.6 thousand tonnes in 1985-86. After that its trend started declining. (Table 2.2)

2.2 Agricultural Production of major crops in Haryana:

Table no 2.1, shows; a remarkable increase in foodgrains production is visible in Haryana since 1980-81. Production of total foodgrains is likely to increase from 60.36 lakh tonnes in 1980-81 to 156.77 lakh tonnes in 2007-08 showing an increase of 159.7 percent. The Wheat and Paddy crops have played a major role in pushing up the agricultural production. The production of Rice which was 12.5 lakh tonnes in 1980-81 is likely to increase to 33.71 lakh tonnes in 2006-07. Similarly, the production of Wheat which was 34.90 lakh tonnes in 1980-81 is likely to increase to 10055 lakh tonnes during 2006-07. The production of paddy which was 12.59 lakh tonnes in 1980-81 has increase to 18.34 lakh tonnes in 1990-91 and further it has increased 33.71 lakh tonnes in 2006-07. The total share of wheat and rice in total foodgrains production was 78.6 percent in 1980-81, and it has increased to 86.4 percent in 1990-91 and it becomes 90.06 percent in 2006-07. It shows that wheat and rice are the major foodgrains crops of Haryana. State made remarkable progress in the field of agriculture production and it has emerged as the grain bowl of the country. Resultantly, foodgrains production touched an impressive figure of 147.63 lakh tonnes during 2006-07 from 25.92 lakh tonnes during 1966-67 registering a more than fivefold increase.³ Although, the total production of foodgrains is

³ Economics Survey of Haryana, 2007-08.

Table 2.2 The Agricultural Production of Major Crops in Haryana (000 tones)

YEARS	WHEAT	PADDY	TOTOL PULSES	TOTAL FOOD-GRAIN	SUGAR-CANE	COTTEN*	OILSEEDS
1980-81	3490	1259	502.5	6036	460	643	188
1985-86	5260	1633	686.6	8146	505	745	288
1990-91	6436	1834	541.7	9559	780	1155	638
1995-96	7291	1847	450.1	10171	809	1284	783
2000-01	9669	2695	99.8	13295	817	1383	805
2006-07	10055	3371	111.8	14763	965	1814	835

Data Source: Statistical Abstract of Haryana (Different Issue) *Cotton (000 Bales)

Table 2.3 Agricultural Production growth of Major Crops in Haryana (in %)

Years	WHEAT	PADDY	TOTOL PULSES	TOTAL FOODG RAIN	SUGAR-CANE	COTTON*	OIL-SEEDS
1980-81 to 1985-86	50.72	29.71	36.64	34.96	9.78	15.86	53.19
1985-86 to 1990-91	22.36	12.31	-21.10	17.35	54.46	55.03	121.53
1990-91 to 1995-96	13.28	0.71	-16.91	6.40	3.72	11.17	22.73
1995-96 to 2000-01	32.62	45.91	-77.83	30.71	0.99	7.71	2.81
2000-01 to 2006-07	8.66	34.06	11	17.92	18.53	36.30	11.80

Data Source: Statistical Abstract of Haryana (Different Issue) *Cotton (000 Bales)

A remarkable increase in foodgrains production is visible in Haryana since 1980-81. Production of total foodgrains is likely to increase from 60.36 lakh tonnes in 1980-81 to 147.63 lakh tonnes in 2006-07 showing an increase of 149.7 percent. The Wheat and Paddy crops have played a major role in pushing up the agricultural production. The production of Rice which was 12.5 lakh tonnes in 1980-81 is likely to increase from 36.13 lakh tones to 100.55 lakh tones in 2006-07 thereby showing the tremendous increase of 146.9 percent. Similarly, the production of Wheat which was 34.90 lakh tonnes in 1980-81 is likely to increase to 105.56 lakh tonnes during 2006-07. (Table 2.2)

The production of total cotton (American and Desi) is showed a remarkable increasing; it increased from 460 thousands bales in 1980-81 to 745 thousand bales in 1985-86, it was 15.8 percent higher in 1985-86 than that of in 1980-81. But a major change takes place in 1990-91, when the production of total cotton recorded 50 percent more than the production of 1985-86. It was 745 thousand bales in 1985 -86 it became 1155 thousand bales in 1990-91. After that it showed a marginal growth in its production.

The productions of sugarcane, oilseeds and cotton are increasing continuously since 1980-81, the production of sugarcane was 46 lakh tonnes in 1980-81, it increased to 78 lakh tonnes in 1990-91; and thereafter it increased to 105 tonnes in 2007-08. The production of oilseeds is increasing continuously;

it increased from 1.88 lakh tons in 1980-81 to 9.00 lakh tonnes in 2007-08. The production of cotton in the State is estimated to increase from 6.43 lakh bales in 1980-81 to 18.5 lakh bales in 2007-08. However the production of all major crops is increasing since 1980-81 except pulses. The growth in production of pulses is not satisfactory, the total production of pulses was 24 thousand tonnes in 1980-81 which increased to 55 thousand tonnes in 1990-91; but it declined to 13 thousand tonnes in 2000-01.

III. PRODUCTION INSTABILITY AMONG DIFFERENT CROPS IN HARYANA

The study finds that instability in the production of Wheat, Sugarcane and Rice remains low during the first period, followed by Desi Cotton, Groundnut, Reap Seed and Mustard, Maize, Massar, Barely and American Cotton registered medium measures of instability.

Jawar, Sesamum, Moong, Gram and Bajra showed high instability in the second period, instability in the production of Rice and Wheat shows a sharp declining trend. In the second period, three more crops American Cotton, Maize and Barley are registered into low instability crops which were noticed under medium instability crops during previous period. Gram and Moong still shows high instability in the second period. A major

change takes place in Jawar in third time period. Jawar registered low instability in this time period. Wheat, Rice and Sugarcane recorded declining trends throughout the period. On the other hand, Gram and Moong were recorded as high instability crops. (See Table No 3.1)

Table No: 3.1 Production Instability among crops in Haryana

	LOW INSTABILITY CROPS	MEDIUM INSTABILITY CROPS	HIGH INSTABILITY CROPS
1980-81 TO 1989-90	Wheat 6.30 Sugarcane 12.15 Rice 12.73	Desi 16.51 Groundnut 17.65 RP seed* 18.41 Maize 19.38 Masoor 20.54 Barley 20.64 American 25.83	Jowar 32.92 Sesamum 33.29 Moong 34.54 Gram 42.98 Bajra 44.91
1990-91 TO 1999-2000	Wheat 4.81 Rice 7.20 American 7.27 Barley 11.02 Maize 11.4 Sugarcane 11.78	Groundnut 16.19 RP seed* 16.48 Desi 20.38 Masoor 25.57 Sesamum 26.81 Jowar 28.02	Gram 34.34 Moong 37.38
2000-01 TO 2006-07	Wheat 4.42 Rice 5.75 Jowar 7.23 Sugarcane 10.55 Barley 12.55	Bajra 28.82 Maize 15.63 RP seed* 18.91 American 21.39 Bajra 23.91 Masoor 25.55 Desi 28.45	Gram 30.3 Moong 30.91 Sesamum 56.98

RP Seed* = Rape seed and mustered, American = American Cotton, and Desi = Desi Cotton.

3.2 Production Instability in Rice across the Districts:

The trends rate of instability in the production of rice declining in Karnal, Kurukshetra, Ambala, Jind, Hisar, Sirsa and Faridabad throughout the study period. Ambala had medium instability during the first period and in the next period it had the lowest instability. Karnal and Kurukshetra, which showed the lowest instability during the first period, have recorded medium instability in second period. Gurgaon, which recorded medium

instability during the first period, has recorded highest instability during third period of time. Rohtak has recorded high instability during first and second period, while it shows medium instability during 2000-01 to 2006-07. Because of rain fed area, the instability of rice in Gurgaon is increasing over the time period and registered as the highest instability district during 2000-01 to 2006-07 (See Table 3.2).

Table No: 3.2 - Production Instability in Rice

Rice	1980-81 to 1989-90	1990-91 to 1999-2000	2000-01 to 2006-07
Low Instability	Karnal 7.32 Kurukshetra 10.61	Ambala 5.16	Kurukshetra 1.52
		Sirsa 6.95	Sirsa 5.5
		Sonepat 9.36	Karnal 5.59
		Faridabad 9.58	Ambala 6.95
		Hisar 10.49	Hisar 9.94
		Jind 11.15	Mahendragarh 12.01
Medium Instability	Sirsa 16.13 Gurgaon 17.64 Hisar 17.69 Ambala 23.88 Jind 23.99 Sonepat 24.69	Karnal 16.93	Sonepat 17.97
		Gurgaon 22.08	Faridabad 18.78
		Kurukshetra 23.74	Jind 20.26
			Bhiwani 21.29
			Rohtak 29.74
		Rohtak 40.09	Rohtak 40.42	Gurgaon 75.89

High Instability	Faridabad	71.09	Mahendragarh	-	
	Mahendragarh	-	Bhiwani	-	
	Bhiwani	-			
Haryana	Rice	12.73	Rice	7.20	Rice 5.75

Data Source: Statistical Abstract of Haryana (Different Issue)

3.3-Production Instability in Jowar across the Districts:

Even in case of Jowar, instability showed a declining trend but it is still high in many districts in 2000-01 to 2006-07. During 1980-81 to 1989-90 there was no district under the low instability category. Sonapat, Bhiwani Mahendragarh and Karnal recorded

under medium instability in second period. Gurgaon recorded statistically significant downward trends during the third time period. Sonapat and Rohtak are two additional districts that showed significant declining trends during third time period.

Table 3.3 Instability in Jowar across the districts

Jowar	1980-81 to 1989-90	1990-91 to 1999-2000	2000-01 to 2006-07	
Low Instability			Sonapat 5.41 Rohtak 7.81	
	Sonapat 22.96 Bhiwani 24.52 Mahendragarh 27.88 Karnal 28.37		Gurgaon 23.64 Faridabad 24.49	
High Instability	Kurukshetra 31.63 Rohtak 37.94 Faridabad 49.38 Jind 50.22 Gurgaon 53.56 Hisar - Sirsa -	Gurgaon 31.52 Hisar 31.63 Bhiwani 33.13 Faridabad 38.30 Sonapat 40.03 Jind 53.85 Karnal 55.28 Rohtak 64.19 Mahendragarh 73.76 Kurukshetra - Sirsa -	Kurukshetra - Karnal - Mahendragarh - Bhiwani - Jind - Hisar - Sirsa -	
	Haryana	Jowar 32.92	Jowar 28.02	Jowar 7.23

Data Source: Statistical Abstract of Haryana (Different Issue)

No one districts recorded under low and medium categories during second time period. At Haryana level instability recorded a significant downwards trend in all the time periods. The new technology has increase instability in coarse cereals, The main reason for increase in instability of cotton jawar Bajra's production after 1992-93 seems to be the extension of its cultivation to non-traditional areas where cotton has replaced jowar, pulses and other cereal crops (Ramesh Chand* and S.S. Raju 2008). (See Table No 3.3)

3.4 Production Instability in Bajra across the Districts

Instability in the case of Bajra has recorded a declining trend throughout the study period. One district recorded under low

category two districts namely; Karnal and Jind were recorded under medium instability during the first period, whereas other districts showed high instability during the first period. Even instability trends declined in all the districts but it significantly declined in Hisar, Rohtak, Kurukshetra and Sirsa; these districts showed under high instability during first period which recorded under low instability during third period. Faridabad recorded a increasing trend in instability from second time period to third time period. Karnal, which was recorded under low instability in the first period, changed to high instability during the second and third time periods. (See Table No 3.4).

Table 3.4 Production Instability in Bajra

Bajra	1980-81 to 1989-90	1990-91 to 1999-2000	2000-01 to 2006-07
Low Instability			Hisar 5.58 Rohtak 8.6 Kurukshetra 11.67 Sirsa 12.34
Medium Instability	Jind 25.62 Karnal 26.01	Faridabad 20.00 Gurgaon 21.18 Jind 24.50 Hisar 25.51 Ambala 27.30 Bhiwani 28.99	Jind 17.6 Gurgaon 19.48 Bhiwani 23.15 Sonapat 24.93
High Instability	Hisar 32.34 Ambala 35.01 Sonapat 41.16 Faridabad 41.38 Sirsa 43.16 Gurgaon 43.83 Kurukshetra 46.74 Rohtak 54.14 Bhiwani 60.85 Mahendragarh 76.28	Rohtak 32.51 Sirsa 39.32 Sonapat 40.15 Mahendragarh 41.07 Karnal 41.37 Kurukshetra 48.32	Karnal 31.55 Mahendragarh 32.22 Faridabad 32.62 Ambala 44.27
Haryana	Bajra 44.91	Bajra 28.82	Bajra 23.91

Data Source: Statistical Abstract of Haryana (Different Issue)

3.5 Production Instability in Wheat across the Districts

The trend rates under wheat reveal that instability varied from a high declining trend in all the districts. For instance, Karnal is an advanced district in agriculture, yet even then it

showed medium instability during the first two time periods. There is no one district under high instability in all the time periods. (See Table No 3.5)

Table 3.5 Production Instability in Wheat

Wheat	1980-81 to 1989-90	1990-91 to 1999-2000	2000-01 to 2006-07
Low Instability		Hisar 3.26	Jind 1.3
	Kurukshetra 6.63	Bhiwani 3.93	Kurukshetra 2.32
	Rohtak 9.86	Faridabad 4.85	Karnal 2.49
	Faridabad 9.89	Jind 5.59	Rohtak 2.58
	Bhiwani 9.95	Gurgaon 6.50	Hisar 2.7
	Hisar 10.4	Ambala 7.21	Sonepat 3.05
	Jind 10.72	Sirsa 8.17	Mahendragarh 3.05
	Gurgaon 10.85	Rohtak 9.96	Ambala 3.88
	Sirsa 11.26	Sonepat 13.40	Sirsa 3.94
	Sonepat 11.8		Bhiwani 4.27
	Ambala 12.05		Gurgaon 5.47
Mahendragarh 14.84		Faridabad 8.33	
Medium Instability		Karnal 17.61	
	Karnal 34.91	Mahendragarh 22.98	
		Kurukshetra 26.61	
High Instability			
Haryana	Wheat 6.30	Wheat 4.81	Wheat 4.42

Data Source: Statistical Abstract of Haryana (Different Issue)

The trends rate of production instability is below the range of 10 in all the districts during 2000-01 to 2006-07. Jind registered a high declining trend in wheat during the all time periods. At the all Haryana level, instability is under low category in all the time periods and registered declining trends in all time periods. Kurukshetra which recorded the lowest instability in first time periods was noticed highest instability during the second period and it noticed second lowest instability district during third time period. (See Table No 3.5)

3.6 Production Instability in Gram across the Districts

The condition of instability in Haryana was the worst in the case of gram since 1980-81. Not one district has been registered

in low instability in all the time period. Karnal was the only district which recorded medium instability during 1980-81 to 1989-90, except this district all districts showed high instability during first time period. A study by Ramesh Chand and S.S. Raju 2008 find the same result in the case of pulses first phase of green revolution show a decline in instability to the extent of 5.4 percent but post 1988 period witnessed an increase of 2 percent. Jind registered the highest instability during this time period. However, the instability of gram improved in some district but it was still high in all the districts. Mahendragarh, which registered the high instability during the first time period, decreased and was registered with medium instability during 2000-01 to 2006-07.

Table 3.6- Production Instability in Gram

Gram	1980-81 to 1989-90	1990-91 to 1999-2000	2000-01 to 2006-07
Low Instability			
Medium Instability		Sirsa 13.90	Mahendragarh 22.51
		Gurgaon 16.75	Gurgaon 26.15
		Bhiwani 19.87	Rohtak 26.74
	Karnal 29.86	Karnal 23.49	Hisar 29.1
		Ambala 26.09	Sirsa 29.42

			Sonepat 26.35		
			Rohtak 28.16		
High Instability	Mahendragarh	32.86	Jind	30.38	Bhiwani 36.67
	Ambala	33.18	Hisar	32.78	Kurukshetra -
	Sirsa	34.05	Mahendragarh	36.37	Karnal -
	Kurukshetra	35.88	Faridabad	45.78	Sonepat -
	Sonepat	37.39	Kurukshetra	47.98	Faridabad -
	Gurgoan	39.05			Jind -
	Faridabad	40.08			
	Hisar	42.92			
	Rohtak	44.63			
	Bhiwani	66.09			
Jind	66.37				
Haryana	Gram	42.98	Gram	34.34	Gram 30.30

Data Source: Statistical Abstract of Haryana (Different Issue)

3.7 Production Instability in Reap seed and Mustard across the Districts

Reapseed and mustard registered medium instability at all Haryana level during all the time periods. Sonepat was the only district which registered low instability during 1980-81 to 1989-90. There were four districts which showed high instability

during 1980-81 to 1989-90. During nineties the condition of instability in some districts like, Sirsa, Faridabad, Jind, and Bhiwani improved and they showed low instability during this time period. One point to be noticed here has that the instability declined only in those districts which are rain-fed areas.

Table 3.7 Production Instability in Rape Seeds and Mustard

	1980-81 to 1989-90		1990-91 to 1999-2000		2000-01 to 2006-07	
Low Instability			Sirsa	8.71		
			Faridabad	11.30	Bhiwani	5.1
	Sonepat	14.68	Jind	12.01		
			Bhiwani	14.69		
Medium Instability	Mahendragarh	17.08	Gurgoan	17.37	Kurukshetra	15.88
	Hisar	23.14	Hisar	17.37	Rohtak	17.41
	Rohtak	23.43	Sonepat	20.66	Jind	19.18
	Sirsa	23.77	Mahendragarh	27.29	Ambala	21.37
	Gurgoan	26.19	Rohtak	28.83	Mahendragarh	23.08
	Jind	27.72			Karnal	26.15
	Faridabad	28.84				
High Instability	Karnal	32.8	Ambala	34.12	Hisar	31.79
	Kurukshetra	35.57	Karnal	35.85	Faridabad	35.09
	Ambala	37.19	Kurukshetra	39.82	Gurgoan	35.58
	Bhiwani	37.52			Sirsa	36.07
					Sonepat	37.17
Haryana	RP seed*	18.41	RP seed*	16.48	RP seed*	18.91

Data Source: Statistical Abstract of Haryana (Different Issue)

3.8 Production Instability in Total Cotton across the Districts

Total cotton shows Medium and high instability in all the districts, over the time period. Its main reason was that it is a kharif crop and there is high fluctuation in its area of cultivation.

Table 3.8 Production Instability in Total Cotton

	1980-81 to 1989-99		1990-91 to 1999-2000		2000-01 to 2006-07	
Low Instability						
Medium Instability	Hissar	15.94	Sirsa	17.82	Rohtak	15.87
	Sonepat	17.82	Hissar	19.33	Sirsa	22.78
	Rohtak	19.33	Karnal	22.35	Hissar	23.2
	Ambala	29.22	Mahendergargh	29.22	Jind	23.55
	Bhiwani	22.35			Bhiwani	26.38
High Instability	Kurukshetra	31.79	Jind	31.79	Kurukshetra	30.29
	Jind	33.04	Faridabad	33.04	Sonepat	39.78
	karnal	34.09	Bhiwani	34.09	Mahendergargh	50.51
	Sirsa	42.23	Kurukshetra	42.23	karnal	-
	Faridabad	-	Sonepat	-	Faridabad	-
	Gurgoan	-	Rohtak	-	Gurgoan	-
	Mahendergargh	-	Gurgoan	-	Ambala	-
		Ambala	-			

Data Source: Statistical Abstract of Haryana (Different Issue)

If in any time period, rainfall is good and monsoon comes on time then the area under cotton cultivated shifted towards rice. That is why there is lot of variation in its production and it makes the reason of medium and high production instability. The result

shows that production instability is comparatively low in rainfed districts like, Hisar, Sirsa, Bhiwani and Rohtak over the periods. It is comparatively high in well irrigated district like, Karnal and Kurukshetra.

Table 3.9 Production Instability in Sugarcane

Sugarcane	1980-81 to 1989-90		1990-91 to 1999-2000		2000-01 to 2006-07	
Low Instability			Bhiwani	6.29	Ambala	4.01
			Hisar	9.20	Karnal	6.89
	Sonepat	14.79	Sirsa	12.68	Faridabad	8.31
	Kurukshetra	14.93			Kurukshetra	9.31
Medium Instability	Karnal	15.42	Jind	18.94	Rohtak	15.6
	Ambala	20.19	Rohtak	27.87	Jind	20.83
	Rohtak	20.64			Hisar	28.9
	Faridabad	29.67			Sirsa	29.55
	Jind	29.82				
High Instability	Hisar	35.18	Mahendragarh	31.72	Bhiwani	50.7
	Bhiwani	55.88	Kurukshetra	35.51	Gurgoan	-
	Gurgoan	86.27	Sonepat	40.52	Mahendragarh	-

	Mahendragarh -	Ambala -		
	Sirsa -	Karnal -		
		Faridabad -		
		Gurgoan -		
Haryana	Sugarcane 12.15	Sugarcane 11.78	Sugarcane 10.55	

Data Source: Statistical Abstract of Haryana (Different Issue)

3.9 Production Instability in Sugarcane across the Districts

Sugarcane showed declining trend in instability, it registered low instability at all Haryana level and declining continuously in all the time periods. During the first time period, there were two districts, Sonapat and Kurukshetra which registered low instability but during the 1990s both districts underwent high instability. There were five districts which registered high instability during the first time period. Whereas in the 1990s there were seven districts, Mahendragarh, Kurukshetra, Sonapat, Ambala, Karnal, Faridabad, and Rohtak, which showed high instability, the major change took place in Ambala, which showed high instability during the 1990s, but underwent low instability district during 2000-01 to 2006-07. Ambala, Karnal, Faridabad, Kurukshetra and Sonapat showed declining trend in instability since 1990-91, and changed to become low instability districts in sugarcane. Bhiwani, which registered the lowest instability by 6.29 during the 1990s became the highest instable (50.7) district during 2000-01 to 2006-07.

IV. CONCLUSION

In Haryana, the growth rate of agricultural production shows changes in spatial pattern of different crops. On the one hand some crops like rice and wheat show a very satisfactory performance in their production in all the three periods (1980-81 to 1989-90, 1990-91 to 1999-2000 and 2000-01 to 2006-07). On the other hand, crops like Gram, Massar, Maize, Sesamum, groundnut, showed unsatisfactory performances in their production. All these crops registered negative growth rate in production over the periods. In the case of total pluses, the production has shown a declining trend over the periods. Gram showed highest declining trend in both, production and area. Moong registered negative growth rate during 1980's and 1990's while it showed positive growth rate during 2006-07. The production of cotton registered positive growth rate over the periods. American cotton registered higher significant growth in production and area than Desi cotton at the state level and districts wise. Oilseeds showed a marginal increase since 1980-81.

The instability has been low and also declined over the time in wheat and rice and there are clear evidence of crop diversification towards rice, wheat, cotton and other crops. Instability is declining in a few crops such as wheat, Paddy, Sugarcane not in India but it is in Punjab, five more states, namely, Haryana, J and K, Kerala, Bihar and Rajasthan recorded a statistically significant declining trend (S Mahendradev 1987). The instability in wheat, rice and sugarcane has been low, while in gram, moong, massar, it has been high in all the periods. The result shows that the trend of instability is

still high in many crops like gram, moong, massar. Instability in Jowar has declined sharply from 1980-81 to 2006-07. During eighties Jowar's production declined due to crop diversification, however being an animal feed it could not be ignored. That was why the production of jowar increased later and with this effect the instability declined and it became low instability crops during 2000-01 to 2006-07. On the other hand, the instability is still high in pluses and coarse cereals because area under these crops is shifted towards rice and wheat and increased the instability in the production of these crops.

District-wise, it is found that the instability is low in wheat in all the districts over time period. The instability in Rice is also low, however only in those districts which are relatively advance in agriculture e.g. Karnal, Kurukshetra. The instability in production of rice is declining in karnal, Kurukshetra, Ambala, Jind, Hisar, Sirsa and Faridabad throughout the study period. Gurgaon which recorded medium instability during first period has recorded highest instability during third period. It may be because larger part of Gurgaon comes under rainfed area; therefore instability of rice is increasing over the period and registered as a highest instability district during 2000-01 to 2006-07. This study finds out that there is a very positive impact of green-revolution and new economic reforms on total foodgrain production. But it has it create big ditch between superior crops such as wheat, rice, Sugarcane and coarse cereals such as Bajra, Jawar, Maize and pluses crops.

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A Study on Power Line Communication

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Abstract- In this paper, we give an overview of the power line communication (PLC) technology.

This paper presents an overview of the research, applications, standards and importance of the power line communication.

Power line communication is an emerging home network technology that allows consumers to use their already existing wiring system to connect home appliances to each other and to the Internet. Noise in power line communication and impulsive noise are presented in this paper. The PLC channel is discussed to such an extent.

Index Terms- Power line communication (PLC), Noise, Impulsive noise, Electromagnetic Compatibility (EMC).

I. INTRODUCTION

To transmit electric power from a small number of sources (the generators) to a large number of sinks (consumers) in the frequency range of 50-60 Hz power lines were design.

Electrical power lines are usually classified into the high (>100kV), medium (1-100kV) and low (<1kV) voltage network.

Power line communication which is also known as Power line carrier, power line digital subscriber line (PDSL), mains communication, power-line telecommunications, or power line networking (PLN) uses the existing electrical network for communication. So the cost of installation is lower than other communication system and availability of communication service can be everywhere outlets exist.

Power line communication is an emerging home network technology that allows consumers to use their already existing wiring system to connect home appliances to each other and to the Internet.

For communication purpose electrical power supply network is used in power line communication. Reduction in operational costs and expenditures for communication is the main thing in power line communication.

For internal communication of electrical utilities, remote measuring and control task high, medium and low voltage supply have been used. PLC is also used in internal electrical installation within buildings and homes called in home PLC for various communication application.

PLC modems are used to make communication in power supply networks. Data signal from conventional communication devices, (computer, telephone) is converted by PLC modem in a form that is suitable for transmission over power lines.

Although, power supply network is not designed for data communication. The PLC transmission channel has some

negative properties as frequency-dependent attenuation, changing impedance, fading and unfavorable noise condition. However, to provide higher data rates PLC network has to operate in a frequency spectrum of up to 30 MHz [13].

PLC network produces electromagnetic radiation and disturb other services operating in the same frequency range.

PLC is divided into two groups: narrowband PLC allowing data rates up to 100 kbps and broadband PLC allowing data rates beyond 2 Mbps [13].

With the inevitable arrival of broadband access, the demand for digital voice, video, internet data within the home increases continuously. PLC technology allows the uses of existing and widespread power distribution infrastructure to provide high speed networking capabilities along with many other benefits.

The rest of the paper is organized as follows. In section II applications of power line communication are presented. Advantages and disadvantages are discussed in section III. Section IV describes the standard. Channel and its related are presented in section V. The paper finishes with the discussion and conclusion in section VI.

II. APPLICATIONS

In 1838, Englishman Edward Davy proposed a solution for remote measurements system between London and Liverpool. In 1897, first patent was submitted by him for the remote measurement of electrical network meters communicating over electrical wiring [1].

Some special applications out of many are:

Automatic meter reading: In this technology, data from energy meter is automatically collected and transfer to the central database for bill and analysis.

The main aim for the automation of meter reading is not to reduce labor cost but to obtain data rate that is difficult to obtain. In most of the places, users have demanded that their monthly bill be based on actual reading, instead of the bill which is based on prediction.

This is the technology which saves periodic trip and billing is based on the real consumption not estimated.

Since, the installation of first ac transmission line in 1886. To measure the energy that consumers pay for was very important.

Mr. Paraskevagos created first AMR system in 1974 by using technology developed by Theodore George [19].

PLC presents an interesting and economical solution for AMR.

Home networking and Internet Access: More number of computers is connected in a building by using existing network as a Local Area Network (LAN).

There is no need to install new wire or cable to connect all the computers due to the availability of low voltage power network which connects all the networks and save the installation cost and time.

Home Automation: for remote control of lighting and appliances it is power line communication technique which is used. Power line communication uses existing wiring in the home.

Transmitting radio programs: Over power line some time power line communication was used for transmitting radio programs. It is known as carrier current system when operated in the AM radio band [21]. For communication large portion of the radio spectrum might be used for high frequency communication.

III. ADVANTAGES AND DISADVANTAGES

As a coin has two sides, every technology has some advantages and disadvantages. Similarly power line communication has advantages and disadvantages which are given as

A. Advantages

Most private dwellings do not have dedicated neither low nor high-speed network cabling installed, and the labor costs required to install such wiring is often quite high. Power line communication uses the existing electrical network for communication. So the cost of installation is lower than other communication system and availability of communication service can be everywhere outlets exist.

For internal communication of electrical utilities, remote measuring and control task high, medium and low voltage supply have been used. PLC is also used in internal electrical installation within buildings and homes called in home PLC for various communication application.

If there is the availability of multiple power outlets in every room, the home power line infrastructure represents an excellent network to share data among intelligent devices, also with high data transfer rate, up to a few hundreds of Mbps

B. Disadvantages

Minimum-security levels: power lines do not necessarily provide a secure media

Data attenuation: due to the presence of numerous elements on a power line network, data attenuation is likely to be an issue

High costs of residential appliances: the cost of a power line network modem is not always competitive with the cost of a standard modem used to connect to a phone line network.

Noise: the greater amount of electrical noise on the line limits practical transmission speed (vacuum cleaners, light dimmers, kitchen appliances and drills are examples of noise sources that affect the performance of a power line-based home network) [24].

IV. STANDARDS

HomePlug and CENELEC standards are the most popular standards for high data rate and low data rate PLC system. Several competing standards are evolving as indicated below:

European Telecommunications Standards Institute (ETSI) power-line telecommunications (PLT): This provides necessary standards for voice and data services over the power line transmission. Interoperability aspects are also discuss [2].

Home-Plug Power-Line Alliance: It is a global organization consisting of some 65 member companies. The main aim of this is to enable and promote rapid availability, adoption and implementation of cost-effective, interoperable and standards-based home power-line networks and products. The resulting standards are expected to offer best performance. The Home Plug Power-Line Alliance has defined some standards like,

- (a) Home Plug 1.0 – specification for connecting devices via power-lines in the home,
- (b) Home Plug AV – designed for transmitting high definition television (HDTV) and VoIP around the home,
- (c) Home Plug BPL – a working group to develop a specification for to-the-home connection and
- (d) Home Plug Command and Control (CC) – command and control a specification to enable advanced, whole-house control of lighting, appliances, climate control, security and other devices[3-5]

Institute of Electrical and Electronics Engineers (IEEE): the standards are due to the IEEE BPL Study Group. Some of those standards are:

- (a) IEEE P1675 ‘Standard for Broadband over Power-line Hardware’ is a working group working on hardware installation and safety issues.
- (b) IEEE P1775 ‘Power-Line Communication Equipment – Electromagnetic Compatibility. (EMC) Requirements – Testing and Measurement Methods’ is a working group focused on PLC equipment, EMC requirements and testing and measurement methods.
- (c) IEEE P1901 ‘IEEE P1901 Draft Standard for Broad-band over Power-Line Networks: Medium Access Control and Physical Layer Specifications’ is a working group for delivering BPL. The aim is to define medium access control and physical layer specifications for all classes of BPL devices – from long distance connections to those within subscriber premises [6-8, 9].

POWERNET: It aims at developing and validating a ‘plug and play’ cognitive broadband over power-lines (CBPL) communications equipment that meet the regulatory requirements concerning electromagnetic radiations and can deliver high data rates while using low transmit power spectral density and working at low signal-to-noise ratio[10,11].

Open PLC European Research Alliance: It aims at improving/developing PLC services and system standardization [12,13].

Universal Power-Line Association (UPA): The UPA aligns industry leaders in the global PLC market to ensure deployment

of interoperable and coexisting PLC products to the benefit of consumers worldwide [14,15].

V. THE CHANNEL

In PLC channel, reflection occurs when a signal propagate from one location to another at every impedance discontinues along the propagation path.

Impedance mismatches generally because of different cables of different characteristic impedances. Electrical appliance plugged into the power line network from the terminate points and branching points where more than two cables are connected.

There is an adverse effect on high signal in power line network as the power line was not design to transmit high frequency signal. It was design for energy transmission. Some distortion factors are there in power line as attenuation, multipath and noise.

Attenuation: Attenuation of power line is mainly influenced by cable losses and multipath.

Attenuation is the loss of power of the signal during its propagation and it also depend on the physical length of the channel and transmission frequency band.

Multipath: Multipath caused by the impedance mismatch.

Multipath can be understood as the transmitted signal reaches the receiving circuit by two or more paths with different delay.

Impedance is influenced by characteristic impedance of the cables, topology of the channel and nature of connected loads. Multipath model and its scenario is described by M. Zimmerman and K. Dostert [22].

Noise: As the power lines were not design to transmit for data transmission they only design for energy transmission. Also the numbers of appliances having different properties are connected to the power network.

An intensive investigation has to be obtain before using this medium for information transmission. Unlike the other telecommunications channels, the power line channel does not represent an Additive White Gaussian Noise (AWGN), whose power spectral density is constant over the whole transmission spectrum.

An interesting description is given in [23] which classify the noise as a superposition of five noise types.

Colored background noise: Power spectral density of this is relatively lower and decrease with frequency. This is caused due to superposition of various noise sources of lower intensity. The parameters of this noise vary over time in terms of minutes and hours.

Narrowband noise: This type of noise consists of sinusoidal form with modulated amplitude. Several subbands are occupied by this type of noise which are small and continuous over the frequency spectrum.

Periodic impulsive noise, asynchronous to the main frequency: This type of noise is in a form of impulses that usually has a

repetition rate between 50 or 200kHz. Switching power supplies cause this type of noise. Noise occupies frequency that are close to each other because of high repetition rate.

Periodic impulsive noise, synchronous to the main frequency: This type of noise is also in a form of impulses with repetition rate of 50 or 100Hz and is synchronous with main powerline frequency. This is generally caused by power supply operating synchronously with the main frequency, such as the power converters connected to the mains supply.

Asynchronous impulsive noise: Asynchronous impulsive noise is the noise whose impulses are mainly caused by switching transients in the network. Their power spectral density can reach values of more than 50dB above the level of the background noise, making them the principal cause of error occurrences in the digital communication over PLC networks.

VI. CONCLUSION

PLC is a technique that allows exchange of data by means of electric power supply network that are presented in every dwelling, office and in every building.

In this we came to know about the application, advantages and disadvantages of PLC technology and gained some idea of the standards, noise and channel.

We hope this paper gives an overall understanding of the topic in concise and quick way to the reader and researcher in the power line communication.

In this we find PLC is attractive research area many studies are still necessary to be better understand and improve the performance of power line for high bit rate transmission .

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Quality Improvement during Camshaft Keyway Tightening Using Shainin Approach

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Abstract- *The two major challenges that industries are facing today are continuous improvement in productivity and quality of the product. An alternative to the Classical and Taguchi experimental design is the lesser known but much simpler Shainin DOE approach. Shainin methods refer to a collection of principles, which make up the framework of a continually evolving approach to quality. Bosch Production System (BPS) - one of the leading manufacturers in Diesel system equipments, has been successfully employing the strong statistical tool 'Shainin' for the root cause identification and Design of Experiments (DOE) techniques for analysis and optimization of the quality related issues. Shainin is popular tool being simplest to employ in the manufacturing related problem solving and very effective tool in identifying quality achievement hurdles. The present paper deals with one of the quality issues resolved by using Shainin methodology at Bosch Ltd, Bangalore.*

Index Terms- *Shainin Methodology, Root Cause Analysis (RCA), Component Search, RedX*

I. INTRODUCTION

Diesel engines have become the most popular power packs for heavy duty vehicles and equipments such as trucks, tractors, passenger vehicles, gensets, etc. as the diesel is one of the most efficient and energy dense fuels available today [1]. Nevertheless, the diesel engine has several great advantages, the quality production and maintenance of critical components of engine system has become yet a challenging task. Diesel Fuel Injection Pump (DFIP) System- the heart of the diesel engine is one such critical system [2]. Nowadays, the quality of the product has become the dominant criteria to acquire the global market. BPS is the leader in quality production by deploying advanced quality measures in its manufacturing processes and thus, satisfying the customer [3]. It has been possible through continuous improvement and proactive quality maintenance techniques like Shainin System, Failure Mode Effect Analysis (FMEA), Six Sigma, etc., in the production processes. The quality of the product may be quantified in terms of money (INR), First Pass Yield (FPY), part per million (ppm), etc. There is a need to employ a simpler and efficient tool along with the traditional seven quality tools in order to achieve Six-sigma quality in manufacturing industries [4]. Failure of parts, products, or systems in the field can cause major damages - such as production loss, rework, warranty

claims, and even image loss of the organization in the market.

1.1 Root Cause Analysis Techniques

Increasing reliability of products demands that the problems that arise during functioning of parts and products need to be identified, the root cause has to be established, and finally, the problem needs to be solved. Defect in any part of a component results in manufacturing of the entire component by itself causing a serious problem. In this regard Loss Causation Mode and RCA methods such as Fishbone diagram, Shainin, Why-Why analysis, Failure tree analysis etc. have been very effectively used in the industries.

1.1.1 Shainin approach for problem solving

The Shainin- method starts with an assumption that there is one single root cause for the problem - or that this root cause has the largest contribution to the problem [5]. The goal is to find that root cause and understand it. The subsequent solution then becomes apparent. Shainin system could be effectively used for solving the problems with the theory that "there is a dominant cause for variation in the process output that defines the problem" and it is analogous to Pareto principle of 'vital few causes are the reasons for trivial many problems' Among the Shainin tools, factorial design and scatter plots are commonly known and used. However, the main differentiators of the Shainin tools are component search method, paired comparison method, product/ process search, and B vs. C analysis. The problem referred here as GreenY is classified under property, feature, defect or event.

2. APPROACH AND EXPERIMENTATIONS

The problem solving methodology Shainin technique follows the order of Focus-Approach-Converge-Test-Understand-Apply-Leverage, which has been discussed in detail in the following sections.

2.1 Focus

The focus of the project is from the business point of view. It is noticed that 2% camshafts produced are rejected and sent to rework due to keyway tightening during final inspection stage.

Camshaft undergoes several operations like keyway milling, taper grinding, cam grinding, carburizing, annealing, etc.,



Fig. 2.1 Illustration of problem statement (GreenY)

Fig 2.1 illustrates the position of the keyway on the camshaft. Camshaft keyway tightening is measured with plug gauge. The results of measurement is identified in terms of GO and NOGO. The component which is measured GO is accepted and the component with NOGO is rejected at the final inspection. The component which does not measures go will be sent to rework, which involves additional expenditure. The objective of the present work is to identify and eliminate the root cause (RedX) as referred in Shainin technique which is causing camshaft keyway tightening during the assembly process.

2.2 Approach

The effective utilization of the statistical tool and quickness of the root cause identification relays on the selection of samples with two extreme characteristics, that is WOW (worst of worst) and BOB (best of best). The type of problem that is being tackled is apparently limited to variation problems. Out of four GreenY types the present problem was identified as defect. The defect could have occurred during the process stage which could be easily identifiable and has a probability distribution which does not meet the demands.

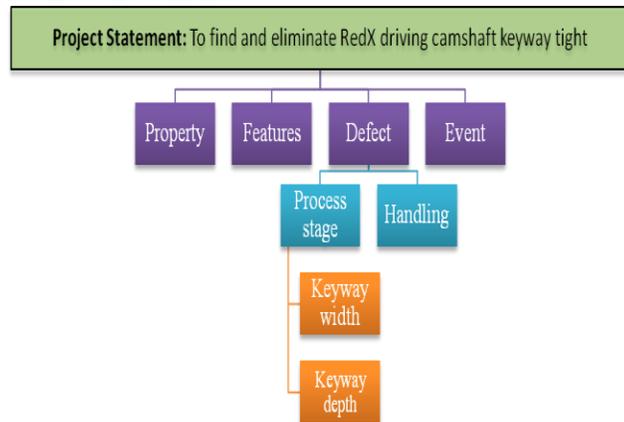


Fig. 2.2 GreenY categorization as ‘Malfunction event’

The defined GreenY is ‘keyway width’ as shown in Fig. 2.2. It is difficult to analyze or use a technique to identify the RedX (dominant cause of variation) since the component undergoes several operations. Hence, each and every process has to be observed to identify the RedX. This problem could be efficiently

handled primarily by doing validation of measurement system through Component search-0, followed by Component search- I, II and Paired comparison.

2.3 Converge

Converging towards RedX causing the GreenY has been achieved by Component search technique. The solution tree for the GreenY to determine the RedX is illustrated in Fig. 2.3. This solution tree guides in a right path to find and eliminate the root cause in a short duration.

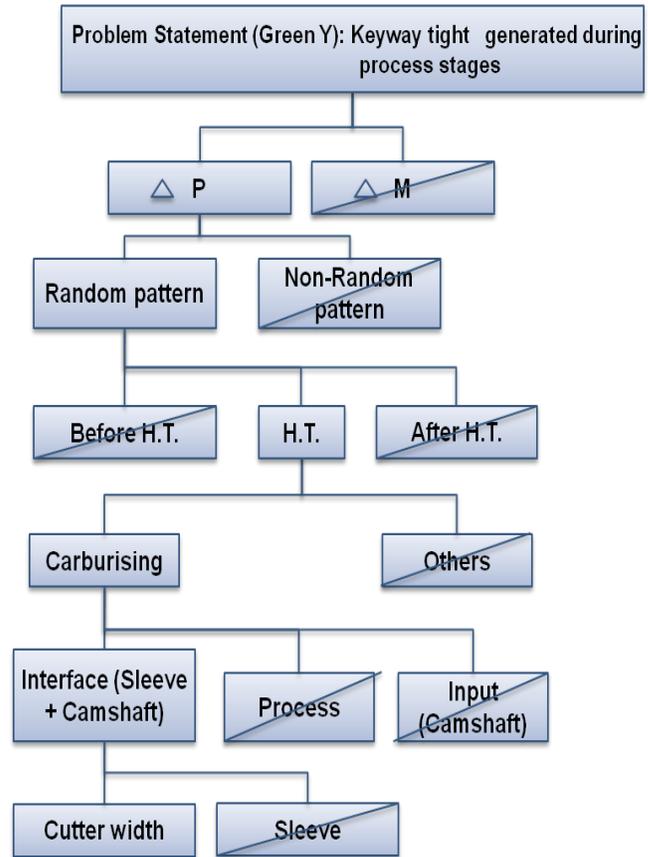
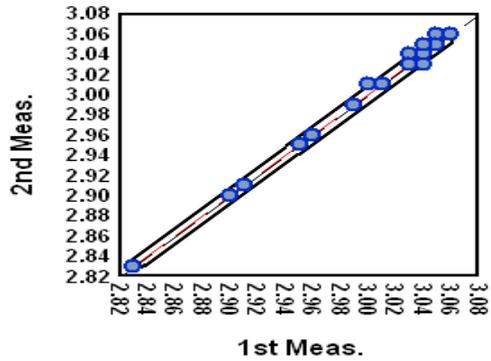


Fig. 2.3 Solution tree of the problem

ΔP is a process and ΔM is the measurement system.

Primary step during Converging process is to recheck the measurement system based on which the problem has been formulated. The solution tree defines the GreenY by eliminating all processes except at process with suspected source of variation. This can be done by Component search Stage-0 exercise. The result of the exercise is shown in Fig. 2.3 & 2.4.



Delta P = 0.23
Delta M = 0.01
Discrimination Ratio = 19.2

Fig. 2.4 Result of Component search stage-0

During measurement, variation can't be ruled out due to unavoidable vibrations. From the component search stage- 0 as shown in fig2.4 the discrimination ratio is found to be 19.2 which is greater than 6 suggesting that the problem at hand is not due to measurement system.

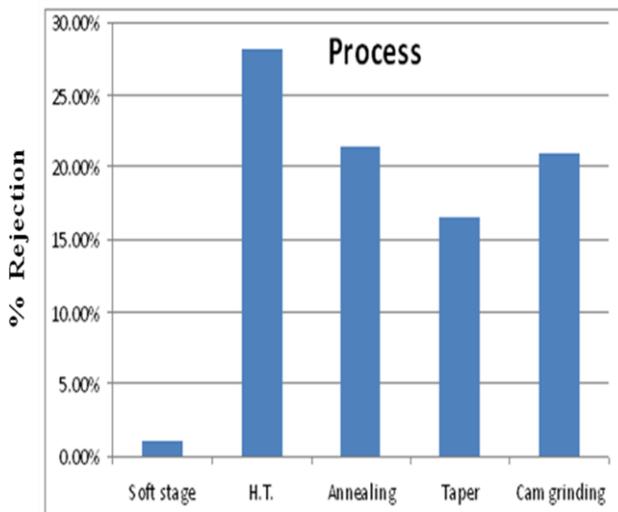


Fig. 2.5 Component search Stage –I and II

To identify the RedX an attempt as been made to identify PinkX (second most important cause for variation) & Pale PinkX (third most important cause for variation) are investigated. Accordingly the possible cause of variation in the process during heat treatment process is investigated and same is shown in Fig 2.5. It can be observed that heat treatment process is resulting in maximum percentage of rejection of camshaft and hence is taken as RedX. Heat treatment involves the carburising of camshaft. To avoid carburising of keyway a protective cap called sleeve is used on either end of the camshaft. Possibility of diffusion of carbon into the keyway due to improper capping is investigated. It was found that the protective caps are not posing any problem. Sleeve is posing a problem & eliminated.

Table1. Full factorial

Trials	Cutter	Sleeve	% Rej. @ Carburizing	% Rej. @ Final Inspection
Trial 1	CS	CS	17%	1%
Trial 2	CS	DS	4%	1%
Trial 3	DS	CS	0%	0%
Trial 4	DS	DS	0%	0%

DS = Driveshaft; CS = Camshaft

Paired comparison of cutters for Drive shaft cutter(which drives the shaft) and camshaft is carried out. It is observed that using drive shaft cutter results in 0% rejection and camshaft resulting in 2.5% rejection. The cutters are interchanged and this resulted in 0% rejection of camshaft also. To substantiate the above results a set of experiments based on full factorial design is conducted and results are shown in table 1. This table suggests that using a driveshaft cutter results in 0% of rejection irrespective of the using of drive shaft sleeve or camshaft sleeve. Further investigation showed that drive shaft cutter width is 4.07 mm and camshaft cutter width is 4.045 mm as shown in table 2.

Table.2. Cutter width of different family of variants

Family	Camshaft	Drive shaft
Cutter width in (mm)	4.045	4.07

Fig 2.6 shown is the concept diagram which represents the rejection percentage of camshaft due to keyway tight while using camshaft (CS) cutter and driveshaft (DS) cutter. From table1 and fig 2.6 it is concluded that cutter width is a RedX.

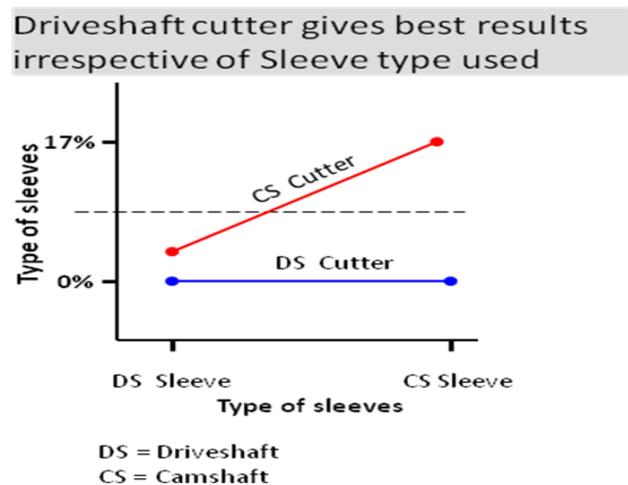


Fig. 2.6 concept diagram

3. RESULTS AND DISCUSSION

3.1 Test

From the past data it was established that camshaft with 4mm keyway width had 1.5% rejection and camshaft with 3mm keyway width showed 2.5% rejection, where as the driveshaft showed 0% rejection under the same circumstances.

Further trials have been carried out by using driveshaft (DS) cutter for camshaft (CS) keyway milling with DS and CS sleeves in two different batches. Each trial batch consisted of 100 numbers of camshafts. The above table.1 shows details of the trial batches carried out in the project and results are tabulated with respect to their change in either cutter or sleeve. From these trails, it is suspected that the camshaft cutter width is 25µm less than that of DS cutter. So, a tolerance relaxation of 8µm in terms of prepart keyway width is considered. Increase of cutter width by 15 µm has been suggested in order to eliminate the keyway tight problem.

The validation results of the trials carried out with new set of cutters having different widths is shown in fig2.7 & fig 2.8 respectively for 4mm & 3mm keyway width. From the results, it is observed that cutter width change would yield better results both to 4mm & 3mm keyway width.

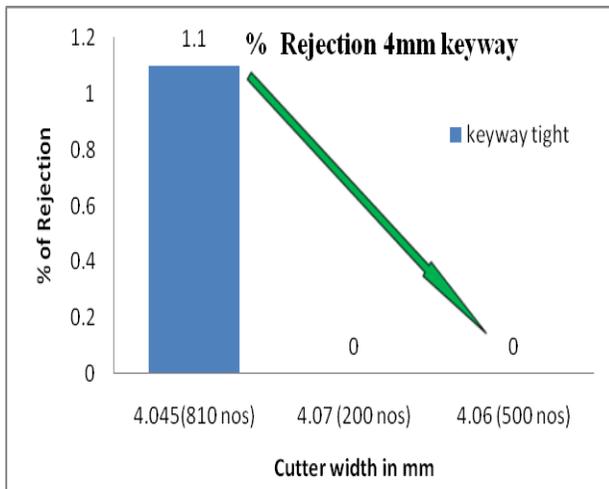


Fig. 2.7 validation of results for 4 mm keyway

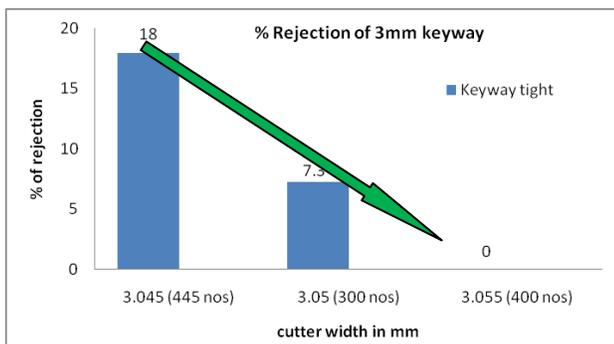


Fig. 2.8 validation of results for 3 mm keyway

3.2 Understand

From the above it can be observed that an increase in cutter width by 10 microns in case of 3mm keyway and 15 microns in case of 4 mm keyway would result in bringing down the camshaft rejection due to keyway tight. Table 3 shows the suggested cutter width for 0% rejection of camshaft and the cutter width currently used which is resulting in 2.5% rejection of camshaft due to keyway tight.

Table.3 comparison of cutter width with current and suggested

Family	Used on	Cutter width (current) in mm	Cutter width (suggested) in mm
Camshaft (339902555)	3mm Keyway	3.045	3.055
Camshaft (339902555)	4mm Keyway	4.045	4.06

4. CONCLUSIONS AND SCOPE FOR FUTURE WORK

Following conclusions have been drawn from the experimental result and discussion.

- Shainin technique was found to be simple and strong statistical tool to handle problems during manufacturing of components.
- Changing the cutter size for milling 3mm and 4 mm keyway has resulted in 0% rejection of camshafts due to keyway tight.

5. SCOPE FOR FUTURE WORK:

- The entire process of milling of keyways on camshafts on monthly basis is to be monitored to consolidate the results that have been arrived at.
- Care has to be taken to avoid PinkX that is keyway tightening that could occur due to handling damages.
- . Effect of PinkX and Pale PinkX is to be investigated in order to completely leverage the problem.

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A Personalized Ontology Model for High Performance in Web Information Retrieval

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Abstract- The number of Internet users and the number of accessible Web pages are ever increasing day by day. It is becoming difficult for users to find relevant documents to their interests or needs. Thus whole process of finding relevant document is becoming time consuming. In this paper, we report on research that attempt information retrieval based on a user profile. A user can create his own concept hierarchy and use them for web searching which attempts to reveal expected documents to user. Ontology models are used to represent user profiles in personalized web information retrieval process. Many models make use of any one of the global knowledge base or user local information for representing user profiles. We attempt a personalized ontology model for knowledge representation. This model uses ontological user profiles based on a world knowledge base and user local instance repositories. It is observed that superior representation of user profiles can be built by using user concept models and it is found that the ontology model improves performance of web information retrieval.

Index Terms: local instance repository, ontology, personalization, semantic relations, user profiles, Web Information gathering, world knowledge.

I. INTRODUCTION

The web-based information available to the user is ever increasing day by day and to gather useful information from the web is a really a challenging issue for the users. The web information gathering systems attempt to satisfy user requirements by creating user profiles of users.

User profiles represent the user concept models possessed by user while gathering web information. A concept model possessed by users is generated from their background knowledge and many web ontologies have observed it in user behavior. When users read through a document, they can easily determine whether it is of their interest and a judgment arises from their implicit concept models. If one can simulates user's concept model then a superior representation of user profiles can be obtained.

Ontologies are the models that are widely used for knowledge description formalization. To simulate user concept models ontologies are used in personalized web information gathering system. These ontologies are named as personalized ontologies or ontological user profiles. Many researchers have attempted to discover user background knowledge from global or local analysis to represent user profiles.

i) Motivation

The objective for this project is to achieve high performance in web information retrieval that makes use of a personalized ontology model. Many times when user searches for some information with some ideas in mind, It is mostly the case that he didn't get the information exactly as he wants in first page. User has to go surf through different pages until he get the information exactly as per his interest. Here the basic idea is to create ontological user profiles from both a world knowledge base and user local instance repositories. This technique attempt fast information retrieval as per the concept model of the user.

ii) Existing systems

Commonly used knowledge bases include generic ontologies, thesauruses, and online knowledge bases. The global analysis produce effective performance for user background knowledge extraction but same is limited by the quality of the used knowledge base. Local analysis investigates user local information in user profiles. Analyzed query logs to discover user background knowledge is also used.

Users were provided with a set of documents and asked for feedback. User background knowledge was discovered from this feedback for user profiles. The discovered results may contain uncertain and noisy information.

iii) Concept or seed idea

We proposed a Personalized Ontology model for web information retrieval to get high performances over the techniques used previously that uses both global analysis as well as local analysis from LIR(Local Instance Repository). Here, we suggest some alternatives such as in a multidimensional ontology mining method, Specificity and Exhaustivity is also introduced by considering the growth of web information and the growing accessibility of online documents. Further we use customized algorithm to calculate the clusters. These clusters minimizes the time for retrieval.

LITERATURE REVIEW

This chapter will introduce the previous system and its analysis. It includes the comparison of existing system with proposed system. This will give us the detail idea about the need of proposed system.

1 Ontology Learning

Many existing models used global knowledge bases to learn ontologies in web information retrieval. e.g. Gauch and Sieg learned personalized ontologies developed from the Open Directory Project which find users' preferences and interests in web search. Use of Dewey decimal classification, King attempted to improve performance in distributed web information retrieval. Downey used Wikipedia to understand user interests in queries. User background knowledge was discovered though performance and the same was limited by the quality of the global knowledge base. Many works attempted to find user background knowledge from user local information to learn personalized ontologies.

Ontologies can be constructed in different ways. Different data mining techniques lead to more user background knowledge being discovered e.g. user local documents makes use of pattern recognition and association rule mining techniques to discover knowledge. Li and Zhong used pattern recognition and association rule mining techniques to find knowledge from user local documents to construct ontology. Tran translated keyword queries to Description Logics' conjunctive queries and made use of ontologies to represent user background knowledge. Domain ontology learning was proposed by Zhong that employed various data mining and natural-language understanding techniques. One can discover semantic concepts and relations from web documents. Web content mining techniques were used to discover semantic knowledge from domain-specific text documents for ontology learning. Finally, Shehata captured user information needs at the sentence level rather than the document level, and represented user profiles by the Ontological Graph.

The knowledge discovered in these works contained noise and uncertainties. Additionally, ontologies were mostly used to improve the performance of knowledge discovery. Using a fuzzy domain ontology extraction algorithm, a mechanism was developed to construct concept maps based on the posts on online discussion forums. To further enhance knowledge discovery, one can integrate data mining and information retrieval techniques. GLUE model was proposed by Doan and used machine learning techniques to identify similar concepts in different ontologies. Dou learned domain ontologies using pattern decomposition, clustering/classification, and association rules mining techniques that attempted to explore world knowledge.

2 User Profiles

User profiles were created to identify user information needs on the basis of interest of users in web information gathering that interpret the semantic meanings of queries. User profiles can be defined as the interesting topics of a user's information need.

User profiles can be categorized into two ways: the data diagram user profiles acquired by analyzing a set of transactions, the information diagram user profiles acquired by using manual techniques, such as questionnaires and interviews or automatic techniques, such as information retrieval and machine learning.

Generic User Model was proposed by Van der Sluijs and Huben that improved the quality and utilization of user modeling. Wikipedia was also used to discover user interests. In order to acquire a user profile, Chirita and Teevan used a

collection of user desktop text documents, emails and cached web pages to explore user interests. Makris acquire user profiles by a ranked local set of categories, and then utilized web pages to personalize search results for a user. These works attempted to acquire user profiles in order to discover user background knowledge.

User profiles can be categorized: interviewing, semi-interviewing, and non-interviewing. Interviewing user profiles are obtained by using manual techniques like questionnaires, interviewing and analyzing user classified training sets. e.g. TREC Filtering Track training sets, which were generated manually. The users read document and gave a positive or negative judgment to the document against a given topic. These training documents reflect user background knowledge accurately. In Semi-interviewing user profiles has limited user involvement. These techniques provide users with a list of categories and ask users for feedback of interesting or non-interesting categories. e.g. Web training set acquisition model, which extracts training sets from the web based on user feedback categories. Noninterviewing techniques do not involve users at all and tries to capture user interests by user activity and behaviour. e.g. OBIWAN model which acquires user profiles based on users' online browsing history.

The interviewing, semi-interviewing, and non-interviewing user profiles can also be defined as manual, semiautomatic, and automatic profiles respectively.

Personalized Ontology Construction

Web search can be personalized by use of personalized ontologies which describes and specifies user background knowledge from captured user interest. i.e. from user profiles. While searching web, users might have different expectations for the same query. Sometimes even the same user may have different expectations for the same search query in a different situation. An assumption is formed on the basis of observation that web users have a personal concept model for their information needs and it may change according to different information needs. Here we introduce a model constructing personalized ontologies from users' concept models.

World Knowledge Representation

World knowledge is commonsense knowledge possessed by people that is acquired through their experience and education. It is important for information gathering. We first need to construct the world knowledge base. That must cover an exhaustive range of topics, since users may from different backgrounds. For this reason, the LCSH system is an ideal world knowledge base. The LCSH was developed for organizing and retrieving information from a large volume of library collections. The LCSH covers comprehensive and exhaustive topics of world knowledge. In addition, the LCSH is the most comprehensive non-specialized controlled vocabulary in English and it has become a de facto standard for subject cataloging and indexing. The LCSH system is superior than other world knowledge taxonomies. Table 1 shows a comparison of the LCSH with the Library of Congress

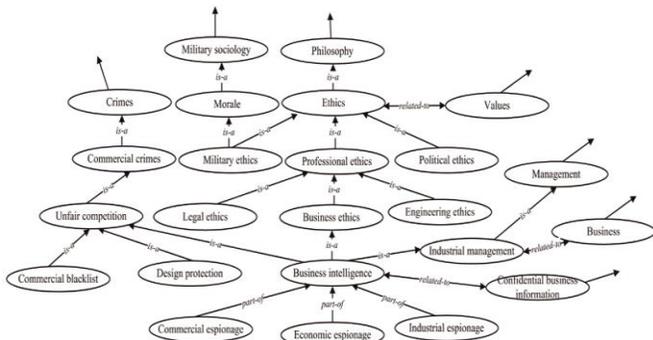
Classification (LCC), Dewey Decimal Classification (DDC) used and the reference categorization (RC).

TABLE 1 Comparison showing different World Taxonomies

	LCSH	LCC	DDC	RC
# of Topics	394,070	4,214	18,462	100,000
Structure	Directed Acyclic Graph	Tree	Tree	Directed Acyclic Graph
Depth	37	7	23	10
Semantic Relations	Broader, Used-for, Related-to	Super- and Sub-class	Super- and Sub-class	Super- and Sub-class

As shown in Table 1, the LCSH covers more topics than other. It has a more specific structure, and it specifies more semantic relations. The structure of LCSH is directed acyclic graph that contains three types of references: Broader term (BT), Used-for (UF), and Related term (RT). The BT references shows different levels of abstraction (or specificity). The primitive knowledge unit in our world knowledge base is subjects. They are encoded from the subject headings in the LCSH.

Fig.1 A sample part of the world knowledge base.



These subjects are formalized as follows:

Def.1 Let S is a set of subjects, an element s is represented as a tuple $s = \langle label, neighbor, ancestor, descendant \rangle$ where

$label$ is the heading of s in the LCSH thesaurus;

$neighbor$ is a function returning the subjects that have direct links to s in the world knowledge base

$ancestor$ is a function returning the subjects that have a higher level of abstraction than s and link to s directly or indirectly in the world knowledge base;

$descendant$ is a function returning the subjects that are more specific than s and link to s directly or indirectly in the world knowledge base.

The semantic relations of *is-a*, *part-of*, and *related-to* links the subjects to each other in the world knowledge base. The relations are formalized as following.

Def.2 Let R be a set of relations, an element $r \in R$ is a tuple $r = \langle edge, type \rangle$ where

An *edge* that connects both subjects that hold a type of relation.

A *type* of relations is element from $\{is-a, part-of, related-to\}$

With Def 1 and 2, the WKB can be formalized as :

Def.3 Let WKB be a world knowledge base, taxonomy constructed as a directed acyclic graph. The WKB consists of a set of subjects linked by their semantic relations, and can be defined as a tuple $WKB = \langle S, R \rangle$ where

S is a set of subjects = $\{s1, s2, \dots, sm\}$

R is a set of semantic relations $R = \{r1, r2, r3, \dots, rn\}$ linking the subjects in S .

Ontology Formation

A tool called OLE (Ontology Learning Environment) is used for constructing ontologies. The subjects of user interest are extracted from the WKB with user interaction. For a given topic, the interesting subjects consist of two subjects: positive subjects and negative subjects. Positive subjects are the concepts relevant to the topic, and negative subjects are the concepts not related to topic as per user need. Thus, for a given topic, the OLE provides users with a set of two candidates to identify positive and negative subjects. These subjects are extracted from the WKB.

For a given topic e.g. "economic" and "espionage", the user selects positive subjects for the topic. The positive subjects selected by user are presented on the top-right in hierarchy. The negative subjects are the descendants of the positive subjects. These are shown on the bottom-left side. From them user selects the negative subjects. These negative subjects to user re listed on the bottom-right panel (here "Political ethics" and "Student ethics"). Some positive subjects (e.g., "Ethics," "Crime," "Commercial crimes," and "Competition Unfair") are also included on the bottom-right panel with the negative subjects. These positive subjects will not be included in the negative set. The candidates that are not either positive or negative as per the feedback from the user, become the neutral to the topic specified.

Ontology is constructed for the given topic using user feedback subjects. It contains three types of Subjects: positive, negative, and neutral subjects. The structure of the ontology is based on the semantic relations linking these subjects in the WKB.

Fig.2 An ontology (partial) constructed for topic 'Economic espionage'

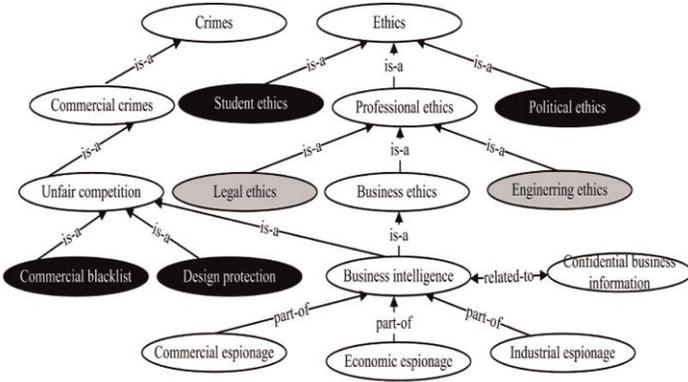


Fig.2 illustrates the ontology constructed for the sample topic “Economic espionage,” where the white nodes are positive, the dark nodes are negative, and the grey nodes are neutral subjects.

Formalization of ontology constructed for a given topic is

Definition The structure of an ontology that describes and specifies topic T is a graph consisting of a set of subject nodes. The structure can be formalized as a 3-tuple $O(T) := \langle S, tax^S, rel \rangle$, where

- S is a set of subjects consisting of three subsets S^+ , S^- , and S° , where S^+ is a set of positive subjects regarding T , $S^- \subseteq S$ is negative, and $S^\circ \subseteq S$ is neutral;
- tax^S is the taxonomic structure of $O(T)$, which is a noncyclic and directed graph (S, \mathcal{E}) . For each edge $e \in \mathcal{E}$ and $type(e) = is-a$ or $part-of$, iff $\langle s_1 \rightarrow s_2 \rangle \in \mathcal{E}$, $tax(s_1 \rightarrow s_2) = True$ means s_1 is-a or is a part-of s_2 ;
- rel is a boolean function defining the related-to relationship held by two subjects in S .

The constructed ontology is personalized as the user selects positive and negative subjects for personal preferences and interests.

Multidimensional Ontology Mining

Multidimensional ontology mining method discovers on-topic and interesting knowledge from the user concepts, semantic relations, and instances in an ontology. Here a 2D ontology mining methods are : *specificity and Exhaustivity*. These methods observes the subjects and the strength of their associations in an ontology structure.

Specificity (denoted *spe*) shows a subject’s focus on a given topic. Exhaustivity (denoted *exh*) shows a subject’s semantic space dealing with the topic. These methods investigate the subjects and the strength of their associations in an ontology structure.

A subject’s specificity is of two types

- 1) Semantic specificity - on the referring-to concepts and
- 2) Topic specificity - on the given topic.

Semantic Specificity

The semantic specificity is investigated from the structure of $O(T)$ inherited from the world knowledge base. The strength of a focus is guided by the subject’s locality in the taxonomic structure of $tax^S O(T)$. The tax^S of $O(T)$ is a graph that links semantic relations. The semantic specificity is measured by hierarchical semantic relations (*is-a* and *part-of*) held by that subject and its neighbors in taxonomic structure tax^S . As subjects have a fixed locality on the tax^S of $O(T)$, semantic specificity can be described as absolute specificity and can be denoted by $spe_a(s)$.

The subjects located at upper bound levels and toward the root are more abstract than those of at lower bound levels toward the “leaves.” The semantic specificity of a lower bound subject is greater than that of an upper bound subject.

```

input : a personalized ontology  $O(T) := \langle tax^S, rel \rangle$ ; a coefficient  $\theta$  between (0,1).
output:  $spe_a(s)$  applied to specificity.
1 set  $k = 1$ , get the set of leaves  $S_0$  from  $tax^S$ , for  $(s_0 \in S_0)$  assign  $spe_a(s_0) = k$ ;
2 get  $S'$  which is the set of leaves in case we remove the nodes  $S_0$  and the related edges from  $tax^S$ ;
3 if  $(S' == \emptyset)$  then return://the terminal condition;
4 foreach  $s' \in S'$  do
5   if  $(isA(s') == \emptyset)$  then  $spe_a^1(s') = k$ ;
6   else  $spe_a^1(s') = \theta \times \min\{spe_a(s) | s \in isA(s')\}$ ;
7   if  $(partOf(s') == \emptyset)$  then  $spe_a^2(s') = k$ ;
8   else  $spe_a^2(s') = \frac{\sum_{s \in partOf(s')} spe_a(s)}{|partOf(s')|}$ ;
9    $spe_a(s') = \min(spe_a^1(s'), spe_a^2(s'))$ ;
10 end
11  $k = k \times \theta, S_0 = S_0 \cup S'$ , go to step 2.
    
```

The semantic specificity of a subject is measured, based on the investigation of subject locality in the taxonomic structure tax^S of $O(T)$. Here the influence of locality comes from the subject’s taxonomic semantic relationships (*is-a* and *part-of*) with the other subjects.

Topic Specificity

User background knowledge that uses user’s local information is used to analyse the topic specificity of a subject.

User Local Instance Repository (LIR)

User background knowledge can be discovered from user local information collections like user’s browsed web pages, stored documents and composed or received emails. The ontology has only subject labels and semantic relations specified. We follow the ontology with the instances generated from user local information collection. A collection of user local information is referred as user’s local instance repository (LIR).

To generate users LIRs is a challenging part. The documents in LIRs may be of different types semi-structured like the browsed HTML and XML web documents or unstructured like the stored local DOC and TXT documents. From this one has to generate

LIR. Some semi-structured web documents has content-related descriptors specified in the metadata sections. These descriptors have direct references to the concepts specified in WKB. These documents are ideal to generate the instances for ontology population e.g. the infoset tags in XML documents. Ontology mapping can be used when different world knowledge bases are used e.g. GLUE system.

For the documents without clear and direct references in Local instance repository (LIR), the different data mining techniques, clustering and classification can be followed.

The clustering techniques group the documents into clusters based on the document features. These features can be extracted from the clusters. These represent the user background knowledge discovered from the user LIR. The semantic similarity between these features and the subjects in $\mathcal{O}(T)$ can be measured and the references of these clustered documents to the subjects in $\mathcal{O}(T)$ can be established. The documents with a strong reference to the subjects in $\mathcal{O}(T)$ can then be used to populate these subjects.

The another strategy that can be applied is Classification that maps the unstructured/semi-structured documents in user LIRs to the representation in the global knowledge base. We can measure the semantic similarity between documents in the LIR and the subjects in $\mathcal{O}(T)$ by using the subject labels. The documents can then be classified into the different subjects based on their similarity, and become the instances of the subjects of which they belong to. Ontology mapping technique can be used to map the features discovered by using clustering and classification to the subjects in ontology $\mathcal{O}(T)$, if they are in different representations.

The WKB is encoded from the LCSH. The LCSH contains the content-related descriptors (subjects) in controlled vocabularies. User background knowledge of a user is to be discovered from both the user's LIR and $\mathcal{O}(T)$.

$\mathcal{O}(T)$ contains a set of positive subjects, a set of negative subjects, and a set of neutral subjects, pertaining to a topic T . Based on the mapping of (2), if an instance refers only to positive subjects, the instance fully supports the T . If it refers only to negative subjects, it is strongly against the T . Hence, we can measure the strength of an instance to the T by utilizing (1) and (2):

$$str(i, T) = \sum_{s \in (\eta(i) \cap \mathcal{S}^+)} str(i, s) - \sum_{s \in (\eta(i) \cap \mathcal{S}^-)} str(i, s). \quad (4)$$

If $str(i, T) > 0$, i contains knowledge relevant to the T . Otherwise, i is against the T .

The topic specificity of a subject is evaluated based on the instance-topic strength of its citing instances. With respect to the absolute specificity, the topic specificity can also be called relative specificity and denoted by $spe_r(s, T, LIR)$. A subject's $spe_r(s, T, LIR)$ is calculated by

$$spe_r(s, T, LIR) = \sum_{i \in \eta^{-1}(s)} str(i, T). \quad (5)$$

Because the $str(i, T)$ from (4) could be positive or negative values, the $spe_r(s, T, LIR)$ values from (5) could be positive or negative as well.

As discussed previously, a subject's specificity has two focuses: semantic specificity and topic specificity. Therefore, the final specificity of a subject is a composition of them and calculated by

$$spe(s, T) = spe_a(s) \times spe_r(s, T, LIR). \quad (6)$$

Based on (6), the lower bound subjects in the ontology would receive greater specificity values, as well as those cited by more positive instances.

SYSTEM ARCHITECTURE

Figure 3 Architecture of ontology model

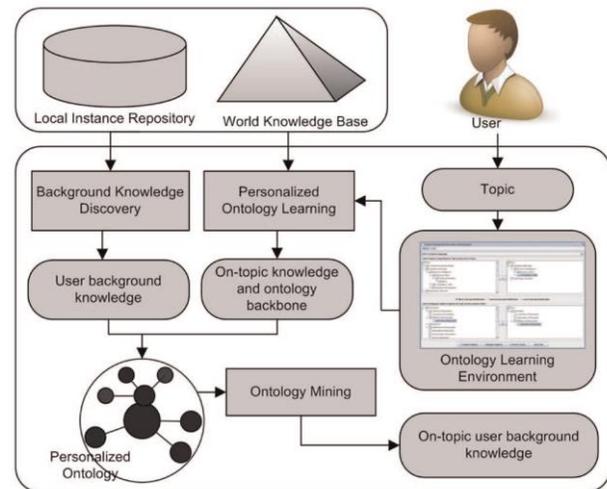


Fig. shows architecture of the ontology model that discovers user background knowledge and learns personalized ontologies to represent user profiles.

A personalized ontology is constructed for the given topic that uses two knowledge resources, the global world knowledge base and the user's local instance repository. The WKB (world knowledge base) provides the taxonomic structure for the personalized ontology. The user background knowledge is then discovered from the user LIR (Local Instance Repository). For the given topic by the user, the specificity and exhaustivity of subjects are investigated to discover user background knowledge discovery.

The input to the proposed ontology model is a topic and the output is user background knowledge which is computationally discovered. User profile consisting of positive documents and negative documents. Each document d is associated with a $Support(d)$ value indicating its support level to the topic.

EVALUATION

EXPERIMENTAL DESIGN

The principal experimental design of the evaluation was to compare the effectiveness of an information gathering system (IGS) for the different sets of user background knowledge.

The comparison is performed using a test set and a set of topics for the ontology model and that of TREC model. TREC model can be viewed as a benchmark model as the knowledge was manually specified by the users. In information gathering evaluation, a common batch style experiment is developed for the comparison of the models using a test set and a set of topics associated with relevant judgements. Our experiments followed this style and were performed under the experimental set up by the TREC-11 filtering track. This track evaluate the methods of persistent user profiles for separation as relevant and non-relevant documents.

In the experiments, user background knowledge was represented by user profiles. A user profile consisted of two sets of documents: a positive document set D^+ containing the on-topic, interesting knowledge and a negative document set D^- containing the ambiguous, paradoxical concepts. For each document d , there is a support value to the given topic. The baseline models in our experiments were carefully selected based on this representations.

User profiles can be broadly classified into three groups: interviewing, semi-interviewing, and non-interviewing. That each is used by the TREC model, Web model, and Category model respectively. We compare the proposed ontology model to the typical model.

1. The TREC model that represented the perfect interviewing user profiles and user background knowledge was manually specified by users.
2. The Category model that represented the noninterviewing user profiles.
3. The Web model that represented the semiinterviewing user profiles.
4. The Ontology model that we have implemented as the proposed ontology model. Here user background knowledge is computationally discovered.

The TREC-11 Filtering Track testing set and topics were used in our experiments. The testing set was the Reuters Corpus Volume 1 (RCV1) corpus [21] that contains 806,791 documents and covers a great range of topics. This corpus consists of a training set and a testing set partitioned by the TREC. The documents in the corpus have been processed by substantial verification and validation of the content, attempting to remove duplicated documents, normalization of dateline and byline formats, addition of copyright statements, and so on. We have also further processed these documents by removing the stop-words, and stemming and grouping the terms.

In the experiments, we attempted to evaluate the proposed model in an environment covering a great range of topics. However, it is difficult to obtain an adequate number of users

who have a great range of topics in their background knowledge. The TREC-11 Filtering Track provided a set of 50 topics specifically designed manually by linguists, covering various domains and topics. For these topics, we assumed that each one came from an individual user. With this, we simulated 50 different users in our experiments. Buckley and Voorhees [3] stated that 50 topics are substantial to make a benchmark for stable evaluations in information gathering experiments. Therefore, the 50 topics used in our experiments also ensured high stability in the evaluation.

The titles of topics were used, based on the assumption that in the real world users often have only a small number of terms in their queries

Web Information Gathering System

The IGS was an implementation of a model developed by Li and Zhong that uses user profiles for web information gathering. The input support values associated with the documents in user profiles affected the IGS's performance. Experiments here assumes Li and Zhong's model that uses support values of training documents for web information gathering.

The IGS first used the training set to evaluate weights for a set of selected terms T . After text preprocessing of stopword removal and word stemming, a positive document d became a pattern that consisted of a set of term frequency pairs $d = \{(t_1, f_1), (t_2, f_2), \dots, (t_k, f_k)\}$, where f_i is t_i 's term frequency in d . The semantic space referred to by d was represented by its normal form $\beta(d)$, which satisfied $\beta(d) = \{(t_1, w_1), (t_2, w_2), \dots, (t_k, w_k)\}$, where w_i ($i = 1, \dots, k$) were the weight distribution of terms and

$$w_i = \frac{f_i}{\sum_{j=1}^k f_j}.$$

A probability function on T was derived based on the normal forms of positive documents and their supports for all $t \in T$:

$$pr_{\beta}(t) = \sum_{d \in D^+, (t,w) \in \beta(d)} support(d) \times w. \quad (11)$$

The testing documents were finally indexed by $weight(d)$, which was calculated using the probability function pr_{β} :

$$weight(d) = \sum_{t \in T} pr_{\beta}(t) \times \tau(t, d), \quad (12)$$

where $\tau(t, d) = 1$ if $t \in d$; otherwise $\tau(t, d) = 0$.

Proposed Model: Ontology Model

The input to ontology model was a topic and the output was a user profile consisting of positive documents (D^+) and negative documents (D^-). Each document was associated with a $support(d)$ value indicating support level to the topic for document d .

Here the WKB was constructed based on the LCSH system. The constructed WKB contained multiple subjects

covering a wide range of topics linked by semantic relations. The user's personalized ontologies were constructed by user interaction. Authors played the user role to select positive and negative subjects for ontology construction, for each topic T , the ontology mining method was performed on the constructed $O(T)$ and the user LIR to discover interesting concepts. The user provided documents was preprocessed by removing the stopwords, and stemming and grouping the terms. Authors have assigned title, table of content, summary, and a list of subjects to each information item in the catalog. These were used to represent the instances in LIRs. For the different users and for different topics experiment was performed. The semantic relations of *is-a* and *part-of* were analyzed in the ontology mining for interesting knowledge discovery. As per algorithm 1, the coefficient θ in some preliminary tests had been conducted for various values

of the coefficient θ such as 0.5, 0.7, 0.8, and 0.9. As a result, $\theta = 0.9$ gave the best performance and was chosen in the experiments.

A document d in the user profile was generated from an instance i in the LIR. The d held a support value $support(d)$ to the T , which was measured by

$$support(d_i) = str(i, T) \times \sum_{s \in \eta(i)} spe(s, T),$$

Various thresholds of $support(d)$ were tested to classify positive and negative documents. As constructed ontologies were personalized and focused on various topics, we could not find a universal threshold that worked for all topics. Hence we set the threshold as $support(d)=0$, following the nature of positive and negative defined.

The documents with $support(d) > 0$ formed D^+ , and those with negative $support(d) \leq 0$ formed D^- eventually.

Experimental Setup

The performance of the experimental models was measured by the precision averages at 11 standard recall levels (11SPR). Precision is the ability of a system to retrieve only relevant documents and Recall is the ability to retrieve all relevant documents. An 11SPR value is computed by summing the interpolated precisions at the specified recall cutoff, and then dividing it by the number of topics:

$$\frac{\sum_{i=1}^N precision_{\lambda}}{N}; \lambda = \{0.0, 0.1, 0.2, \dots, 1.0\},$$

where N = number of topics

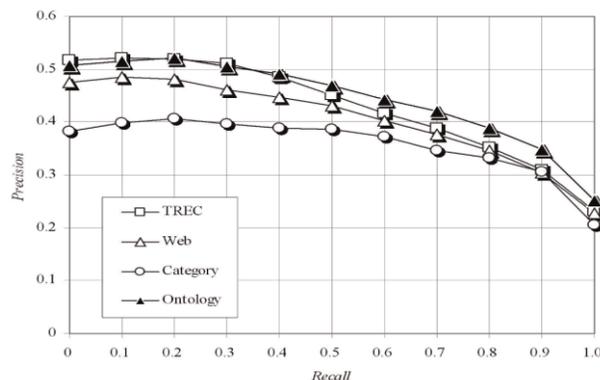
λ = cutoff points where precisions are interpolated.

At each λ point, an average precision value over N topics is calculated. These average precisions then link to a curve describing the recall-precision performance. The experimental 11SPR results are plotted in Fig. 4, where the 11SPR curves show that the Ontology model was the best, followed by the TREC model, the web model.

The average precision for each topic is the mean of the precision obtained after each relevant document is retrieved.

As per graph TREC model was the best, followed by the Ontology model, and then the web.

Fig.4 The 11SPR experimental results.



CONCLUSION

An ontology model is evaluated that represents user background knowledge in personalized web information retrieval. The model discovers user background knowledge from LIR and builds userwise personalized ontologies extracting world knowledge from LCSH. The model was compared against benchmark models such as TREC model and WEB model. The results show that our model is promising model in web information gathering that attempts to retrieve documents as per user interest that obviously improves performance of web information retrieval system. It is found that the use of both i.e global and local knowledge performs better than using any one.

The proposed ontology model is a single computational model that discovers background knowledge from both global and local knowledge. In future this model can be applied to the design of web information gathering systems to achieve high performance. Thus it contributes to the fields of Information Retrieval, Recommendation systems, web Intelligence and Information Systems.

The present work assumes that all user local instance repositories uses data mining techniques such as web page clustering that improves results and extends the applicability of the ontology model to the majority of the existing web documents and increase the contribution and significance of the present work. We are hopeful to find different areas to improve background knowledge of user and thus improving user personal profile.

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Application of PCR Technique on Confirming *Theileria* Infection in Cattle and Buffaloes with Determining the Relationship between Animals' PCV and WBC Count with the Infection

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Abstract- Theileriosis is a bovine haemoprotozoal infection caused by *Theileria* species. It is a tick transmitted haemoparasite and the disease can develop as clinical or subclinical infections. This study was carried out in order to determine *Theileria* infection by Polymerase Chain Reaction in cattle and buffaloes in a National Livestock Development Board farm at Polonnaruwa, Sri Lanka. Forty-one blood samples were collected from the herd of diseased and non diseased cattle and buffaloes. Packed cell volume of each blood sample was analyzed using microcentrifugation which revealed that 85.7% (18/21) cattle and 20% (4/20) buffaloes had PCV values below the average. White Blood Cell count was calculated using haemocytometer method and 33.3% (7/21) cattle and 15% (3/20) buffaloes had WBC count above average value. Light microscopic examination of thin blood smears was used to detect *Theileria* infection primarily where 7.31% (3/41) samples became positive and Polymerase Chain Reaction was carried out in order to confirm the infection and to identify the *Theileria* species. For the amplification of *Theileria* genus, 989F and 990R primers were used to amplify a 1098-bp fragment of the ssurRNA gene. *T. annulata* species amplification was done using N516(F) and N517(R) primers derived from the 721-bp fragment of the gene encoding the 30-kDa major merozoite surface antigen for *T. annulata*. Amplification of *T. parva* was done using TPF and TPR primers which used to amplify a 277-bp internal fragment located between bases 2784 and 3061 of the p104 gene. Three samples which became positive for *Theileria* piroplasms were highly specific for the primers used for the *Theileria* genus. PCR reaction of species specific primers used for *T. parva* and *T. annulata* became negative. DNA sequencing was proposed for the positive samples to identify the *Theileria* species since it is not either of *T. annulata* or *T. parva*.

Index Terms- *Theileria*, Sri Lanka, PCR, WBC, PCV

I. INTRODUCTION

Theileriosis is a disease caused by several species of *Theileria*, causing livestock production losses in Africa, Asia and Middle East (Urquhart *et al.*, 1996). In Sri Lanka *Theileria orientalis* is predominant in Nuwara Eliya while *Theileria annulata* is more common in dry zone (Sivakumar *et al.*, 2012). This is associated with infections which range from clinically in-

apparent to fatal. The two species of major veterinary importance in cattle are *Theileria annulata* and *Theileria parva*. Mildly pathogenic species infecting cattle has also been identified (Urquhart *et al.*, 1996). Intraerythrocytic *Theileria* piroplasms are commonly rod-shaped and can also occur in round, oval and ring shapes. There are three phases in an acute *Theileria* infection and each phase last for about a week. First phase is the incubation period in which parasite and lesions are not yet evident. This is followed by the second phase in which the hyperpalasia and expansion of the lymphoblasts occur. In the third phase lymphoid depletion, disorganization associated with lymphocytolysis and reduction in lymphopoiesis will occur (Urquhart *et al.*, 1996). Theileriosis is characterized by a marked anaemia and fever (Durrani, *et al.*, 2008). In *Theileria parva* infections the lymph node draining the area of tick bite which is usually the parotid becomes enlarged and later swelling of the superficial lymph nodes will occur. In addition loss of body condition, dyspnoea, terminal diarrhoea and petechial haemorrhages may occur under the tongue and on the vulva (Urquhart *et al.*). Clinical signs developed in *Theileria annulata* infections are similar but in later stages there is haemolytic anaemia an icterus (Urquhart *et al.*, 1996). Diagnosis of clinical theileriosis in cattle is usually based on Giemsa stained blood smear examination and detection of piroplasms in red cells, but the detection of the infective agent by this method is not reliable in carrier stages (Durrani, *et al.*, 2008). Also in sick animals, macroschizonts can be demonstrated in biopsy smears of lymph nodes and dead animals, in impression smears of lymph nodes and spleen (Urquhart *et al.*, 1996). PCR is a relatively non invasive technique, which is fairly rapid and affordable.

II. METHODOLOGY

Forty-one blood samples were collected haphazardly from cattle and buffaloes in a NLDB farm at Polonnaruwa. Volume of 5ml was collected in to EDTA coated blood collecting tubes with 18 gauge needles and 10ml syringes. Blood smears from each sample was made and stained with Leishmann stain according to method described by Silva, (1996). Also micro capillary tubes were used to detect Packed Cell Volume and the readings were obtained using the microhaematocrit reader according to the method described by Silva, (1996). Each blood sample was mixed well by repeated inversions. Blood was diluted with WBC

diluting fluid in 1:20 ratio and chambers of the haemocytometer was filled with the mixture and allowed 3-5 minutes for the WBCs to settle down. WBC count for each sample was determined using this method by examining under the light microscope. DNA was extracted using Promega Wizard Genomic DNA purification kit (Promega, Madison WI, USA) according to manufacturer's instructions. Extracted DNA was stored at 4 °C in a refrigerator. Primer sets used in this study are listed in Table 1. For the amplification of *Theileria* genus, 989F and 990R primers were used to amplify a 1098-bp fragment of the ssurRNA gene. *Theileria annulata* species amplification was done using N516 (F) and N517(R) primers derived from the gene encoding the 30-kDa major merozoite surface antigen for *T. annulata*. Amplification of *Theileria parva* was done using TPF and TPR primers which used to amplify a 277-bp internal fragment located between bases 2784 and 3061 of the p104 gene. PCR was performed for 30µl of total reaction volume containing 13.5 µl of Promega DEPC water, 1.5 µl of MgCl₂ (25mM/ml), 2.0 µl of Promega dNTP, 2.5 µl of 10×Taq buffer, 0.5 µl of 50u/ µl Promega Taq polymerase and 1.5 µl of each primer and 2 µl of template DNA. The reaction for *Theileria* genus was repeated for 30 cycles under the following conditions: 5 minutes at 94 °C, 30 seconds at 94 °C, 30 seconds at 55 °C, 45 seconds at 72 °C and 7 minutes at 72 °C. The reaction for *Theileria annulata* and *Theileria parva* was repeated for 35 cycles under the following conditions: 3 minutes at 94 °C, 1 minutes at 94 °C, 1 minute at 57 °C, 1 minute at 72 °C and 7 minutes at 72 °C.

TPF TPR	<i>Theileria parva</i> specific GGCCAA GGTCTC CTTCAG ATTACG TGGGTG TGTTTC CTCGTC ATCTGC	277bp	Protein 104-KDa gene	Odongo, <i>et al.</i> , 2009
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Table 2: Master mixture of constituents for the PCR

Constitute	Volume
10× Promega Taq buffer	2.5 µl
MgCl ₂ (25mM/ml)	1.5 µl
Promega dntp	2.0 µl
Primer (F)	1.5 µl
Primer (R)	1.5 µl
DNA template	2.0 µl
50u/ µl Promega Taq polymerase	0.5 µl
DEPC water	13.5 µl

Each of the above values are for a one sample and these values should be multiplied from the sample number and additional one (eg: sample number 3 + 1 = 4) to minimize the possible pipetting error.

Agarose gel electrophoresis was used for the analysis of amplified DNA and a 0.8% gel was prepared. Gel electrophoresis was performed under 50v for 30 minutes and results were visualized using UV transilluminator.

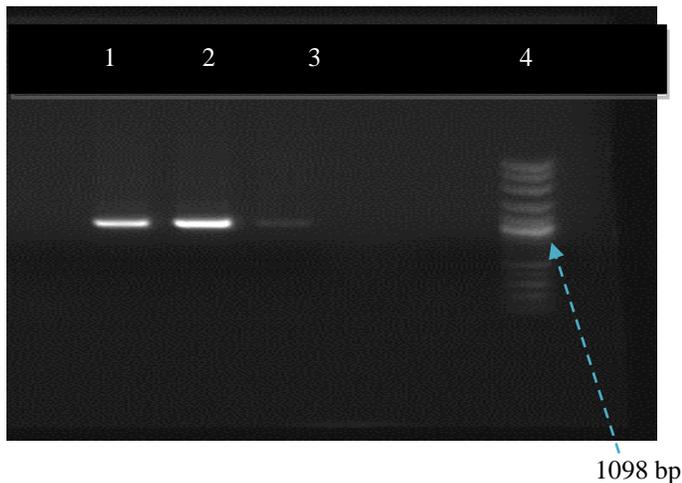
III. RESULTS AND DISCUSSION

Theileria piroplams are commonly comma shaped intra erythrocytic organisms. Structural abnormalities of erythrocytes were also examined in *Theileria* positive blood smears which included anisocytosis, poikilocytosis and presence of reticulocytes. Blood smear examination revealed 7.31% (3/41) samples to be positive for intraerythrocytic piroplams of *Theileria*. Detection of PCV values showed that 85.7 % (18/21) cattle were having PCV below the average value of 35±1 (Mahima, 2013) where as 20% (4/20) of the buffaloes were having PCV values below the average value of 27 (Naveen Chandra *et al.*, 2008). Statistical analysis of the data using a chi-square with MINITAB software revealed that there is a considerable relationship between being infected by *Theileria* and reduced Packed Cell Volume. (P value which is < than 0.05 and the null hypothesis which is there is a relationship between two variables was ruled in). According to the study 33.3% (7/21) cattle were having high WBC counts than normal value (8.59 – 14.81 × 10³/µl of blood) (Mahima, 2013) where as 15% (3/20) of buffaloes were having high WBC count than normal (3.6 – 20 × 10³/µl of blood) (Silva, 2010).

Table1: *Theileria* genus specific and species specific primers used in this study.

Primer	Primer sequence	Predicted amplification size	Gene name	Reference
989(F) 990(R)	<i>Theileria</i> specific AGTTTC TGACCT ATCAG TTGCCT TAAACT TCCTTG	1098 bp	Small subunit rRNA gene	Durrani, <i>et al.</i> , 2008
N516(F) N517(R)	<i>Theileria annulata</i> specific GTAACC TTAAA AACGT GTTACG AACATG GGTTT	721bp	Gene encoding the 30-KDa major merozoite surface antigen	Durrani, <i>et al.</i> , 2008

Figure 1: Agarose gel electrophoresis for PCR products of *Theileria* positive samples DNA extracts with primers specific for *Theileria* genus. A band size of 1098 is visible from three samples.



Molecular size marker and samples as indicated above, 1,2,3 – Three samples identified as *Theileria* positive from blood smear examination. (sample 1 and 2 are cattle blood samples, sample 3 was a buffalo sample) 4 – 100 bp DNA ladder.

Genus *Theileria* is composed of many species which can infect cattle and buffaloes. *Theileria annulata* and *Theileria parva* are the two main species responsible for infections in cattle. These species have different vectors that transmit the merozoites to cattle. Three host tick *Rhipicephalus* transmits *T. parva* while *Hyalomma* transmits *T. annulata*. Therefore it is essential for the tick to be present in the particular region for an infection to occur (Urquhart *et al.*, 1996). Theileriosis is a disease that can lead to major economic losses in animal production (Urquhart *et al.*, 1996). Clinical signs developed in infected animals may be slightly different due to each *Theileria* species. Diagnosis of the disease based on clinical signs is very non-specific because there are other infections such as Babesiosis and Trypanosomiasis which may lead to similar clinical manifestations. Examination of Geimsa stained blood smears and detection of piroplasms is the conventional method of identification of *Theileria*. But the detection of infective agent by this method is not reliable and is almost impossible in carrier stages (Durrani, *et al.*, 2008). Also this method cannot differentiate between each species of *Theileria* genus which can infect cattle and buffaloes. There are different methods to differentiate between *Theileria* species but in most cases it is necessary to use a combination of these methods to identify a species definitively. Geographic distribution, vector specificity, morphology, host immunity, pathogenicity, cross immunity, serology, DNA probes and restriction fragment length polymorphism are some of those methods used for the species identification (Morzaria, 1987). The geographical distribution of two most important *Theileria* species for cattle, *T. parva* and *T. annulata*, correlates well with the distribution of their vector. *Theileria parva* is transmitted predominantly by the brown ear tick, *Rhipicephalus appendiculatus*, which is restricted to eastern, central and southern Africa; *T. annulata* is transmitted by several *Hyalomma* species, which are distributed widely in

North Africa, southern Europe, the Middle East, India, southern Russia and China (Morzaria, 1987). Even though it is not very accurate, geographic distribution of the vector and vector specificity of each *Theileria* species can be used in species identification. It is difficult to differentiate *Theileria* species by examining the morphology of the parasites because parasites of different species look alike in most piroplasm and schizont stages (Morzaria, 1987). Pathogenicity of each *Theileria* species can also be used in species differentiation. *Theileria parva* replicates mainly in lymphocytes and it causes destruction of the lymphocytes where as Erythrocytic merogony is limited and haemolytic anaemia is not present. *Theileria annulata* replicates in both lymphocytes and erythrocytes, thus causing disease with severe lymphocytopenia, anaemia and occasionally jaundice (Morzaria, 1987). One of the serological tests used to diagnose *Theileria* species is the Indirect Fluorescent Antibody Test (IFAT). Cross-reactions have been observed among *T. parva*, *T. mutans* and *T. annulata* species when IFAT is used. Under experimental conditions and using appropriate controls, the test can be useful in identifying *Theileria* species. But its usefulness in the field reduces the usage. DNA probes are also a powerful and sensitive technique in identifying mixed theilerial infections, in cattle exposed to natural tick challenge where differentiation of *Theileria* species is needed (Morzaria, 1987). But use of DNA probes is expensive compared to other methods. Polymerase Chain Reaction was used to identify *Theileria* species in the current study. PCR was an accurate, easy to perform, less time consuming and a less expensive method compared to the other methods. DNA extraction was carried out prior to PCR to the samples which were identified as positive for the infection from conventional stained blood smear examination method. The DNA extraction procedure used in this study was able to extract genomic DNA successfully for amplification. It was less expensive but was time consuming compared to rapid, ready to use, one step commercial DNA extraction solutions. And this reduced the value of PCR as a rapid test to detect *Theileria* infections. PCR with *Theileria* genus specific 989F and 990R primers which used to amplify 1098-bp fragment of the ssurRNA gene (Durrani, *et al.*, 2008) was positive for all the three samples which was identified as positive from blood smear examination. *Theileria annulata* species amplification was done using N516(F) and N517(R) primers derived from the gene encoding the 30-kDa major merozoite surface antigen for *T. annulata* (Durrani, *et al.*, 2008) which the samples became negative. For the amplification of *Theileria parva* TPF and TPR primers were used to amplify a 277-bp internal fragment located between bases 2784 and 3061 of the p104 gene (Odongo, *et al.*, 2009) and correct size fragment was not amplified. Since negative results can occur due to the mechanical errors during sample handling, pipetting etc. and also due to failure of annealing temperature optimization, PCR was carried out for the second time to the DNA extracts together with primers specific for genus and both the species. It was proposed to perform DNA sequencing on the genus positive samples because it suggested that this could be another *Theileria* species other than *Theileria annulata* or *Theileria parva*. Cattle and buffaloes PCV and WBC count were also measured in this study. All the animals infected with *Theileria* were having Packed Cell Volume below average where as only one out of three infected animals had White Blood

Cell count higher than the average. This suggests that there is a relationship between drop in Packed Cell Volume and *Theileria* infections (Durrani, *et al.*, 2008). This hypothesis was proved by the statistical data analysis.

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The Ogboni of Egbaland and Constitutional Controversy

Olaide Ismail Aro

Abstract- The question of who are the Ogboni of Egbaland is one of the major controversial issues which in fact call for deliberation. It is in view of the above fact that the author becks to holistically examine whether reference to Ogboni of Egbaland is exclusively restricted to Ologboni Section alone or includes Ologun, Olorogun and Parakoyi Section of Egbaland among others.

I. INTRODUCTION

Egbaland today comprises of six (6) Local Governments⁴ which has been politically delineated as Ogun Central Senatorial District of Nigeria with few other settlements under Remo and Ado-Odo/Ota Local Government which is basically divided into 4 Sections/Provinces namely Egba Alake, Egba Oke-Ona, Egba Agura and Owu. Historians generally agreed that before 1830, Egba people from the time immemorial with exception of Owu settled at a place called Igbo-Egba⁵ (Egba-Forest) under different clanship with their own different *Oba* (King) independence of their own but were later dislodged from Igbo-Egba around 1825 and subsequently settled at Abeokuta after series of tribulation around 1830 from where they spread their tentacles to other Villages that form part of Egbaland today with Abeokuta as the capital as a result of war waged against them by combined effort of Oyo, Ife and Ijebu Warlords.

Also Owu section of Egbaland before now settled among others at a place called Owu-Ipole (also known as Orile-Owu) currently under Osun State but were dislodged by the same forces that dislodged Egba people from Igbo-Egba as a result of which Owu settled with Egba at Abeokuta around 1834 after lots of tribulation⁶ as well. By the nature of Egbaland, each of the section have ancient settlement order wisely known as township under them and as a matter of fact, Egbaland did not only spread its tentacles from Abeokuta to Villages under them alone but also spread from ancient township of Abeokuta to other settlement known with those ancient township as Abeokuta today. The ancient township under Egba Alake section are Ake, Ijeun, Oba, Igbein, Ijemo, Itoku, Imo, Emere, Keesi, Ikopa, Iporo, Ijako, Ijoko, Kemta, Iro, Erunwon, Itori, Igbore, Itesi, Itoko, Irowo, Taffin, Adewo, Ijade, Arawo, Sagamu, Abaka, Ijaiye, Agunrodo,

⁴ The six (6) Local Governments are Abeokuta South Local Government, Abeokuta North Local Government, Odeda Local Government, Obafemi-Owode Local Government, Ifo Local Government and Ewekoro Local Government.

⁵ Igbo-Egba is said to stretch from River Oba in the North to Ebute-Metta in the South and from Osun River in the East to Ipokia with Yewa River in the West.

⁶ The dislodgement of Owu pre-date dislodgement of Egba from Igbo-Egba and as a matter of fact Owu crisis has been partially associated to the cause of dislodgement of Egba.

Adao and Arawo while the ancient township under Egba Oke-Ona section are Ago-Oko, Ikija, Ilugun, Ikereku, Ilawo, Ago-Odo, Idomapa, Iberekodo, Odo, and Imala.

The ancient township under Egba Agura section are Ido, Ojoo, Owe, Ibadan, Ika, Oje-Ile, Ojesemi, Idere, Ikeye, Ojokodo, Offa, Oorun, Ikereku Idan, Ikereku Iwere, Ijaye Kukudi, Iwo, Iraa and Ijaye Obirintin while the ancient township under Owu Kingdom are Ago-Owu, Apomu and Erunmu. Please note that each of this ancient township have their own independence government⁷ which is divided into Ologboni⁸, Ologun⁹, Olorogun¹⁰ and Parakoyi¹¹ section with exclusion of Owu Kingdom who have both Ologun and Olorogun Section fused together as Ologun Section. Egbaland does not really have mush

⁷ Basically, Egbaland system of governance is confederal in Nature.

⁸ Ologboni section is been governed by Iwarefa Ologboni (the body of six (6) Ologboni most Senior Chiefs who function as Executive Committee of Ologboni section). They are Oluwo, Lisa, Odofin, Aro, Baase and Baala. Oluwo is the head of Ologboni section as well as head of its township with exclusion of Gbagura who have Balogun as the head of the Township instead and Owu Kingdom who have Akogun, Obamaja, Osupori, Oyega Omolashin and Olosi as Iwarefa with Akogun as the head. Other Ologboni Chieftaincy Title are Apena, Baasala, Sagbua, Adila, Aruke, Sanu, Balesi, Bayinbo, Bantun, Bagbile, Losi, Baloye, Bagbimo, Nlado, Legun, Luwoye, Ntoye, Otunbayan, Lemo, Asero, Lisemo, Agbusi, Otunbade, Leragun, Liyebi, Nlosi, Bayan, Asalu, Ilagbe, Emulu, Latemo and Bamokun among others.

⁹ Ologun section is been governed by Iwarefa Ologun (the body of six (6) Ologun most Senior Chiefs who function as Executive Committee of Ologun section). They are Balogun, Otun, Osi, Ekerin, Seriki and Bada. Balogun is the head of Ologun section while other Ologun Chieftaincy Title are Sarumi, Bashorun, Asiwaju, Ogboye, Oganla, Agbaakin, Mayegun, Akinlagun, Apesin, Gbogunniyi, Abese, Aare, Aare-Ona-Kakanfo, Aare-Onibon, Aare-Alasa and Apagun among others.

¹⁰ Olorogun section is been governed by Iwarefa Olorogun (the body of six (6) Olorogun most Senior Chiefs who function as Executive Committee of Olorogun section). They are Jaguna, Lukotun, Lukosi, Sakotun, Sakosi and Akogun (some town has Jagunmolu instead of Akogun). Jaguna is the head of Olorogun section while other Olorogun Chieftaincy Title are Egbadia, Eesiki, Laderin, Mogunniyi, Gbanja, Akinsete, Akingbogun, Arogun, Akinyegun, Leragun, Agoro, Lebuute, Eruku, Akinlatun, Toleni, Esija, Lukugbo, Dagunja, Emulu, Agbomod, Akinsiku, Saliki, Saki, Liseri, Gbopaa and Luponna among others.

¹¹ Parakoyi section is been governed by Iwarefa Parakoyi (the body of six (6) Parakoyi most Senior Chiefs who function as Executive Committee of Parakoyi section). They are Olori-Aje, Jagunna-Aje, Jagunmolu-Aje, Lukotun-Aje, Lukosi-Aje and Bada-Aje. Olori-Aje is the head of Parakoyi section while other Parakoyi Chieftaincy Title are Sakotun-Aje, Sakosi-Aje, Babalaje, Oloraje, Asiwaju-Aje, Seriki-Aje, Sarumi-Aje, Yeye-Ajose, Ogboye-Aje, Otunbade-Aje, Iyalaja, Iyalate, Ntoye-Aje among others

controversy as far as fact peculiar to them and other Yorubaland are concerned but there are series of controversy as far as Egbaland is concerned internally and among the dominant controversial issues¹² is constitution of Ogboni of Egbaland. Whether the term Ogboni of Egbaland is exclusively refers to Ologboni Section or comprises of Ologboni, Ologun, Olorogun and Parakoyi, Ode, Erelu and Egan section of the Egba.

The fact deduced after clearly merged Egbaland's past with present situation is that in some occasion, reference to Ogboni is said to strictly restricted to Ologboni while sometimes reference to Ogboni is said to comprise of Ologboni, Ologun, Olorogun, Parakoyi, Ode, Erelu and Egan. The implication of the above fact is that what determine the meaning of Ogboni of Egbaland is subject of usage which as a matter of fact appear as major factor behind the constitutional controversy. This Author have clearly observed that the issue of constitution of Ogboni has been dominated with politics due to circumstantial usage of the term which have create avenue for individual set objective at a point in time to be influencing their position because those that belief that Ogboni constitution is beyond Ologboni also have the issue of who is superior among them.

Some Ologboni beliefs that Ologboni are superior to others follow by Olorogun, Ologun and Parakoyi while non Ologboni are contending that Ologboni, Ologun, Olorogun and Parakoyi are equal in status but only have the head of Ologboni (Oluwo) as their head at township level follow by the head of other section with no one playing second fiddle to each other¹³. Disappointedly, few people that make attempt to express true desire of the situation of things consciously or unconsciously create more confusion on the ground that the term Ogboni are been used in the same context to refer to Ologboni alone as well as sometimes used to refer to Ologboni, Ologun, Olorogun, Parakoyi, Ode, Erelu and Egan. It is in an attempt to resolve this controversy that the paper beck to holistically consider the brief historical antecedent of Ogboni, the nature of Ogboni of Egbaland and the Ogboni of Egbaland constitutional controversy with restriction to Ologboni, Ologun, Olorogun and Parakoyi.

II. BRIEF HISTORICAL ANTECEDENT OF OGBONI

There are separate accounts of how Ogboni emerged in Yorubaland; each of them relate with separate historical antecedent of Yoruba as a Nation. One body of tradition that beliefs in Ife as cradle of human existence¹⁴ stated that Oduduwa suggested to Obatala; his partner in earth creation that a constitution be drawn up and a government should be established with himself as the head which was seriously objected by Obatala on the ground that if such arrangement will be created, he deserved if not higher rank than Oduduwa but equal rank as the person solely saddled with creation of mankind among two of them sent to create the earth coupled with the fact that he is also stronger than Oduduwa. The issue degenerate into crisis among them as a result of which Oduduwa sought alliance of some Elders then among who is Obameri to form Ogboni which was used to defeat Obatala. (J. A. Atanda, 1980:5).

The second account which relates to migration of Yoruba to Ile-Ife¹⁵ stated that Oduduwa wrestled power in contest for hegemony with the aborigines of Ife while Oduduwa formed Conclave of Elders which was used to defeat the opponents hence the emergence of Ogboni in Yorubaland as well as Oduduwa as the head of Yoruba race. Conjunctive reading of this separate account in spite of the differences had shown that Oduduwa struggle for power with another set of people while Ogboni was formed to suppress the opposing alliance. Oduduwa formed Ogboni do have their meeting privately which make it to be tagged secret society. It is the positive oriented result brought by this society that influence their inclusion in the affairs of Yorubaland; hence the emergence of Ogboni in Yorubaland.

The formed Ogboni upon their inclusion in Yorubaland affairs are not the real governing institution but rather group of brave people who provides aids for their community and perform rituals or sacrifice as a means of appeals to gods on behalf of their community which is been done in private which serve as the basis of known them as Conclave of Elders. It is this privacy as an instrument that really make them sacred because any issues that members agreed to be make secret are been kept away from public domain and secretly kept to themselves.

III. THE NATURE OF OGBONI OF EGBALAND

The historical antecedent of Ogboni of Egbaland is unknown but the fact deducible from surrounding circumstance is that Ogboni as a system of governance has been part of Egbaland

¹² The author have observed with respect that the reason behind controversial nature of Egbaland is based on presence of some Nigerian politicians who introduced cunning way of doing things into the administration of Egbaland coupled with avoidance of truth by some respected figures in Egbaland as a result of selfish desire of those concern figures or selfish interest of belonged section in the chieftaincy administration of Egbaland.

¹³ Having Oluwo as the head of the all sections is restricted to township level alone because Balogun Egba (who is the head of all Ologun and Olorogun Chieftaincy Holders in Egbaland) ranked next to Alake of Egbaland which is follow by Oluwo Egba (which may likely not be the head of Ologboni Egba because whenever all Ologboni Egba are having joint meeting, the meeting point is Ile-Ogboni Itoku (Ogboni Itoku House) under the leadership of whoever is the Oluwo of Ijeun Township. Whereas, the Chieftaincy Title of Oluwo Egba is in rotational between Ijeun and Kemta while the emerged candidate may likely not be the reigning Oluwo of Ijeun Township) even if it is the turn of Ijeun Township to provide candidate.

¹⁴ Ife as cradle of human existence theory stated that Olodumare (God) sent Oduduwa and his younger brother; Obatala from heaven to create earth by sand-filled earth that is full of water while Obatala alone was given the task of creating mankind on earth but on their way, Obatala got drunk while Oduduwa proceeded to complete the task through landed at today's known Ile-Ife in Yorubaland. It is the belief that the place where the sand filling started from those days is today's known as Ile-Ife.

¹⁵ Another body of history stated that Yoruba under the leadership of Oduduwa migrated from one Arabian State to their present homestead as a result of political crisis after the rise of Islam. When Oduduwa reach Ile-Ife, he met an aborigines group of Yoruba speaking people which some historians called Agbonmiregun while some called them Ugboh.

from their days at Igbo-Egba; their homestead where each of the ancient township that constitute Abeokuta today are independent of their own. Hopefully, it may be that Ogboni was adopted as a result of consequential impact made during leadership struggling era of Oduduwa. Corroborating this, Saburi O. Biobaku (1957:5) stated that the Egba brought the Ogboni institution with them from Ile-Ife and developed it to such an extent that it has become the most characteristic Egba institution. Also F. I. Sotunde (2012:32) stated that there were three stages of the structural development of chieftaincy in Egbaland. The first stage was the pre-Lisabi era where Ogboni emerged as the instrument of governance. What happen before the emergence of Ogboni is difficult to say beyond the realm of anthropological guesswork.

The administration of Egbaland later include those that is now known as Olorogun, Ologun and Parakoyi section in view of the lacunae in the administration of Egbaland as a result of inability of the then Ogboni to successfully secure Egba people coupled with wideness of commerce and trade activities beyond their control as well as the failure to stop the activities of marauders. The fact that is been established here is that Ogboni as a system of governance did not emerged in Egbaland or associated with Egbaland alone but peculiar to the whole Yorubaland though Ogboni of Egbaland is complex than Ogboni of others Yorubaland. Ogboni of Egbaland compare to Ogboni of other Yorubaland is said to be complex than them because the Ogboni of majority of other Yorubaland are still known as sacrifice or rituals performer for their respective community as well as mediators between their Obas and his Chiefs whereas, Ogboni of Egbaland are the governing institution of each of the ancient township of Egbaland but some ignorantly described them as Awo or Alawo.

Upon the emergence of Ogboni in Egbaland and before Egba settlement at Abeokuta around 1830, Ogboni main duty was to perform sacrifice as well as propitiation of the gods as well as ancestral consultation of the Ifa Oracle for each of the township that constitute Egbaland at Igbo-Egba during the cause of which non-members are fenced out of its activities; hence the secrecy because it is Egba different Clanship Obas that is in total control of administering their different Clan. Please note that this era is clearly differ from the era of "*Egba ko L' Olu, gbogbo won ni se bi Oba*" which literary means Egba have no King while all of them act like a King but really means that King in Egbaland is acknowledged as the head of the government alone while Egba Chiefs determine the faith of Egbaland over issues¹⁶.

It is the believe of this present writer that it is the above fact that drove Saburi O. Biobaku (1957:6) to state that Ogboni stood between the Oba and his subjects, preventing the one from becoming despotic and ensuring proper subordination of the other. Ogboni at this period are misconceived to be the real ruler of the town because of enormous influence each of the clanship Ogboni have over their respective Oba's decision.

IV. THE OGBONI OF EGBA CONSTITUTION CONTROVERSY

In determine the constitution controversy of Ogboni of Egbaland; the first issue that needs to be noted is that Ogboni of Egbaland are institution of governance which can be view from 2 different perspective namely restrictive sense and elaborate sense. Ogboni of Egbaland can be view from restrictive sense to mean traditional chieftaincy title holders of each of the ancient township that constitute Egbaland collectively while in elaborate sense, Ogboni of Egbaland does not only consist of traditional chieftaincy title holders of each of the ancient township that constitute Egbaland collectively but also include Alake and Paramount Ruler of Egbaland as well as all Sectional Obas in Egbaland¹⁷, District and Other Obas¹⁸ as well as Coronet Obas¹⁹ with all Egba General Chieftaincy Title Holders as well as all Egba Sectional General Chieftaincy Title Holders.

But the constitution controversy which brought about this paper relates with definition of Ogboni of Egbaland in restrictive sense; that is Ancient Township Traditional Chieftaincy Title Holders. By the nature of Egbaland, township governing institution is divided into different sections namely Ologboni, Ologun²⁰, Olorogun, Parakoyi, Ode²¹, Egan²² and Erelu²³. Please note that this classification also applicable to Egba General and Sectional Chieftaincy Title but the issue that calls for determination is whether all this sections constitute Ogboni Egba. It should be noted that the issue whether Ologboni are Ogboni are never controversial because today's known Ologboni are those that have been existing since Egba days at Igbo-Egba as Ogboni who are in-charge of performing sacrifice and rituals as well as propitiation of the gods and ancestral consultation of the

¹⁷ Egba Sectional Obas are Osile of Oke-Ona Egba, Agura of Gbagura and Olowu of Owu.

¹⁸ Egba District and Other Obas are Olu of Itori, Olu of Ifo, Olofin of Isheri, Onishaga of Ishaga-Orile, Oniro of Iro, Omala of Imala, Onijale of Ijale-Papa, Olofa of Ota, Olubara of Ibara and Elewo of Ilewo-Orile. Please note that the contention of Isheri, Ishaga-Orile, Imala, Ota, Ibara and Ilewo-Orile as at today is that they are not part of Egbaland but there are sometimes under over lordship of Alake of Egbaland that is why the stool of monarchical head of those township were grouped since colonial era till today as part of Egba Traditional Council.

¹⁹ The list of Egba Coronet Obas is not close but include Olu of Igbein, Olu of Aga-Olowo, Oniwasinmi of Wasinmi, Olu of Ifo, Onikoka of Coker town, Olu of Itori-Odo, Onigbore of Igbo, Olu of obafemi, Olu of Owode-Egba, Olu of Ajura, Olosiele of Osiele, Olu of Odeda, Olu of Orile-Imo, Onipapalanto of Papalanto, Onijagan of Ijagan, Alabalabi of Abalabi, Onibogun of Ibogun, Olu of Ibogun Olaoparun, Olu of Akinala, Alakija of Orile-Ikija, Onijaye of Ijaye-Titun, Olu of Itori-Oke among others.

²⁰ Ologun are primitively refers to as Jagunjagan.

²¹ The modern day practice did not accommodate Ode (Hunters) section as events have overtaken their relevancy.

²² Egan are part and parcel of Ologboni been in-charge of each of the township forest and henceforth reference to Ologboni shall include Egan.

²³ Erelu are female Chiefs under the leadership of Iyalode but some Female Chiefs had Parakoyi with very few as a result of new innovations under Ologun as well as Olorogun. Hence this paper will also silent on Erelu section.

¹⁶ The "*Egba ko L'Olu*" era is post Egba sojourn under Maye episode of Egba journey.

Ifa Oracle to ensure peaceful reigned within their community that is why the duty is still exclusively reserved for Ologboni.

And as a matter of fact, Ologboni of Egba are not part of those that ruled Egbaland when they settled at Abeokuta around 1830²⁴ while their role has been restricted to performing sacrifice and rituals as well as propitiation of the gods and ancestral consultation of the Ifa Oracle for their respective ancient township and the whole Egbaland. Corroborating this F. I. Sotunde (2012: 54) stated that while it is true that the Ogboni²⁵ as a class apparently played second fiddle to the warlords, given the circumstances at the time, it is not true that the Ogboni were mere passive participants in such matters. The true position is that while warlords and fighting men were the direct physical combatants engaged in battle, the conduct of each war right from the contact with gods and ancestors through the Ifa Oracle to decide whether or not to go to war, to the procurement of provisions, to the logistics, to the propitiation of the Earth and ancestors, to the final blessing of the army just before it marched out into battle – all had input from the Ogboni. As a matter of fact, many of the activities and functions listed here, which had to be undertaken before engaging the enemy, were exclusively the duty of the Ogboni as a class.

Ologboni Egba gradually moved beyond this sacred duty to being a section of traditional governance in Egbaland starting from acting as Regent to Ologun during war time when none of them are at home which was solidify with restoration of overall leadership of Egba from Warrior (Ologun) due to their role in selection and installation of Oba²⁶. The fact that is been established here is that Ologboni emerged as a section of administration of Egba township at a latter day. On the issue of whether Olorogun are Ogboni, the fact remain that Olorogun are Military and Para-Military Service Provider but have their blood running in the administration of Egbaland around 1770s due to the failure of Ologboni who is exclusively known as Ogboni then to suppress the then oppressive activities of Alaafin of Oyo through his Ilari (Residents) as a result of which Lisabi formed 'Egbe Aaro' (Mutual Society) which was later converted to 'Egbe Olorogun' (Military Society) that was used to massacre almost all the Ilaris that was in Egbaland.

As well as waged consequential war against Oyo warriors; hence the emergence of Lisabi as father of Egbaland as well as inclusion of Olorogun as a section of governance in respective Egba township at Igbo-Egba; hence the inclusion of Olorogun as Ogboni which became something of past by subsequent dislodgement of Egba from Igbo-Egba by combined warriors of Ife, Oyo and Ijebu but latter re-emerged in the administration of Egbaland after Egba settlement at Abeokuta²⁷. This can be infer

²⁴ The leadership of Egba as at that time rest on Chief Sodeke; the Seriki Egba who was later elevated as Balogun Egba which later shifted to Chief Apati; the Bashorun Egba as a result of the demised of Chief Sodeke before the emergence of Oba Okukenu as the first Alake of Egbaland which was restored back to Chief Somoye; the Basorun Egba upon the death of Oba Okukenu.

²⁵ Reference to Ogboni here simply refers to Ologboni.

²⁶ It is Ologboni that are Ifa diviner for selection of Obas as well as perform rituals and sacrifice associated with the stool and serve as teachers for Obas at Ipebi (the School of Royalty).

²⁷ That is why Olorogun as a section of governance only exist as an independent section at Township level as there is no known Central

from speech of immediate past Alake of Egbaland; Oba Mofolorunso Oyebade Lipde on the occasion of the First Lisabi Day of 4th to 8th November 1987 when he stated that Lisabi was the liberator of the Egba people just as George Washington was the liberator of the people who founded the United State of America. When Egba were under the yoke of the Alaafin of Oyo who stationed his intendants the ILARI'S, in the different Egba towns in our Federation in the Egba Forest, it was Lisabi who used the traditional institution of "Egbe Aaro" to build up an army which drove back the punitive expedition sent from Oyo after the Egba had killed off all their Ilari Oppressors.

On the issue of whether Ologun are Ogboni, the fact remain that Ologun are then known to be military as well as solely in-charge of security policy of Egbaland from the days of Egba sojourn at Maye camp as a result of dislodgement of Egba from Igbo-Egba by combined effort of Oyo, Ife and Ijebu warlords. It is on record that during Egba sojourn at Maye camp, Chief Yisau from Itoko became the first Balogun Egba and later handover to Chief Lamodi from Igbein as a result of old-age while Chief Debokun from Ijeun became the first Seriki Egba who also handover to Chief Denlu and later to Chief Sodeke; also on the basis of old-age. It must be noted that this era did not only result to emergence of Ologun Chieftaincy Title in Egbaland but also result to emergence of Egba General Chieftaincy Title²⁸. It must be noted that it is the failure of Ologboni and Olorogun to safely secure Egba people that resulted to emergence of Ologun section in Egbaland.

It must also be noted that Ologun are in exclusive administration of Egbaland from Maye camp with slighted changes around 1854 when Oba Okukenu was crowned as the first Alake of Egbaland and even extended upon the demised of Oba Okukenu to when Oba Ademola 1 emerged as the second Alake of Egbaland which make them Ogboni from Egba perspective. Please note that in-spite of having Obas in Egbaland, Ologun still have overwhelming power in administration of Egbaland then, it is this era that is known as 'Egba ko L' Olu, *gbogbo won ni se bi Oba*²⁹ era. This is contrary to Lanre Davies (2013:4 - 5) account when he stated that the death of Sodeke in 1845 however saw the questioning of the leadership of the war chiefs. This was partly due to the fact that there was no obvious successor of sufficient standing and partly because military interests with the exception of the question of defence against attacks from Dahomey were no longer quite so dominant. Therefore, an Ogboni chief, the Sagbua of Ake, emerged as the leading chief after Sodeke's death and eventually became the first Oba in Abeokuta.

The author did not take cognisance of the fact that it is Chief Apati; the Bashorun Egba that took over mantle of leadership of Egbaland after Chief Sodeke's death while Chief Okukenu; the

Olorogun Egba while their existence at the central has been fused with Ologun Egba and known as Ologun/Olorogun Egba.

²⁸ Please note that prior to this era, there is nothing like Egba General Chieftaincy Title of Ologboni, Olorogun, Ologun and Parakoyi. What is in existence is Chieftaincy Title of each of the ancient township of Egbaland.

²⁹ It literary means that Egba have no King while all of them act like a King but really means that King in Egbaland is acknowledged as the head of the government alone while Egba Chiefs particularly Ologun Chiefs determine the faith of Egbaland over issues.

Sagbua Ake only emerged as the head of Ologboni Egba (A. K. Ajisafe, 1972:74). On Parakoyi issue, some belief that Parakoyi are part of Ologboni which by implication make then Ogboni while other beliefs that Parakoyi are separate section of governance in Egbaland. It must be noted that Parakoyi in Egbaland are separate section³⁰ as well as saddle with control and management of commerce, trade and industry as well as ensuring existence of law and orders in markets across Egbaland. It is this governing role in the affairs of Egbaland that make them Ogboni from Egba perspective. The fact that has been established so far is that reference to Ologboni in Egbaland has moved beyond reference to rituals and or sacrifice performer as well as propitiation of gods and ancestors as well as Ifa Oracle consultants but have become governing institution in Egbaland which as a matter of fact moved reference to Ogboni beyond Ologboni section to include Ologun section, Olorogun section and Parakoyi section among others. No wonder F. I. Sotunde (2012:47) stated that what has been said here so far applies to other arms of the Ogboni as the traditional government. The Olorogun, the Parakoyi, the Ode, the Egan, the Erelu, and Ologboni together make up the Ogboni and they operate on similar principles, including the qualification of their titles.

The author also stated further having address Ologboni, Olorogun, Jagunjagun (Ologun), Parakoyi, Erelu/Iyalode, Ode and Egan under functions of Ogboni (in General terms) that it is the body of these seven cadres of chiefs at both the general-title and township level plus the Obas that is now known collectively as Ogboni (2013:51).

V. CONCLUSION

The facts that need to be noted here is that just like Nigeria are practicing presidential system of government, Ogboni are the instrument of governance of each of the ancient town of Egbaland with complex definition beyond the known Ogboni at Igbo-Egba to include Ologun, Olorogun and Parakoyi among others. That is why those that are then known as Ogboni have now worn new identity as Ologboni from the time immemorial. It is worthy of notes at this junction that why Ologboni, Ologun, Olorogun and Parakoyi have Iwarefa; that is the body of six (6) Senior Chiefs who function as the Executive Committee of each of the section at Township level, there is nothing like Iwarefa Ogboni while Oluwo, Balogun, Jaguna and Olori-Parakoyi are the body of most Senior Chiefs who function as the Executive Committee of each of the township Ogboni. And it should not be forget that there is nothing like Iwarefa of Ologboni, Ologun, Olorogun and Parakoyi at the central.

³⁰ That is why Parakoyi of each of Egba Ancient Township are meeting at the resident or reserved place of Olori-Aje of each of the township. At Egba Township level, Olori-Aje is the head of Parakoyi of each of the township. Also all Parakoyi Egba General Chieftaincy Title Holders as well as Sectional General Chieftaincy Title Holders and all Parakoyi Township Chieftaincy Title Holders do meet at the house or reserved place of Olori-Parakoyi Egba who by Egba custom and tradition is also the Olori-Aje Igbore Township. Olori-Parakoyi is synonymous to Traditional Minister of Commerce, Trade and Industry while Olori-Aje is synonymous to Traditional Commissioner of Commerce, Trade and Industry.

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Integrated Pest Control of the Eggfruit and Shoot Borer *Leucinodes Orbonalis* Guenee on the Garden Egg *Solanum Aethiopicum* L in Southwest Nigeria.

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Abstract- Indiscriminate use of insecticides in the control of the EFSB and other vegetables makes it expedient to seek for safe and eco-friendly measures. In two separate experiments, the first compared the effect of integrating nylon net barrier with weekly cutting of infested shoot, and the other the effect of integrating use of nylon net barrier, weekly clipping of infested shoot with application of 150ltrs/ha of Karate® 5EC. Treatments were arranged in a Randomized complete block design with three replicates each. Integrating nylon net and weekly cutting of infested shoots significantly reduced EFSB infestation by 27.61% in 2006 and 7.87% in 2007 compared to the control. Single application of Karate® 5EC at 150ltrs/ha at four weeks interval gave comparatively the same control as more frequent applications. However, integrating nylon net, weekly cutting of infested shoot and monthly application of karate at 150ltrs/ha significantly reduced EFSB infestation by 92.03% compared to control. Therefore integrating physical barrier of nylon netting, weekly clipping of infested shoot and monthly application of Karate® 5EC is recommended for effective control of field infestation by the pest. This study shows that the integration of different control techniques can significantly reduce damage by the eggfruit and shootborer.

Index Terms- Nylon net barrier, Eggfruit and shootborer(EFSB), *Leucinodes orbonalis*, *Solanum aethiopicum*, Integration, Karate®5EC

I. INTRODUCTION

Garden egg, also known as African eggplant (*Solanum aethiopicum*), is one of the most important vegetable crops in West Africa (Owusu-Ansah *et al.*, 2001; Grubben and Denton, 2004). It is cultivated all-year round in different parts of Nigeria and West Africa and serves as the main source of income for many rural farmers and households. Production is however constrained by a wide range of pests and diseases reducing total production as well as production quality. A great diversity of species of insects from different Orders and Families have been recorded on the garden egg of which very few are of economic importance (NRI, 1997). The egg fruit and shoot borer (EFSB) *Leucinodes orbonalis* (Lepidoptera: Crambidae) is one of the most important insect pest of this vegetable crop with fruit damage as much as 80% recorded sometimes.

Insecticides are currently the main method used in the control of this all important pest with farmers relying on them

exclusively in order to be able to produce blemish-free fruit (Kabir *et al.*, 1994; Alam *et al.*, 2003). Complications associated with indiscriminate use of these insecticides are well documented. Non optimal and non-judicious use of pesticides results in a series of problems related to both loss of effectiveness on the long-run and certain externalities such as pollution and health hazards (AVRDC, 2003). The use of these chemicals has to reduce drastically and effort put into the production of safer crops.

The application of Integrated pest management (IPM) is desirable and sustainable in managing these pests because it combines biological, cultural, physical, and chemical tools in a way that minimizes economic, health and environmental risks (Rechcigl and Rechcigl, 2000). Chakraborti (2001) assessed the effectiveness of a biorational integrated approach for the management of *L. orbonalis* and found that it reduced the heavy use of synthetic chemicals and produced results superior to the chemical method. Sasikala *et al.* (1999) reported that the combination of mechanical destruction of infested shoots and fruits, neem oil and the release of the egg parasitoid *Trichogramma japonicum* Ashwood gave good control of *L. orbonalis* in Bapatla, India. Arida *et al.* (1999) and Alam *et al.* (2003) reported that the combination of physical barrier and prompt destruction of infested shoots (sanitation) significantly reduced EFSB damage to eggplant crops. Alam *et al.* (2003) recommended a net barrier 2m high which significantly reduced migration of EFSB adults. Kaur *et al.* (2004) in the bid to reduce the use of insecticide in the control of *L. orbonalis* Guenee transplanted 6 cultivars of eggplant under net house and field conditions. Fruit damage in the net house was nearly 50% lower than the fruit damage recorded under field condition.

Karmakar and Bhattacharya (2000) showed that a pest population can be maintained at well below the economic injury level using mechanical methods of control, this Gapud *et al.* (1998) affirmed. AVRDC in consultation with some other agricultural research agencies developed an Integrated Pest Management Program aimed at developing a safe and sustainable control strategy that would reduce farmer's dependence on toxic chemicals (Alam *et al.* 2003). They concluded that the successful adoption of an IPM program will increase profits, protect the environment, and improve public health (Alam *et al.* 2003; Rashid *et al.* 2003). Raju *et al.* (2007) in his report 'Scenario of infestation and management of EFSB' also concluded that the development of location specific pest management modules to

combat EFSB through farmers' participatory research approaches could be appropriate in sustainable management of this pest.

This investigation is aimed at employing two different integrated measures that had been reported successful in the control of EFSB on *S.melongena*. The first combines use of net barrier with clipping of infested shoots while the second integrates the use of net barrier, weekly clipping of infested shoots together with application of a commonly used insecticide, Karate® 5EC.

II. MATERIALS AND METHODS

2.1 Location and site attributes

The experiment was carried out at the research farm of the National Institute for Horticultural Research (NIHORT), Ibadan located on latitude 3° 5'E, 5° 3'N at 168m above sea level in the wet season of 2006 and 2007.

2.2 Land preparation, raising and transplanting of seedlings

Clean healthy seeds of *S. aethiopicum* -local variety Lv Makurdi, were sown in nursery in the Institute for a period of 5 weeks. Meanwhile, two plots of land 15.7 x 11.4 m were cleared and sub-divided into 12 sub-plots made into elevated beds (2.8 x 2.8 m) with 1.5 m spacing between them. At the end of 5 weeks the seedlings were transplanted on each of the sub-plots very early in the morning and spaced 0.7 x 0.7 m within and between rows, giving a total of 25 stands per sub-plot. The plots were maintained following normal agronomic practices.

2.3 Experimental design and treatments

2.3.1 Effect of integrating weekly clipping of infested shoots and a net barrier on fruit infestation of *S. aethiopicum* by *L. orbonalis*.

This experiment involves the erection of nylon net barrier as in Alam *et al.* (2003) and the clipping of infested shoots 1cm below the wilting point. In the first experiment the seedlings were administered 4 different treatments replicated thrice and arranged in 4 X 4 Randomized Complete Block Design (RCBD). The treatments are: i) erection of 2 m high nylon net (mesh 16), ii) weekly clipping of infested shoots (sanitation), iii) erection of 2 m high nylon net (mesh 16) combined with weekly clipping of infested shoots, and iv) untreated control. Mature fruits were harvested weekly from 15 randomly selected stands and bulked in separately labeled polythene bags. Sampling was for a period of 12 weeks. All the harvested fruits were cut open and properly examined for EFSB larva. The number of infested and uninfested fruits were counted, recorded and expressed as percentage of total fruits collected per week per sub-plot.

2.3.2 Effects of integrating weekly cutting of infested shoots, nylon net barrier and insecticide (Karate® 5EC) on fruit infestation of *S. gilo* by *L. orbonalis*.

A trial experiment integrating different control measures with Lambda-cyhalothrin Karate® 5EC (one of the most commonly used insecticides among vegetable farmers) was carried out in 2007. The seedlings were administered 4 different treatments, with each treatment replicated thrice and arranged in a 4 X 4 Randomized Complete Block (RCBD). The individual treatments integration were: nylon net barrier erected 2m high round the sub-plot as in Alam *et al.* (2003), monthly application

of 150 mls/ha of Karate® 5EC as recommended in Onekutu *et al.* (2010) and weekly clipping of infested shoot as in Gapud *et al.* (1998). The 4 treatments were combined and applied as follows; i) Nylon net + weekly cutting + Karate® 5EC(150 mls/ha) ii) Nylon net + Karate® 5EC (150 mls/ha) iii) Weekly cutting + Karate® 5EC (150 mls/ha) and iv) Karate® 5EC only (150 mls/ha). At the onset of fruiting mature fruits were harvested weekly from 15 randomly selected stands and bulked in separate labeled polythene bags. Sampling was for a period of 12 weeks. All the harvested fruits were cut open and properly examined for infestation by the EFSB. The number of infested and uninfested fruits were counted and expressed as percentage of total fruits collected per week per sub-plot.

Statistical analysis

Data collected were arcsin transformed, subjected to Analysis of variance (Anova) and means separated using Duncan's new multiple range test (DNMRT).

III. RESULTS

Effects of integrating periodic clipping of Infested Shoots of *S. aethiopicum* and net nylon barrier on *S. gilo* infestation by *L. orbonalis*.

The combined effect of periodic clipping of infested shoot and nylon net barrier on percentage infestation of *S.aethiopicum* fruits by *L.orbonalis* in 2006 and 2007 is presented in Table 1. The combination of nylon net barrier and weekly clipping of infested shoot significantly reduced mean percentage infestation in both years. In 2006, the lowest mean percentage infestation of 19.58% was recorded on plots treated with net barrier and clipping of infested shoots while the highest of 53.13% was recorded on plots subjected to prompt and weekly clipping of infested shoots only. The use of net barrier plus clipping of infested shoots (19.58%) and use of net barrier only (31.51%) were significantly lower than records obtained from the untreated plot (47.16%). Clipping of infested shoot only had no significant effect on mean percentage infestation when compared with the control. Mean percentage infestation of 53.13% recorded on plots treated with cutting of infested shoot only was not significantly different from the untreated plots. No significant difference was observed between plots with net barrier only and untreated plots.

The results in 2007 were similar to what was obtained in 2006. Net barrier plus clipping of infested shoots (26.02%) and use of the net barrier only (30.66%) significantly reduced mean percentage infestation when compared with untreated plots (33.89%). No significant difference was observed when plots treated with net barrier + clipping of infested shoots (26.02%) were compared with net barrier only treated plots (30.66%) and plots subjected to clipping of infested shoot only (32.52%). No significant difference was observed between plots treated with clipping of infested shoot only (32.52%) and untreated plots (33.89%)

Table 1 Effect of nylon net barrier and clipping of infested shoots of *S. aethiopicum* on percentage infestation of *L. orbonalis* in 2006 and 2007

Treatments	Percentage infestation (%)	
	2006	2007
Net only	31.51bc*	30.66bc
Net + clipping of infested shoots	19.58c	26.02c
Clipping of infested shoots only	53.13ab	32.52ab
Untreated control	47.16a	33.89a

Values are means of 3 replicates.*Means with the same letter in a column are not significantly different (P>0.05) using DNMRT

Effects of integrating nylon net barrier, weekly clipping of infested shoots and insecticide application (Karate® 5EC) on fruit infestation of *S. aethiopicum* by *L. orbonalis*.

The effect of integrating nylon net barrier, weekly clipping of infested shoot and the application of Karate® 5EC at the rate of 150 mls/ha is presented in Table 2. The combined treatments significantly reduced mean percentage infestation of *S.gilo* fruits by *L.orbonalis*.

The lowest mean percentage infestation of 4.34% observed on plots treated with the combination of nylon net, weekly clipping of infested shoot and Karate® 5EC was significantly

lower than mean percentage infestation recorded on plots treated with Karate® 5EC only (9.87%) and plots treated with weekly clipping of infested shoot + Karate® 5EC (8.58%). It was however not significantly different from plots with nylon net + Karate® 5EC (6.76%). No significant difference was observed when the mean percentage infestation on plots treated with Karate® 5EC only was compared with mean infestation from plots treated with Karate® 5EC + cutting of infested shoots. Combined effect of all three treatments significantly reduced infestation.

Table 2 Effect of integrating nylon net barrier, cutting of infested Shoot and application of karate 5EC on percentage infestation in 2007.

Treatments	Percentage infestation (%)
Nylon net barrier + Karate® 5EC	6.76a*
Nylon net barrier + clipping of infested shoot + Karate® 5EC	4.34a
Clipping of infested shoot + Karate® 5EC	8.58b
Karate® 5EC only	9.87b

Values are means of 3 replicates.*Means with the same letter in a column are not significantly different (P>0.05) using DNMRT

IV. DISCUSSION

Combination of a physical barrier and sanitation (removal of infested plant parts) was utilized to minimize EFSB damage to garden egg crops. In this study the combination of nylon net as a physical barrier and weekly cutting of infested shoot significantly reduced mean percentage infestation in 2006 and 2007. This findings agrees with Alam *et al.* (2003), Arida *et al.* (2001), Rahman *et al.* (2006) and Kaur *et al.* (2003), that reported the positive effect of using net barriers combined with prompt destruction of pest-damaged shoots. Combining removal of infested plant parts with other measures as reported by Alam *et al.* (2003) can be adopted in to cut cost and reduce immigration of pest adults into the farm area. In a similar experiment Rahman *et al.* (2006) reported that combined sanitation of the

environment and removal of infested plant part did not significantly reduce damage when compared with the removal of plant part alone. Combining insecticidal treatments with removal of plant part has been reported to be very effective having significantly reduced damage. Consequently that prompt clipping and removal of pest-damaged shoots can be combined with other community-wide measures in the bid to combat the EFSB.

When compared with all other treatments employed in the control of the eggfruit and shootborer, integration of different control measures remains one of the most effective ways of reducing damage done to the garden egg and related crops. In this study integrating use of Karate with prompt clipping of infested shoot with erection of 2m high net barrier significantly reduced infestation to as low as 4.34% when compared with 60% infestation recorded in Onekutu *et al.* (2010).The measure

reduced infestation by a significant margin. Rahman *et al.* (2006) reported a similar result when they combined prompt removal of infested fruits and shoots at weekly interval with application of Cymbush 10EC at 1 ml/litre of water and a routine spray of Cartap 50SP at 1.2g/litre of at weekly interval. The treatment significantly lowered shoot and fruit infestation by as much as 38.9% when compared with the control they pointed out. Higher percentage infestation was recorded on plots treated with Karate® 5EC only and it was significantly higher than records from other treatments, affirming the fact that continuous dependence on insecticides might not at all times produce the best results as far as pest control is concerned. Kabir *et al.* (1994) had reported that chemical insecticide was not solely effective against the EFSB. Khorsheduzzaman *et al.* (1998) achieved significant reduction in fruit infestation when chemical and non-chemical approaches were integrated for the management of ESFB. Kumar *et al.* (2000; 2001); Biradar *et al.* (2001); Rashid *et al.* (2003); Alam *et al.* (2003) and Rahman *et al.* (2006) all attest to the effectiveness of insecticides in the control of the eggfruit and shoot borer and many other pest, but consider the integrated approach a better option. It is obvious therefore that the use of insecticides in combination with other control measures always proves more effective than when used alone.

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Association Rule Mining in the field of Agriculture: A Survey

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Abstract- Data mining is the art and science of intelligent analysis of (usually large) data sets for meaningful (and previously unknown) insights and is nowadays actively applied in a wide range of disciplines related to agriculture. Association Rule Mining is a powerful tool for generating rules from vast and diversified data such as agricultural datasets. Due to the emerging importance of data mining techniques and methodologies in the area of agriculture, this paper is a survey of some previous researches done in this field. For sustainable growth of agriculture, these methodologies need to be monitored and analyzed optimally.

Index Terms- Association rule mining, Agricultural data, Data mining.

I. INTRODUCTION

Generally, data mining [1] (sometimes called data or knowledge discovery) is the process of analyzing data from different perspectives and summarizing it into useful information. Data mining software is an analytical tool that allow users to analyze data from many different dimensions or angles, categorize it, and summarize the relationships identified. Technically, data mining is the process of finding correlations or patterns among dozens of fields in large relational databases. The patterns, associations, or relationships among all this data can provide *information*.

Information can be converted into *knowledge* about historical patterns and future trends. For example, summary information about crop production can help the farmers identify the crop losses and prevent it in future. Use of data mining techniques can provide more suitable system for the decision making. Today, data mining is used in numerous areas, for example financial data collected from banking and financial industries are often comparatively absolute, reliable, and of high quality, which helps methodical data analysis and data mining. Retail industry is also an important application field for data mining since it gathers huge amount of data on customer shopping history, consumption, sales etc. Retail data mining can help to identify customer buying behaviors, customer shopping patterns and trends; can help to improve the quality of customer service, achieve better customer satisfaction, enhance goods consumption ratios, design more effective goods & transportation policies and reduce the cost of business. Another application of data mining is in telecommunication industry that has quickly changed from providing telephone services to offer many add-on communication services including fax, cellular phone, Internet

services. This evolution creates a great demand for data mining in many scientific applications like Biological Data Analysis, Intrusion Detection and Agricultural sector. Agricultural sector is relatively an emerging research field where lot of work is to be done.

II. ASSOCIATION RULE MINING

An Association rule is an implication of the form $P \Rightarrow Q$, where $P \cap Q = \Phi$ and P & Q are subsets of all itemset I . There are two measures of rule interestingness i.e. Support (σ) and Confidence (T). They reflect the usefulness and certainty of the rules. The rule $P \Rightarrow Q$ (support $\sigma = 10\%$, confidence $T = 80\%$) shows that 10% of all the transactions under analysis shows the simultaneous purchase of items P and Q by customers and 80% of confidence shows that 80% of customers who purchased item P also bought item Q [2].

Association rules relate objects to each other and how they tend to group together.

Association rules can be classified in numerous ways, based on type of values handled in rule (Boolean association rule or Quantitative association rule), based on the dimensions of data involved in the rule (Single dimension or Multidimensional) and based on level of abstractions involved (Single level association rules or Multilevel association rules).

Various algorithms have been proposed for mining the association rules and can be decomposed in two phases.

I. Find all the itemsets whose support and confidence are greater than the user specified minimum support (σ) and minimum confidence (T) respectively. Such items are called frequent itemsets.

II. Frequent items are used to find desired association rules. These rules must satisfy minimum support (σ) and minimum confidence (T).

The five major algorithms proposed for discovery of association rules, are as follows:

2.1. A Priori Algorithm

The process is divided in two steps (R. Aggarwal & Srikant) -

1. Minimum support is applied to find all frequent itemsets in a database.

2. These frequent itemsets and the minimum confidence constraint are used to form rules.

2.2. Partition Algorithm

Partition algorithm [3] works in two scans of the database. In one scan it generates a set of all potentially large itemsets by scanning the database once. This set is a superset of all large itemsets, i.e. it may contain false positives. But no false negatives are reported. During the second scan, counters for each of these itemsets are set up and their actual support is measured in one scan of the database.

The algorithm executes in two phases. In the first phase, the Partition algorithm logically divides the database into a number of non-overlapping partitions. The partitions are considered one at a time and all large itemsets for that partition are generated. At the end of phase I, these large itemsets are merged to generate a set of all potential large itemsets. In second phase, the actual support for these itemsets are generated and the large itemsets are identified. The partition sizes are chosen such that each partition can be accommodated in the main memory so that the partitions are read only once in each phase.

2.3. Pincer search Algorithm

The algorithm [4] begins with generating 1-itemsets as A Priori algorithm but uses top-down search to prune candidates produced in each pass. This is done with the help of MFCS set. Let MFS denote set of Maximal Frequent sets storing all maximally frequent itemsets found during the execution. So at anytime during the execution MFCS is a superset of MFS. Algorithm terminates when MFCS equals MFS. In each pass over database, in addition to counting support counts of candidates in bottom-up direction, the algorithm also counts supports of itemsets in MFC, this set is adapted for top-down search.

2.4. Dynamic Itemset Counting Algorithm

The DIC algorithm [5] works as follows :

Step 1. The empty itemset is marked with a solid box. All the 1-itemsets are marked with dashed circles. All other itemsets are unmarked.

Step 2. Read M transactions. Let the values of M range from 100 to 10,000. For each transaction, increment the respective counters for the itemsets marked with dashes.

Step 3. If a dashed circle has a count that exceeds the support threshold, turn it into a dashed square. If any immediate superset of it has all of its subsets as solid or dashed squares, add a new counter for it and make it a dashed circle.

Step 4. If a dashed itemset has been counted through all the transactions, make it solid and stop counting it.

Step 5. If we are at the end of the transaction file, rewind to the beginning.

Step 6. If any dashed itemsets remain, go to Step 2.

This way DIC starts counting just the 1-itemsets and then quickly adds counters 2,3,4,...,k-itemsets. After just a few passes over the data (usually less than two for small values of M) it finishes counting all the itemsets.

Since agricultural data is diversified in terms of its attributes and needs to be processed efficiently and well in time and the above methods have two main disadvantages.

(a) These methods may need to generate a huge number of candidate sets.

(b) These methods may verify a large set of candidates by pattern matching and scans the database repetitively.

Whereas, the frequent-pattern tree (FP-tree) is a compact structure that stores quantitative information about frequent patterns in a database. This method adopts divide & conquer strategy. First it compresses the database representing frequent items into a frequent pattern tree or FP-tree, which retains the itemset association information. It then divides the compressed database into a set of conditional database, each associated with one frequent item or 'Pattern Fragment' and mines each such database separately.

2.5 FP-Tree Growth Algorithm

This method, [6] adopts divide & conquer strategy. First it compresses the database representing frequent items into a frequent pattern tree or FP-tree, which retains the itemset association information. It then divides the compressed database into a set of conditional database, each associated with one frequent item and mines each such database separately. The method considerably decreases the search cost. This algorithm has an advantage that there is no need of multiple scans of data like other algorithms, because it stores the data in a tree structure and it does not generate the candidate as in other algorithms.

III. LITERATURE SURVEY

3.1. Application of Spatial Data Mining for Agriculture

D.Rajesh [7], has provided an overview of data clustering methods using cluster analysis for generating patterns and rules. Since association rule mining needs to evaluate multiple spatial relationships among a large number of spatial objects, the process could be cumbersome, so another method called progressive refinement can be used in spatial association analysis. His work is in the direction of extracting patterns from spatial database using k-means algorithm. Large data sets are mined roughly using a fast algorithm and then improves the quality of mining in a pruned data set. The above concept is applied in the area of agriculture where giving the temperature and the rainfall as the initial spatial data and then by analyzing the agricultural meteorology for the enhancement of crop yields and also reduce the crop losses.

3.2 Developing Innovative Applications in Agriculture using Data mining

Sally Jo Cunningham and Geoffrey Holmes [8] have described a WEKA (Waikato Environment for Knowledge Analysis) system which provides a complete suite of facilities for applying data mining techniques to large data sets. This WEKA-based analysis and application construction process is illustrated through a case study in the agricultural domain—mushroom grading.

The mined data is represented as a model of the semantic structure of the dataset, and it can be used for pattern discovery. For accomplishing the purpose, machine learning techniques have been used for analyzing data.

3.3. Data Mining for Evolution of Association rules for Droughts and Floods in India using Climate Inputs

C. T. Dhanya and D. Nagesh Kumar [9] have worked in the direction of designing an effective risk management system for tracing frequent occurrences of droughts and floods because

these two factors directly affect the Indian agriculture. A data-mining algorithm is used to discover association rules between extreme rainfall events and climatic indices. Association rules are generated for the regions of India which shows strong relationships between the climatic indices chosen, i.e., Darwin sea level pressure, North Atlantic Oscillation, Nino 3.4 and sea surface temperature values, and the extreme rainfall events.

3.4. PARM -- An Efficient Algorithm to Mine Association Rules From Spatial Data

[10] Association rule mining is applied to remote sensed imagery (RSI) data composed mainly of images and ground data mainly from the field of agriculture. In most of the cases applying existing algorithms on RSI data for generating association rules can consume a reasonable amount of time. Keeping that in mind an efficient algorithm has been devised for spatial data using Peano count tree (P-tree) structure. P-tree structure provides a lossless and compressed representation of images. Based on P-trees, an efficient association rule mining algorithm PARM with fast support calculation and significant pruning techniques is introduced to improve the efficiency of the rule mining process. Experimental results showed that PARM is more efficient than FP-growth and A Priori algorithms when applied on RSI spatial data.

3.5. Mining of Quantitative Association Rules in Agricultural Data Warehouse: A Road Map

J. Bhatia and Anu Gupta [11], have done a comparative study on various association rule mining techniques, which include A Priori Algorithm, Partition Algorithm, Pincer Search Algorithm, Dynamic Item Set(DIC) Algorithm and FP-tree growth algorithm. When these are applied in agricultural domain the best results are generated by FP-Tree growth Algorithm. Since it scans the database the least number of times from all the above algorithms, it gives the lowest time complexity. Apart from this the agricultural dataset is stored in the form of a data cube to make it concise, so that it can be monitored, analyzed and allocated optimally.

3.6. The Application of Association Rule Mining to Remotely Sensed Data

In this paper [12], we defined a new data mining problem -- Association rule mining from imagery data and its application in agricultural domain. A priori algorithm has been used as base algorithm for inventing a new data mining technique which provides effective pruning for candidate 2-item set generation. According to this novel technique a significant amount of unnecessary candidate itemsets can be pruned during the early phase of mining.

3.7. Data Mining Techniques and Applications to Agricultural Yield Data

In this paper by D Ramesh and B Vishnu Vardhan [13], different Data Mining techniques, such as K-Means, K-Nearest Neighbour(KNN), Artificial Neural Networks(ANN) and Support Vector Machines(SVM) were adopted to estimate crop yield analysis with existing data. Multiple Linear Regression (MLR) is used to model the linear relationship between a dependent variable and one or more independent variable(s). The

dependent variable is rainfall and independent variables are year, area of sowing and production. By adopting K-Mean clustering approach four clusters are formed.

3.8. Data Mining Techniques: A Tool for Knowledge Management System in Agriculture

Latika Sharma and Nitu Mehta [14] have attempted to bring out the computational needs of agriculture data and how data mining techniques can be used as a tool for knowledge management in agriculture. Data warehouses can be prepared to hold agriculture data, which makes transaction management, information retrieval and data analysis much easier. On Line Analytical Processing (OLAP) can easily answer multi-dimensional queries it can be used for applications such as forecasting or prediction in agriculture. It also provides an opportunity of viewing agriculture data from different points of view to discover data characterization, data discrimination and association analysis.

3.9. Classification of Agricultural Land Soils -- A Data Mining Approach

Ramesh Vamanan and K.Ramar [15] have surveyed the various classification techniques of data mining to be applied on soil database to establish meaningful relationships. The characteristics used to classify soil are as follows- soil moisture regimes, soil temperature regimes and physical and chemical properties of soil. Furthermore, the survey showed that soil can be divided into eight classes depending upon its agricultural productivity.

IV. CONCLUSION

This paper is an Endeavour to provide an overview of some previous researches and studies done in the direction of applying data mining and specifically, association rule mining techniques in the agricultural domain. We have also tried to evaluate the current status and possible future trends in this area. The theories behind data mining and association rules are presented at the beginning and a survey of different techniques applied is provided as part of the evolution.

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DESIGN AND FABRICATION OF LATHE FIXTURE FOR BRAKE DRUM (cargo) MACHINING

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Abstract- Design of new fixture is a modified over the old fixture due to some drawback. The old fixture is not suitable for drum having slot on top face. This is because of the brake drum is seated on fixture ring instead of button so there is no gap maintained. Without sufficient gap it is difficult to machine the brake drum bore (pilot diameter), as well as brake drum surface in single set up to achieve the concentricity. Also current fixture is complicated in design and there is more work in fitting the button to fixture ring. So we designed new lathe fixture over the old fixture. In new modified lathe fixture, pads are provided instead of buttons and it could be suitable for brake drum having slot on the top face and other drum also. By trial run this lathe fixture is more comfortable than old fixture. So this fixture can be used in brake drum (cargo) manufacturing companies because of its simple design and less cost.

Index Terms- Fixture design, Fabrication, Fixture and Brake drum

I. INTRODUCTION

The successful running of any mass production depends upon the interchangeability to facilitate easy assembly and reduction of unit cost. Mass production methods demand a fast and easy method of positioning work for accurate operations on it. Jigs and fixtures are production tools used to accurately manufacture duplicate and interchangeable parts. Jigs and fixtures are specially designed so that large numbers of components can be machined or assembled identically, and to ensure interchangeability of components. [1]N.P.Maniar and D.P.Vakhariya have introduced the proposed direction for future research of fixture. In his paper basic requirements of fixture, phases of fixture design, flexible mechanical fixtures, locating and clamping consideration, fixture design process and computer aided fixture design have explained very well for the Design and Development of Fixture. [2]Makwana and Gosavmi have found that there are different steps and approaches are available for designing the fixture. Among those geometry method (3-2-1 principle) and it is very useful for the complex fixture design though it is the basic principle of the fixture design.

1.1 Jigs:

It is a work holding device that holds, supports and locates the work piece and guides the cutting tool for a specific operation. Jigs are usually fitted with hardened steel bushings for guiding or other cutting tools. A jig is a type of tool used to control the location and/or motion of another tool. A jig's primary purpose is to provide repeatability, accuracy, and interchangeability in the

manufacturing of products. A device that does both functions (holding the work and guiding a tool) is called a jig. An example Of a jig is when a key is duplicated; the original is used as a jig so the new key can have the same path as the old one.

1.2 Fixture:

It is a work holding device that holds supports and locates the work piece for a specific operation but does not guide the cutting tool. It provides only a reference surface or a device. What makes a fixture unique is that each one is built to fit a particular part or shape. The main purpose of a fixture is to locate and in some cases hold a work piece during either a machining operation or some other industrial process. A jig differs from a fixture in that; it guides the tool to its correct position in addition to locating and supporting the work piece. Example: chucks.

1.3 Brake drum:

A broad, very short hollow cast-iron cylinder attached to the wheel against which the brake shoes press in a drum brake. The brake drum is generally made of a special type of cast iron that is heat-conductive and wear-resistant. It rotates with the wheel and axle. When a driver applies the brakes, the lining pushes radial against the inner surface of the drum, and the ensuing friction slows or stops rotation of the wheel and axle, and thus the vehicle. The drum provides a friction surface, usually iron, to which the brake shoes are applied. When the shoes and drum come together, they convert the kinetic energy of the moving vehicle into heat, which then dissipates. The brake drum rotates with the wheel. In some brake systems, the drum contains the wheel hub and the wheel bearings.

If the drum contains the hub, the drum provides the mounting hardware for the wheel and tire assembly. If the drum and hub are separate, the hub provides the mounting hardware for both the drum and the wheel/tire assembly. The brake drum must be perfectly round and concentric with the spindle or axle. Brake pedal pulsation occurs if the drum is out of round with the spindle or axle.

2. TYPE OF MACHINING OPERATION ON BRAKE DRUM CARRIED OUT IN THE LAMINA FOUNDRIES LIMITED

- Top diameter facing and inside flange roughing.
- Step turning and brake drum surface roughing.
- Inside step turning operation.
- Drilling operation.
- Finishing operation.

2.1 Top diameter facing and inside flange roughing:



Fig.2.1 Top diameter facing and inside flange roughing

In this operation first brake drum has to be held in four jaw chuck and then it is centered with the help of surface gauge. Once brake drum is centered, top facing operation is to be carried out. After top facing, next boring and inside flange roughing operations are to be carried out. After achieving of the required dimension, brake drum will be sent to next operation.

2.1.1 Step turning and brake drum surface roughing:



Fig.2.1.1 Step turning and brake drum roughing

In this operation, brake drum is to be held with help of spigot, screw rod and clamp as shown in fig.2.1.1 and brake drum base is seated in spigot which is bolted to face plate of the lathe. In this operation first inner diameter have to be machined and at the same time outside step turning operation also to be carried out. In step turning, step length, step height and depth are to be

maintained. After achieving this dimension the brake will be moved to next operation.

2.1.2 Inside step turning operation:



Fig.2.1.2 Inside step turning operation

In this operation brake drum is held with special types of c-clamp and brake drum is seated in the spigot but no clamp or screw rods are used. Fig.2.1.2 shows the arrangement of third operation with help c-clamp. After fixing of brake drum in c-clamp, inside step turning will be carried out. But this operation is not for all brake drum but only for mentioned one.

2.1.3 Drilling operation:



Fig.2.1.3 Drilling operation

Drilling operation is 4th operation, carried with help of radial drilling machine to drill ten hole of equal diameter. Drilling operation is carried with help of jig which guide the drill tool in order to drill ten holes. After drilling, reaming operation is carried to size the drilled hole. Fig.2.1.3 shows the drilling operation with help of jig. Drilling carried on at top face of drum which already machined in first operation. After completion of drilling operation, next operation is finishing operation that is final operation with help of lathe of fixture.

2.1.4 Finishing Operation:



Fig.2.1.4 Finishing operation setup and lathe fixture

When changing brakes from machine to machine, to carry out these four machining operations, there is chance of some error in the brake drum. Main problem is out of round or non-concentric. So in finishing operation some final touch has to be given in order to achieve fine finish as well as concentricity. Here concentricity means brake drum bore diameter that is 'd' (pilot-

diameter) and brake surface diameter that is 'D' must be concentricity, means center axis of both diameter should lies in same line. So for that purpose, one type lathe fixture is used to achieve the concentricity between bore diameter (pilot diameter) and brake surface diameter. It mainly consists, buttons, locater and threaded holes as shown in fig.2.1.4. In this operation first lathe fixture is bolted to face plate of lathe firmly. After tightening of fixture, brake drum is placed in the locater and tighten with help of allen bolt and brake drum is seated on the buttons of lathe fixture so one thing we have to under stood that buttons plays major role in this fixture. Because they not only allow the brake drum to seat but also helps to machine the brake drum bore(pilot diameter) by providing some gap to move the lathe tool freely in order to machine. So it is easy to achieve concentricity in a simple way by machining the brake drum surface as well as brake drum bore (pilot diameter) in a single setup.

3. PROBLEM DEFINITIONS



Fig.3.1 Lathe fixture and brake drum

As we know that current shown in fig.3.1 which is used in final finishing operation is not suitable for the brake drum having slot on the top face. Because here brake drum is seated on fixture ring instead of button so there is no gap maintained and without sufficient gap, not easy to machine the brake drum bore. Also old fixture is complicate in design and there is more work in fitting the button to fixture ring. Buttons required equal in height and need hardening and totally more fabrication work. Other drawback is loosening of buttons sometimes while handling because buttons are screwed and heavy in weight.

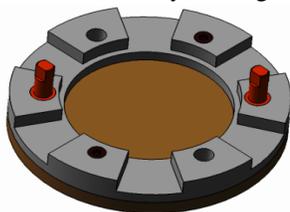


Fig.3.2 Ideal lathe fixture

After studying the problems of old lathe fixture, we feel that buttons are the main drawback and it should be modified. So we took this challenge to design a new fixture in order to overcome all problem of old fixture. Fig.3.2 shows the ideal modified lathe fixture and the fixture provided with pads instead of buttons and it can be suitable for brake drum(cargo) having slot on the top face and this fixture provides sufficient gap so that tool can be

freely moved inside the brake drum bore and fixture is an in simple design.

4. DESIGN AND FABRICATION OF LATHE FIXTURE

4.1. Design of lathe fixture plate ring:

Material: mild steel & Standard: ISO 9001

Fig. 4.1 shows the design detail of fixture plate having outer diameter 269mm and inner diameter 163mm which matches to spigot of outer diameter 163mm And thickness 30 mm as per analysis. Pad having 15 mm thickness which allows the drum to seat on it. Two number of M16 tap for allen bolt which helps to bolt the fixture to face plate and two number of M18 tap for bolting the locater and two number of drill hole of diameter 12.5 mm are give in which helps the fixture to bolt the face plate. Here brake drum top face is seated on the pad provided on ring. This ring eliminate the buttons and provide comfortable gap in order to machine the brake drum bore(pilot bore) which helps to maintains concentricity of brake drum bore diameter as well as brake drum surface diameter.

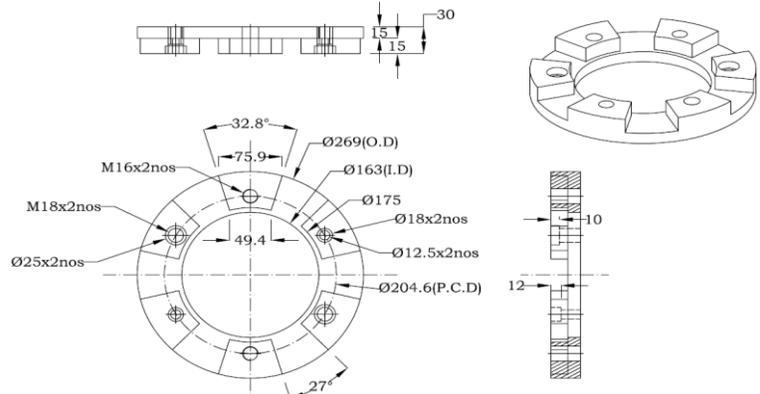


Fig.4.1 Lathe fixture ring design

4.2. Design of fixture locater:

Material for allen bolt: Mild steel (harden and tempered)

Standard: ISO 9001

The main purpose of the locater is to hold brake drum properly before bolting brake drum to lathe fixture. After proper placing in the locater, brake drum next is tighten with help of M16 allen bolt which is made up of mild steel. Detailed design as shown in the fig. 4.2

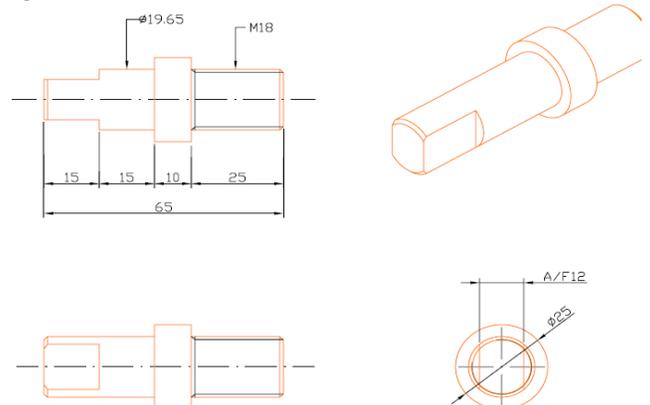


Fig.4.2 Locater pin design.

5. FABRICATION OF LATHE FIXTURE

5.1 Process planning of lathe fixture ring:



Fig.5.1 Lathe fixture plate ring

5.1.1. Cutting operation:

In cutting operation raw material is cut into required diameter and thickness. In this operation 32mm size mild steel plate is cut into outer diameter of 272mm and internal diameter cut into 158mm by using CNC cutting machining.

5.1.2. End milling operation:

An end mill is a type of milling cutter, a cutting tool used in industrial milling applications. It is distinguished from the drill bit in its application, geometry, and manufacture. While a drill bit can only cut in the axial direction, a milling bit can generally cut in all directions, though some cannot cut axially. End mills are used in milling applications such as profile milling, tracer milling, face milling, and plunging. In end milling operation, the plate machined to thickness 30mm, outer diameter 269mm and inner diameter 163mm as per the design. Slot is provided at equal place and depth of pad is 15mm.

5.1.3. Drilling and reaming operation:

Drilling is a process of producing round holes in a solid material or enlarging existing holes with the use of multi tooth cutting tools called drills or drill bits. Various cutting tools are available for drilling, but the most common is the twist drill. Drilling operation is carried out at six places on the fixture ring pad. Here hole size of 15.5mm diameter is drill at two place on the pad for locater pins and hole size of 14mm diameter is drill at two place for allen bolt and hole size of 12.5 mm diameter is drilled at two place for allen bolt of 14M size.

5.1.4. Counter boring operation:

A counter bore is a cylindrical flat-bottomed hole that enlarges another coaxial hole, or the tool used to create that feature. A counter bore hole is typically used when a fastener, such as a socket head cap screw, allen bolt are required to sit with or below the level of a work piece's surface. Here counter boring is done to lathe fixture ring at four places on the pad. Two for allen bolt of M14 and other two locater step of size diameter 25mm and thickness 10mm.

5.1.5. Tapping operation:

Taps are cutting tools used to create screw threads, which is called threading. A tap is used to cut the female portion of the mating pair (e.g., a nut). A die is used to cut the male portion of the mating pair (e.g., a bolt). The process of cutting threads using a tap is called tapping. Here M18 tapping used for locater at two place on drilled pad of diameter 15.5mm and M16 tapping used to allen bolt at two place on the drilled pad of size 14mm diameter.

5.2 Process planning of lathe fixture locater:



Fig.5.2 Locater pin

5.2.1. Turning operation:

Turning is a machining process to produce parts round in shape by a single point tool on lathes. The tool is fed either linearly in the direction parallel or perpendicular to the axis of rotation of the work piece, or along a specified path to produce complex rotational shapes. The primary motion of cutting in turning is the rotation of the work piece, and the secondary motion of cutting is the feed motion. Here locater is turned to diameter of 19.65mm and step is turned 25mm.

5.2.2. Threading operation:

Different possibilities are available to produce a thread on a lathe. Threads are cut using lathes by advancing the cutting tool at a feed exactly equal to the thread pitch. The single-point cutting tool cuts in a helical band, which is actually a thread. Fig.5.2 shows the threading operation carried on locater of pitch 2.5mm (M18).

5.2.3. End milling operation:

In end milling operation, locater of head machined to get 12mm size as shown fig. 5.2.

5.2.4. Hardening:

In hardening treatment, locater pin is heated to a temperature of 800 to 850°C and then oil quenched. Hardening increases the hardness and strength of the locater, but makes it less ductile and more brittle. To remove some of the brittleness, it should be tempered after hardening.

5.2.5. Tempering:

In tempering locater pin is heated to a temperature of to 550°C, holding it at that temperature for the required length of time and then cooling it, usually in still air.

5.2.6. Grinding operation:

Grinding is an abrasive machining process in which a rotating abrasive removes metal from the work piece. Grinding is a process for machining material which is too hard for other machining process. Material such as die steel and harder steel are generally machining by grinding. Here cylindrical grinding used for locater after hardening and tempering.

6. CONCLUSIONS

The purpose of both fixture is to hold the brake drum in such way that these should facilitate machining of brake drum bore as well as brake surface diameter in a single set up in lathe. So these fixtures are used in final machining operation in order to achieve the concentricity. The old fixture mainly consist buttons, locater and threaded holes and here brake drum is seated in the buttons. But current fixtures have some drawback and are not suitable for the brake drum having slot on the top face. Because here brake drum is seated on fixture ring instead of button and fixture is complicate in design and there is more work in fitting the button to fixture ring and complicate design. Other drawback is loosening of buttons sometimes while handling because buttons are screw to fixture ring and heavy in weight. In new modified lathe fixture, pads are provided instead of buttons and it could be suitable for brake drum having slot on the top face and other drum also. By trail run this lathe fixture is more comfortable than old fixture. So this fixture can be used in brake drum manufacturing companies because of its simple design and less cost.

7. FUTURE SCOPE



Fig.7.1 modified and old lathe fixture

By the successful trail run new lathe fixture is more comfortable than old fixture. So this fixture can be used in brake drum (cargo) manufacturing companies because of its simple design and less cost. The fixture can be improved further for better work and mainly that length of the locater pin and thickness of pads can be reduced for better design. In this design the length of the locater has extended 30mm from ring surface after tightening but thickness of the drum is (back plate thickness) 12mm. So extended locater length from fixture ring surface can be reduced to around 15mm for better design and also as the length increases it is difficult to match or fit the brake drum hole. So locater pin correctly fit to the hole of drum and there should not be any play. Also pad thickness can reduced further, for better balancing.

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Predict Optimal Transmission Power by Comparing Three Fading Channel (Rayleigh, Rician & Shadowing) using random strategy

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Abstract- In wireless sensor network, where nodes are power driven by batteries and it is important to prolong the network lifetime by minimize the energy consumption of each node. Thus the choice of optimal transmission power is one of the prime concerns in such network. Optimal transmission power is the minimum power required to sustain the network connectivity while maintain the predetermined maximum tolerable bit error rate (BER). In this paper, optimal transmission power is derived for a WSN deployed based on random topology. In this paper the effect of three fading channel (Rayleigh, rician & shadowing) on optimal transmission power; route BER and energy consumption for successful delivery of data in multihop is studied for such randomly deployment in wireless sensor network. In random network, an intermediate node in the route selects the nearest node with in a sector of angle (Θ) towards the direction of the destination of the next hop. The effect of search angle (Θ) on optimal transmission power, route BER performance & energy consumption in case of the here fading channel are also indicated.

Index Terms- Wireless sensor network; optimal transmission power; search angle; random topology.

I. INTRODUCTION

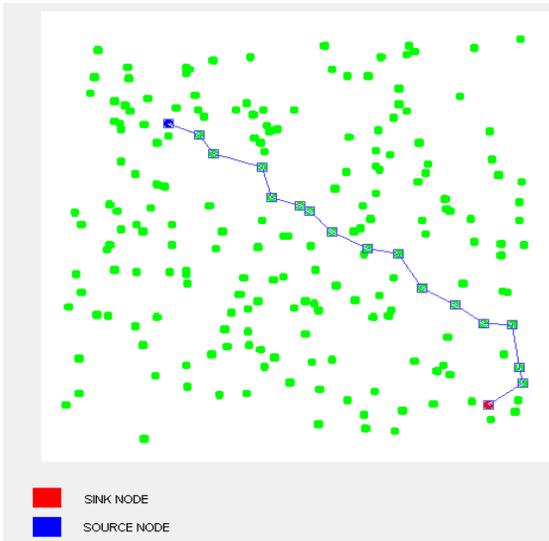
Recent developments in wireless communication technologies such as Bluetooth and Zigbee have led to great interest in wireless sensor network (WSN) sensor nodes are constructed only by using sensor devices with wireless communication facilities at physical layer. Energy conservation is one of the most important issues in WSN, where nodes are likely to rely on limited battery power. If transmission power is not sufficient high then may be single or multiple link failure. Further transmitting at high power reduces the battery life and introduces excessive internode interference. Most of the work on performance of WSN assumes idealized radio propagation model & regular topology without considering impact of fading & shadowing at physical layer. In [1] Arnab Nandi, Sumit Kundu derived optimal transmission power for a wireless sensor network where MRC space diversity is employed at destination nodes in presence of Rayleigh fading while maintain a certain predefined maximum tolerable route BER. In [2] optimal transmission power for a modified square grid architecture of WSN incorporating MRC based space diversity power is investigated in presence of lognormal shadowing. In [3] Sumit Kundu, Arnab Nandi evaluate energy level performance of three

packets delivery scheme in a wireless sensor network in multipath rician fading channel. In [4] proposed an adaptive power scheme for WSN where transmit power is adapted as node density and level of shadowing become different so as to maintain the detection probability at a given level as demanded by sensing range. In [5] investigate the optimal common transmit power in a random WSN over Rayleigh fading channel. They also evaluate the energy consumption for successful delivery of a file via multihop route in such fading scenario considering an infinite ARQ scheme between a pair of nodes. In this paper, we investigate the optimal transmission power in a random WSN by comparing fading channels i.e. Rayleigh, rician & shadowing fading channel. We also evaluate energy consumption for successful delivery of a file via multihop route in such fading scenario Optimal transmission power & energy consumption is evaluated under several condition of network such as node density, data rate & search angle (Θ).

The rest of the paper is organised as follows: in section II, we delineate the system model. Section III shows result and discussion .finally conclusions are drawn in section IV.

II. SYSYTEM MODEL

We consider a random topology of network as shown in fig 1. It assumed that N no. of nodes are distributed over a region of area 'A' obeying random topology. The node spatial density is defined as number of nodes per unit area i.e. $\rho^2 = \frac{N}{A}$ position of nodes in the network are independent & uniformly distributed. It is assumed that all sensor nodes are stationary in present study.



We consider a routing scheme where each intermediate node in a multihop route relays the packet to its nearest neighbours in the direction of the destination. In particular, we assume that an intermediate node in the route select the nearest node with in a sector of angle ‘ Θ ’ towards direction of the destination as next hop[5]

Here we consider a simple reservation based MAC protocol called Reserve – and-go (RESGO) following [7]. According to this protocol, a source node first reserve intermediate nodes on a route for relaying its packets to the sink. A transmission is activating only after a route is discovered and reserved. If destination node is busy, it waits for an exponential random back off time before or relay each packet. When the random back off time expires then the node starts dispatch a packet. Note that the random back off time helps to reduce interference among nodes in the same route and also among nodes in different routes right through this paper, we assume that the random back off time is exponential with mean $1/\lambda_1$, where λ_1 is packet transmission rate.

The major perturbation in wireless transmission are large scale fading and small scale fading[6].The fading represent the average signal power attenuation or path loss due to motion over large area is large scale fading. This observation is affected by jutting out terrain contains mounds (hills), forest, large outdoor boards, clumps of building, etc. between the source & sink. In case of small scale fading it display rapid changes in signal amplitude & phase as a result of small changes in the spatial separation between a sink & source. The rate of change of these proliferate condition accounts for fading rapidly. Rayleigh fading is also called small scale fading because if the multiple reflective paths are large in number and there is no line of sight signal constituents, the envelop of the received signal is statically described by Rayleigh PDF given below [5]

$$p(r) = \begin{cases} r/6^2 \exp[-r^2/26^2] & \text{For } r \geq 0 \\ \text{null} & \text{else} \end{cases} \quad (1)$$

If there is a dominant non-fading signal constituent, the small scale fading shroud is described by a rician PDF given below [7]

$$p(r) = \begin{cases} r/6^2 \exp\left[-\frac{r^2+s^2}{26^2}\right] I_0\left(\frac{rs}{6^2}\right) & \text{For } r \geq 0 \\ \text{null} & \text{else} \end{cases} \quad (2)$$

Here r is the envelope amplitude of the received signal and 26^2 is the pre detection Mean power of the multipath signal.

Large scale propagation model (or shadowing) re used to predict the mean signal strength decay as a function of the transmitter-receiver (T-R) separation distance raised to some power. In the presence of shadowing with a T-R partition of d , the path loss $PL(d)$ at a fastidious location is random & distributed log normally about the mean distance dependent value of $\overline{PL(d)}$. The received signal can be expressed as below [2]

$$P_{sw}(d)|_{dBm} = G_t|_{dB} + G_r|_{dB} + P_{Tx}|_{dBm} - \left(\overline{PL(d)}\right)|_{dB} + X_\sigma \quad (3)$$

III. SIMULATION MODEL

We now present our simulation model developed in MATLAB to evaluate the performance WSN based on a random topology in Rayleigh, rician & shadowing fading channel:

- Digital data 1 and 0 with equal probability is generated at base band. Our transmitted signal is +1 or -1 corresponding to data 1 and 0.
- Fading channel coefficients are generated following Rayleigh distribution ,rician distribution as in equation (1) & (2)
- Next, a number of interfering nodes with in the circle of radius $2W$ centred at the receiver are generated according to a two dimension passion distribution with mean $\alpha 6^2$
- Operative (active) interfering nodes are identified using binomial distribution random variable for node activity.
- Interference from such operative interfering nodes is generated assuming interference undergoes similar kind of fading as the desired signal.
- The desired message signal is affected by multipath fading, thermal noise and interference from other nodes or another node. The s/g received by the receiving antenna in destination nodes is generated following equation.

$$Y_i = h_i S_{rcv} + \sum_{j=1}^{N-2} S_j + n_{thermal} \quad (4)$$

- The received signal Y as given in equation (4) is then detected considering the threshold level at 0. If the received signal is greater than the threshold level 0 then it is detected as 1 otherwise it is detected as 0.
- Each received bit is then compared with the transmitted bits. If there is mismatch an error counter is incremented now dividing the error count by the total number of transmitted bits, link BER is obtained in case of three fading channel.

- Transmit power is increased gradually in step starting from a very low power till desired BER_{th} is satisfied. The transmit power satisfying desired BER_{th} is optimal common transmit power. Thus optimal transmit power for various bit rate and node spatial density is obtained in case of three Rayleigh ,rician & shadowing fading channel.
- The energy consumption in random network in case of Rayleigh, rician and shadowing fading channel is evaluated using equation

$$E_{total} = \sum_{i=1}^{n_{rmdm}} E_{hopi} \tag{5}$$

IV. RESULTS AND DISCUSSION

Table shows the important network parameter used in simulation study.

TABLE 1:
Network parameter used in simulation

Parameter	values
Path loss exponent(α)	2
No of nodes in network	1000
Node spatial density(P_{sq})	$1 * 10^{-3} - 9 * 10^{-3}$
Carrier frequency(f_c)	2.4Ghz
Packet arrival rate at each node(λ)	1 pck/s
Noise figure(F)	6dB
Room temperature(T_0)	300k
Search angle	$\pi/2, \pi/4$
Transmission power(P_T)	1mW

Fig 3 shows route BER as function of node spatial density. It is observed that BER performance improves with increases the node spatial density. However it is seen that beyond a certain node density the BER does not change with further increase in node spatial density and a floor in BER route, as denoted as BER_{floor} appear. It is seen that BER_{route} performance improves as bit rate decreases. This is due to the increases in vulnerable interval with decreases in bit rate.as a result transmission probability of the interfering node increases. Further BER_{route} performance improves with increase in search angle (θ).This is due to fact that for high value of search angle (θ) the hop length is likely to be short.

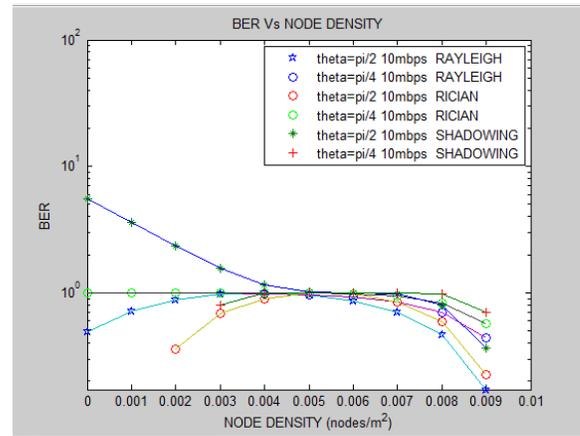


Fig 3: Route BER vs node spatial density; $P_T=1mW$

As shown in fig, there is a comparison of three fading channel i.e. Rayleigh fading channel, rician fading channel & shadowing fading channel. When the search angle is $\pi/2$ BER_{route} performance is degrade as when search angle is $\pi/4$ BER route performance is improve. Fig. shows that in case of rician fading channel. Bit error rate is less as compared to Rayleigh & rician fading channel with search angle $\pi/4$. In case of shadowing it has a more bit error rate with search angle $\pi/4$.

In fig 2,we compare the optimal common transmit power in a random work a function of bit rate in Rayleigh fading channel, rician fading channel & shadowing fading channel. Optimal transmit power is the minimum transmit power sufficiently to preserve network connectivity while satisfy a predetermined BER value at end of multiple route. It is seen that optimal transmit power increases as data rate increases. It is mainly because of high thermal noise introduced due to high bit rate.

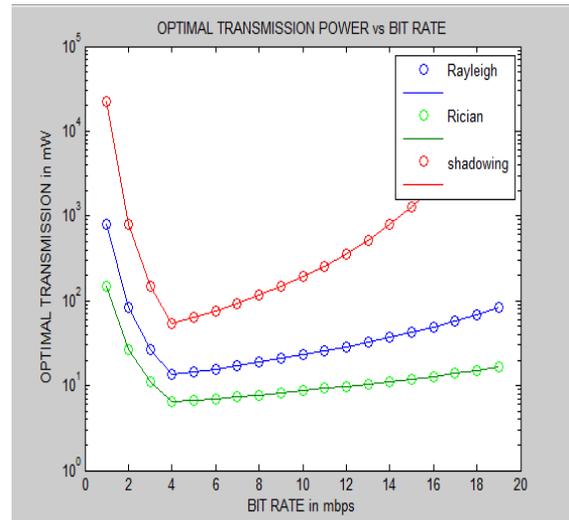


Fig 4: Optimal transmit power as function of bit rate

The critical bit rate occurs at the point when the BER_{floor} for particular data rate become high than desired BER. Further it is seen that critical bit rate increases in presence of fading.in this fig critical bit rate is 1Mbps in presence of fading. Critical bit rate decreases with increases in search angle ($\pi/2$).rician fading channel in case of this perform better than Rayleigh fading &

shadowing fading. Shadowing fading channel has more optimal transmit power than Rayleigh fading channel.

In fig 5, the graph is drawn between the energy and bit rate. In this graph show that energy requires to successful deliver a file, it is seen that energy requirement increases in presence of fading.

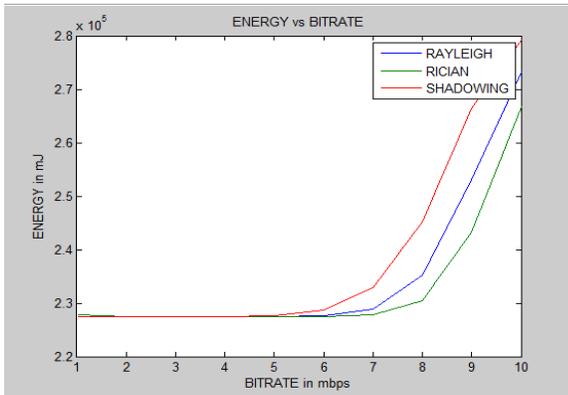


Fig 5: Energy consumption vs. bit rate to transfer a file

Further energy spent in successful delivery of file increases with increases in search angle (Θ). In case of shadow fading channel, depend on characteristics, it take more energy for successful delivery of files as compare to Rayleigh fading channel & rician fading channel.

V. CONCLUSION

In present work optimal common transmit power in presence of Rayleigh fading channel, rician fading channel & shadowing fading channel for a WSN following a random topology is evaluated. Energy consumption for successful delivery of file is also evaluated in such scenario. It is observed that optimal transmit power required to maintain network connectivity satisfy a given maximum acceptable BER threshold value in shadow fading channel is more as compared to rician & Rayleigh fading channel. Further it is seen that optimal transmission power increases with increase data rate .critical bit rate increases in presence of fading. It is seen that the route BER in case of rician fading channel is less as compared to Rayleigh fading channel & shadowing fading channel. Further shadowing fading channel required more energy for successful delivery of file. The study helps in designing energy efficient randomly deployed WSN.

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Performance Evaluation of Zigbee and Wimax

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Abstract- The world of wireless communications is quickly progressing. Technologies under research and development promise to deliver more services to more users in less time. Emerging wireless technologies: Wireless Local Area Networks (WiFi-802.11n), Wireless Personal Area Networks (ZigBee) and Wireless Metropolitan Area Networks (WiMAX).. In this paper physical layer parameters are tuned to study the characteristics of ZigBee and WiMAX technologies independently and proposes a study and comparison of two of most advancing communication technologies (Zigbee and WiMax). Both of these technologies are breakthrough in communication and both of them have their own positive and negative points. In some situations, in a near future highly advanced and area specific application of WSN will be required. We will analyze these two technologies, which would be appropriate for those applications & analyse weather, location and terrain conditions are capable for the communication through such networks.

Index Terms- Wireless sensor network (WSN), ZigBee, WiMAX, QOS

I. INTRODUCTION

The emerging IEEE 802.15.4 (ZigBee) standard aims to provide low data rate wireless communications with high-precision ranging and localization, for a low-power and low cost solution. WiMAX (Worldwide Interoperability for Microwave Access) is a standard for wireless data transmission covering a range similar to mobile phone towers. With high staging in both range and throughput, WiMAX technology can be a gain to present internet providers seeking to become the leader of next generation wireless internet access. IEEE 802.15.4, ZigBee's name is derived from the bees whirl, that permits them to exchange data, is a low cost and low power consumption Wireless Personal Area Network (WPAN) standard, which can be used in many different wireless sensor network applications such as home/building automation, consumer electronics, industrial controls, medical sensor applications, etc. The IEEE 802.16, the Air Interface for Fixed Broadband Wireless Access Systems, also known as the IEEE Wireless MAN air interface, is an appearing set of standards for fixed, portable and mobile BWA in MAN. These standards are provided by IEEE 802.16 that initially describes the wireless local loop (WLL) technologies in the 10.66 GHz spectrum, which were further enlarged through altered projects to include both licensed and unlicensed spectra from 2 to 11 GHz ^[7].

II. RELATED WORK

In [1] energy consumption optimization in ZIGBEE (IEEE 802.15.4 standard) is done by an algorithm and mathematical formulation. Various parameters of physical layer are tuned depending on various applications. The equation is formulated in which parameters like BER (Bit error rate), SNR (Signal to noise ratio), number of payloads and distance between nodes are optimized. The author focused on physical layer and proposes a model using MATLAB that automatically optimize transmission power, throughput and latency. Various simulations are done to find energy consumption to increase battery lifetime. The results show that the energy consumption depends upon bit rate, payload size and distance.

In [2] author evaluated essential QOS (quality of service) parameters of WIMAX. The parameters are delay, PLR (packet loss ratio), PDR (packet delivery ratio), throughput and jitter. This is found that with increase in number of nodes the optimum value of QOS parameters can be obtained. For QOS there must be guaranteed throughput and less delay, jitter and packet loss.. By using AODV protocol high average value of throughput and packet delivery is obtained. In general QOS is dependent upon type of application and usage. The advantages of WIMAX over LAN are as high data rates, low deployment cost, ease of usage and coverage of large area.

In [3] author measures QOS (quality of service) parameters of ZIGBEE using different protocols OLSR INRIA, OLSRv2 NAGATA, ZRP, AODV and DYMO with star topology and CBR application. QOS parameters studied are end to end delay, throughput, jitter and data packet delivery ratio. In results it is found that highest throughput is of AODV and also receives 25 packets but on overall basis OLSR INRIA protocol is best for CBR application. OLSR INRIA is best in overall performance and also gives less jitter and average end to end delay comparing to other protocols.

III. PHYSICAL LAYER ENERGY CONSUMPTION

Energy per bit is defined as average energy consumption to transmit single bit. It is directly proportional to signal to noise ratio, distance and antenna gain and inversely proportional to bit error rate, range and payloads. This is calculated by varying these parameters using the equation:

$$Eb = \frac{1}{(1-pb)^{L+a}} [SNR(ud^2 - 1)] \frac{L+a}{RL} \quad (1)$$

E_b = Average energy consumption per bit.

y= PN*FN

$$u = \sqrt{\frac{4\pi}{\lambda G_T G_R}} \cdot (1 + \eta)$$

η = The transmit amplifier efficiency
 L = Payload size
 a = Header size
 R = Data rate
 $G_{T,R}$ = Transmit/receive antenna gain
 d = Transmitting distance
 PN = Noise power
 SNR = Signal-noise power ratio at the receiver
 FN = Noise figure
 Pb = The bit error rate and is related to SNR
 R and a are constants and taken from datasheets of ZigBee and WiMAX, 250kbps and 70Mbps are taken respectively. E_b , now can be computed for particular SNR range.

IV. QUALITY OF SERVICE

Quality of service is overall network performance. It does not refer to single parameter. Quality of Service is an essential parameter to judge performance of any Network [5]. In our work two parameters are taken they are: Throughput and End-to-End delay. Same parameters are taken for both technologies for proper comparison. The word Quality is always termed as the degree to which a set of inherent characteristics fulfils a particular requirement. The term Quality of service refers to the probability of the communication network meeting a given traffic contract. In the field of networking it could be termed as the probability of a packet successfully passing between two points in the network. QOS is the potential of network element to have some level of assurance that its traffic and service requirements would be satisfied.

A. Throughput

Throughput is number of bits passed through a network in a second. It computes how rapidly data can pass through a body. The throughput of a node is sustained by enumerating the total number of data packets successfully delivered at the node and also enumerating the number of bits received, which is divided by the total simulation time [2]. The throughput of the network is defined as the average of the throughput of all nodes involved in data transmission.

$$T_{nn} = \frac{\Sigma T_n}{N_n} \quad (2)$$

T_{nn} = Network Throughput

ΣT_n = Sum of Throughput of Nodes Involved in Data Transmission

N_n = Number of Nodes

B. End-to-End delay End-to-End delay indicates the length of time taken for a packet to travel from the CBR (Constant Bit Rate) source to the destination. It represents the average data detained, an application encounters during transmission of data. The end-to-end delay is the time acquired for data bytes to reach the end node. The delay for a packet is the time taken by packet to reach the terminal. And the average delay is obtained by considering the average of delays for each data packet transmitted [2]. The parameter is

enumerated only if the data transmission has been done successfully.

$$A_D = \frac{\Sigma P_D}{N_r} \quad (3)$$

A_D = Average Delay

ΣP_D = Sum of all Packet Delays

N_r = Total Number of Received Packets.

V. SIMULATION RESULTS

Simulations were performed in MATLAB to find the optimal value of 802.15.4 and 802.16, Physical layer energy consumption and how it is affected by the Physical layer parameters such as BER, SNR, Noise power, payloads and distance between nodes. The energy consumption per bit E_b as shown in Eq. (1) is affected by the value of d. First simulation compares E_b at different distances (50,100,200,300 and 400) m and different values of SNR (0.8 to 5) dB at L=10 bytes, as shown in Fig. 1 and Fig.2. E_b Increases with decreasing SNR and increasing d at given L for both technologies, ZigBee consumes much less energy compared to WiMAX. The energy consumption per bit E_b as shown in Eq. (1) is also affected by the value of L. E_b decreases with decreasing L as shown in Fig. 3 and Fig. 4 with different L (50,100,150,200 and 250) bytes, distance d = 400m and different SNR. Also, for each value of L, E_b decreases with increasing SNR for both technologies. The energy consumption per bit E_b is also affected by the value of P_n . E_b Decreases with decreasing L as shown in Fig. 5 and Fig. 6 with different (10, 20, 30, 40 and 50) dB-m, distance d = 400m, L= 10 bytes and different SNR. Also, for each value of P_n , E_b decreases with increasing SNR for both technologies. For all simulations, ZigBee consumes much less energy compared to WiMAX. Next part is calculation of QOS parameters. Throughput and end-to-end delay are calculated for both technologies using Eq.(2) and Eq.(3). Throughput and end-to-end delay for both technologies have greater value in WiMAX and ZigBee. The graph is drawn between throughput and number of packets as shown in Fig. 7 and end-to-end delay versus number of packets shown in Fig. 8.

VI. CONCLUSION

In this paper, energy consumption using the 802.15.4 and 802.16 Physical layers at different environmental and interference noise levels is calculated. QOS is also calculated. The simulation results show how the energy consumption (E_b) versus the SNR values were affected by various communication parameters such as payload size, noise power and distance between transmitter and receiver. After delivering certain number of packets QOS parameter are calculated. Overall it is concluded that ZigBee is appropriate technology for sensor networks because main requirement of WSN is less power consumption, in such applications where energy consumption is not severe WiMAX can be implemented as it gives high throughput value as compared to ZigBee. In our future work, we will extend the simulation to include the effects of the MAC and network layers.

We are also exploring the possibility to tune some of these parameters automatically, in order to achieve a required QOS under given performance.

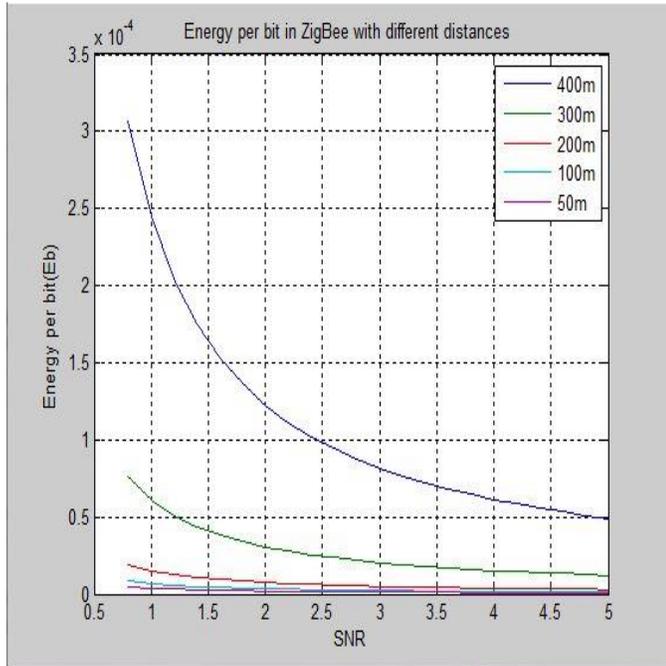


Figure 1: Energy Consumption per bit versus SNR at different distance for ZigBee

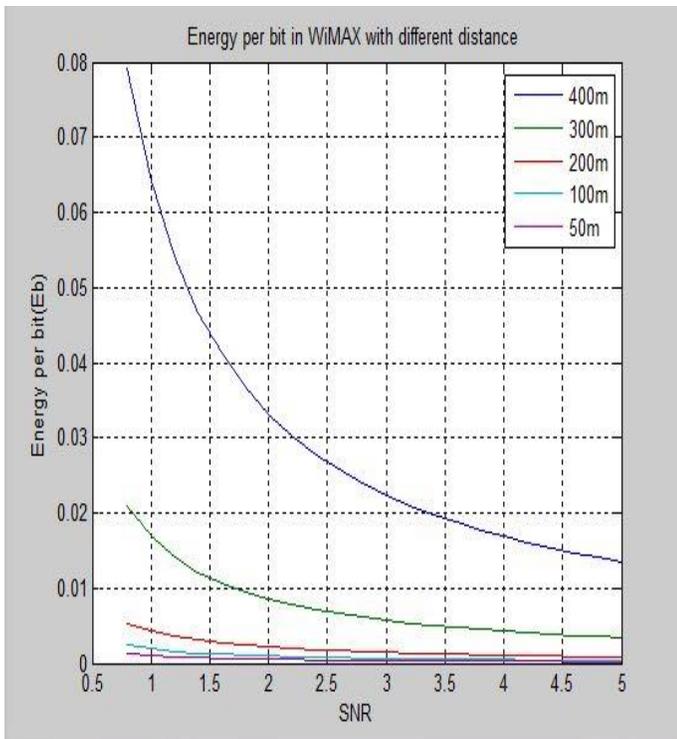


Figure 2: Energy Consumption per bit versus SNR at different distance for WiMAX

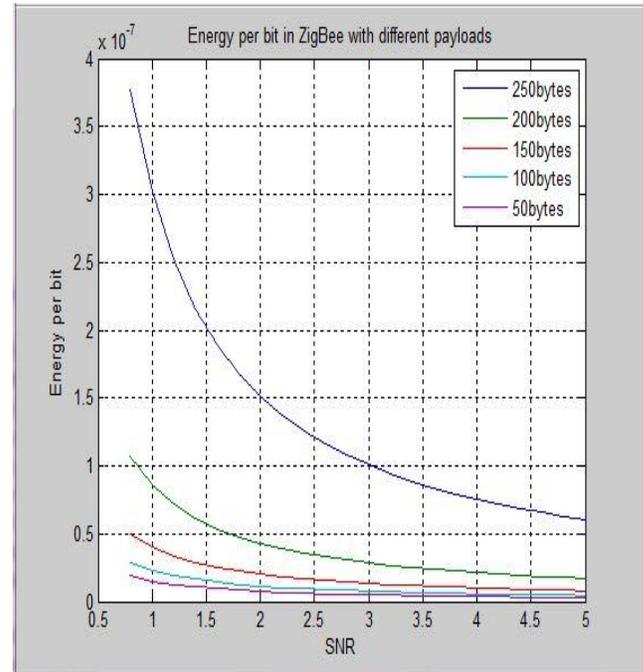


Figure 3: Energy Consumption per bit versus SNR at different payloads for ZigBee

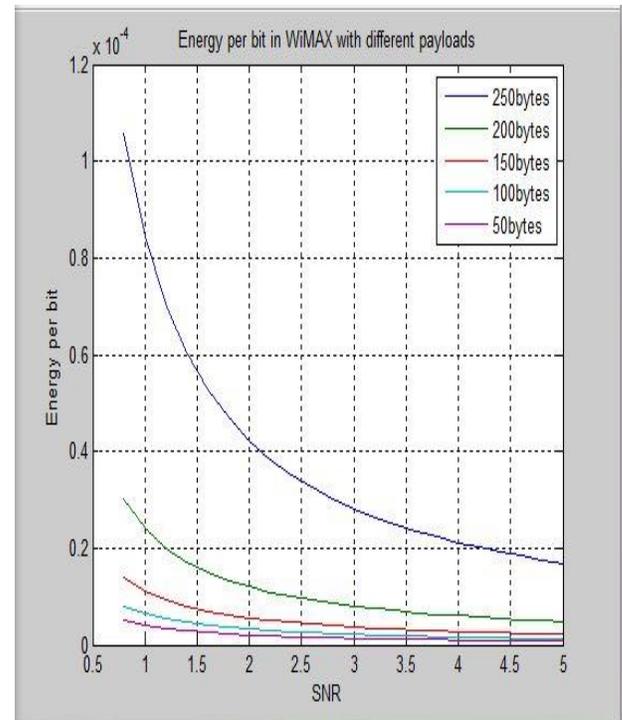


Figure 4: Energy Consumption per bit versus SNR at different payloads for WiMAX

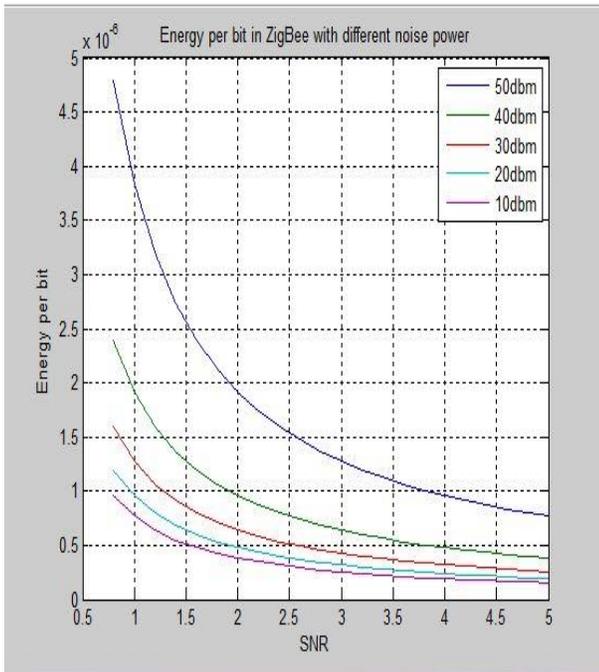


Figure 5: Energy Consumption per bit versus SNR at different noise power for ZigBee

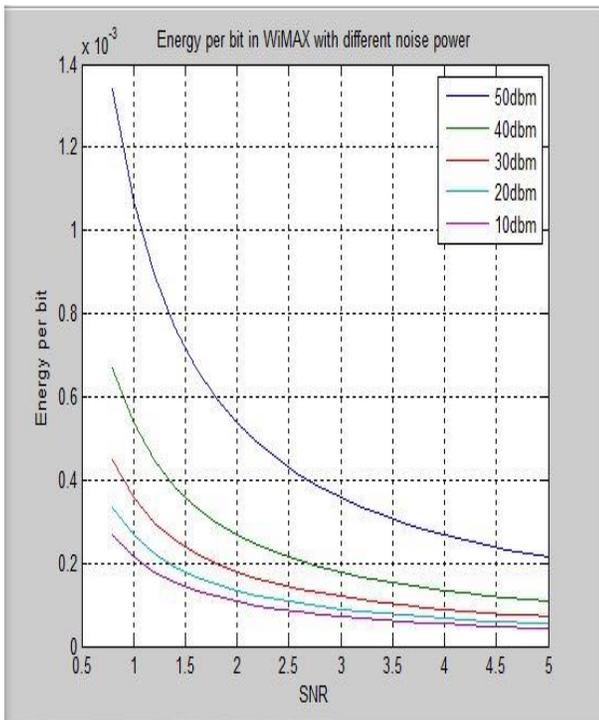


Figure 6: Energy Consumption per bit versus SNR at different payloads for WiMAX

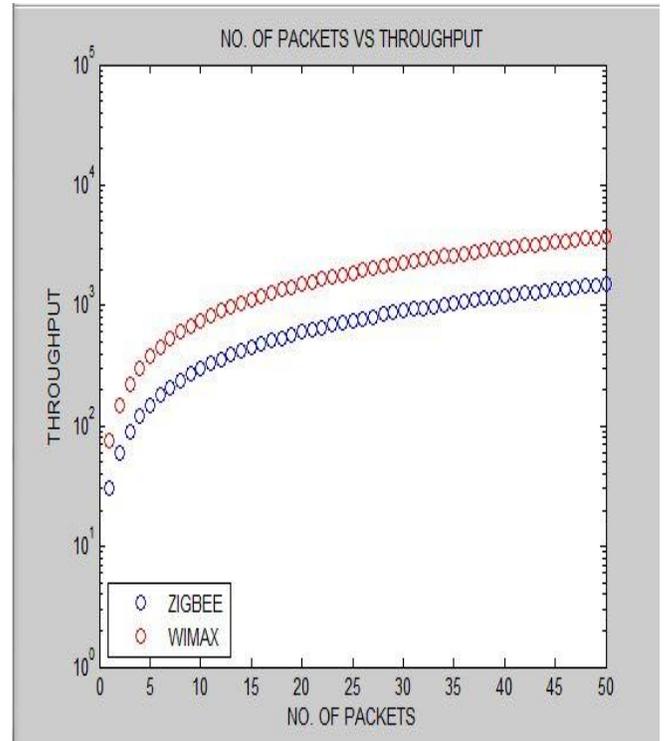


Figure 7: Comparison of throughput for ZigBee and WiMAX

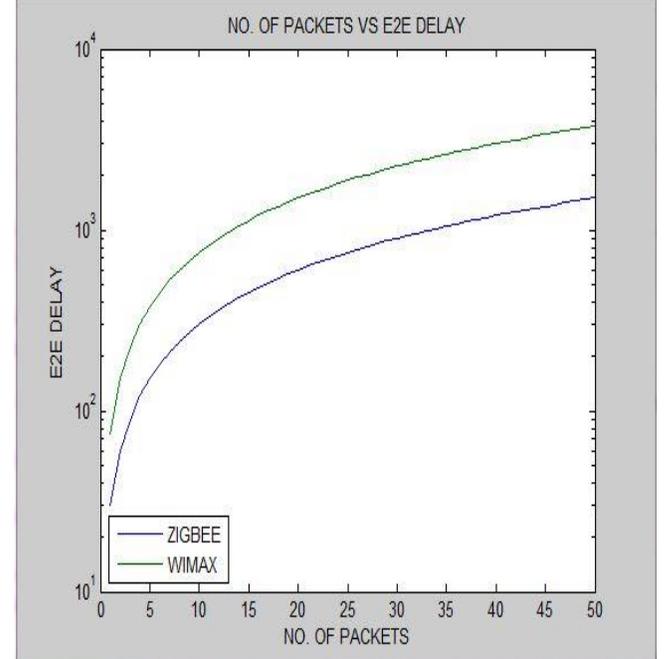


Figure 8: Comparison of End-to-End delay for ZigBee and WiMAX

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Comparative Study on Structural, Optical, Dielectric and Thermal Properties of Pure and L-Alanine Doped Bis-Thiourea Cadmium Acetate Crystal

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Abstract- Structural, optical, dielectric and thermal properties of pure and L-alanine (LA) doped bis-thiourea cadmium acetate (BTCA) crystals have been studied in present investigation. Pure and L-alanine (LA) doped bis-thiourea cadmium acetate (BTCA) crystals have been grown by slow evaporation technique. The crystal system of pure and doped BTCA crystal has been determined by single crystal XRD technique. The shifts in the vibrational frequencies of functional groups of doped BTCA crystal have been identified by FT-IR spectral analysis. The improved optical transparency and large transmission range of doped BTCA crystal has been assessed under UV-visible study. The enhanced optical band gap of LA doped BTCA is found to be 4.83 eV. The thermal stability of doped BTCA crystal was determined by means of thermogravimetric & differential thermal analysis. The dielectric characteristics of pure and doped BTCA crystals were investigated using dielectric studies. Significant enhancement in SHG efficiency was observed after doping LA in BTCA which is determined to be 4 times that of pure BTCA crystal.

Index Terms- Crystal growth, Nonlinear material, Optical properties, Electric properties, thermal properties

I. INTRODUCTION

Nonlinear thiourea metal complexes with high mechanical hardness, structural stability, high optical and nonlinear behavior are advantageous for applications in the fields of optical information-storing devices, second harmonic generation (SHG), nonlinear optical (NLO) and telecommunication systems [1]. A large family of thiourea metal complexes include zinc thiourea sulphate (ZTS), zinc thiourea chloride (ZTC), copper thiourea chloride (CTC), bis thiourea zinc acetate (BTZA), bis-thiourea cadmium acetate (BTCA), bis thiourea cadmium formate (BTCF), potassium thiourea chloride (PTC), potassium thiourea bromide (PTB) and potassium thiourea iodide (PTI) has been reported in literature [2-7]. BTCA is a potential semiorganic metal complex crystallizing with orthorhombic crystal system exhibiting potential optical mechanical and electrical properties

[5]. L-alanine is the natural amino acid with zwitterionic nature which induces potential electro-optic properties and thermo-mechanical stability. Studies on structural, optical and electrical properties of LA doped KDP crystal has been reported by Firdousi Akhter et. al. [8]. The influence of LA on SHG efficiency, optical, electrical and thermal properties of ZTC and ZTS crystal has been reported by our group in earlier investigations [9-10]. The growth and characterization studies of Zn²⁺ doped BTCA crystal have been reported by S. Selvakumar et. al. [11]. Recently, comparative studies on SHG efficiency, microhardness, HRXRD, optical and dielectric properties of 2mole% Mn(II), glycine & LA doped BTCA crystals have been explored by V. Ganesh et. al. [12]. Hitherto, no systematic comparative studies of pure and LA doped BTCA crystals are available in literature. The present manuscript is the first comparative investigation on growth, SHG efficiency, structural, optical, dielectric and thermal properties of pure and 1mole% LA doped BTCA crystal.

II. EXPERIMENTAL

Synthesis and growth

The AR grade thiourea and cadmium acetate were mixed in 2:1 molar ratio in deionised water to synthesis the pure crystalline BTCA salt. The supersaturation of pure BTCA was achieved at room temperature in deionised water. The calculated amount of 1mole% L-alanine was gradually introduced to the supersaturated solution of BTCA and allowed to stir at a constant speed for six hours to attain the homogeneity throughout the volume. The solution was filtered using number one whatman filter paper and kept for evaporation at room temperature in constant temperature bath of accuracy $\pm 0.01^{\circ}\text{C}$. The purity of the synthesized salt was achieved by successive recrystallisation. The pure CTA crystals were grown in 22 days while LA doped BTCA crystals were obtained within 16 days. The as grown pure and LA doped BTCA crystals are shown in Fig. 1a and 1b.

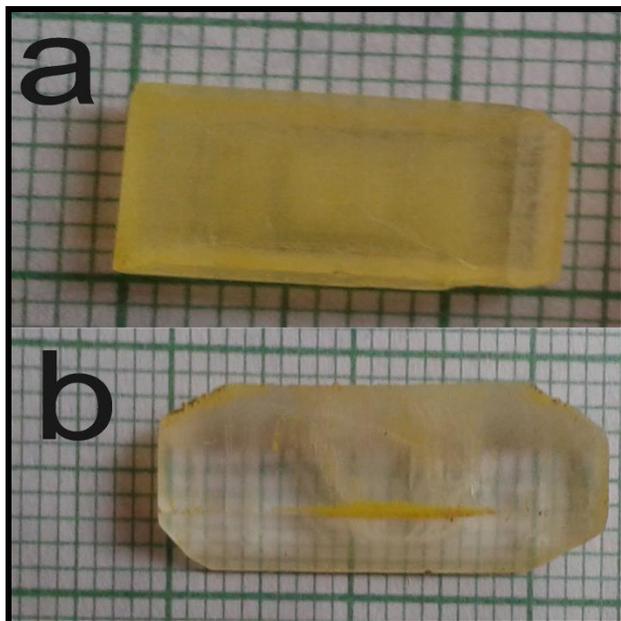


Figure 1: a) Pure BTCA, b) LA doped BTCA crystal

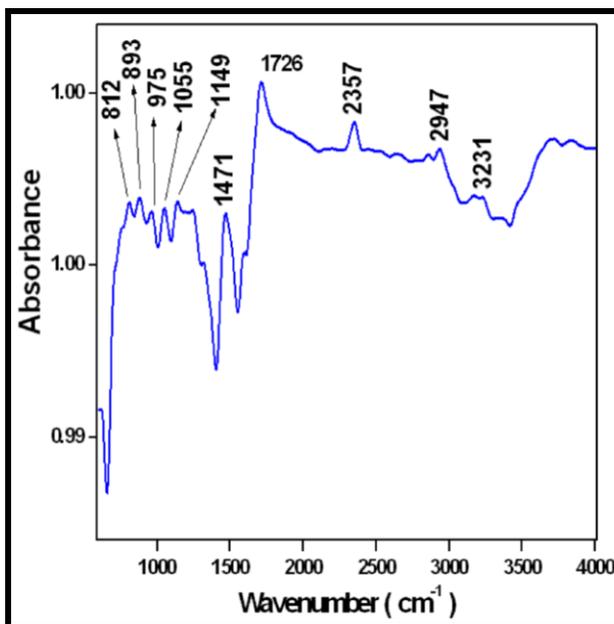


Figure 2: FT-IR spectrum of LA doped BTCA

III. RESULTS AND DISCUSSION

Single crystal XRD

The cell parameters of pure and LA doped BTCA crystals have been determined by single crystal XRD technique using Enraf Nonius CAD4 X-ray diffractometer. The XRD data confirmed the orthorhombic crystal system of pure BTCA. The determined cell parameters of pure and LA doped BTCA crystals are tabulated in table 1. Though doping of LA did not affect the orthorhombic crystal system of BTCA, but the resulted change in cell parameter clearly indicates the incorporation of LA in BTCA crystal.

Table 1: Single crystal XRD data

Samples	BTCA	LA doped BTCA
Cell parameters (Å ⁰)	a = 7.56 , b = 11.86 , c = 15.68	a = 5.76 , b = 6 , c = 12.3
Cell volume (Å ⁰) ³	1374	425
Crystal System	Orthorhombic	Orthorhombic

Fourier transform infrared (FT-IR) analysis

The FT-IR spectrum of LA doped BTCA crystal shown in Fig. 2 has been recorded using the Bruker Alpha-ATR spectrophotometer in the range 600-4000 cm⁻¹. The characteristic vibrational frequencies of BTCA are reported in literature by Shahil Kirupavathy et. al. [6]. The identified functional groups in LA doped BTCA crystal are systematically assigned with corresponding wavenumber, discussed in table 2. The prominent shifts in the vibrational frequencies of BTCA indicate the incorporation of LA in BTCA crystal.

Table 2: FT-IR assignments of pure and LA doped BTCA crystal

Wavenumber (cm ⁻¹)		Assignments
BTCA [6]	LA doped BTCA	
789	812	C=S stretching
	893	CH ₂ out of plane wagging
942	975	C-H stretching
1050	1055	C-N stretching
1110	1149	N-C-N stretching
1495	1471	COO ⁻ stretching
1667	1726	C=O stretching
2387	2357	C-C stretching
2932	2947	C-H stretching
3228	3231	NH ₂ stretching

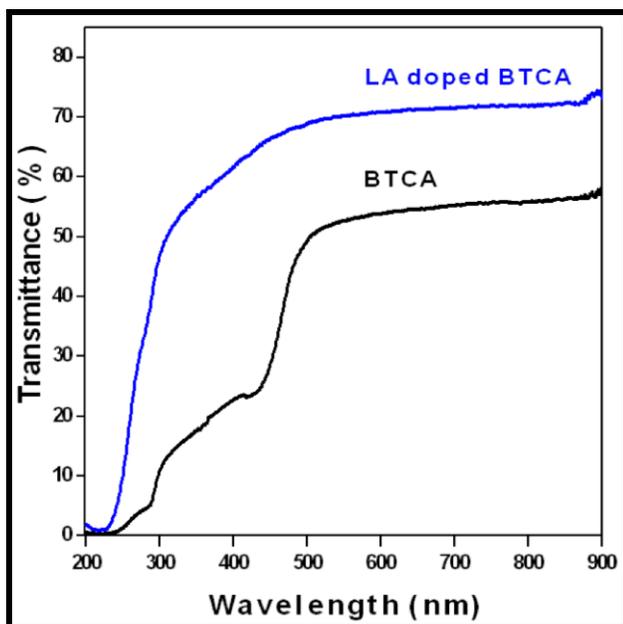


Figure 3: Transmittance spectrum

Figure 3: Transmittance spectrum

UV-visible studies

The UV-visible studies of pure and LA doped BTCA crystals of thickness 1 mm were investigated using Shimadzu UV-2450 spectrophotometer in the range of 200-900 nm. The recorded transmittance spectra shown in Fig. 3 revealed that LA doped BTCA crystal has greater apex of optical transparency (70%) without any absorbance impede, as compared to pure BTCA. The transmittance efficiency of LA doped BTCA crystal is much higher in lower visible range from 300 to 450 nm offering wide transmission range. The high and large transmission of doped BTCA is offered by the effective ($n \rightarrow \pi$) transitions and photoinduced effects observed in dopant LA [13]. The LA doped BTCA crystal with improved optical transparency suggest its exclusive suitability for SHG transmission devices and NLO applications [14]. The transitory nature of electron in presence of optical field serves the evidence for energy band gap obeying the relation given as $\alpha = A (h\nu - E_g)^{1/2}$, where absorption coefficient $\alpha = 2.303 \log (1/T)/d$, $h\nu$ is photon energy and E_g is energy band gap [15]. The energy band gap of pure and doped BTCA crystal was determined from the tauc extrapolation method depicted in Fig. 4. The band gap of doped BTCA is found to be 4.83 eV which is greater than pure BTCA. Thus LA doped BTCA with large optical band gap meets the demand of material imperative for UV tunable lasers [16].

SHG efficiency test

The powder SHG efficiency of pure and LA doped BTCA crystal has been determined using the Q switched Nd:YAG laser with operating wavelength of 1064 nm having pulse width of 8 ns and repetition rate of 10 Hz delivering the energy of 3 mJ pulse^{-1} . The crystals were finely powdered and tightly packed in a microcapillary tube of uniform bore. The prepared samples of pure and doped BTCA were illuminated by the gaussian filtered

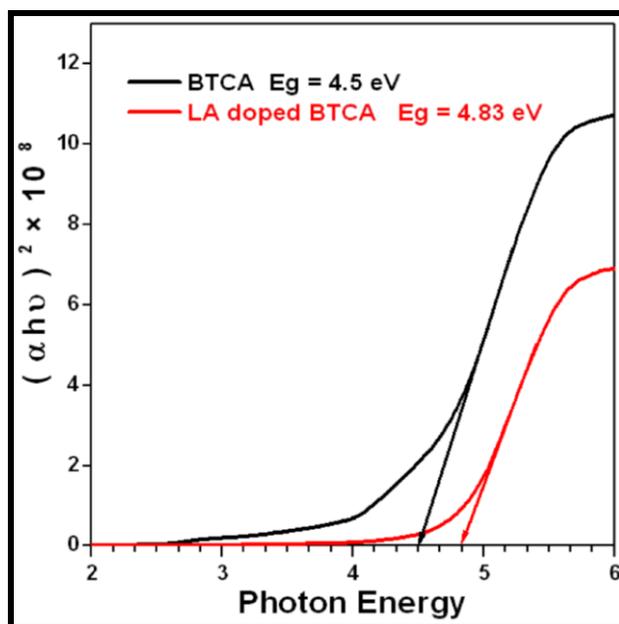


Figure 4: Tauc plot

beam of Nd:YAG laser. The emergence of bright green colour observed at the output of both the samples confirmed the effective SHG by grown crystals. The digital oscilloscope recorded the output voltage of 4 mV for pure BTCA and 16 mV for doped BTCA sample. The delocalization of pi electrons in presence of optical field and the photoinduced absorbance due to electron-phonon anharmonicities observed in dopant LA are the principle effects accountable for enhancing the second order susceptibility of doped BTCA crystal [13]. The SHG efficiency of LA doped BTCA is 4 times that of pure BTCA which substantiates its potential suitability for frequency doubler and optical parametric oscillator devices [17].

Thermal studies

The thermal behavior of doped BTCA crystal has been investigated using the TQA-500 thermal analyzer in the homogeneous nitrogen atmosphere with a constant heating rate of $20^\circ\text{C}/\text{min}$. The recorded TG-DTA curve of doped BTCA in the range of 30 to 400°C is shown in Fig. 5. The thermal studies of pure BTCA are already reported in literature [11]. The TGA curve of doped BTCA revealed the two stage decomposition of compound. The slight decomposition at 140°C might have occurred due to loss of water molecules in the crystal lattice. A major weight loss of doped BTCA occurs at 203°C which further decomposes completely at 240°C . The endothermic peak at 184°C resembles the melting point of doped BTCA which is substantially less than BTCA due to unstable nature of dopant LA at higher temperature [10]. The doped BTCA undergoes to melt state at 240°C which is also the final decomposition temperature of compound. The LA doped BTCA crystal shows significantly higher thermal decomposition temperature than several amino acid doped thiourea complex crystals [10, 16].

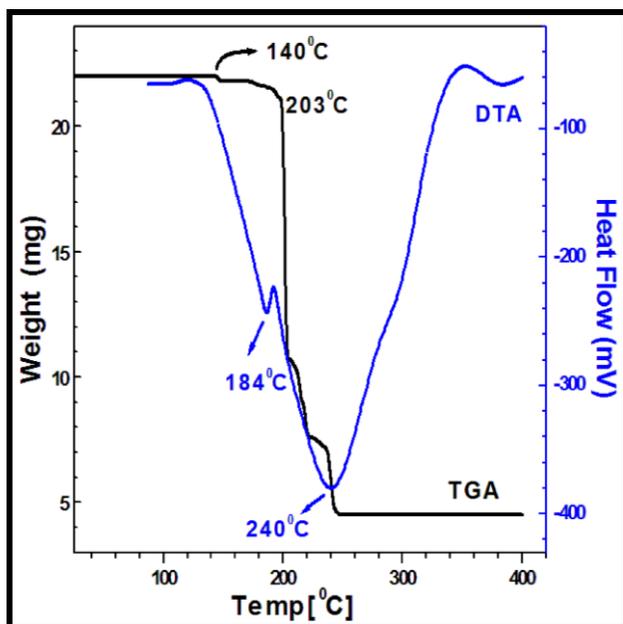


Figure 5: TG-DTA curve of LA doped BTCA

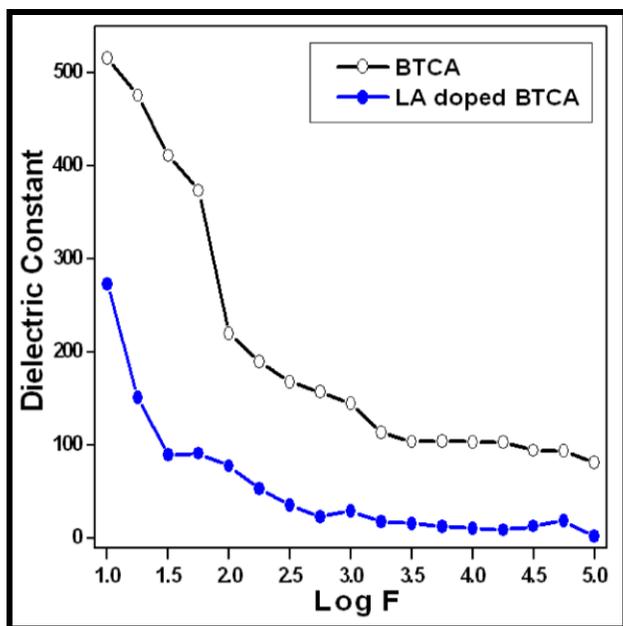


Figure 6: Dielectric constant vs. Log F

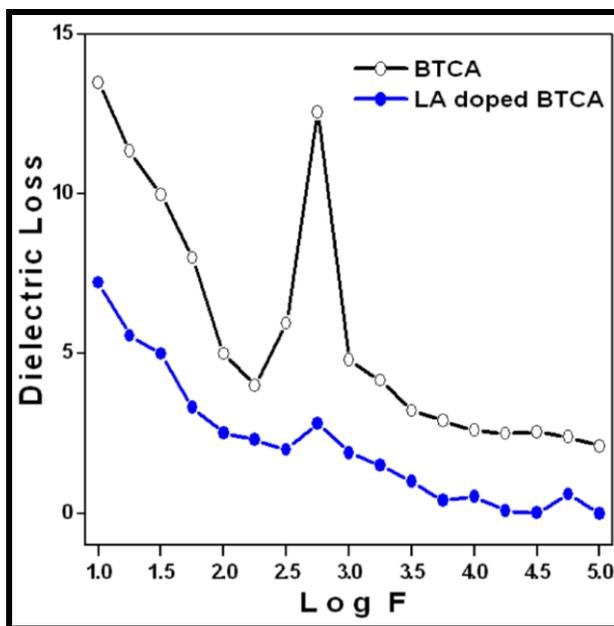


Figure 7: Dielectric loss vs. Log F

The dielectric properties of pure and doped BTCA were studied using the Gwinstek-819 LCR meter at room temperature. The frequency response of dielectric constant ($\epsilon_r = Cd/\epsilon_0A$) of pure and doped BTCA crystal is shown in Fig. 6. The higher dielectric constant in lower frequency domain are attributed to dominance of polarization (electronic, ionic and space charge) effects while the suppression of these polarization effects at the higher frequencies confine to effectively lower values of dielectric constant [18]. The lower dielectric constant of doped BTCA crystal than pure suggests its potential candidature for microelectronics and photonics applications [18-19]. The lower

dielectric constant of material serves good parameter for enhancing SHG coefficient as demonstrated by Millers rule [18]. The energy dissipation factor of material medium can be evaluated from the nature of dielectric loss, displayed in Fig. 7. The lower dielectric loss of doped BTCA crystal in high frequency regime indicates its superior optical quality and reduced ratio of defects [20].

IV. CONCLUSION

The pure and LA doped BTCA crystal has been grown by slow solution evaporation technique. The single crystal XRD revealed

that doping of LA offered change in cell parameters of BTCA without altering its orthorhombic crystal system. The prominent shifts in the vibrational frequencies of the identified functional groups confirmed the incorporation of LA in BTCA crystal. The doped BTCA crystal showed high optical transparency, large transmission and wide optical band gap (4.83 eV) than pure BTCA confirming its suitability for distinct optical applications. The thermal stability of doped BTCA crystal was ascertained from TG-DTA curve and it can be utilized for any application up to 184^o C. The doping of LA favored lower dielectric constant and dielectric loss to BTCA imperative for microelectronics applications. The photoinduced effects in LA doped BTCA resulted enhancement in SHG efficiency which is 4 times of pure BTCA crystal. The doping of LA improved the optical, electrical and SHG efficiency of BTCA confirming its effective usability for NLO applications.

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Yield, Quality and Post Harvest Nutrient Status of Chickpea as Influence by Application of Sulphur and Phosphorus Fertilizer Management

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Abstract- A field experiment was conducted at the College Agronomy Farm, B.A. College of Agriculture, Anand, Gujarat during *rabi* season 2002-03 on loamy sand soil. The experiment was conducted to study the effect of sulphur, phosphorus fertilization and PSB inoculation on growth and yield of chickpea (GC-2). It was consisting of combination of three levels of sulphur and four phosphorus management treatments. The experiment was laid down in Factorial Randomized Block Design (FRBD-2) with four replications. The results revealed that application of sulphur and phosphorus fertilization with PSB inoculation gave significant effect on yield, protein content, nitrogen content, sulphur content and post harvest soil nutrients status. From the yield and economic point of view, it is concluded that for securing maximum yield the chickpea crop should be fertilized with 20 kg S ha⁻¹ and 25 kg P₂O₅ ha⁻¹+ PSB and also maintained soil health.

Index Terms- sulphur, phosphorus, PSB and chickpea

I. INTRODUCTION

Pulses are considered as an important part of food crop occupying a unique position in agriculture and also an important component of food grain crops because of their high nutritive value. Pulses also have inherent capacity to fix atmospheric nitrogen and adaptability to a wide range of agro-ecological, cropping system and management ability. Chickpea occupies third position among the grain legumes. Phosphorus is known to play beneficial role in legume growth by promoting extensive root development and nodulation. Phosphorus dissolving micro organisms have a capacity to render insoluble form of phosphate more available to plants, besides metabolic products of soil microbes, such as organic acids and humic substance form complex with Aluminium and iron compounds thereby reducing further fixation. Sulphur has their role in growth and development of legumes. Phosphorus and sulphur reported synergistic effect on crop growth.

II. MATERIALS AND METHODS

A field experiment was conducted at the College Agronomy Farm, B.A. College of Agriculture, Anand, Gujarat during *rabi* season 2002-03 to study the Influence of Sulphur, phosphorus fertilization and PSB inoculation on growth and yield of chickpea (GC-2) under middle Gujarat Condition. The soil of

experimental plot was loamy sand in texture having good draining with 7.9 pH. The soil was low in organic matter and available nitrogen, medium in available phosphorus and high in potassium. The experiment comprised of combination of three levels of sulphur application viz., S₀ : 0 kg S ha⁻¹, S₁ : 20 kg S ha⁻¹ and S₂ : 40 kg S ha⁻¹ and four phosphorus management treatment viz., P₀ : No phosphorus, no PSB, P₁: PSB inoculation, P₂ : 25 kg P₂O₅ ha⁻¹, P₃ : 25 kg P₂O₅ ha⁻¹ + PSB. The experiment was tried in Factorial Randomized Block Design (FRBD-2) with four replications. One common application of 25 kg N ha⁻¹ was given to all the treatments as starter dose.

Effect of sulphur

Application of sulphur with rate of 20 kg S ha⁻¹ gave maximum grain (807 kg ha⁻¹) and straw yields (1996 kg ha⁻¹), which was remain at par with the treatment of S₂ (40 kg S ha⁻¹). Sulphur besides improving vegetative growth it activates certain photolytic enzymes and co-enzymes (Bixby and Beaton, 1970). Thus, these bio-activities of sulphur might have played important role in improving yield attributing characters and total yield of chickpea.

Further, result revealed that (Table-1) application of sulphur @ 40 kg S ha⁻¹ were gave higher % N in grain, Protein % and S content. While, sulphur application gave not significant effect on P content (%) of chickpea grain. The increasing N, S and protein content in grain might be due to synergistic effect of both N and S which increased their availability in the soil (Ramkala and Gupta, 1999) and an increasing in protein content obtained with S₂ was mainly owing to greater absorption of N and S by chickpea grain. Since both nutrient are closely linked with protein metabolism and their relation is synergistic (Aulakh and Pasrich, 1983).The increasing in grain protein content is expected.

Data presented in Table-1 indicated that significantly higher available nitrogen, available phosphorus and available sulphur were observed under sulphur treated plots over no sulphur application. In general, the residual available status of nitrogen and phosphorus in soil after crop harvest showed considerable improvement over initial levels irrespective of the treatments. It may be concluded that growing of chickpea enhanced the soil fertility status due to heavy leaf drop and leaf over root system coupled with nitrogen fixation. The acid secreted by the nodule bacterial increase the available soil phosphorus by dissolving the acid soluble phosphorus.

Effect of Phosphorus management

Perusal of data presented in Table-1 indicated that Grain (899 kg ha^{-1}) and straw (2074 kg ha^{-1}) yields were significantly affected by application of phosphorus management treatments. Treatment P_3 ($25 \text{ kg P}_2\text{O}_5 \text{ ha}^{-1}$ + PSB) gave better results as compared to rest of phosphorus management treatments (Table-01). The increasing in grain and straw yields due to PSB inoculation may be attributed to solubilization of native (insoluble) or applied P in soil by bacteria and thus making it available for the plant use (Ahmad and Jha, 1997). It also might be due to combine effect of significant increasing in growth attributing characters as well as N and S content in grain and there by their uptake by plant. Phosphorus is known to play beneficial role in legume growth promoting extensive root development and nodulation there by better nutritional environment for growth and finally the grain and straw yields. (Singh *et.al.*, 1984).

Further, results revealed that (Table-1) application of phosphorus management treatment found significant effect on N, P and S content in grain of chickpea. Application of $25 \text{ kg P}_2\text{O}_5 \text{ ha}^{-1}$ + PSB (P_3) recorded significantly highest N and P content, while in case of sulphur content it was remain at par with application of $25 \text{ kg P}_2\text{O}_5 \text{ ha}^{-1}$ (P_2). This was due to adequate application of phosphorus to the crop might have induced increased root growth and nodulation resulting in increased absorption and availability of N, P and S upper soil layer. Phosphorus management treatment had also significantly influenced on protein content in grain. The effect was similar to that of N content in grain. Increasing protein content in respective treatment was mainly on account of significant increase in N content and also more absorption of sulphur by chickpea grain. Since, both nutrients are closely linked with protein metabolism and their relationship is synergistic (Aulakh and Pasricha, 1983).

Post harvest nutrient status of soil was significantly influenced by phosphorus management treatment (Table-1). Significantly the maximum post harvest nutrient status were observed under P_3 ($25 \text{ kg P}_2\text{O}_5 \text{ ha}^{-1}$ + PSB) treatment. It was only due to in general the residual available status of nitrogen and phosphorus in soil after crop harvest showed considerable improvement over initial status it may be concluded that growing of chickpea enhanced the soil fertility status due to heavy leaf drop and leaf over root system coupled with nitrogen fixation. The acid secreted by the nodule bacterial increase the available soil phosphorus by dissolving the acid soluble phosphorus (Jain and Singh 2003).

III. CONCLUSION

From the study it could be concluded that yield, quality parameters and post harvest soil nutrient status were significantly influenced by application of sulphur and phosphorus fertilizations with PSB inoculation. Application of 20 kg S ha^{-1} with $25 \text{ kg P}_2\text{O}_5 \text{ ha}^{-1}$ + PSB was produced more yield. From the yield and economic point of view, it is concluded that for securing higher yield the chickpea crop should be fertilized with 20 kg S ha^{-1} and $25 \text{ kg P}_2\text{O}_5 \text{ ha}^{-1}$ + PSB and also maintained soil health.

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Treatment	Grain yield (kg/ha)	Straw yield (kg/ha)	N % content	Protein content (%)	P %	S %	Post harvest soil nutrient status (kg ha ⁻¹)		
							P ₂ O ₅	K ₂ O	S
Sulphur Levels (S)									
S ₀ (0 kg S ha ⁻¹)	720	1862	2.76	17.27	0.36	0.27	223.85	45.10	20.68
S ₁ (20 kg S ha ⁻¹)	807	1996	2.90	18.14	0.36	0.29	231.26	47.76	22.75
S ₂ (40 kg S ha ⁻¹)	783	1985	3.37	21.6	0.37	0.31	233.77	47.71	25.31
S.Em.±	10.75	10.67	0.09	0.56	0.005	0.004	0.43	0.50	0.399
C.D. (P=0.05)	30.94	30.71	0.26	1.62	NS	0.013	1.24	1.45	1.15
Phosphorus management (P)									
P ₀ = No phosphorus and No PSB	614	1803	2.48	15.50	0.34	0.26	225.98	42.76	19.65
P ₁ : PSB alone	714	1890	2.70	16.91	0.36	0.28	228.51	45.71	21.84
P ₂ : 25 kg P ₂ O ₅ ha ⁻¹	855	2023	3.26	20.38	0.37	0.30	230.05	47.93	24.06
P ₃ : 25 kg P ₂ O ₅ ha ⁻¹ + PSB	899	2074	3.60	22.50	0.39	0.31	233.97	51.02	26.10
S.Em.±	12.41	12.32	0.10	0.65	0.006	0.005	0.45	0.58	0.461
C.D. (P=0.05)	35.72	35.47	0.30	1.87	0.016	0.015	1.44	1.67	1.33
C.V. %	5.57	2.19	11.90	11.92	5.39	6.18	3.75	4.30	6.97

Table-1 : 1 Effect of sulphur and phosphorus management treatments on yield, grain quality parameters, post harvest soil nutrient status.

Coordinated Control of DFIG under Grid Fault Condition in Wind Energy Conversion System

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Abstract: - This paper proposes a coordinated control of rotor side converters (RSCs) and grid side converters (GSCs) of variable speed doubly-fed induction generator (DFIG) based wind generation systems under unbalanced voltage conditions. The control scheme uses stator flux-oriented control for the rotor side converter and grid voltage vector control for the grid side converter. System behaviours and operations of the RSC and GSC under unbalanced voltage are illustrated. The co-ordinated control schemes manage to restore the wind turbines normal operation after the clearance of fault. A complete simulation model is developed for the control of the active and reactive powers of the doubly fed generator under variable speed operation. Several studies are performed to test its operation under different wind conditions. The paper characterizes the control of a double-fed induction generator (DFIG) for variable speed wind power generation under grid fault condition. Detailed Models are used in Electromagnetic Transients Programs and capture both fast dynamics due to the electromagnetic transients and slow dynamics due to electromechanical transients. Simulation has been carried out for a detail model from Matlab & Simulink.

Key words: Doubly Fed Induction Generator (DFIG), Rotor Side converter (RSC), Grid Side converter (GSC), Vector oriented control (VOC), Stator Flux Orientation (SFO)

I. INTRODUCTION

The global electrical energy consumption is rising and there is steady increase of the demand on power generation. So in addition to conventional power generation units a large no. of renewable energy units is being integrated into the power system. It has been reported [1] that renewable energy will provide as much as 10% of the world's energy supply by 2020, and will increase to as much as 50% by 2050.

Among the other renewable energy sources, wind energy has proven to be one of the most promising technologies because they are cost competitive, environmental clean and safe renewable power sources, as compared to fossil fuel and nuclear power generation.

Nowadays, the most widely and extensively used wind turbine in high power wind Energy Conversion System (WECS) is based on doubly fed induction generator (DFIG) due to its noticeable advantages:

- 1) Various speed generation
- 2) Double output Generator feeds active and reactive power to the Grid via both stator as well as rotor.
- 3) Generates power more than rated without overheating.
- 4) Decoupled control of active and reactive power
- 5) Improve power quality.
- 6) Mechanical stress reduction of turbine and acoustic noise reduction.

DFIG's ability to control rotor currents allows for reactive power control and variable speed operation, so it can operate at maximum efficiency over a wide range of wind speeds.

However, wind turbines based on the DFIG are very sensitive to grid disturbance, especially to voltage dips, large negative and zero sequence components will appear in the stator flux causing excessive over current or voltage in rotor windings, which will damage the electronic devices in the converter. Electromagnetic torque and the active and reactive power start to oscillate with big amplitudes, which are harmful to the mechanical system of the wind turbine and the stability of the connected power network.

So it is very important to analyze the transient behavior of DFIG and to apply certain control strategy which will allow DFIG to stay connected to the grid under faulty conditions.

II. DOUBLY FED INDUCTION GENERATOR (DFIG)

Doubly Fed Induction Generator (DFIG) is based on an induction generator whose rotor windings are connected back to the grid via an ac-ac voltage controller i.e. back to back Voltage Source Converters. The stator is directly connected to the AC mains, whilst the wound rotor is fed from the Power Electronics Converter via slip rings to allow DFIG to operate at a variety of speeds in response to changing wind speed. In a DFIG, both the stator and the rotor are able to supply active power, but the direction of this power flow through the rotor circuit is dependent on the wind speed and accordingly the generator speed. Below the synchronous speed, active power flows from the grid to the rotor side and rotor side converter (RSC) acts as the voltage source inverter while the grid side converter (GSC) acts as rectifier but above the synchronous speed, RSC acts as the rectifier, and GSC acts as the inverter. So the machine can be controlled as a generator or a motor in both super and sub-synchronous operating modes realizing four operating modes. The slip power can flow in both the directions from rotor to grid or grid to rotor depending upon the mode of operation.

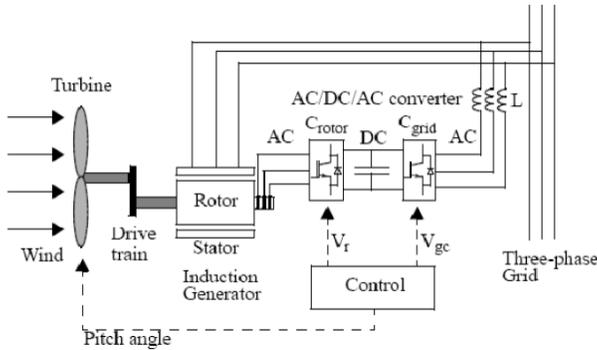


Fig 1: A typical wind energy system with Doubly Fed Induction Generator

In modern DFIG designs, the frequency converter is built by self-commutated PWM converters, a machine-side converter, with an intermediate DC voltage link.

- AC/DC/AC converter consists of an AC/DC converter connected to rotor winding called as rotor side converter (RSC) and another DC/AC converter connected to grid called as grid side converter(GSVC).
- RSC ensures the decoupled control of active and reactive power. GSC keeps the D.C. link voltage constant regardless of the direction and magnitude of rotor power.

The DC capacitor linking stator- and rotor-side converters allows the storage of power from induction generator for further generation. To achieve full control of grid current, the DC-link voltage must be boosted to a level higher than the amplitude of grid line-to-line voltage.

III. UNBALANCE GRID VOLTAGE:

Reason:

It may be voltage dip i.e. a sudden reduction (between 10% and 90%) of the voltage at a point in the electrical system, and sudden change of load (dynamic load) .There can be many causes for a voltage dip:

- 1) Short circuits somewhere in the grid
- 2) Switching operations associated with a temporary disconnection of a supply
- 3) The flow of the heavy currents that are caused by the start of large motor loads, or large currents drawn by arc furnaces or by transformer saturation.

Consequence:

Unbalanced grid voltage cause many problems for Induction Generator

- 1) Torque pulsations.
- 2) Reactive power pulsations.
- 3) Unbalanced currents.

A voltage dip can cause high induced voltages or currents in the rotor circuit. The high currents might destroy the converter, if nothing is done to protect it. Voltage dips due to short-circuit faults cause the majority of equipment trip and therefore of most interest..

IV. DOUBLE FED INDUCTION GENERATOR UNDER GRID FAULT CONDITION:

Consider DFIG in which, immediately after a 3-phase fault occurs, the stator voltage and flux reduces toward zero. The voltage drop depends, of course, on the location of the fault. The rotor current then increases to attempt to maintain the flux linkage within the rotor windings constant.

DFIG under fault can be shown in fig. 3. However, for a DFIG the increase in the rotor current immediately after a fault will be determined by two factors. The first is the change in the stator flux and the second is the change in the rotor injected voltage.

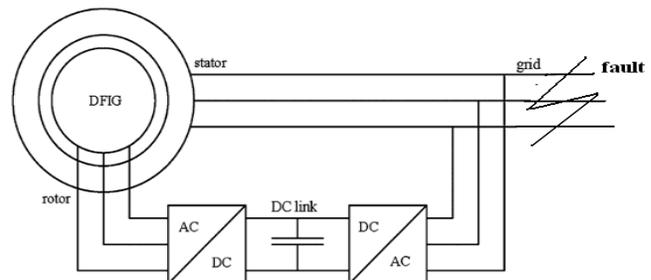


Fig 3: Block Diagram of DFIG with fault in Grid condition

A. Operation of DFIG Under Unbalanced Condition:

Behavior immediately after the fault: In the fault instant, the voltage at the DFIG generator terminal drops and it leads to a corresponding decrease of the stator and rotor flux in the generator. This results in a reduction of the electromagnetic torque and active power. As the stator flux decreases, the magnetization that has been stored in the magnetic field has to be released. The generator starts thus its demagnetization over the stator by the reactive power peak in the moment of fault. In the fault moment, as the stator voltage decreases significantly, high current transients appear in the stator and rotor windings. In order to compensate for the increasing rotor current, the rotor side converter increases the rotor voltage reference, which implies a “rush” of power from the rotor terminals through the converter. On the other side, as the grid voltage has dropped immediately after the fault, the grid side converter is not able to

transfer the whole power from the rotor through the converter further.

B. Behavior at fault clearance:

During the fault, the stator voltage and rotor flux have been reduced, the injected rotor voltage has been changed and the rotor speed has been increased. Immediately after the fault is cleared the stator voltage is restored, and the demagnetized stator and rotor oppose this change in flux thus leading to an increase in the rotor and stator currents.

V. CONTROL OF DFIG UNDER FAULT CONDITION:

The DFIG allows the stator to be connected directly to a constant frequency, three-phase grid even though the wind turbine, to which it is coupled, has a variable speed. Variable speed operation is indispensable for optimal wind power acquisition because the DFIG speed must track the changing optimal speed which is a function of the wind velocity as the wind fluctuates in time. Hence the control of DFIG plays a major role in achieving the variable speed operation. The DFIG is economical because when controlled by a Voltage-Source Converter connected to the rotor slip-ring terminals, its MVA rating is reduced by a factor of S_{msx} , the maximum slip being $S_{msx} = 0.3$.

The vector control scheme is applied to GSC and Instantaneous Reactive Power Theory is applied to the RSC taking into account the two converters within a DFIG system. The control scheme uses stator flux-oriented control for the rotor side converter and grid voltage vector control for the grid side converter. The power converters are usually controlled utilizing vector control technique, which allows decoupled control of both active and reactive power. The co-ordinated control schemes manage to restore the wind turbines normal operation after the clearance of fault. To provide enhanced operation, the RSC is controlled to eliminate the torque oscillations at double supply frequency under unbalanced stator supply. The oscillation of the stator output active power is then cancelled by the active power output from the GSC, to ensure constant active power output from the overall DFIG generation system.

There are different types of control method for DFIG, which are as follows:

A. Scalar control

Scalar control is due to magnitude variation of the control variables only, and disregarding the coupling effect in the machine. For example, the voltage of the machine can be controlled to control the flux, and the frequency and slip can be controlled to control the torque. Scalar controlled drives are easily implementable and hence widely used in industry. However their importance has diminished recently because of

the superior performance of vector controlled drives, which is demanded in many applications.

B. Vector control or field oriented control:

For Scalar control the inherent coupling effect i.e. both torque and flux are functions of voltage or current and frequency gives the sluggish response and the system is easily prone to instability because of high order system harmonics. If the torque is increased by incrementing the slip, the flux tends to decrease. The flux variation is then compensated by the sluggish flux control loop, feeding additional voltage. This temporary dipping of flux reduces the torque sensitivity with slip and lengthens the system response time.

These foregoing problems can be solved by vector control or field oriented control where an induction generator can be controlled like a separately excited DC motor, brought a renaissance in the high performance control of AC drives. Because of DC machine like performance, vector control is known as decoupling, orthogonal, or Trans vector control. Vector control is applicable to both induction and synchronous motor drives. Vector control and the corresponding feedback signal processing, particularly for modern sensor less vector control, are complex and the use of powerful microcomputer or DSP is mandatory. Because of the above mentioned advantages over scalar control, vector control will be accepted as the industry standard control for AC drives.

C. Decoupled Control of Active and reactive power

It can be achieved by d-q model. After converting a-b-c axes of 3 phase voltage to d-q axis and then converting it to compensating terms and addition of the compensating terms to the uncompensated voltage terms makes it possible to achieve decoupled performance of the rotor side converter.

A current regulated PWM scheme is used where q and d axes currents are used to regulate DC-link voltage and related power respectively.

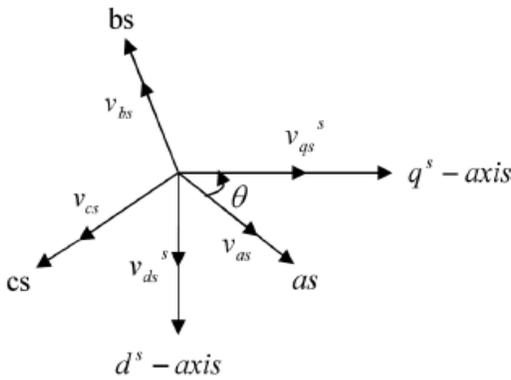


Fig 4: Stationary frame a-b-c to d^s - q^s axes transformation

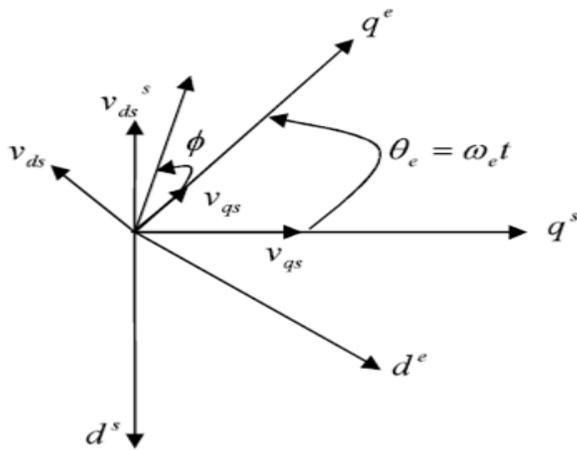


Fig 5: Stationary frame d^s - q^s to synchronous rotating frame d^e - q^e

Rotor Side Converter

Rotor side converter, ensures decoupled control of active and reactive power. The reference frame used here is also the synchronously rotating frame i.e. SFO or SVO control scheme is used. The rotor side converter provides the actuation and the control requires rotor and stator currents, stator voltage and rotor position. Analysis of d-q currents and voltages outlines the control scheme for the converter.

Starter-side converter

Keep the DC Link voltage constant regardless of the direction and magnitude of rotor power. The 3-phase AC variables are referred to synchronously rotating frame using Park's Transformation which converts them into two DC variables at quadrature with each other, namely the direct component and quadrature component. The converter is current regulated, with direct component used to regulate DC Link voltage and quadrature component to regulate reactive power.

Generator control of DFIG wind turbine

Basically the speed control of a DFIG is achieved by controlling the power. The rotor-side converter is responsible for power control which is a two-stage controller comprising of a real and reactive power controller [8-11]. Stator-flux oriented frame has been the most commonly utilized frame for the design and analysis of DFIG [8-9, 10-13]. In this frame the q-axis and d-axis components of the rotor currents are used for active and reactive power control respectively (Fig.6) [8,11]. In order to operate converters at same constant frequency, the current control strategy is implemented through a voltage regulated PWM converter. The d-q control signals are generated by comparing the d-q current set values with the actual d and q components of the rotor current. The two-stage rotor side converter controller structure is shown in the fig. below:

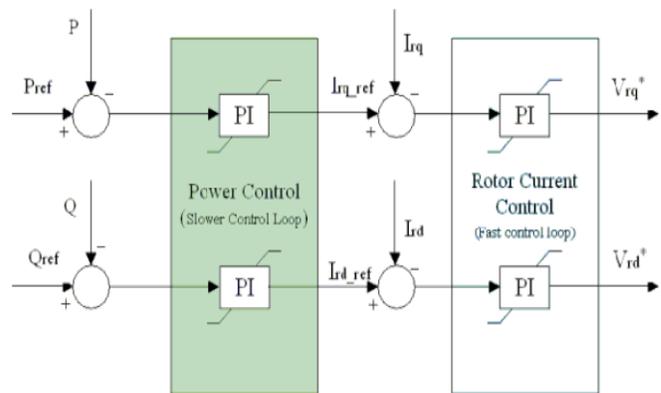


Fig 6: DFIG rotor side controller

The transformation of d-q signals to three-phase sinusoidal signals for the rotor side converter can be achieved by the technique as shown in Fig. 7. The two signals v_{rd}^* and v_{rq}^* represent the d and q reference voltage control signals respectively, generated by the controller. The α and β stationary reference frame voltages, v_{α}^* and v_{β}^* are obtained through a suitable vector transformation of $e^{j(\theta_s - \theta_r)}$, where θ_s is the position of the stator-voltage space vector and θ_r is the position of the rotor. Then by applying by Park's vector transformation, the stationary reference frame voltages, v_{α}^* and v_{β}^* are used to generate a three-phase pulse width modulated sinusoidal reference voltage, v_{α}^* , v_{β}^* and v_c^* to control the rotor-side converter. The three-phase sinusoidal voltage $v_{\alpha}, v_{\beta}, v_c$ injected into the grid by the converter is directly proportional to the three-phase reference voltage signals, $v_{\alpha}^*, v_{\beta}^*$ and v_c^* in the converter linear modulation mode. The gain factor between the two quantities is given by $k_{pwm} = v_{dc} / v_{tri}$ where v_{dc} is the capacitor DC-link voltage

and v_{tri} is the amplitude of the bipolar triangular reference carrier signal waveform.

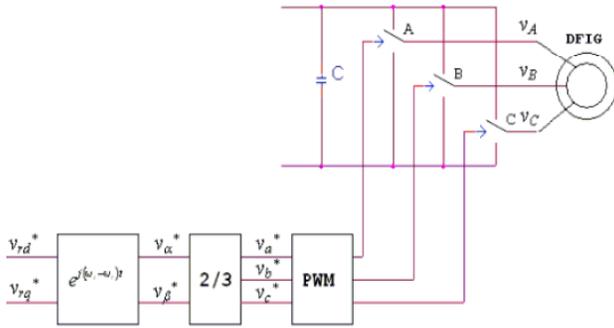


Fig.7: Decoupled d-q vector control structure for DFIG rotor-side converter

Simulation:

A detail model of 9 MW wind farm connected to three bus-B120, B25 and B575 has been simulated to analyze the results. Detailed Models are used in Electromagnetic Transients Programs and capture both fast dynamics due to the electromagnetic transients and slow dynamics due to electromechanical transients. This model includes detailed representation of power electronic IGBT converters. This model is well suited for observing harmonics and control system dynamic performance over relatively short periods of times (typically hundreds of milliseconds to one second).

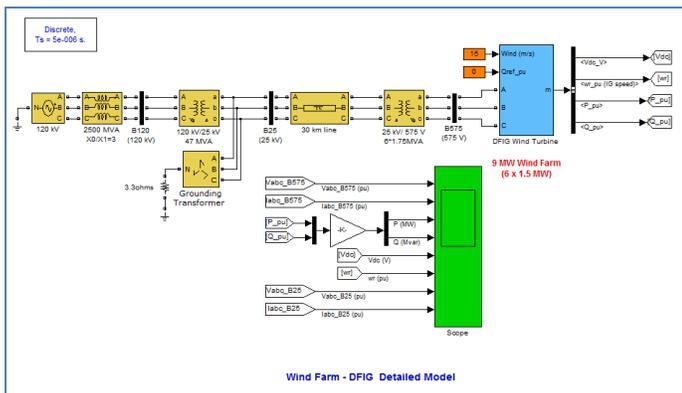


Fig 8: The Detailed Model of DFIG in WECS

Initially the DFIG wind farm produces 9 MW. The corresponding turbine speed is 1.2 pu of generator synchronous speed. The DC voltage is regulated at 1150 V and reactive power is kept at 0 Mvar. At $t=0.03$ s the positive-sequence voltage suddenly drops to 0.5 p.u. causing an oscillation on the DC bus voltage and on the DFIG output power. During the voltage sag the control system tries to regulate DC voltage and reactive power at their set points (1150 V, 0 Mvar). The system recovers in approximately 6 cycles at $t=0.13$ s

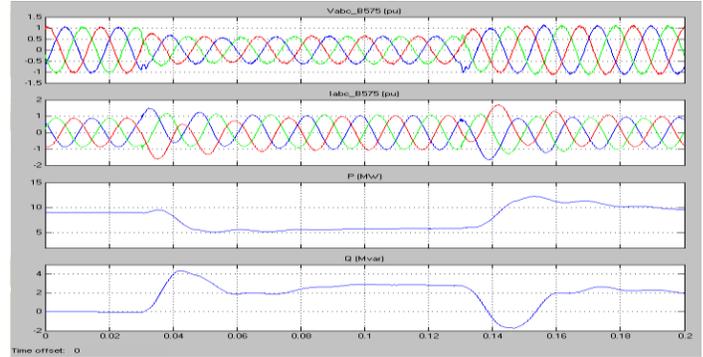


Fig. 9: Simulation result at bus B575 due to the fault (voltage sag) in the 120kv motor-load

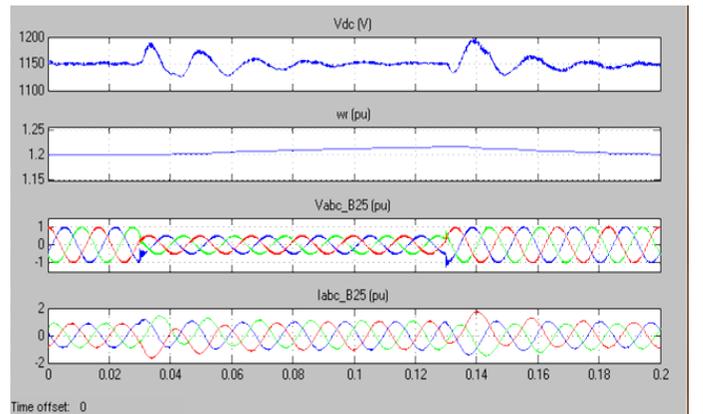


Fig:10 Simulation result at bus B25 due to the fault(voltage sag) in the 120kv motor-load.

VI. CONCLUSION

The DFIG considered in this analysis is a wound rotor induction generator with slip rings. The stator is directly connected to the grid and the rotor is interface via a back to back partial scale power converter (VSC). Power converter are usually controlled utilizing vector control techniques which allow the decoupled control of both active and reactive power flow to the grid. In the present investigation, the transient response of DFIG is presented for both normal and abnormal grid conditions. The control performance of DFIG is satisfactory in normal grid conditions and it is found that, both active and reactive power maintains a study pattern in spite of fluctuating wind speed and net electrical power supplied to grid is maintained constant. During grid disturbance, considerable torque pulsation of DFIG system has been observed.

In view of that, future scope aims to develop a controller, which can effectively improve the dynamic stability, transient response of the system during faulty grid conditions.

To develop a protection system for power converter and DFIG for large disturbances like 3-phase fault of little cycle duration as the power converter is very sensitive to grid disturbance.

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Integral Solutions of the Sextic Equation with Five Unknowns

$$x^6 - 6w^2(xy + z) + y^6 = 2(y^2 + w)T^4$$

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Abstract- We obtain infinitely many non-zero integer quintuples (x, y, z, w, T) satisfying the non-homogeneous sextic equation with five unknowns. Various interesting properties among the values of x, y, z, w and T are presented. Some relations between the solutions and special numbers are exhibited.

Index Terms- Integral solutions, sextic equation with five unknowns, special numbers.

MSC 2000 Mathematics subject classification: 11D41.

NOTATIONS:

$T_{m,n}$ - Polygonal number of rank n with size m

P_n^m - Pyramidal number of rank n with size m

SO_n - Stella octangular number of rank n

S_n - Star number of rank n

PR_n - Pronic number of rank n

OH_n - Octahedral number of rank n

J_n - Jacobsthal number of rank of n

j_n - Jacobsthal-Lucas number of rank n

KY_n - keynea number of rank n

$CP_{n,3}$ - Centered Triangular pyramidal number of rank n

$CP_{n,6}$ - Centered hexagonal pyramidal number of rank n

$F_{4,n,5}$ - Four Dimensional Figurative number of rank n whose generating polygon is a pentagon

$F_{4,n,3}$ - Four Dimensional Figurative number of rank n whose generating polygon is a triangle

I. INTRODUCTION

The theory of Diophantine equations offers a rich variety of fascinating problems [1-4]. Particularly, in [5,6], sextic equations with 3 unknowns are studied for their integral solutions. [7-12] analyse sextic equations with 4 unknowns for their non-zero integer solutions. [13, 14] deals with sextic equation with 5 unknowns.

This communication analyses a sextic equation with 5 unknowns given by $x^6 - 6w^2(xy + z) + y^6 = 2(y^2 + w)T^4$.

Infinitely many non-zero integer quintuples (x, y, z, w, T) satisfying the above equation are obtained. Various interesting properties among the values of x, y, z, w and T are presented.

II. METHOD OF ANALYSIS

The sextic equation with five unknowns to be solved is

$$x^6 - 6w^2(xy + z) + y^6 = 2(y^2 + w)T^4 \quad (1)$$

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The introduction of the linear transformations,

$$x = u + v, y = u - v, w = 2uv, z = 2v^2 \quad (2)$$

in (1) leads to

$$u^2 + v^2 = T^2 \quad (3)$$

The above equation (3) is solved through different approaches and thus, one obtains

different sets of solutions to (1)

Approach12:

The solution to the Pythagorean equation (3) is,

$$u = 2pq, \quad v = p^2 - q^2, \quad T = p^2 + q^2 \tag{4}$$

In view of (2) and (4), the corresponding values of x, y, z, w and T are represented by

$$\left. \begin{aligned} x(p, q) &= 2pq - p^2 - q^2 \\ y(p, q) &= 2pq - p^2 + q^2 \\ z(p, q) &= 2(p^2 - q^2)^2 \\ w(p, q) &= 4pq(p^2 - q^2) \\ T(p, q) &= p^2 + q^2 \end{aligned} \right\} \tag{5}$$

Properties:

1. $x(a(a+1), a) + y(a(a+1), a) = 4(6p_a^3 - 6T_{3,a} - 2SO_a + 4CP_{a,6})$

2. The following expressions are nasty numbers:

(a) $30[5S_a + 90(OH_a) - 60CP_{a,6} - x(2a, a) + y(2a, a)]$

(b) $3[x(a, b) + y(a, b) + 2T(a, b)]$

3. The following expressions are cubic integers:

(a) $2T(a, b)[(x(a, b) + y(a, b))^2 + 2z(a, b)]$

(b) $9[T(2^{2n}, 2^{2n}) - 2KY_{2n} + j_{2n+2}]$

4. $4[w(a, 1) + z(a, 1) + 2T(a, 1) - (8CP_{a,3} + 48F_{4,a,3} - 72P_a^3 + 24T_{3,a} + 2T_{12,a} - 10T_{4,a})]$
is a biquadratic integer

5. $432F_{4,a,3} - 504P_a^3 + 134T_{3,a} - [x(2a, a) + y(2a, a) + z(2a, a) + w(2a, a) + T(2a, a)] \equiv 0 \pmod{7}$

6. $x(a, a).y(a, a) + z(a, a).w(a, a) + T(a, a) - 2CP_{a,6}(3T_{4,a} - T_{8,a}) - T_{6,a} - 2T_{3,a} + T_{4,a} = 0$

7. $S_a + 9T_{4,a} - 2T_{10,a} - 2T_{4,a}.T_{3,a} + T_{4,a} + CP_{a,6} - x(a, 1).y(a, 1) - T(a, a) = 1$

8. $w(2a, a).T(2a, a) - 120[6F_{4,a,5} - 18P_a^3 + 14T_{3,a} - 3(OH_a) + 2CP_{a,6}] = 0$

Remark:

The equation (4) can also be written as

$$u = p^2 - q^2, \quad v = 2pq, \quad T = p^2 + q^2 \tag{6}$$

and the corresponding solution can be obtained.

Approach2:

(3) can be written as

$$T^2 - v^2 = u^2 \tag{7}$$

Writing (18) as a set of double equations in two different ways as shown below:

Set1: $T + v = u^2, T - v = 1,$

Set2: $T + v = 1, T - v = u^2,$

Solving **set1**, the corresponding values of u, v and T are given by

$$v = 2k^2 + 2k, u = 2k + 1, T = 2k^2 + 2k + 1 \tag{8}$$

In view of (19) and (2), the corresponding solutions to (1) obtained from set1 are represented as shown below:

$$\left. \begin{aligned} x(k) &= 2k^2 + 4k + 1 \\ y(k) &= 1 - 2k^2 \\ z(k) &= 8(k^2 + 1)^2 \\ w(k) &= 4(k^2 + k)(2k + 1) \\ T(k) &= 2k^2 + 4k + 1 \end{aligned} \right\} \tag{9}$$

Properties:

1. $w(k) + z(k) - 2x(k)(t(k) - 1) = 0$
2. $3[x(k) + y(k) + z(k) + T(k) + 6SO_k - 12CP_{k,6} - 3 - 2T_{4,k}]$ is a nasty number
3. The following expressions are cubic integers
 - (a) $2[x(k) + y(k) + 2T(k) - 8T_{3,k} - 6T_{4,k} + 2T_{8,k}]$
 - (b) $2z(k)w(k) - 128(6P_k^3 + 2T_{3,k} - 2T_{4,k} + 1)T_{4,k}^2$
4. $(x(k) - y(k))^2 - (z(k))^2 - 48F_{4,k,5} + 16P_k^5 = 0$
5. $8 [T(2^{2n}, 2^{2n}) - 2KY_{2n} + j_{2n+1}]$ is a biquadratic integer
6. $w(k) + y(k) - 16P_k^5 - 7T_{4,k} + T_{8,k} = 1$
7. $12T_{3,k} - 12P_k^4 + 1 - y(k)T(k) - 4(2T_{3,k}T_{4,k} - CP_{k,6}) \equiv 0 \pmod{2}$
8. $z(k) + T(k) - 192F_{4,k,3} + 64P_k^5 + 92T_{3,k} = 1$

$$y^2(k) + z(k) - 288F_{4,k,3} + 336P_k^3 - 80T_{3,k} = 1$$

Similarly, the solutions corresponding to set2 can also be found.

Approach3:

Now, rewrite (3) as, $u^2 + v^2 = T^2 * 1$ (10)

Let $T = a^2 + b^2$ (11)

Also 1 can be written as

$$1 = i^n \cdot (-i)^n$$
 (12)

Substituting (8) in (9) in (7) and using the method of factorisation, define

$$u + iv = i^n (a + ib)^2$$
 (13)

Equating real and imaginary parts in (10) we get

$$\left. \begin{aligned} u &= \cos \frac{n\pi}{2} (a^2 - b^2) - 2ab \sin \frac{n\pi}{2} \\ v &= \sin \frac{n\pi}{2} (a^2 - b^2) + 2ab \cos \frac{n\pi}{2} \end{aligned} \right\}$$
 (14)

In view of (2), (8) and (14), the corresponding values of x, y, z, w, p, T are represented as

$$\left. \begin{aligned} x &= \cos \frac{n\pi}{2} (a^2 - b^2 + 2ab) + \sin \frac{n\pi}{2} (a^2 - b^2 - 2ab) \\ y &= \cos \frac{n\pi}{2} (a^2 - b^2 - 2ab) - \sin \frac{n\pi}{2} (a^2 - b^2 + 2ab) \\ w &= 2 \left[\cos \frac{n\pi}{2} (a^2 - b^2) - \sin \frac{n\pi}{2} 2ab \right] \left[\sin \frac{n\pi}{2} (a^2 - b^2) + 2ab \cos \frac{n\pi}{2} \right] \\ z &= 2 \left[\sin \frac{n\pi}{2} (a^2 - b^2) + 2ab \cos \frac{n\pi}{2} \right]^2 \\ T &= a^2 + b^2 \end{aligned} \right\}$$
 (15)

Approach4:

$$1 = \frac{(2mn + i(m^2 - n^2))(2mn - i(m^2 - n^2))}{(m^2 + n^2)^2}$$

Write 1 as

Following the same procedure as above we get the integral solution of (1) as

$$\left. \begin{aligned} x &= (m^2 + n^2)[f_1(A, B) + g_1(A, B)] \\ y &= (m^2 + n^2)[f_1(A, B) - g_1(A, B)] \\ z &= 2(m^2 + n^2)^2 g_1^2(A, B) \\ w &= 2(m^2 + n^2)^2 f_1(A, B) \cdot g_1(A, B) \\ T &= (m^2 + n^2)^2 (A^2 + B^2) \end{aligned} \right\} \quad (16)$$

Where

$$\left. \begin{aligned} f_1(A, B) &= [2mn(A^2 - B^2) - 2AB(m^2 - n^2)] \\ g_1(A, B) &= [(m^2 - n^2)(A^2 - B^2) + 4mnAB] \end{aligned} \right\} \quad (17)$$

The above approaches satisfy the following interesting relations:

1. $w - z - xy + y^2 = 0$
2. If u, v are the generators of the Pythagorean triangle with sides $(u^2 - v^2, 2uv, u^2 + v^2)$ then
 - (i). $x(u, v) \cdot y(u, v) \cdot w(u, v) = 2(\text{area of the triangle})$
 - (ii). $x^2 + y^2 - z + w = \text{the perimeter of the pythagorean triangle}$
3. The following expressions are nasty numbers:
 - (a) $6(z^2 + w^2)$
 - (b) $3z(T^2 + w)$
 - (c) $6[x^2(1 - z) + y^2(1 - z) + z^2 + w(4 + w) + 2T^2]$
 - (d) $\frac{6(x + y)(2xy + 2T^2 + 2zw)}{2x + (x - y)(z - 1)}$
5. The following expressions are cubical integers:
 - (a) $T^2(x^2 y^2 + w^2)$
 - (b) $4(x^3 + y^3) - 6(x + y)z$
 - (c) $\frac{wz}{2(x + y)}$
 - (d) $x(T^2 + w)$
6. The following expressions are biquadratic integers:
 - (a) $4(x + y)^2 T^2 + 4(w^2 + z^2)$
 - (b) $16xyT^2 + 4z^2$
7. $x^2 - y^2 - 2w = 0$
8. $z^2 - w^2 + 2xyz = 0$
9. 10. $4xyzwT^2 = x^2 w^3 - x^2 z^2 w + w^3 y^2 - wz^2 y^2$
10. $x + y + z + w + 2T^2 - (2x - y)x - y^2 \equiv 0 \pmod{2}$

$$11. 2x^2 + 4yz + 2zw - 2T^2 = 2w + (x - y)(x^2 - y^2 - 2z + xz + yz)$$

III. CONCLUSION

In conclusion, one may search for different patterns of solutions to (1) and their corresponding properties

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Improving the Performance of Energy Attack Detection in Wireless Sensor Networks by Secure forward mechanism

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Abstract- Wireless ad-hoc sensor networks and routing data in them is a significant research area. The objective of this paper is to examine resource depletion attacks at the routing protocol layer, which attempts to permanently disable network nodes by quickly draining their battery power. This type of attack is called as vampire attack. Vampire attacks are very difficult to detect because they attack the node only by sending protocol-compliant messages. These attacks are not specific to any protocol, but rather rely on the properties of many popular classes of routing protocols. In the worst case, a single Vampire can increase network-wide energy usage by a factor of $O(N)$, where N is the number of network nodes. Methods to detect and secure data packets from vampires during the packet forwarding phase is discussed. PLGP with attestations (PLGP-a) is used for identifying malicious attack. M-DSDV routing protocol is used to detect and eliminate the resource depletion attack from the network.

Index Terms- Denial of service, routing, ad-hoc networks, sensor networks, wireless networks, routing.

I. INTRODUCTION

Wireless Sensor Network (WSN) consists of mostly tiny, resource-constraint, simple sensor nodes, which communicate wirelessly and form ad hoc networks in order to perform some specific operation. Due to distributed nature of these networks and their deployment in remote areas, these networks are vulnerable to numerous security threats that can adversely affect their proper functioning. Simplicity in WSN with resource constrained nodes makes them very much vulnerable to variety of attacks. The attackers can eavesdrop on its communication channel, inject bits in the channel, replay previously stored packets and much more. An adversary can easily retrieve valuable data from the transmitted packets that are sent (Eavesdropping). That adversary can also simply intercept and modify the packets' content meant for the base station or intermediate nodes (Message Modification), or retransmit the contents of those packets at a later time (Message Replay). Finally, the attacker can send out false data into the network, maybe masquerading as one of the sensors, with the objectives of corrupting the collected sensors' reading or disrupting the internal control data (Message Injection). Securing the WSN needs to make the network support all security properties: confidentiality, integrity, authenticity and availability.

Attackers may deploy a few malicious nodes with similar or more hardware capabilities as the legitimate nodes that might collude to attack the system cooperatively. The attacker may come upon these malicious nodes by purchasing them separately, or by "turning" a few legitimate nodes by capturing them and physically overwriting their memory. Also, in some cases colluding nodes might have high-quality communications links available for coordinating their attack. The sensor nodes may not be tamper resistant and if an adversary compromises a node, it can extract all key material, data, and code stored on that node. As a result, WSN has to face multiple threats that may easily hinder its functionality and nullify the benefits of using its services.

Routing and data forwarding is a crucial service for enabling communication in sensor networks. Unfortunately, current routing protocols suffer from many security vulnerabilities. For example, an attacker might launch denial of-service attacks on the routing protocol, preventing communication. The simplest attacks involve injecting malicious routing information into the network, resulting in routing inconsistencies. Simple authentication might guard against injection attacks, but some routing protocols are susceptible to replay by the attacker of legitimate routing messages. The wireless medium is inherently less secure because its broadcast nature makes eavesdropping simple. Any transmission can easily be intercepted, altered, played by an adversary. The wireless medium allows an attacker to easily intercept valid packets and easily inject malicious ones. Although this problem is not unique to sensor networks, traditional solutions must be adapted to efficiently execute on sensor networks.

This paper makes three primary contributions. First, a thorough evaluation of the existing routing protocols towards battery depletion attacks is done. We observe that existing secure routing protocols such as Ariadne, SAODV, and SEAD do not protect against Vampire attacks. Existing work on secure routing attempts to ensure that adversaries cannot cause path discovery to return an invalid network path, but Vampires do not disrupt or alter discovered paths, instead use existing valid network paths to carry out the attack. Protocols that maximize power efficiency are also inappropriate, since they rely on cooperative node behavior and cannot optimize battery power usage.

Second, simulation results quantifying the performance of several representative protocols in the presence of a single Vampire (insider adversary) is shown. Third, modification of an existing sensor network routing protocol is made to prevent the damage caused by Vampire attacks during packet forwarding phase.

1.1 Classification

Denial of service is an attack, where a victim can use 10 minutes of the CPU time to transmit a data packet, but whereas an honest node uses 1 minute of its CPU time to transmit the same data packet. In multi hop routing network: a source composes the shortest path and transmits the data packet to the next hop, which transmits it further, until the destination is reached; consuming resources not only at the source node but also at every node the packet moves through. Vampire attack can be defined as a voluntary action of composing and transmitting a malicious message that chooses the longest path which consumes more energy of the network than if an honest node transmits a message of identical size to the same destination. The strength of an attack can be measured by the ratio of network energy used in the honest case to the energy used in the malicious case.

1.2 Protocols and Assumptions

In this paper, we consider the effect of Vampire attacks on Destination sequence distance vector routing protocols, as well as a logical ID-based sensor network routing protocol proposed by Parno et al. These protocols are likely to prevent Vampire attacks, so the covered protocols are an important subset of our routing solution space. We differentiate on-demand routing protocols, where topology discovery is done at transmission time, and static protocols, where topology is discovered during an initial phase, with periodic rediscovery to handle rare topology changes. The adversaries are malicious insiders and have the same resources and level of network access as honest nodes. Sending malicious packet automatically allows few Vampires to attack many honest nodes. We will show later that a single Vampire may attack every network node simultaneously, meaning that vampires are to be isolated from the honest nodes. Vampire attacks may be weakened by using groups of nodes with staggered cycles: only active-duty nodes are vulnerable while the Vampire is active; nodes are safe while the Vampire sleeps.

1.3 Overview

In the remainder of this paper, we present a series of increasingly damaging Vampire attacks, evaluate the vulnerability of several example protocols, and suggest how to improve flexibility. In source routing protocols, we show how a malicious packet source, can specify paths through the network, which are far longer than optimal, thus wasting energy at intermediate nodes that forward the packet as suggested by the source. In routing schemes, where forwarding decisions are made independently by each node (as opposed to specified by the source), we suggest how directional antenna and wormhole attacks can be used to deliver packets to multiple remote network positions, forcing packet processing at nodes that would not normally receive that packet at all, and thus increasing network-wide energy expenditure. Lastly, we show how an adversary can target not only packet forwarding but also route

and topology discovery phases—if discovery messages are flooded, an adversary can, for the cost of a single packet, consume energy at every node in the network.

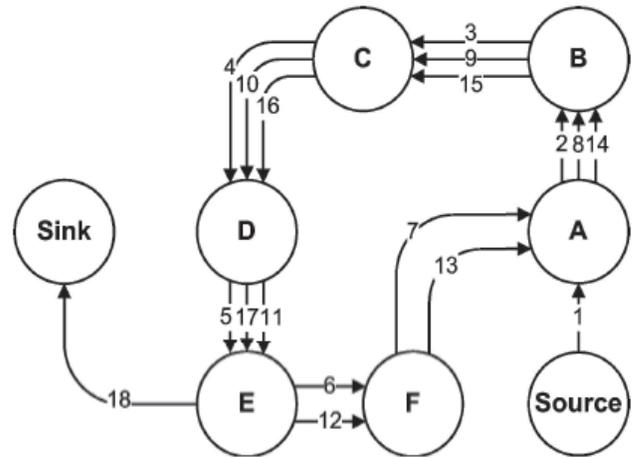


Figure 1: carousel Attack

CAROUSEL ATTACK:

In this type of attack, a malicious node sends a packet with a route composed as a series of loops with the same node appears in the route many times.

STRETCH ATTACK:

In this type of attack, a malicious node constructs artificially long routes from the source in spite of shorter routes being available. It increases packet path lengths, causing packets to be processed by a number of nodes that is independent of hop count along the shortest path between the adversary and packet destination.

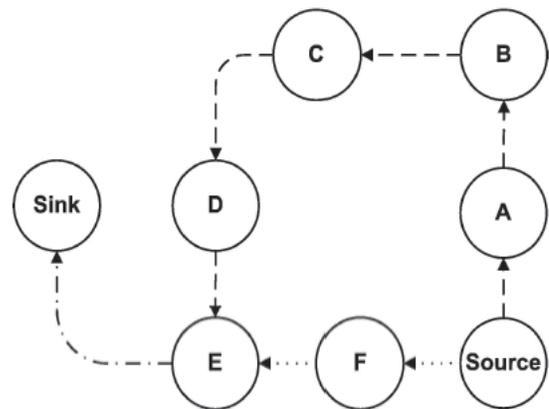


Figure 2: stretch attack

This attack causes the packets to be travelled a long route in the network. An adversary constructs

artificially long routes, potentially traversing every node in the network.

Increase packet path lengths, causing packets to be processed by a number of nodes that is independent of hop count along the shortest path between the adversary and packet destination.

II. RESEARCH ELABORATIONS

SNEP Protocol

SNEP protocol was designed as basic component of another protocol SPINS (Security protocol for wireless Sensor Networks) that were basically designed for secure key distribution in wireless sensor networks. SNEP define the primitives for authentication of sensor node, data confidentiality and data integrity. However the drawback of this protocol is lower data freshness. SNEP protocol uses shared counter for semantic confidentiality not initial vectors. Using SNEP the plain text is ciphered with CTR encryption algorithm. Both sender and receivers are responsible to update the shared counter once when they sent or receive cipher blocks. Therefore sending counter in message is not important; however every message has message authentication code (MAC). This is computed from cipher data with the help of CBC-MAC algorithm. When the receiver node receives data it recomputed MAC and compared with the received MAC.

REWARD

Z. karakehayou proposed a new algorithm know as REWARD for security against black hole attack as well as malicious nodes. It works on geographic routing. There are two different kinds of broadcast messages used by REWARD.

MISS message helps in the identification of malicious sensor nodes. While the second message SAMBA is used to recognize the physical location of detected black hole attacks and broadcast that location. REWARD uses broadcast inter radio behavior to observe neighbor node's transmission and detect black hole attack. Whenever any sensor misbehaves it maintain a distributed database and save its information for future use. However the main drawback of this protocol is high energy consumption.

Statistical En-Route Filtering

F. Y. Haiyon et al present a statistical en-route filtering technique to control attacks on compromised sensor nodes, where a compromised node can easily inject wrong report in the network that cause depletion of finite resources at sensor nodes as well as causes false alarms. Statistical En-Route Filtering is able to detect and destroy such false reports in the network. For this purpose message authentication code (MAC) is used to check the validity of each message. When sensed data is forwarded toward sink node each node in the middle verify that message. Statistical En-Route Filtering relies on collective information from multiple sensor nodes. When an event occurs the sensor nodes in the surrounding collectively generate a legitimate report that carries multiple message authentication codes (MAC's). The report is forwarded toward sink node and each node in the middle verifies the report with certain probability, when the report is found incorrect it is dropped. The probability of message incorrectness increases with number of hops. In many cases a false report may reaches to a sink

node where sink node will be responsible to verify it again. However this approach causes delay as well as increase communication overhead and energy consumption in resource limited networks.

The effect of denial or degradation of service on battery life and other finite node resources has not generally been a security consideration, making our work tangential to the research mentioned above.

SYSTEM METHODOLOGY

The network is composed of multiple nodes. An energy based mechanism to detect the Vampire Attacks is implemented. Once we constructed a network, the malicious message will be send from the attacker node to any of the normal node. So that the normal node's energy will be consumed more than the normal message level So that we can conclude that the node is affected by the attack. Once the node is identified as the attacked node, the node is eliminated from the network. Hence the attacked node is not able to communicate with the other nodes in the Network. It uses one-way hash chains to limit the number of packets sent by a given node, limiting the packet transmission rate. Energy usage by malicious nodes is to be reduced, since they can always unilaterally drain their own batteries.

The proposed system containing two important technologies, they are

PLGP:

PLGP is a clean-slate secure sensor network routing protocol which is used to detect the vampire node.

PLGP consists of **two** levels:

- a) Topology Discovery Phase
- b) Packet Forwarding Phase

Topology Discovery Phase: Discovery phase organizes nodes into a tree that will later be used as an addressing scheme that is repeated on a fixed schedule and discovery deterministically organizes nodes into a tree that will later be used as an addressing scheme. When discovery begins, each node has a limited view of the network that is the node knows only itself.

Nodes discover their neighbors using local broadcast, and form ever expanding "neighborhoods," stopping when the entire network is a single group. Throughout this process, nodes build a tree of neighbor relationships and group membership that will later be used for addressing and routing.

Packet Forwarding Phase: In this phase, all decisions are made independently by each node. When receiving a packet, a node determines the next hop

by finding the most significant bit of its address that differs from the message originator's address. Thus, every forwarding event shortens the logical distance to the destination, since node addresses should be strictly closer to the destination.

```

Function forward_packet(p)
    s ← extract_source_address(p);
    c ← closest_next_node(s);
    if is_neighbor(c) then forward(p,c);
    else
        | r ← next_hop_to_non_neighbor(c);
        | forward(p,r);
    
```

```

Function secure_forward_packet(p)
    s ← extract_source_address(p);
    a ← extract_attestation(p);
    if (not verify_source_sig(p)) or
    (empty(a) and not is_neighbor(s)) or
    (not saowf_verify(a)) then
        | return ; /* drop(p) */
    foreach node in a do
        | prevnode ← node;
        | if (not are_neighbors(node,prevnode)) or
        | (not making_progress(prevnode,node)) then
        | | return ; /* drop(p) */
    c ← closest_next_node(s);
    p' ← saowf_append(p);
    if is_neighbor(c) then forward(p',c);
    else forward(p', next_hop_to_non_neighbor(c));
    
```

PLGP WITH ATTESTATIONS (PLGP-a) Phase:

The verifiable path history is added to every PLGP packet. The resulting protocol, PLGP with attestations (PLGP-a) uses this packet history together with PLGP's tree routing structure so every node can securely verify progress, preventing any significant adversarial influence on the path taken by any packet which traverses at least one honest node. These signatures form a chain attached to every packet, allowing any node receiving it to validate its path. Every forwarding node verifies the attestation chain to ensure that the packet has never traveled away from its destination in the logical address space.

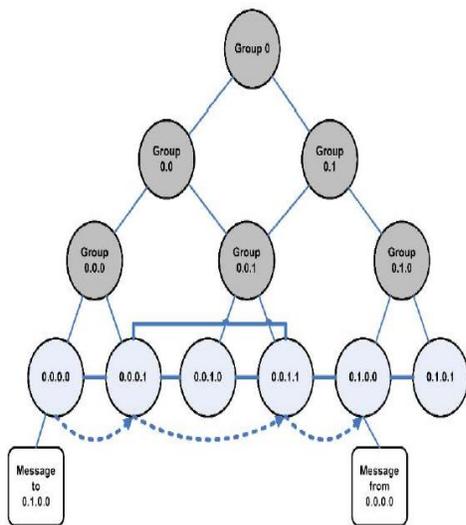


Fig. 6. The final address tree for a fully converged six-node network. Leaves represent physical nodes, connected with solid lines if within radio range. The dashed line is the progress of a message through the network. Note that nonleaf nodes are not physical nodes but rather logical group identifiers.

Packet forwarding PLGP-a

M-DSDV NETWORK ROUTING: In this section, we show that destination sequence distant vector a proactive network routing protocol [24] can be modified to provably resist Vampire attacks during the packet forwarding phase. Even though the existing DSDV is designed to overcome routing loop problems, it is still not a feasible method for efficient packet transmission, as the protocol is proactive which utilizes more battery power and bandwidth. M-DSDV consists of a topology discovery phase, followed by a topology maintenance phase. Legitimate network node has a unique certificate of membership, which includes its public key and code word (assigned by a trusted offline authority before network deployment). Topology Discovery of the neighboring nodes begins, when there is a need to transmit the data packet.

Each node has a limited view of the network—the node knows only itself. Nodes use the local broadcasting scheme to discover their neighbors', where the certificate identity verification is done to isolate the external unauthorized nodes from the network. Thus, each honest node learns its active neighbor node's address and public key.

When a source node S, wants to send a data packet to destination D, first constructs and broadcasts a route request packet consisting of (source address, destination address, sequence number, next hop, metric, index number and time to live) fields. The source address and destination address are the internet protocol addresses, the sequence number is used to differentiate new routes from stale routes, the next hop and metric is a local counter maintained separately by each node and incremented each time a RReq is broadcasted, the index number is initialized to zero, is used to keep track of the loops the packet has made and the final time to live field is used as a clock which increments whenever a RReq packet is sent.

On receipt of RReq, intermediate nodes inspect it to see if it is a duplicate, in which case it is rejected. If not the (source address, next hop, metric) pair is entered into the local history table. The destination address is looked up in the routing table, if a fresh route to it is known an RRep a route reply packet is sent back to S. If not, it increments the index number and rebroadcasts the RReq. This also creates a backward route towards S and exists has an optimization technique.

When destination receives RReq, it sends back an RRep packet to the node from which it got the first RReq packet.

The format of the route reply packet includes (source address, destination address, destination sequence, index number, life time). Here, the source address, destination address and index number are copied from the incoming RReq packet, but the destination sequence number is taken from its counter in memory. The life time field indicates how long the route is valid. On receipt of RRep, intermediate nodes on the way back, inspect the packet and create a backward route towards destination. Intermediate nodes that got the original RReq packet but were not on the reverse path discard the reverse route table entry when the associated timer expires. When the next hop link in the routing table entry breaks, all active neighbors' are informed by means of RERR packets which updates the sequence number. RERR packets are also generated when a node X is unable to forward packet P from node S to node D on link (X, Y). The incremented sequence number N is included in the RERR. When node S receives the RERR, it initiates a new route discovery for D using the sequence number that is at least as large as N.

In the presence of vampires, carousel attack and stretch attack can be prevented by using the index number. In case of carousel attack, where a packet which traversed through the shortest path of the network, returns back again to the same node, that could be eliminated by checking the index number stored on the packet header and the index number stored in the local routing table of the node.

We can prevent the stretch attack by independently checking on the packet progress: the nodes keep track of route "Metric" and, when acknowledgement returns back, the route metric value and the index number, which indicates the hop count, can be verified. If the index value is greater than the metric value the source concludes that the stretch attacks as occurred.

Moreover, to prevent truncation of the routing path, which would allow Vampires to hide the fact that they are moving a packet away from its destination, we use Saxena and Soh's one-way signature chain construction, which allow nodes to add links to an existing signature chain, but not remove links, making attestations append only. Thus if malicious intervention has been suspected the packet is dropped from further forwarding strategy. Thus, the damage from an attacker is bounded as a function of network size.

III CONCLUSION

Vampire attacks has been defined as a new class of resource consumption attacks that use routing protocols to permanently disable ad hoc wireless sensor networks by depleting nodes' battery power. Defenses against some of the forwarding-phase attacks has been proposed and PLGP-a, the first sensor network routing protocol that reduces the damage from Vampire attacks by verifying that packets consistently make progress toward their

destinations. The routing protocol has been used at the time of routing to make efficient energy utilization during the packet forwarding phase' s-DSDV, routing protocol that provably bounds damage from Vampire attacks by verifying that packets consistently is proposed in this paper. Prevention of data packets from entering into a malicious node is left for future work.

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Efficient pest control of Pollen beetle (*Meligethes aeneus* F.) and possibilities for protecting the pollinators in oilseed rape agrocenosis

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Abstract- Pollen beetle (*Meligethes aeneus* F.) is a damaging pest of oilseed rape. Its harmful activity directly threatens the production and in some years it could compromise the yield. In many cases, the products applied in pest control, turn to be less efficient due to the conditions under which they are applied and the restricted application regime. In order to avoid the development of resistance, it is necessary to use insecticides having different mechanisms of action, which continue for a long enough period of time, with the aim of limiting the application of chemical substances and protecting natural pollinators and bees. There is a combination of chemicals for a good control of Pollen beetle (*M.aeneus*). Knowing the mechanism of their action and their proper combination enables the increase of their efficiency. For achieving that, the insecticide activity of the chemical compounds indoxacarb, deltamethrin + thiacloprid and thiacloprid in the commercial products Avaunt 150 EC, Proteus 110 OD and Calypso 480 SC, applied separately and in a combination with the adjuvant Codacide (95% rape oil + 5% plant emulsifier), was studied.

The results obtained showed that the product Avaunt 150 EC combined with the adjuvant Codacide, applied at the rate of 200 ml/da, provided an adequate protection against pollen beetle at the buttoning and flowering stages of oilseed rape, allowing the preservation of natural pollinators and providing an efficient pest control.

Index Terms- pollen beetle, chemical control, pollinators.

I. INTRODUCTION

The pollen beetle – *Meligethes aeneus* F. belongs to the category of the potentially significant pests on oilseed rape, whose harmful activity directly threatens the yield and compromises the quality of the production.

In many European countries – Denmark, Sweden, Switzerland and others, the pollen beetle is considered to be one of the key pests causing losses that may reach to 60-100% [1-13]. The damages are caused by both the adult insects and the larvae as well [14]. They feed on the flower buds, which significantly reduces the yield of seeds [15].

According to Coll et al. [2] the fight against the pollen beetle can be successful if conducted during the buttoning stage with density of 0,5-1 beetles per plant. Owing to the extended

flowering stage of the oilseed rape and the migration of the pollen beetle, it is often necessary to apply two treatments: the first one during the buttoning stage and the second one in the beginning of the flowering stage [16].

Synthetic pyrethroids and neonicotinoids are usually used in the fight against the pollen beetle [17]. According to some authors Derron et al., [18]; Hansen, [19-20]; Wegorek, [17]; Muller et al., [21]; Glattkowski et al., [22], this pest has rapidly developed resistance to most of the active substances.

In his studies, Hansen [19] examines the resistance of the pollen beetle to synthetic pyrethroids: tau-fluvalinate, lambda-cyhalothrin, esfenvalerate and dimethoate. The conducted surveys show that the beetles survive up to 99% of the standard doses of the synthetic pyrethroids and up to 36% of dimethoate. Neonicotinoids are among the most widely used insecticides in the world but the European Food Safety Agency restricted the use of some compounds of this class owing to the potential risk for the pollinators and the empty hive syndrome „Colony Collapse Disorder”.

The studies conducted in Europe in the 90s prove that the neonicotinoid remains can accumulate in the pollen and the nectar of the treated plants and pose a potential risk to the pollinators [23].

Tennekes [24] has established that the neonicotinoids pass through the entire plant and reach the nectar and the pollen but also accumulate in the soil and the underground water. They have a negative effect not only on the insects that feed on the plant but also on those that pollinate it.

According to Bommarco et al., [25], the bees play an important role in the pollination of the oilseed rape, as a result of which we obtain higher yield compared to when the pollination has been done by the wind.

The limited number of insecticides and the developed resistance of the pollen beetle are the reasons that necessitate looking for new ways of fighting the pest that act differently, preserve the ecological balance in the environment and also the pollinators. Avaunt 150 EC is a suitable preparation which has a different course of action – it is the only insecticide from the new chemical group of oxadiazines. Avaunt 150 EC is an insecticide with stomach and contact action intended to control a large number of pests. This preparation blocks the sodium ducts in the nervous system of the insecticides by connecting with them directly and suppresses the flow of sodium ions. As a result, they stop eating, become disorientated with uncoordinated

movements, paralyze and die within 24-60 hours after applying the treatment. Unlike the other insecticides, there is no “knock-down” effect but they stop eating and do not cause damages. Avaunt 150 EC is applied during the green button stage till the yellow button stage to control the adult insects of the pollen beetle when there are 1-2 beetles on the buttons.

For the purpose of extending the duration of the action of the applied insecticides, over the last few years the adjuvants have become very popular especially with the Brassicaceae family, whose leaves are covered with wax coating. They help improve the retention and the sticking of the working solution to the leaf surface. For that reason, the adjuvant Codacide is used, which contains 95% of oilseed rape + 5% of plant-based emulsifiers. The structure of the product is similar to that of the wax coating in plants, it is harmless and does not pollute the environment. Considering the aforementioned, the purpose of this study is to test the duration and the efficiency of the insecticide Avaunt 150 EC with the adjuvant Codacide against the economically most significant pest on oilseed rape – the pollen beetle.

II. MATERIALS AND METHODS

The studies were conducted in the Experimental field of the Agricultural University – Plovdiv in an area sown with oilseed rape of the hybrid type Xenon as the size of the experimental lots was 25 m². The preparation Avaunt 150 (Indoxacarb) with a structural formula presented in Fig. 1 and adjuvant Codacide were used.

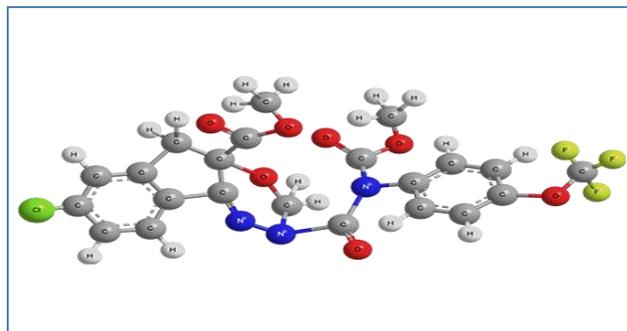


Figure 1: Structural Formula of Indoxacarb



Indoxacarb: (S)-methyl 7-chloro-2, 5-dihydro-2-[(methoxycarbonyl) [4-(trifluoromethoxy) phenyl] amino] carbonyl] indeno [1,2-e] [1,3,4] oxadiazine-4a (3H) carboxylate

The treatments were applied during the buttoning stage. The experiment was based on the block method, three repetitions in eight variants.

Variant I – Avaunt - 17 ml/da;

Variant II – Avaunt - 17 ml/da + Codacide – 50 ml/da;

Variant III – Avaunt - 17 ml/da + Codacide – 100 ml/da;

Variant IV – Avaunt -17 ml/da + Codacide – 150 ml/da;

Variant V – Avaunt - 17 ml/da + Codacide – 200 ml/da;

Variant VI –Proteus - 45 ml/da + Codacide – 45 ml/da;

Variant VII – Calypso - 10 ml/da;

Variant VIII – control sample.

In each variant we marked 10 plants and the recording was done on the 3rd, 5th, 7th, 10th, 12th and 15th days.

We used as a reference the preparations Proteus 110 OD and Calypso SC from the group of the neonicotinoids. This enabled us to compare the efficiency and the duration of the activity of Avaunt with the adjuvant Codacide against the adult pollen beetles.

III. RESULTS AND DISCUSSION

As a result of the conducted spraying during the buttoning stage – the appearance of a yellow button, we registered good efficiency of the preparation Avaunt 150 EC compared to the products Proteus 110 OD and Calypso 480 SC. During the first counting, the number of the living pollen beetles in the variant treated with Avaunt was the largest 5,10 compared to the variants treated with Proteus + Codacide and Calypso (Table 1). The fast initial effect of the neonicotinoids can explain the obtained results. During the next counting, the number of the living pollen beetles in

Table I. Comparative analysis of the duration of the action of various insecticides on adult pollen beetles

Insecticides	Registered living adult pollen beetles						
	Before the treatment	3 rd day	5 th day	7 th day	10 th day	12 th day	15 th day
Avaunt	15,66	5,10*	3,06*	2,66*	1,33*	2,20*	0,43*
Proteus + Codacide - 45ml/da	12,93	2,20*	2,96*	4,56 ^{n.s}	2,86*	1,90*	0,76 ^{n.s}
Calypso	14,76	3,66*	4,30 ^{n.s}	6,83*	4,16*	2,93 ^{n.s}	0,90 ^{n.s}
Control sample	11,70	6,73	5,00	5,00	1,76	3,53	1,00

LSD method with a risk of mistake α - 0,05%

Table II. Comparative analysis of the duration of the action of the insecticide Avaunt in combination with the adjuvant Codacide

Variants	Registered living adult pollen beetles						
	Before the treatment	3 rd day	5 th day	7 th day	10 th day	12 th day	15 th day
I. Avaunt – 17ml/da	15,66	5,10*	3,06*	2,66*	1,33 ^{n.s}	2,20*	0,43*
II. Avaunt + Codacide - 50ml/da	16,60	3,16*	1,36*	1,96*	1,33 ^{n.s}	1,73*	0,33*
III. Avaunt + Codacide - 100ml/da	12,70	3,70*	0,86*	2,50*	0,56*	1,53*	0,26*
IV. Avaunt + Codacide - 150ml/da	9,40	2,56*	0,93*	2,66*	1,13 ^{n.s}	0,93*	0,60*
V. Avaunt + Codacide - 200ml/da	10,83	2,36*	0,53*	2,76*	0,36*	0,46*	0,10*
VI. Control sample	11,70	6,73	5,00	5,00	1,76	3,53	1,00

LSD method with a risk of mistake α - 0,05%

The variant treated with Avaunt gradually decreased and on the 15th day it reached 0,43 insects. Probably, as a result of the unilateral blocking of the Na⁺ exchange in the ducts (in this case the chemical compound indoxacarb), unlike the synthetic pyrethroids which block the Na⁺ and K⁺ exchange, there is a slight initial effect. Eating is suppressed as well as the overall life activity of the treated beetles. As the disrupted exchange accumulates in the nervous system of the insects, the efficiency increases and reaches its highest values at the end of the period of testing (the 15th day).

After the applied combination with the adjuvant Codacide in a dose of 200 ml/da (Table 2), there is a good insecticide synergy which is manifested in the increased initial effect and the higher mortality rate among the insects. This combination compared with the reference Calypso and Proteus has higher indicators of the mortality rate throughout the entire period of registering.

The obtained results show that the product Avaunt 150 EC in combination with the adjuvant Codacide in a dose of 200 ml/da ensures good protection of the oilseed rape from the pollen beetle during the buttoning-flowering stage, which protects the natural pollinators and makes the fight against the pest successful.

IV. CONCLUSIONS

As a result of the conducted studies we can draw the following conclusions:

- in order to fight the pollen beetle – *Meligethes aeneus*, the preparation Avaunt 150 EC (indoxacarb) in a dose of 17 ml/da can be applied once at the end of the buttoning stage.

- the use of plant oils, such as Codacie in a dose of 200 ml/da increases the initial effect of the insecticide Avaunt and its efficiency for a period of 15 days.

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Exploring the Effect of Work Life Conflict on Job Satisfaction of Doctors of Pakistan

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Abstract- This study is conducted to check the impact of work life conflict on job satisfaction of doctors in hospitals of Pakistan. In this current study two dimensions of work life conflict were used to check relationship with job satisfaction. Those two dimensions are: Work to Family conflict and Family to Work conflict. Regression analysis was used to check the relationship between the variables. The result of this study reveals that there is a significant negative relationship between work to family interference and job satisfaction. The results have been discussed in the context of Pakistani culture.

Index Terms- Work to Family Conflict, Family to Work Conflict, Job Satisfaction, Pakistan.

I. INTRODUCTION

The economy of Pakistan is rapidly growing economy of the world. In recent decades work and family setting is distorted by practical and societal changes. The expanding rate of this setting changed the work place of the economies. The month to month consumptions are additionally getting higher in view of general increase of price level. This brought about surfacing of double family earners.

When the wave of globalization caught the Pakistani markets the employment got all the more requesting and the working hours additionally builds. The quick rate improvement in the nation has requested more endeavors from its representatives. Presently associations in Pakistan are paying off great pay bundles, recompense and profits yet the way of the work is all the more requesting. This change has pushed the associations for roused hard to addition and maintain their playing point, by lessening expense, expanding benefits and upgrading the operations. The long working hours, work weight, high requesting occupations, utilization of confounded innovation made it troublesome for representatives to keep a harmony between their occupation and work duties. This circumstance offered adapt to present circumstances of human asset administration issue i.e. Work Life Conflict (WLC). The work related anxiety, work weight, long working hours prompts work disappointment which is one of the principle hamper in the components identified with work/family obstructions.

Clash between work and family obligations and the effect of it on representatives is concern of expanding vitality in prevalent and scholarly distributions. Enterprises are not appraised by their financial standing by Business Week but on the basis of managing work and family convergence (Hammonds, 1997). Netemeyer et al. (1996) given these clashes names of work family clash and family work clash respectively.

Demographic change and behavioral movements in vocation and family unit game plans have brought about researchers and social commentators to address the way of people's inclusion with work and family.

Scholars have found many ways of satisfying the people of organization which are attraction, motivation and retention. Job satisfaction has direct impact on level of absenteeism, commitment, performance and productivity. Employee intention to stay in organization is increased by which cut down in cost of recruitment of new staff.

Significance of occupation fulfillment could be acknowledged by taking Pakistani doctors (physicians) as an illustration. Specialists were on strike in some areas of Punjab, Baluchistan, in Sindh and in twin urban communities Islamabad and Rawalpindi on the grounds that they were not fulfilled by the pay, advancement and improvement strategies, mind given to specialists and numerous different components. This headed them a strike activity and consequently, they stayed out of their employments. Economic study conducted in 2008-2009 shows that there was only one specialist doctor for 2192, which revealed that these doctors are on duty for long hours. In broad daylight healthcare centers specialists are obliged to work for 24 hours, 48 hours and once in a while considerably more. Long working hours quicken work to family clash which thusly comes about the specialists disappointed with their employments.

Most research has been carried out on work-family clash and occupation fulfillment all inclusive and not many analysts gave careful consideration to the connection between the diverse features of work-life clash with employment fulfillment. The reason for the present study is to investigate the connection design between the distinctive measurements of work life clash and occupation fulfillment in general society healing facilities of Rawalpindi, Pakistan.

II. RESEARCH QUESTION

- What is the impact of work life conflict on job satisfaction?

III. RESEARCH OBJECTIVES

- To find the impact of work to family conflict on job satisfaction.
- To find the impact of family to work conflict on job satisfaction.

IV. LITERATURE REVIEW

For most of men and women work and home are the vital domains of living. There is no such conflict in two or more domains which interfere with each other, except work-family congruence but this case is not with few people also. Conflict between work and family arise when one domain interfere with other. As WFC originated in role conflict studies, so according to role theory as “a form of inter-role conflict in which the role pressures from the work and family domains are mutually incompatible in some respect. Greenhaus and Beutell (1985) inferred that participation in the work (family) role is made more difficult by participation in the family (work) role.

According to Netermeyer et al. (1996) there are two dimensions of work-family conflict that is interference of family life in work (Family to work conflict) and the other is interference of work life in family life (Work to family conflict).

Issue of work family conflict and its effects employee on employee is gaining popularity in research because Business week is rating enterprises on the basis of resolving the issues of work and family not on the economic conditions of that enterprise (Hammonds, 1997). Netmeyer et al. (1996) and Adams et al. (1996) concluded that WFC is strongly related with job satisfaction and other job related outcomes. Employee job satisfaction and turnover intention is decreased by increase of work family conflict.

People are more satisfied and show commitment toward their organization if organizations are supporting work life balance (Burke, 2000). Boles, Howard and Donofrio (2001) concluded that increase in work family conflict of employee causes decrease in different job satisfaction facets. The results of this research suggest that work and family responsibilities cannot be seen as mutually exclusive entity in the life of an employee.

Butler and Skattebo (2004) studied men and women while there performances were being rated on the basis of managing conflicts of work family and they found low performance of those men who have experienced work family conflict have low performance then men who didn't experienced and same case was with women. Same finding was revealed by Wang. Le and Zhang (2004), who found that female teacher in university, have a big issue concerning work and family.

Jayaweera (2005) reported that those men who are involved in professional jobs are more satisfied from their work and family, which further improve their emotional well being and work life. Diaz-Serrano and Cabral Vieira (2005) argued that most of the experts and academicians see that job satisfaction might effect job market and can also effect the production, absenteeism and employee intentions to leave consider, so individual being as overall effected by job satisfaction.

Analysis of a study conducted in hotel industry revealed that both dimensions of WFC have negatively relation with job satisfaction (Namasivayam & Zhaao, 2007). Lapiere et al. (2008) found that when family and work satisfaction is increased by reducing work family conflict it also thus enhance life satisfaction. Abbas and Nadeem (2009) also found negative association between work and family conflict and job satisfaction in Pakistani cultural context.

Work to family and family to work conflict both of these two dimensions is negatively associated with our emotional response to work and those people who have less work family conflict, they have positive and enjoy their life in family as well as in work (Zhao, Qu & Ghiselli, 2011).

Nowadays globally nurses are in shortage and leaving the organization, which is a big problem. The underlying factor behind this phenomenon is job satisfaction of nurses. The increasing nursing scarcity and their turnover intention is global issue. The core factor among nurses turnover intention is job satisfaction. Different studies has been conducted in health sector in this regard and found that job satisfaction can be increased by increasing employee commitment and by decreasing work and family conflict, job stress, role ambiguity and role conflict (Lu ,While & Barriball, 2006).

V. HYPOTHESIS

H₁: There is significantly negative relationship between work to family conflict and job satisfaction.

H₂: There is significantly negative relationship between of family to work conflict on job satisfaction.



Figure1: Theoretical Framework

VI. RESEARCH METHODOLOGY

This study is conducted on doctors (House Officers, Medical Officers and Post Graduate Trainees) of Pakistan. Data was collected from Benezir Bhutto Hospital Rawalpindi, Holy Family Hospital Rawalpindi and Pakistan Institute of Medical Sciences (PIMS) Islamabad. Stratified sampling technique was used for data collection. The sample size of this study is 100 and response rate is 71%. Five point likert scale questionnaire ranging from (1)

Strongly Disagree to (5) Strongly Agree was used. Adopted questionnaire was used in this study. Gutek, B.A, Searle, S, & Klepa, L, 1991; Carlson, D.S, & Perrew, P.L. 1999 questionnaire was used for work to family conflict and family to work conflict while Agho et al. 1993 questionnaire was used for job satisfaction. SPSS V20 was used for the analysis.

Table 1: Reliability Analysis of the variables

Variables	Items	Cronbach alpha
WFC	6	.92
FWC	6	.90
Job satisfaction	6	.81

The value of Cronbach's alpha (α) of all variables in the study is greater than .60 which means that that data is reliable and the scale scores are reliable for the study respondents.

variable. Independent variable in this study are work to family conflict and family to work work conflict while dependent variable is job satisfaction.

VII. RESULTS AND DISCUSSION

Correlation and Multiple Regression is used for the analysis between the relationship of Independent variable and dependent

Table 2: Correlation Analysis

	WFC	FWC	JS
Work to Family Conflict	1		
Family to Work Conflict	.261**	1	
Job Satisfaction	-5.180**	-4.872*	1

*. Correlation is significant at the 0.05 level (2-tailed).
**. Correlation is significant at the 0.01 level (2-tailed)

Regression Analysis

H1: There is significantly negative relationship between work to family conflict and job satisfaction.

Table 3: Regression Analysis of Work Family Conflict and Job satisfaction

	R Square	F value	Beta
WFC			
Job Satisfaction	.385	21.274	-5.180***

*p < .05, **p < .01, ***p < .001

The R-square value in above table shows that there is 38.5 % variation in job satisfaction caused by work to family conflict. The value of F (21.274 p<0.001) shows that model is overall strong. The value of Beta coefficient (-5.180 p<0.001) shows that work to family conflict is significant negatively related to job satisfaction. Hence results support our H1.

H2: There is significantly negative relationship between family to work conflict and job satisfaction.

Table 4: Regression Analysis of Family to work conflict and Job Satisfaction

	R Square	F value	Beta
FWC			
Job Satisfaction	.319	19.547	-4.872**

*p < .05, **p < .01, ***p < .001

The R-square value in above table shows that there is 31.9 % variation in job satisfaction caused by family to work conflict. The value of F (19.547 p<0.01) shows that model is overall strong. The value of Beta coefficient (-4.872 p<0.01) shows that family to work conflict is significant negatively related to job satisfaction. Hence results support our H2.

VIII. CONCLUSIONS

Study results indicate that the relationship between work life conflict and job satisfaction is negatively related among doctors. Furthermore, the association between work to family conflict and job satisfaction is strongly negatively related while the relationship between family to work conflict is weakly negative among doctors. The analysis shown that doctors will not be satisfied if they have work life conflict. The results were consistent with the finding of Namasivayam and Zhao (2007) that both the dimensions of Work life conflict were negatively related with job satisfaction.

The main objective of this research was to check the effect of work to family conflict on job satisfaction. The results of hypothesis H1 which was developed and tested in this regard revealed that there is strong negative association between work to family conflict and job satisfaction. Similar finding was shown by (Boles, Howard & Donofrio, 2001) that work to family conflict is significantly negative related with job satisfaction. Work-family conflict reduces employees' job satisfaction which again reduces job performance of an employee.

The other objective of this research was to find out the impact of family to work conflict on job satisfaction. The results if hypothesis H2 revealed that there is negative relationship between family to work conflict and job satisfaction which is also supported with the findings of (Abbass & Nadeem, 2009) who have shown similar results. But here the result of H2 hypothesis the association between two variables was slightly weak which explains that work to family conflict reduces job satisfaction in doctors more than family to work conflict. Job satisfaction among doctors is more reduced when their work interferes with their family, and family to work interference in negatively related to job satisfaction.

IX. LIMITATIONS

One of the big limitations of this study was the generalization of results, a big sample might give results different from ours. Other problem was that if data was collected from more cities that could also be effective. 100 doctors were our target sample size but the response rate was only 71 %. Other major problem was acquiring the data.

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Comparative Study of Neurosecretory Cells in Female *Penaeus Indicus* after Unilateral Eyestalk Ablation

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Abstract- In *Penaeus indicus* neuroendocrine organs plays an important role in the growth and reproduction. In *Penaeus indicus* four different types of neurosecretory cells such as A cell, B cell, C cell, D cell were identified. The Eyestalk of *Penaeus indicus* shows many neurosecretory cells, but the Brain and Thoracic ganglion shows only few neurosecretory cells. After the unilateral Eyestalk ablation the Brain and Thoracic ganglion has many neurosecretory cells. The neuroendocrine glands are stimulatory and inhibitory in function. Brain, Thoracic ganglion are stimulatory principles of growth and reproduction. But the neurosecretory cells in the Eyestalks are inhibitory influence of these function.

Index Terms- Eyestalk, Brain, Thoracic ganglion, Neuro secretory cells .

I. INTRODUCTION

Marine water prawn *Penaeus indicus* are available in the various coast of India in different seasons. The environmental stimuli induces the neuroendocrine system of crustaceans that plays an important role in physiological changes (Adiyodi and Adiyodi, 1970; Anilkumar and Adiyodi, 1985).

Observation of synthetic phase, vacuolar phase and secretory phase in *P. homarus*, and the synthesis and movement of neurosecretory substances in invertebrates (Bern 1963) and (Bern and Hagadorn 1965). The detailed study of neurosecretory cells in *P.indicus* (Mohamed, 1989) and in *P. monodon* (Joseph, 1996). In *M.rosenbergii* the cytoarchitecture of Eyestalk shows similar structure when compared to *M.kistnensis* (Mirajkar et al., 1984). Hence the aim of the study is to compare the neurosecretory cells in *P.indicus* before and after the Eyestalk ablation. The reason for giving much importance to the neurosecretory cells is that induces the reproductive organ, resulting the faster maturation of reproductive organs after the Eyestalk ablation.

II. MATERIALS AND METHODS

Penaeus indicus (Indian white prawn) were collected in and around the Pattipuzham near Mahabalipuram. The specimens were collected from the Madha Prawn Hatchery Centre. The prawns were collected by the local fishermen and they were reared in a big cement tank having the capacity of 0.5 tones water. The cement tank was filled with sea water which was

aerated continuously and the water was removed periodically in every 12 hours.

For the histological studies, healthy female *Penaeus indicus* was selected, dissected and the following tissues were taken out from the normal and unilateral Eyestalk ablated female *Penaeus indicus*, namely Eyestalk, Brain and Thoracic ganglion. For the fixation process Aqueous bouin's solution was used as the fixative. Haematoxylin & eosin stains are used for staining process.

III. RESULTS

Morphology of Eyestalk, Brain and Thoracic ganglion :
Eyestalk:

The Eyestalks are covered with chitinous structure. It is situated in the anterior region at the sides of the cephalic regions of carapace (Figure 1).

Brain:

Brain or supraoesophageal ganglion lies at the base of rostrum, anterior to the oesophagus. It looks white in color and bilobed in structure (Figure 2).

Thoracic ganglion:

It was elongated and oval in structure. It was situated above the thoracic sternal plates. It is white mass in colour giving rise to many nerves. It has 5 segments. (Figure 3).



Figure 1. *Penaeus indicus* unilateral Eyestalk ablation

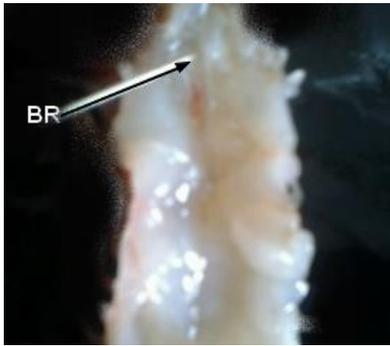


Figure 2. Brain of *Penaeus indicus*
BR- Brain

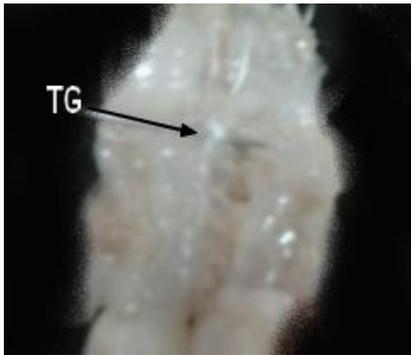


Figure 3. Thoracic ganglion of *Penaeus indicus*.
TG- Thoracic ganglion

Histology of Eyestalk , Brain and Thoracic ganglion:

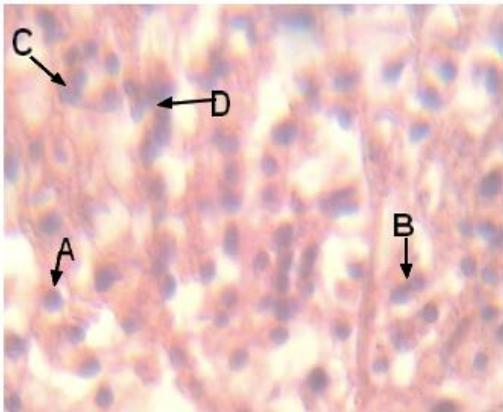


Figure 4 . Eyestalk of *P.indicus*
A- Unipolar cell, B- Bi-polar cell, C- Tripolar cell, and
D- Multipolar cell.

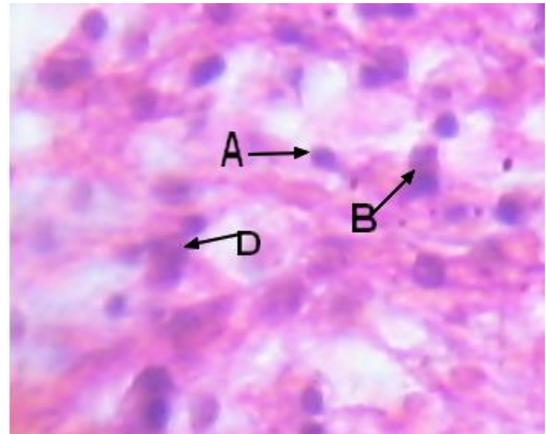


Figure 5. Brain of *P.indicus* before unilateral Eyestalk
ablation
A- Unipolar cell, B- Bi-polar cell, and D- Multipolar
cell.

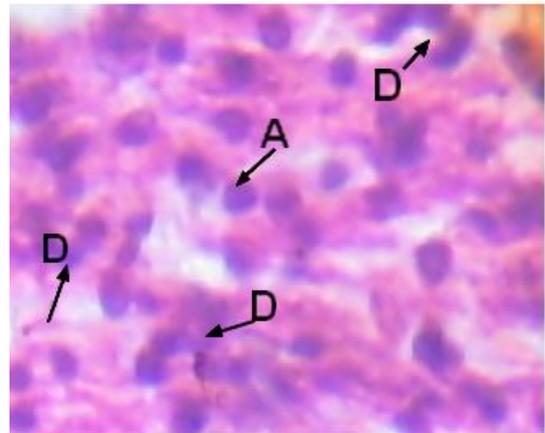


Figure 6. Brain of *P.indicus* after unilateral eyestalk
ablation
A- Unipolar cell and D- Multipolar cell.

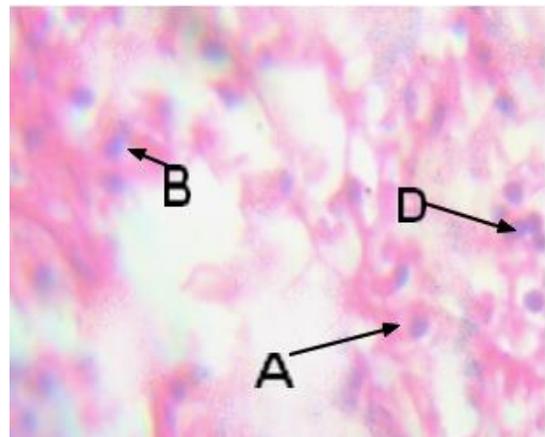


Figure 7. Thoracic ganglion of *P.indicus* before unilateral
Eyestalk ablation
A- Unipolar cell, B- Bi-polar cell and D- Multipolar
cell.

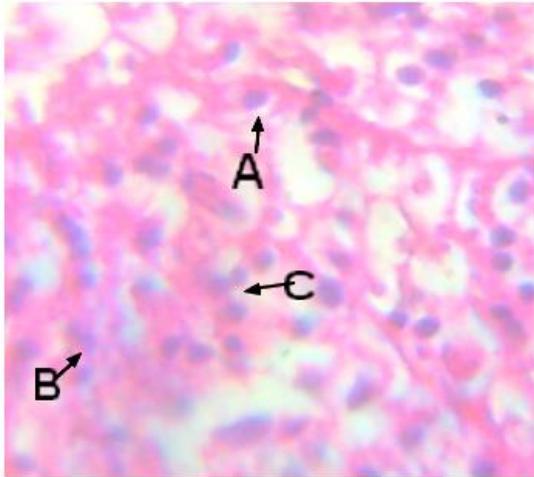


Figure 8. Thoracic ganglion of *P.indicus* after unilateral Eyestalk ablation
A- Unipolar cell, B- Bi-polar cell, and C- Tripolar cell.
Before the unilateral Eyestalk ablation:

In *Penaeus indicus*, before the unilateral Eyestalk ablation the Eyestalk contains many number of neurosecretory cells such as unipolar, bipolar, tripolar, and multipolar cells and it was named as A, B, C, and D (Figure 4). These cells secrete GIH (gonadal inhibiting hormone) that inhibits the gonadal maturation. But Brain and Thoracic ganglion contains less number of neurosecretory cells than in the Eyestalk. In Brain and Thoracic ganglion (Figure 5 & 6) there are three types of neurosecretory cells such as A, B, and D were identified. These cells secrete GSH (gonadal stimulating hormone) that stimulates the gonadal maturation. So that the secretion of neurohormone GIH is more than the GSH, that inhibits the gonadal maturation.

After the unilateral Eyestalk ablation:

In *Penaeus indicus*, after the unilateral ablation the Brain contains many number of neurosecretory cells such as A and D cells (Figure 7). In Thoracic ganglion A, B, and C cells were seen (Figure 8). Especially the number of D cells are more in the Brain of *Penaeus indicus* (Figure 7). After the unilateral Eyestalk ablation the number of neurosecretory cells were reduced which in turn reduces the secretion of GIH. So that the inhibition of gonadal maturation was reduced. Simultaneously, the Brain and Thoracic ganglion containing many number of neurosecretory cells that stimulates the secretion of more GSH resulting the faster gonadal maturation.

IV. DISCUSSION

The secretory activity of different types of neurosecretory cells in different phases such as Quiescent phase, vacuolar phase, secretory phase of the Eyestalk of prawn that induces the gonadal development in *Squilla holoschista* (Deccaraman and Subramoniam 1983a). The formation of granulation is more in sinus gland of immature crabs, but it is less or totally absent in sinus gland of mature crabs *S. holoschista* (Deccaraman and Subramoniam 1983b). In five species of crabs such as, *Eriocheir japonicus*, *Chionectes opilio*, *Potaman dehanni*,

Neptunus trituberculatus, *Sesarma intermedia*, different types of neurosecretory cells were explained. But the optic ganglia of *P. homarus* and optic ganglia of the above mentioned five species of crabs are similar in structure and size. In *P. homarus* has many different types of neurosecretory cells but these cells are different from the other crustaceans. The size of the neurosecretory cells also larger in *P. homarus* when compared to other crustaceans (Matsumoto, 1958).

The distribution of neurosecretory cells and the synthesis of neurohormones, which control the vitellogenesis in female *Panulirus homarus* after Eyestalk ablation (Radhakrishnan and Vijayakumaran, 1984). In *metapenaeus affinis* giant neurons were not seen in the Eyestalk (Rao et al., 1988). In spiny lobster, molting and gonadal maturation was controlled by the hormones of Eyestalk (Quackenbush and Herrnkind, 1981). The present investigation in *Penaeus indicus* after the unilateral ablation of Eyestalk that shows many number of neurosecretory cells in Eyestalk, Brain, and Thoracic ganglion that induces the gonadal maturation.

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Morphological and Molecular Characterization of *Pyricularia Oryzae* Causing Blast Disease in Rice (*Oryza Sativa*) from North India

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Abstract- Rice blast is not only one of the earliest known plant disease but also one of the most widely distributed, occurring in every region of the world where rice is grown. Ten isolates of *Pyricularia oryzae* causing rice blast disease were evaluated for their morphological, pathogenic, virulence and genetic characterization using RAPD marker. Isolates were classified into three groups based on pathogenicity viz. severely pathogenic, moderately pathogenic and mildly pathogenic and also into four another group i.e. PG-I, PG-II, PG-III and PG-IV based on cultural & morphological characteristics. The molecular polymorphism among isolates by means were analyzed by means of RAPD-PCR and the genetic coefficient matrix derived from the scores of the RAPD profile showed that minimum and maximum per cent similarities among isolates were in the range of 80 to 35 percent respectively. The cluster analysis by unweighted pair group method with arithmetic average (UPGMA) separated the isolates into two major groups at 0.53 of similarity coefficient. Through morphological characterization, pathogenicity and RAPD grouping of isolates suggested no correlation among test isolates but genetic variability among *P.oryzae* isolates should be taken into account for the screening of blast resistant rice genotypes.

Index Terms- Blast disease, Rice, RAPD, Pathogenicity,

I. INTRODUCTION

Blast disease is caused by *Magnaporthe oryzae* (Hebert) Barr., anamorph *Pyricularia oryzae* (Rossman *et al.*, 1990) is an important fungal disease of rice known to occur in most rice producing areas of the world (Ou, 1985). The disease can strike all aerial parts of the plant. Most infections occur on the leaves,

causing diamond-shaped lesions with a gray or white center to appear, or on the panicles, which turn white and die before being filled with grain (Scardaci *et al.*, 1997). *P. oryzae* is highly specific to rice, although certain strains that don't attack rice can harm weeds in the rice field. Once on a rice plant, the fungus rapidly produces thousands of spores, which are carried readily through the air, by wind or rain, onto neighboring plants (Rick and Lee, 2000). Blast was first reported in Asia more than three centuries ago and is now present in over 85 countries. It is highly adaptable to environmental conditions and can be found in irrigated lowland, rain-fed upland, or deepwater rice fields (Rao 1992). The disease results in yield loss as high as 70-80% (Ou, 1985) when predisposition factors (high mean temperature values, degree of relative humidity higher than 85-89%, presence of dew, drought stress and excessive nitrogen fertilization) favor epidemic development (Piotti *et al.*, 2005).

The analysis of genetic variation in plant pathogen populations is an important prerequisite for understanding coevolution in the plant pathosystem (Mc Donald *et al.*, 1989). Populations of rice blast pathogen throughout the world have been studied for their phenotypic and genetic variation (Levy *et al.*, 1991; Kumar *et al.*, 1999). Although earlier studies focused on pathotypic variability (Ou, 1985) but recent studies utilized molecular markers to characterize population diversity. The use of molecular markers in population genetic studies has unraveled epidemiologic information to levels of accuracy not previously possible.

Unlike traditional markers, molecular markers are direct manifestations of genetic content and can therefore serve as reliable indices of genetic or pathotypic variation which provide a framework to understand the taxonomy and population structure. They are not influenced by environmental factors and therefore are highly reproducible. Besides, these are cost-effective and less cumbersome. Polymerase chain reaction

(PCR)-based molecular markers are useful tools for detecting genetic variation within populations of phytopathogens (Vakalounakis *et al.*, 1999; Kolmer *et al.*, 2000) Random amplified polymorphic DNA (RAPD) (Welsh *et al.*, 1990; Williams *et al.*, 1990) markers have been widely used for estimating genetic diversity in natural populations (Annamalai *et al.*, 1995), mainly because the technique does not need previous molecular genetic information and increases marker density for evaluating genetic relationship. Many phytopathogenic fungi have been characterized using this technique (Malvickan and Grau, 2001; Vakalounakis and Fragkiadakis, 1999; Muller *et al.*, 2005; Jahani *et al.*, 2008). The present study is planned to investigate the diversity of *P.oryzae* from different geographical regions of north India by using morphological, pathological, and RAPD analysis.

II. MATERIAL AND METHOD

Collection and Isolation of blast pathogen:

Samples of typical blast symptoms on rice leaves were collected from different rice growing regions of north India during 2010-11. The infected portion were cut into small pieces and surface sterilized by dipping in 0.1% HgCl₂ for 1 min. and rinsed three times with sterile distilled water and transferred onto the surface of water agar. The mycelium growing out of the plant tissue was subcultured to potato agar (PDA) and incubated at 25°C for 7 to 10 days. The isolates were identified based on the morphological and cultural characteristics of pathogen. After confirming microscope examination, one monoconidial culture from each isolate was prepared and used in this study (Table 1).

Examination of cultural and morphological characteristics:

The isolates were cultured on PDA as well as on OMA (Oat meal agar) media at 25°C for 7 days, after which mycelia disks were transferred to the center of a new PDA/OMA medium. The colony morphology and colony colour of each isolates on PDA/OMA medium were examined daily from 5 -10 days. For sporulation the culture were maintained in 12 hr night and dark alternatively, then conidia were harvested from each isolates and mounted in water. The shapes of conidia were measured under image analyzer.

Pathogenicity test under in vitro and glasshouse condition:

Pure culture of each isolates are grown on OMA for 7-10 days at 25°C under alternating 14 hour of fluorescent light and 10 hour dark cycle to induce sporulation (Barksdale and Asai, 1961). The conidial suspension was harvested, filtered and centrifuged at 5000 rpm. The mass of spore sedimentation was collected, resuspended with sterilized distilled water and spore density was adjusted to a concentration of 1x 10⁶ spore/ml using haemocytometer. Freshly collected immature and untreated leaves were washed under running tap water for 60 seconds

followed by surface sterilization and immersing the leaves in 70% ethanol for 3 minutes, 1% sodium hypochlorite solution for 3 minutes and then rinsing three times in sterilized distilled water for 2 minutes each time and drying with sterile tissue paper and then air drying. The surface rice leaves were pinpricked with sterile needle then placed in the petridish which is equipped with moist cotton. The drop of 6 µl of 10⁶ spores/ml was placed on the pinpricked or wounded spots and incubated in moist chamber at 25°C and 95% relative humidity (Barksdale and Akai, 1961). The sterile water was used instead of spore suspension served as control under in vitro condition. In another experiment, the conidial spore suspension @ 1 x 10⁶ spore/ml was prepared and sprayed at 3-4 leaf stage on rice leaves under glass house condition. The inoculated plants were covered with polythene sheets for incubation and maintenance of temperature and relative humidity. The appearance of symptom was observed four days after inoculation (Padmanabhan, 1965 and 1965b).

Genomic DNA isolation:

P. oryzae isolates were revived and grown on potato dextrose agar (PDA, Hi Media) plates at 25°C for 5 days (Table 2). For DNA extraction, isolates were grown in 100 ml of potato dextrose broth for 4 days at 25°C in a rotary shaker at 100 rpm. Mycelial mat was filtered, dried and ground to a fine powder in liquid nitrogen. Powdered mycelia were vortexed in pre-warmed lysis buffer [100 mM Tris (pH 8.5), 250 mM NaCl, 0.5 mM EDTA and 0.5% SDS], incubated at 65°C for 30 min followed by the addition of 1.7 M potassium acetate solution. The contents were gently mixed and incubated on ice for 30 min. Samples were then extracted with chloroform and the total nucleic acid was precipitated with chilled isopropanol. The pellet after centrifugation and drying was dissolved in TE (10 mM Tris and 1 mM EDTA, pH 8.0). After RNAase treatment, the DNA was purified with phenol: chloroform (1: 1; v/v) and chloroform: isoamylalcohol (24: 1; v/v) and precipitated with chilled ethanol after adding 1/10th volume of 3 M sodium acetate. The DNA was dissolved in TE buffer (Hamer and Givan 1990).

Molecular diversity analysis using RAPD analysis:

PCR amplification was carried out according to the protocol of Williams *et al.*, 1990 with minor modifications. For RAPD analysis, initially fifteen random primers were selected after screening of 25 RAPD primers (Table 1). Genomic DNA was amplified in a 20 µl reaction volume containing 10 mM Tris-Cl, pH 8.3, 50 mM KCl, 2 mM MgCl₂ 200 µM each of dNTP, 0.2 µM primer, 50 ng of genomic DNA and 0.5 U of Taq DNA polymerase (Merck India, Pvt. Ltd.) in BIO-RAD PTC-100 thermal cycler (USA). The PCR program with an initial denaturation, 94 °C for 5 min., followed by 1.0 min. denaturation at 94 °C, annealing temperature at 35 °C for 1 min, and 72 °C

temperatures for 2 min. elongation were repeated 40 times with the final elongation step at 72 °C for 5 min. The amplified DNA fragments were resolved through electrophoresis in 1.2 % agarose gel prepared in TAE (tris acetic acid) buffer. Finally the gel was stained with ethidium bromide (0.5 µg/ml) and visualized in a gel documentation system (Alpha Digi Doc System, USA). Most informative RAPD primers were scored based on polymorphism information content (PIC) values of individual primers.

$$PIC = 1 - \sum p_i^2;$$

where p_i is the frequency of the i^{th} allele (Smith *et al.*, 1997)

III. RESULTS

Examination of cultural and morphological characteristics:

Ten isolates of *P. oryzae* assigned to six morphological groups (PG-I to PG-VI) based on the differences in morphological characteristics (colony color, colony morphology and conidia shape). Various isolates produced ring like, circular, irregular colonies with rough and smooth margins on OMA media having buff color, grayish black to black color. The colony diameters of different groups were ranged from 67.40 to 82.50 mm. The colonies of group PG-I produced ring like smooth margin with buff to grayish color, PG-II produced circular smooth margin with buff color, PG-III produced circular rough margin with grayish black to black color, PG-IV produced Ring like cottony colony with buff color, PG-V produced irregular rough margin colony with buff color, PG- VI produced circular smooth colony with raised mycelium having buff color. The conidia shape of the different groups was pyriform (pear-shaped) with rounded base, and narrowed towards the tip which is pointed or blunt (Table 1).

Pathogenicity test:

The existence of strains of *P. oryzae* differing in pathogenicity was first noticed by Sasaki (1922). The variable pathogenicity was observed upon inoculation of *P. oryzae* on the rice leaves. All the isolates were pathogenic and produced blast symptoms. On leaves symptoms first appear as small spot and later they enlarge up roundish, slightly elongated necrotic sporulating spots to narrow or slightly elliptical lesions more than 3 mm long with a brown margin. Based on the blast lesions and affected area of leaves isolates were designated into three groups *i.e.* PGV-I, PG-II, PG-III. The first group, PGV-I was designed as mildly virulent strain consisting of two isolates Blast B4, Blast 2. Five isolates, Blast H-1, Blast 4, Blast 6(2), Blast H-8 and Blast H-3 were assigned to group PGV-II designated as moderately virulent strain with the remaining isolates assigned to

group PGV-III Blast 6(2)B, Blast H-13, Blast H-5 severely virulent isolates. .

Random amplified polymorphic DNA (RAPD) analysis:

A total of 10 isolates of *Pyricularia oryzae* were tested or their genetic variability by RAPD analysis using twenty five random primers. Of these, eighteen primers produce easily scorable and consistent banding patterns, which were used for RAPD analysis of test isolates (Table 2). The generated fingerprints were evaluated for overall clearness of the banding pattern. The primers showed polymorphism and consistently produced 2 to 7 bands of 0.3kb to 2 kb although majority was below 1kb. All eighteen primers were polymorphic and having PIC values ranging from 0.54 to 0.90 (Fig 1)

The RAPD scores were used to create a data matrix to analyze genetic relationships using the NTSYS-pc software program version 2.02 described by Rhoif, (1993). Dendrogram constructed based on Jaccard's similarity coefficient using the marker data from *P.oryzae* isolates with UPGMA analysis separated into two major groups A and B at 0.53 of similarity coefficient. In group A three isolates Blast B4, Blast 2, Blast H1 separated whereas in group B seven isolates Blast 4, Blast 6(2), Blast 6(2)B, Blast H13, Blast H5, Blast H8 & Blast H3. Major group A is again divided into two subgroups *i.e.* subgroup IA and IIA. Subgroup IA is clustered with two isolates Blast B4 and Blast 2. Blast H1 is clustered alone in subgroup IIA (Fig 2)

Major group B was again divided into four subgroups *i.e.* subgroup IB, IIB, IIIB, IV B. Blast 4 and Blast 6(2) B separated in the same group and Blast 6(2) separated alone in subgroup IB. In subgroup IIB Blast H13 and Blast H5 separated while Blast H8 and Blast H3 separated in subgroup IIIB and IV B respectively.

Maximum similarity among ten blast fungus isolates based on RAPD profile were found in between Blast H5 and Blast H13 (80% of similarity) followed by in between Blast 6(2) B and Blast B4 (75% of similarity) whereas minimum similarity were found in between Blast H3 and Blast H1 (35% of similarity) followed by in between Blast H3 and Blast 6(2) (43% of similarity).

IV. DISCUSSION

Rice blast is the most serious disease in all rice growing regions of the world. *Pyricularia oryzae* a filamentous ascomycete fungus *i.e.* causal agent of the rice blast disease. The fungus has an ability to overcome resistance within a short time after the release of a resistant cultivar and thus breeding for resistance has become a constant challenge. The analysis of genetic variation in plant pathogen populations is an important pre-requisite for understanding coevolution in the plant

pathosystem (McDonald *et al.*, 1989). The population structure of *P. oryzae* rice isolates from the northwestern Himalayan region of India was analysed using RAPD markers, which showed high genotypic variation in the pathogen population (Rathore *et al.*, 2004). Studies on morphological character of different isolates of *P. oryza* revealed variation with respect to colony color, morphology and conidia shape. Colony colour varies from buff colour to black colour and producing smooth and rough margin colony. However, no variation with respect to conidial shape was noticed. Where conidia was pyriform, almost hyaline to pale olive, 2-septate, 3-celled. These characters are in agreement as described by Shirai (1896). Rice hosts of *P. oryzae* show a continuous array of symptoms in reaction to the infection of various isolates of the fungus—from very minute brown specks (resistant), to roundish lesions a few millimeters in diameter with small, grey necrotic centers and brown margins (intermediate), to large elliptical lesions, with large, grey necrotic centers and brown or grey margins (susceptible). The lesion morphology commonly observed with the rice infection are the typical eye shaped with grayish center and brown margin. Tremendous variation in virulence has been documented in field population of the blast fungus (Bonman *et al.*, 1986; Correa-Victoria *et al.*, 1993; Lee and Chao, 1990; Ou, 1980, 1985; Zeigler *et al.*, 1995) and to some degree among asexual derivatives of single spore isolates (Latterell and Rossi, 1986; Valent *et al.*, 1991). In present study Blast 6(2)B, Blast H-13, Blast H-5 possess higher pathogenicity collected from north India (Siddhathnagar and Delhi) respectively whereas two local isolate Blast B4 and Blast 2 were mildly virulent collected from Kumarganj, Faizabad and Siddharthanagar respectively. Differences in pathogenicity between individual isolates have been used for a long time to assess variation in natural pathogen populations (Burdon, 1993).

Analysis of the diversity of the plant pathogen has been revolutionized by molecular techniques and particularly PCR techniques have helped to understand taxonomy and population structure. According to Burdon and Silk (1997), plant pathogenic fungi most commonly rely on mutation and recombination as the main source of genetically based variations. Molecular marker has been used widely to characterize fungal plant pathogen populations, in particular for the assessment of genetic diversity, phylogenetic relationships and the characterization of pathotypes. The level of degree of genome coverage and the type of DNA sequence variation being assayed. In present study total 25 RAPD primers were used among them 18 were amplified that gives total of 193 band out of them 106 band were polymorphic. Similarly 32 primers were used for the assessment of genetic diversity of Indian isolates of rice blast pathogen (*Pyricularia oryzae*) by Sonia and Gopalakrishna (2005 a) and gives total of 269 band among them 171 band were polymorphic. Sere *et al.*, (2007) used ten primers out of 82 primers that showed polymorphism among individual isolates. The amplification

reactions with the 10 primers generated 153 bands, 108 of them being polymorphic. The primers showed polymorphism and consistently produced 2 to 7 bands of 0.3kb to 2 kb although majority was below 1kb. However this value was lower than the study of Kumar *et al.*, 2010 ranges from 40 bp to 4.2 kb. But nearly similar result was found by Chada and Gopalakrishna (2005b) with REMAP marker and value ranges from 0.1 to 2 kb. Dendrogram constructed based on Jaccard's similarity coefficient using the marker data from *P. oryzae* isolates with UPGMA analysis separated into two major groups A and B at 0.53 of similarity coefficient and this coefficient was lower than the Rathour *et al.*, 2004 *i.e.* 0.84 who tested 48 *P.oryzae* isolates with total of 65 RAPD primers among them 5 were polymorphic. Similarities among ten blast fungus isolates based on RAPD profile were ranged from 35 to 80%. Our result was in agreement with previous studies in which similarity values ranged from 20 to 80% (Sharma *et al.*, 2002).

V. CONCLUSION

We conclude that *P. oryzae* from various regions of North India consists of variable populations based on cultural morphology, virulence pattern and RAPD analysis. Molecular phylogenetic grouping obtained by RAPD analysis did not correlate with morphological characteristics and virulence pattern. In the present study RAPD data failed to reveal relationship between clustering in the dendrogram and in pathogenicity but two isolates from Delhi having high pathogenicity were clustered in same group shows close genetic identity. However other isolates were genetically varied with respect to geographical distribution. Pathogen diversity plays a major role in disease dynamics and consequently, in the success of disease management strategies, including the development of cultivars resistant to diseases. The result of the present study demonstrates that there is a certain level of genetic diversity among isolates of *P.oryza* from various regions of north India. Pathogenicity tests revealed that these isolates expressed different level of virulence. The genetic variability among the isolates of *P. oryzae* should be taken in to account when *P. oryzae* are used for screening of rice genotypes for blast resistance. On the basis of the present study, it is concluded that the population of rice blast fungus collected from different regions of north India is genetically heterogeneous and the interrelationships amongst the different isolates can be easily, precisely and reliably explained by RAPD.

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Table 1: Cultural and morphological characterization of different isolates of *P. oryzae* causing rice blast disease

Isolate	Location	Colony morphology	Colony colour	Conidia shape	Pathogenicity	Morphology group	Pathogenicity group
Blast B4	Kumarganj, Faizabad (U.P. India)	Ring like, smooth margin	Buff colour	Pyriiform, small	Mild	PG-I	PGV-I
Blast 2	Dhensa-A, Siddharthnagar	Circular smooth margin	Buff colour	Pyriiform, medium	Mild	PG-II	PGV-2
Blast H-1	IARI, New Delhi	Circular, rough margin	Grayish Black	Pyriiform, medium	Moderate	PG-III	PGV-II
Blast 4	Kumarganj, Faizabad	Ring like, cottony, smooth margin	Buff colour	Pyriiform, medium	Moderate	PG-IV	PGV-II
Blast 6(2)	Parsiya, Siddharthnagar	Circular smooth margin, raised mycelium	Buff colour	Pyriiform, small	Moderate	PG-VI	PGV-II
Blast 6(2)B	Chhatra (Shoharatgarh), Siddharthnagar	Irregular rough margin	Buff colour	Pyriiform, medium	High	PG-V	PGV-III
Blast H-8	IARI, New Delhi	Circular, rough margin	Black colour	Pyriiform, large	Moderate	PG-III	PGV-II
Blast H-3	IARI, New Delhi	Ring like, smooth margin	Grayish black colour	Pyriiform, large	Moderate	PG-I	PGV-II
Blast H-13	IARI, New Delhi	Circular, rough margin	Black colour	Pyriiform, medium	High	PG-III	PGV-III
Blast H-5	IARI, New Delhi	Circular, rough margin	Black colour	Pyriiform, large	High	PG-III	PGV-III

Table 2: RAPD primers used in the present study; their sequence, annealing temperature, % polymorphism and Polymorphic Information content (PIC) value

S.N o.	Primer	Primer sequence (5'-3')	Total no. of band amplified	Polymorphic band	Polymorphism (%)	PIC
1	OPA 13	CAGCACCCAC	6	4	66.7	.90
2	OPA 16	AGCCAGCGAC	8	5	62.5	.82
3	OPA 17	GACCGCTTGT	9	6	66.7	.83
4	OPA 19	CAAACGTCGG	6	5	83.3	.80
5	OPB 08	GTCCACACGC	10	7	70	.85
6	OPB 11	GTAGACCCGT	11	6	54.5	.72
7	OPB 13	TTCCCGCGCT	8	6	75	.86
8	OPB 18	CCACAGCACT	7	5	71.4	.82
9	OPB 10	CTGCTGGGAC	10	6	60	.73
10	OPN 01	CTCACGTTGG	8	6	75	.87
11	OPN 07	CAGCCCAGAG	12	9	75	.85
12	OPK 11	AATGCCCCAG	10	6	60	.70
13	OPK 17	CCCAGCTCTG	7	4	57.2	.67
14	OPO10	TCACAGCGCC	11	9	81.8	.79
15	OPO 12	TCACAGCGCC	8	7	87.5	.82
16	OPO 11	GACAGGAGGT	-	-	-	-
17	OPC 07	GTCCCGACGA	-	-	-	-
18	OPC 15	GACGGATCAG	7	4	57.1	.57
19	OPO 08	GTGTGCCCCA	9	5	55.6	.54
20	OPY 15	AGTCGCCCTT	10	6	60	.71
21	OPY 18	GTGGAGTCAG	-	-	-	-
22	OPY 14	GGTCGATCTG	-	-	-	-
23	OPY 09	AGCAGCGCAC	-	-	-	-
24	OPF 14	TGCTGCAGGT	-	-	-	-
25	OPF17	AACCCGGGAA	-	-	-	-
		Total	193	106	54.92	

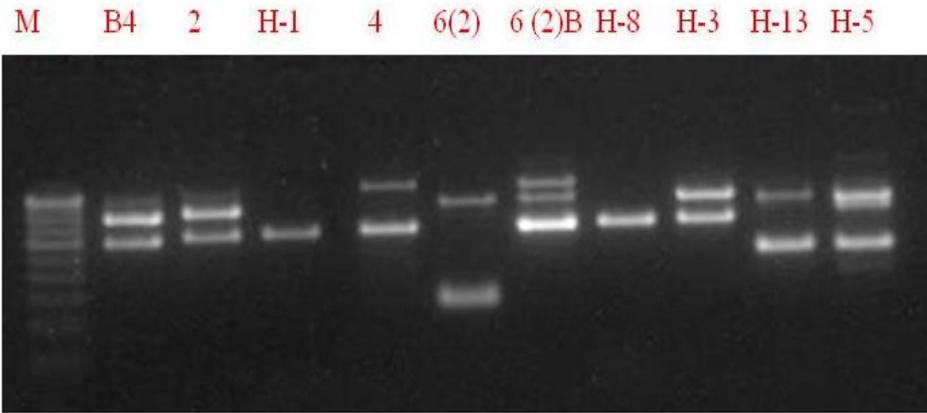


Fig. 1: Amplification of *P. oryzae* genomic DNA with primer OPB18, M: 100 bp ladder (B4 to H5 *P. oryzae* isolate)

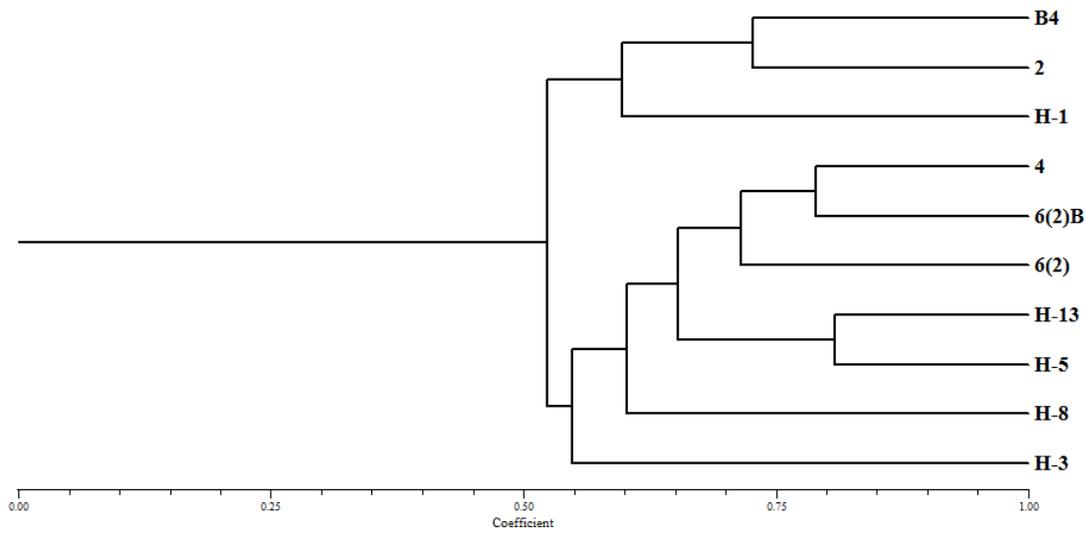


Fig .2: Dendrogram showing the relationship between the ten *P. oryzae* isolates derived from cluster analysis of the RAPD profile.

Effect of concentration of the Electrolyte on the performance of Photoelectro Chemical (PEC) Solar Cell using MoSe₂ Single Crystal

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Abstract - The single crystal of MoSe₂ grown by chemical vapour transport (CVT) technique are used for the fabrication of Photoelectro chemical (PEC) solar cells. The effect of the concentration of the electrolyte on the conversion efficiency of the fabricated PEC solar cell is studied.

Index Terms - Single crystal of MoSe₂, Photoelectrochemical solar Cell, Effect of concentration of the Electrolyte, conversion efficiency

I. INTRODUCTION

The transition metal dichalcogenides (TMDCs) materials have considerable importance because of their usefulness as lubricating materials, switching devices, electrodes for photoelectrochemical solar cells, etc. The chemical vapour transport (CVT) techniques using halogen (Br or I) as the transporting agent has been found to be a suitable technique by several researchers [1-7] for growing the single crystals of layered compounds. It appears from the literature that there has been no previous attempt to grow the single crystals of MoSe_xTe_{2-x} (0 ≤ x ≤ 2). Kline et al [8] reported that the transition metal dichalcogenides (TMDCs) form a wide range of solid solutions [9,10] with either mixed metal or chalcogenide composition or both and the properties, like crystal structure, band gap, band positions and stability to corrosion, which are of prime interest to photoelectrochemist might be influenced by changing the composition of the layered crystals.

The author did the growth of MoSe₂ single crystal by chemical vapour transport (CVT) technique. The grown single crystals of MoSe₂ were used for the fabrication of photoelectrochemical (PEC) solar cells. The PEC studies were undertaken in I₂/I⁻ electrolytes. The study of varying concentration of electrolyte was studied. The results obtained are deliberated in this research paper.

II. EXPERIMENTAL

A. Single Crystals Growth

Stoichiometric amounts of 99.999% pure molybdenum and selenium were introduced into a cleaned, etched and vacuum backed quartz ampoule of internal diameter 25 mm and length 200 mm. A total charge of about 9-12 gm was used in the experiment. The transporting agent bromine by weight of 3 mg / cm³ to 4 mg / cm³ of ampoules volume was introduced into the ampoule in a sealed capillary tube. The

ampoule was then evacuated to a pressure less than 10⁻⁵ torr and sealed at the constriction 3 mm in diameter.

The ampoule was vigorously vibrated to ensure that the capillary tube breaks releasing the bromine and the powders were mixed properly. The mixture was distributed along the length of the ampoule and placed in a two zone horizontal furnace and the temperature was slowly increased to 900°C. The ampoule was left at this temperature for 120 hours.

Then the furnace was shut down and allowed to cool down to room temperature. A free flowing shining dark mixture resulted from the reaction.

The charge thus prepared was well mixed by vigorous shaking of the ampoule. The powder was then placed at one end of the ampoule known as charge zone. Whereas the other end the ampoule was empty for crystal growth to happen and known as growth zone. The ampoule with this distribution of the charge was kept in the furnace again for the growth of crystals as shown fig.1. The furnace temperature was increased slowly, as was done for charge preparation to the required final temperature for growth.

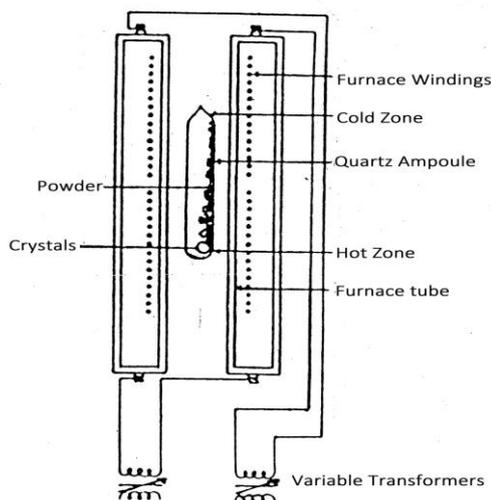


Fig 1 : Schematic view of the furnace showing the position of ampoule inside the two furnace during crystal growth.

The exact growth conditions adopted for MoSe₂ has been described in Table 1. Fig. 2 shows in general the temperature gradient maintained along the ampoule. After the required period of growth the furnace was shut off and allowed to cool

down to room temperature. The ampoule was broken and crystals were removed for further studies.

The crystals obtained were grey black, in colour and plate like with the c axis normal to the plane of the plates and all of them grew over the transported charge inside the ampoule.

Table 1 : Growth conditions used to produce single crystals of MoSe₂

Nominal composition	Reaction temperature (°C)	Growth temperature (°C)	Growth time (hrs)
MoSe ₂	900	800	120

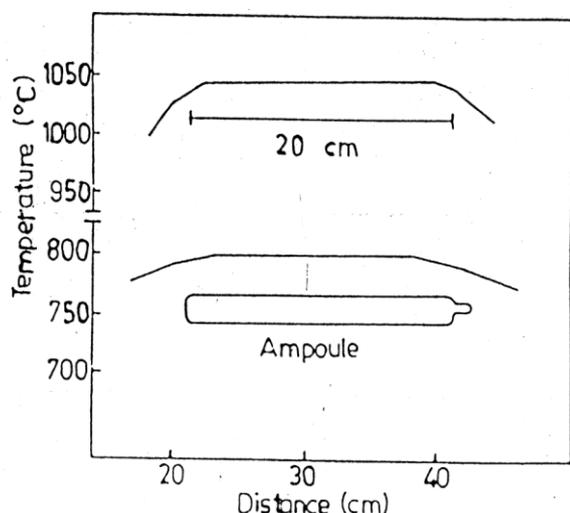


Fig 2: Temperature profile of the furnace.

B. Photoelectrochemical (PEC) Solar Cells

There have been several discussions in recent years on photoelectrochemical (PEC) methods of solar energy conversion. An important factor affecting the conversion efficiency is the electrolyte. The detailed studies have been carried out by various workers[11-23] on the photoelectrochemical behavior in contact with different aqueous and non aqueous redox electrolytes. Their results have indicates that iodine / iodide, I₂/I⁻ system to be optimal redox couple for the best performance and stability. Since the light conversion efficiency of the cell based on I₂/I⁻ depends upon iodine contact of the redox couple, the iodine concentration has been optimized in the present work for better conversion efficiencies of MoSe₂ photo electrodes.

A key element of PEC devices is the semiconductor electrolyte interface. The degree of effectiveness of minority carrier charge transfer across their interface will have direct bearing on the ultimate energy conversion efficiency of the system.

The strategy of enhancing this charge exchange by electing the temperature has the added advantage of utilizing the near IR region of solar spectrum, which otherwise would

be wasted. Temperature also has beneficial effects on the optical properties of the semi conductor.

An effort has therefore been made to critically evaluate the effect of electrolyte concentration on the photovoltaic performance of MoSe₂ photoelectrodes.

C. RESULTS AND DISCUSSION

Single crystals of MoSe₂ have been grown by the chemical vapour transport (CVT) technique because it yields large single crystals with relative ease.

The crystals are strain free because they grow vertically in the form of thin platelets directly above the transported charge.

The X-ray diffraction studies of MoSe₂ indicate that the crystal formed are of single phase .

A. Iodine Concentration Effect

The grown single crystals of MoSe₂ as photo electrodes and platinum grid as counter electrode have been used for fabrication of PEC cells. The photo electrochemical glass cell has been so designed that the electrolyte can be changed without disturbing the electrode position. Electrolytes of different concentrations of iodine are prepared by addition of Na I and Na₂SO₄ in double distilled water. All chemicals are of A.R. Grade. The effect of iodine concentration on the efficiency (η%) for MoSe₂ is shown in fig.3 The decrease in efficiency at higher concentrations of iodine is due to absorption of light in electrolyte which results into lower short circuit currents . The decrease in efficiencies can also be attributed to the presence of large amounts of elemental iodine which can interact with the surface and generate surface states which can trap charges of either sign. This causes large charges of potential drop in Helmholtz double layer as well as shifts in the energy position on band edges. The amount of iodine adsorption, which affects the band bending in the semiconductor can also be considered as a factor affecting efficiency[19].

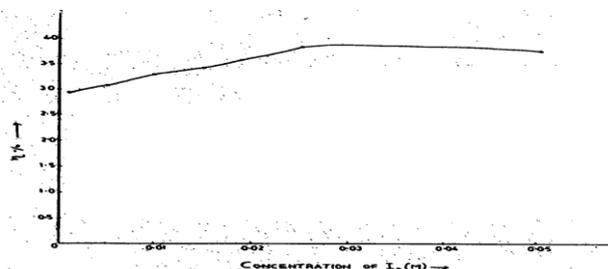


Fig 3: Plot of efficiency versus iodine concentrations I₂(M) for PEC solar cells based on MoSe₂

D. CONCLUSION

The efficiency, fill factor, open circuit voltage and short circuit current of PEC solar cell is found to depend upon the electrolyte content concentration specifically over here iodine

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Assessment of suitability of Fly Ash and Rice Husk Ash burnt clay bricks

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Abstract- The proposed study involves the experimental investigation of effect of fly ash and rice husk ash on the properties of burnt clay bricks. Determination of properties of the bricks casted with varying proportions of admixtures is taken up to ascertain whether the admixtures can be used for the production of clay bricks. On seeing the present day demand for bricks, an attempt is made to study the behavior of bricks manufactured using, different waste materials like rice husk ash and fly ash. The main aim of this research was to compare the compressive strength of the bricks, so for this purpose different percentage of materials were separately added 5%, 10%, 15%, 20% and 25% by weight and then the compressive strength of the bricks was established, and then with the help of graph a comparison between compressive strength of bricks, made out of clay, Fly Ash, Rice husk ash and combination of all these was determined. The bricks were made, sun dried and burnt in a kiln, and then with the help of Compression Testing Machine (C.T.M.) finely their compressive strength was calculated. From this test in this research work it was concluded that the bricks with fly ash as the waste material admixture, gave the highest compressive strength. The fly ash admixture, in line with its pozzolanic nature, was able to contribute in attaining denser products with higher compressive strength, higher water absorption rates, better durability and better overall performance. The effects of the addition of rice husk ash and combination of fly ash and rice husk ash by percentage-clay mix was also investigated.

Index Terms- Bricks, Clay, Compressive strength, Fly Ash, Rice Husk Ash, Water absorption.

I. INTRODUCTION

A brick is a block made of clay burnt in a kiln. It is one of the primary building materials known to mankind. Bricks are composed of inorganic non-metallic material and are widely used as building components all over the world. Over time, bricks have appeared, gained prominence, lost importance and then come to the forefront again with various styles of architecture. Burnt bricks were used in ancient Indian, Babylon, Egypt and Roman civilizations. Bricks find mention in the Bible; the tower of Babel was built with burnt bricks.

The need for locally manufactured building materials has been emphasized in many countries of the world because of their easy availability and low cost. Bricks also have been regarded as one of the longest lasting and strongest building materials, made from locally available sources, used throughout

history. Ordinary building bricks are made of a mixture of clay, which is subjected to various processes, differing according to the nature of the material, the method of manufacture and the character of the finished product. After being properly prepared the clay is formed in molds to the desired shape, then dried and burnt. Burnt bricks are usually stronger than sundried bricks, especially if they are made of clay or clayey material. Burnt clay bricks are weaker compared to bricks made of cement in terms of strength and durability. Another important factor adding to the disadvantages of burnt clay brick is the environmental impact involved in the manufacturing process of clay bricks. To overcome these drawbacks an attempt has been made to increase the overall efficiency of clay brick by adding other suitable materials along with clay in the manufacturing process. In this project, we have tried to study the effects of adding fly ash and rice husk ash to the conventional clay bricks. The effect of addition of fly ash and rice husk ash, in varying percentages, to different properties of clay bricks such as compressive strength, water absorption etc. is investigated.

The construction industry in India contributes to about 10 % of the Gross Domestic Progress (GDP), registering an annual growth of about 9 %. Clay fired bricks form the backbone of the construction industry which is valued at approximately US\$ 70.8 billion. The brick sector in India, although unorganised, is tremendous in size and spread. India is the second largest brick producer (China dominates with 54 % share) in the world. It is continuously expanding on account of a rapid increase in demand for bricks in infrastructure and housing industries. In order to meet this demand, over 150,000 brick units provide direct employment to more than 8 million workers. During the eleventh Five-year Plan period (2007-2012), the annual demand of 220 million bricks per year was estimated to be generating revenues of over US\$ 5.3 billion.

Considering all the points discussed above, there is a need to find some alternative so as to reduce the impact of clay brick manufacturing process on the environment and at the same time increase the overall performance of the bricks. This research aims to achieve both the mentioned improvements by using admixtures along with clay during the manufacturing process. Certain group of admixtures are added to increase the bond between the particles and thus the strength of the brick. Such admixtures are either cementitious or pozzolanic materials. Pozzolanic materials include the traditional lime. The recent non-traditional pozzolanic admixtures used for brick production include wood ash, sawdust ash and fly ash. A second category of admixtures includes organic matter, such as rice husks, sawdust, coal, etc., which burn out when the bricks undergo firing. They

regulate the temperature to which the brick is fired during burning, which is of paramount importance. The higher the firing temperature, the higher is the quality of the finished product. The addition of admixtures serves the following purposes:

1. Addition of pozzolanic admixtures like fly ash, wood ash etc. increases the strength of the brick.
2. As the organic admixture like saw dust, rice husk ash, etc. burn out they leave pores in the product. This permits the control of the bulk density of brick products and help in producing lighter porous bricks. The pores produced as the admixtures are burnt out permit the heat to reach innermost part of the core, thereby avoiding unburnt cores.
3. The admixtures result in more uniformly burnt bricks, especially when the firing is being done outside of factory conditions, in which case inability to reach the minimum desired temperature of 1000 °C results in unburnt cores especially in solid bricks.
4. Overall, there is a reduction in fuel and power expenditures involved in the brick manufacturing process.

II. MATERIAL USED FOR THE STUDY

2.1 CLAY:

Clay used for brick manufacturing should have the following properties:

- Plastic when mixed with water
- Have enough tensile strength to keep its shape
- Clay particles must fuse together

Clay soils are compounds of silica and alumina. Calcareous clays have calcium carbonate and will burn to a yellow or cream color. Non-calcareous typically contain feldspar and iron oxides, and will burn to a brown, pink or red, depending on the amount of iron oxide. The silica in the clay, when fired at 900-1200 degrees C, will turn to a glassy phase. This process, called vitrification, will turn the clay to a crystalline structure. Therefore, for the process of vitrification temperature is important. If under-fired, the bonding between the clay particles will be poor and the brick will be weak. If the temperature is too high, the bricks will melt or slump. Vitrification does not have to be complete, and does not actually occur in many of the small traditional brickmaking plants around the world. However, the vitrification does occur enough to give sufficient strength to the brick. It takes approximately 3 cubic meters of clay soil to make 1000 bricks.

2.2 FLY ASH:

Fly ash is the by-product of coal combustion collected by the mechanical or electrostatic precipitator (ESP) before the flue gases reach the chimneys of thermal power stations in very large volumes. All fly ash contain significant amounts of silicon dioxide (SiO₂), aluminum oxide (Al₂O₃), iron oxide (Fe₂O₃), calcium oxide (CaO), and magnesium oxide (MgO). However, the actual composition varies from plant to plant depending on the coal burned and the type of burner employed. Fly ash also contains trace elements such as mercury, arsenic, antimony, chromium, selenium, lead, cadmium, nickel, and zinc.

These particles solidify as microscopic, glassy spheres that are collected from the power plant's exhaust before they can —flyl away — hence the product's name: Fly Ash. Chemically, fly ash is a pozzolan. When mixed with lime (calcium hydroxide), pozzolans combine to form cementitious compounds.

The power requirements of the country are rapidly increasing due to growth of industries.65% of the total power produced in India is by thermal power plants and hence there is an increase in fly ash production. Further Indian coal contains 30 to 40% of ash content which further gives rise to air pollution, soil pollution, disrupts ecological cycles and causes other environmental hazards. Fly ash also contains traces of toxic substances which may affect human health, plant life and also the land on which fly ash is deposited. The disposal of this waste material is a matter of great concern from the environmental and ecological point of view. The safest and gainful utilization of fly ash has been one of the topics of research over the last few decades. The options of ash utilization including the ash based products are at development stage and need to be made more environments friendly by bringing ash revolution. It is estimated at present nearly 160 million ton fly ash is produced every year.

2.3 RICE HUSK ASH:

Rice husk ash (RHA) is obtained by burning rice husk. Physical properties of RHA are greatly affected by burning conditions. When the combustion is incomplete, large amount of un-burnt carbon is found in the ash. When combustion is completed, grey to whitish ash is obtained.

The amorphous content depends on burning temperature and holding time. Optimum properties can be obtained when rice husks are burnt at 500 - 700°C and held for short time, this temperature at which the husk is being burnt is less than that required for formation of clinkers in cement manufacturing process, the resulting ash can be used as a replacement of cement in concrete. The Rice Husk ash used in plain cement concrete oft en achieves economy and cost savings and imparts specific engineering properties to finished products. The chemical composition of RHA produced by utilizing the fluidized bed type furnace is reported to be SiO₂ (80-95%), K₂O (1- 2%) and un-burnt carbon (3-18%). The pozzolanic activity of rice husk ash is effective in improving the strength.

III. MATERIAL TESTING

3.1 SPECIFIC GRAVITY:

The specific gravity test was done using pycnometer for all samples passing through 4.75mm IS sieve.

TABLE NO. 3.1 SPECIFIC GRAVITY OF MATERIALS USED

Sl.No	Material	Specific Gravity
1	Clay	2.25
2	Fly Ash	2.00
3	Rice Husk Ash	0.45

IV. ANALYSIS AND RESULTS

4.1 COMPRESSIVE STRENGTH TEST:

The compressive strength of the samples prepared was determined in a Compression testing Machine. For the research 3 samples of each composition were tested and average of the results is as tabulated below.

TABLE NO. 4.1 COMPRESSIVE STRENGTH TEST RESULTS

Sl. No.	Type of Sample	Avg compressive strength (MPa)
1	100% Clay	4.938
2	95% Clay + 5% Fly ash	5.074
3	90% Clay + 10% Fly ash	5.126
4	85% Clay + 15% Fly ash	5.457
5	80% Clay + 20% Fly ash	5.801
6	75% Clay + 25% Fly ash	6.081
7	95% Clay + 5% Rice Husk ash	5.027
8	90% Clay + 10% Rice Husk ash	4.806
9	85% Clay + 15% Rice Husk ash	4.288
10	80% Clay + 20% Rice Husk ash	3.991
11	75% Clay + 25% Rice Husk ash	3.823
12	95% Clay + 2.5% Fly ash + 2.5% Rice Husk ash	3.786
13	90% Clay + 5% Fly ash + 5% Rice Husk ash	5.039
14	85% Clay + 7.5% Fly ash + 7.5% Rice Husk ash	5.199
15	80% Clay + 10% Fly ash + 10% Rice Husk ash	5.509
16	85% Clay + 12.5% Fly ash + 12.5% Rice Husk ash	5.753

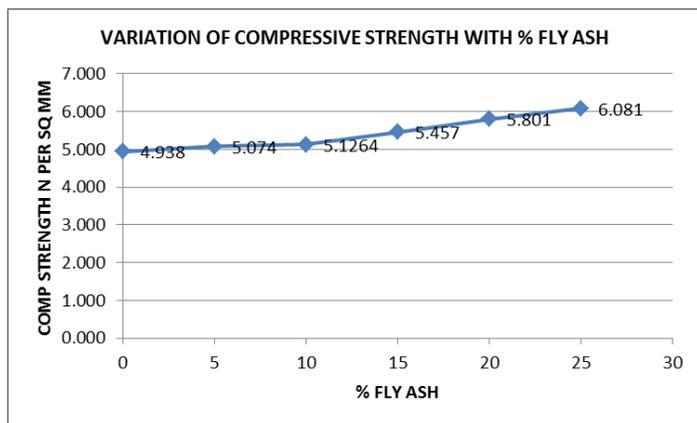


Figure 4.1: Compressive strength of Fly ash bricks.

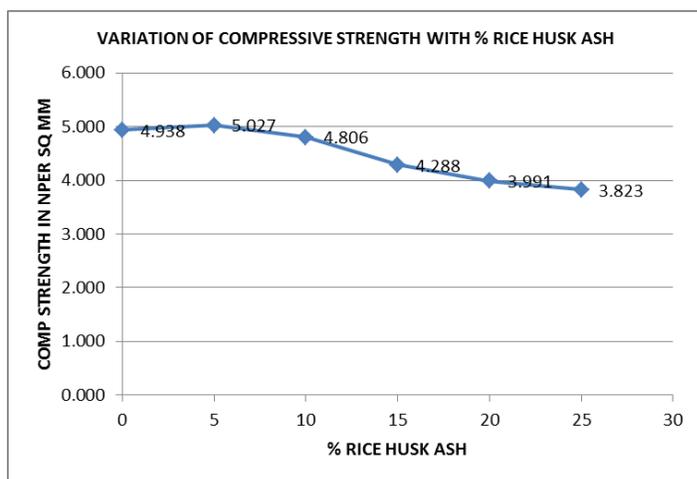


Figure 4.2: Compressive strength of Rice Husk ash bricks.

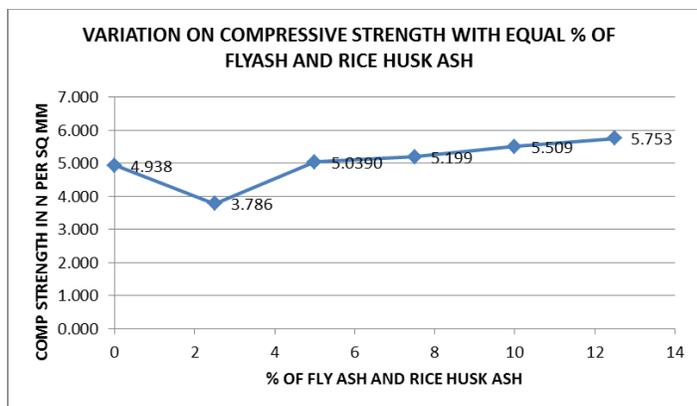


Figure 4.3: Compressive strength of Fly ash and Rice Husk ash bricks.

4.2 WATER ABSORPTION TEST:

The water absorption of the samples prepared was determined by 24 hour cold water immersion test. For the research 6 samples of each composition were tested and average of the results is as tabulated below.

TABLE NO. 4.2 WATER ABSORPTION TEST RESULTS

Sl. No.	Type of Sample	Water Absorption (%)
1	100% Clay	4.75
2	95% Clay + 5% Fly ash	9.81
3	90% Clay + 10% Fly ash	11.84
4	85% Clay + 15% Fly ash	14.58
5	80% Clay + 20% Fly ash	15.07
6	75% Clay + 25% Fly ash	16.43
7	95% Clay + 5% Rice Husk ash	8.16
8	90% Clay + 10% Rice Husk ash	12.78
9	85% Clay + 15% Rice Husk ash	13.66
10	80% Clay + 20% Rice Husk ash	14.43
11	75% Clay + 25% Rice Husk ash	16.16
12	95% Clay + 2.5% Fly ash + 2.5% Rice Husk ash	11.21
13	90% Clay + 5% Fly ash + 5% Rice Husk ash	13.36
14	85% Clay + 7.5% Fly ash + 7.5% Rice Husk ash	15.05
15	80% Clay + 10% Fly ash + 10% Rice Husk ash	16.38
16	85% Clay + 12.5% Fly ash + 12.5% Rice Husk ash	17.09

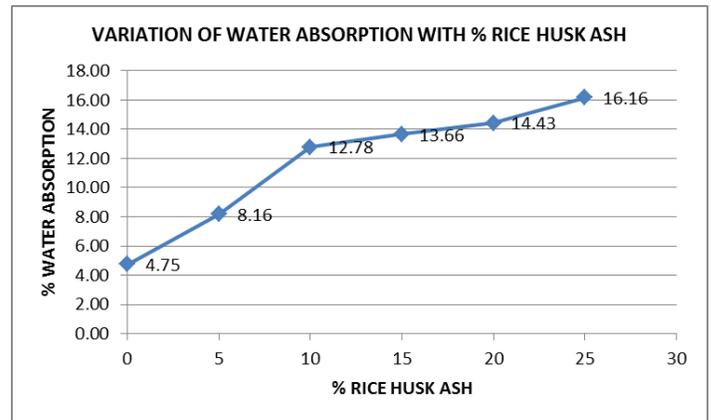


Figure 4.5: Water absorption of Rice Husk Ash bricks.

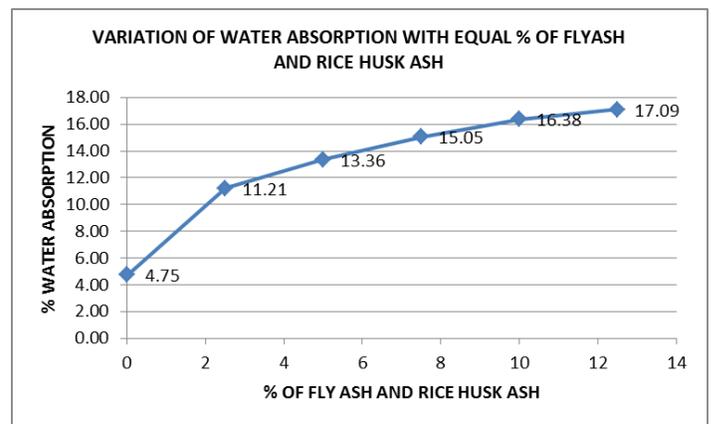


Figure 4.6: Water absorption of Fly Ash and Rice Husk Ash bricks.

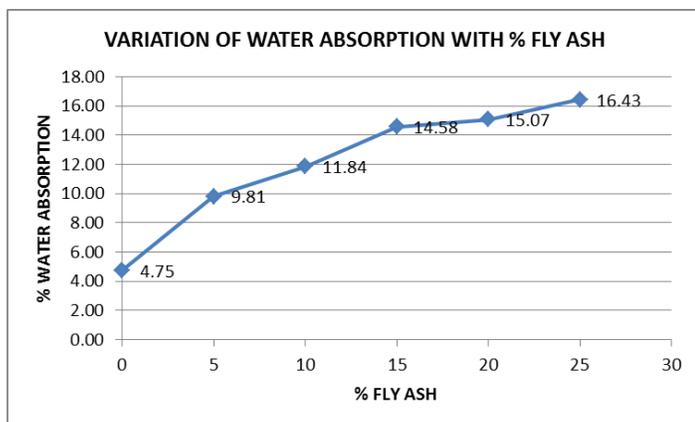


Figure 4.4: Water absorption of Fly ash bricks.

4.3. BLOCK DENSITY TEST:

The block density of the samples prepared was found out by considering the dry weight and overall volume of 6 samples and the average of the results is as tabulated below.

TABLE NO. 4.3: BLOCK DENSITY TEST RESULTS

Sl. No.	Type of Sample	Block Density (Kg per cubic meter)
1	100% Clay	1828.707
2	95% Clay + 5% Fly ash	1825.580
3	90% Clay + 10% Fly ash	1822.743
4	85% Clay + 15% Fly ash	1771.367
5	80% Clay + 20% Fly ash	1760.398
6	75% Clay + 25% Fly ash	1734.171
7	95% Clay + 5% Rice Husk ash	1811.157
8	90% Clay + 10% Rice Husk ash	1799.099
9	85% Clay + 15% Rice Husk ash	1783.044
10	80% Clay + 20% Rice Husk ash	1767.668
11	75% Clay + 25% Rice Husk ash	1729.405

Sl. No.	Type of Sample	Block Density (Kg per cubic meter)
12	95% Clay + 2.5% Fly ash + 2.5% Rice Husk ash	1814.726
13	90% Clay + 5% Fly ash + 5% Rice Husk ash	1802.044
14	85% Clay + 7.5% Fly ash + 7.5% Rice Husk ash	1789.672
15	80% Clay + 10% Fly ash + 10% Rice Husk ash	1772.079
16	85% Clay + 12.5% Fly ash + 12.5% Rice Husk ash	1735.154

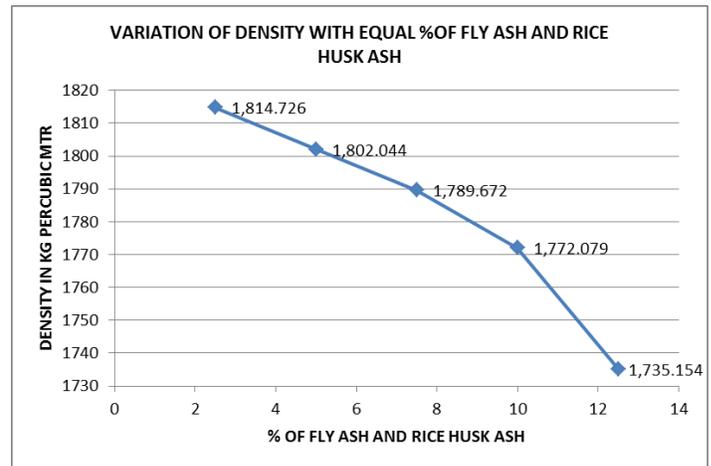


Figure 4.9: Block Density of Fly ash and Rice Husk ash bricks.

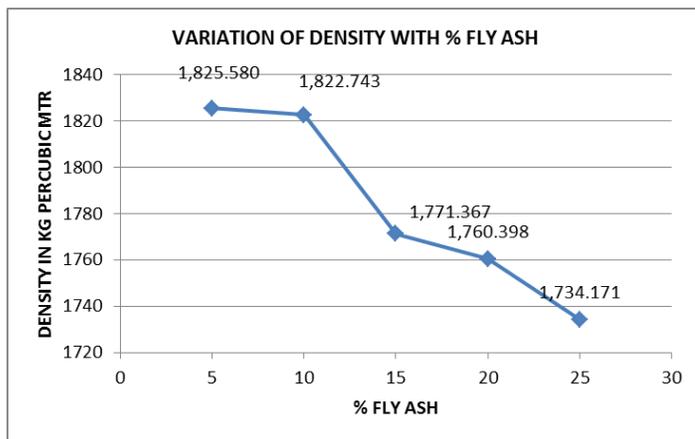


Figure 4.7: Block Density of Fly ash bricks.

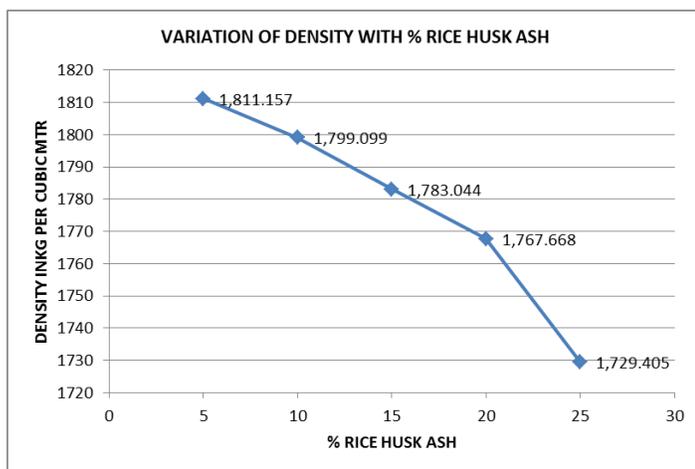


Figure 4.7: Block Density of Rice Husk ash bricks.

V. CONCLUSIONS

From the experimental results obtained, it can be concluded that

1. The clay burnt bricks manufactured with fly ash and rice husk ash had similar appearance when compared to the conventional clay bricks.
2. The clay bricks having fly ash as an admixture showed the best performance, having a compressive strength of about 23% greater than that of conventional bricks. The percentage of water absorption for these bricks was found to be more than that of conventional bricks but still within the prescribed maximum limit as per Indian Standards. (Maximum allowable water absorption as per Indian Standards is 20%) Hence fly ash can be used as an admixture with clay bricks.
3. The brick having rice husk ash as an admixture showed lower compressive strength and higher percentage of water absorption when compared to the conventional clay bricks. Also, for higher percentages of rice husk ash, the edges were found to be irregular in nature. Hence, rice husk ash is not recommended to be used as an admixture with clay bricks.
4. The bricks having both fly ash and rice husk ash as admixtures in equal proportions showed a marginal increase in strength for higher percentages of admixture. The water absorption of these bricks was found to be more than that of conventional bricks. Addition of both the admixtures together gives only a small increase in performance, hence it is not highly recommended.

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Design of Reversible Pump Turbine for its prospective application in Nepal

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Abstract- Most hydropower plants in Nepal are run-off type, which cannot supply the designed amount of energy during dry season and peak demand period resulting in energy crisis. Therefore, pumped storage plants can be an ideal solution to meet the current energy needs of the country. Most of these storage plants make use of a single unit acting both as turbine as well as pump; hence aptly called Reversible Pump Turbine (RPT). This paper explains the new application concept for use of such RPTs as auxiliary unit to supplement the main power unit in hydropower plants of Nepal. It also summarizes the design process of such runner with reference to the parameters available at Chilime region in central part of Nepal. The design is performed in two steps. The first step is an analytical design, which gives an initial geometry of the RPT runner. The process resulted in a runner of larger size than a normal Francis runner for same parameters since it has to work as pump as well. The next step is an optimization procedure involving CFD analysis under which the simulation of the RPT in turbine mode yielded an efficiency of 88.71%. The detail laboratory experiments on a model RPT will be performed later to validate the results from CFD and determine the characteristics of the designed runner at different mode and operating conditions.

Index Terms- CFD, Chilime, Design, Pumped Storage plant, Reversible Pump-Turbine (RPT)

I. INTRODUCTION

Located at the laps of young Himalayas, Nepal is a small country with abundant rivers and other water resources. The glaciers originating from the Himalayas feed the river systems in Nepal, which accompanied by small rivers, flow through the slope terrains of the country and provide an excellent opportunity for hydropower generation [1]. Study reveals that a total of 43000 MW hydro-electricity can be generated from the water resources in Nepal [2] out of which only 762 MW has been generated [3], which is less than 2% of the total generation capacity. Most hydropower plants in Nepal are run-off type [4] and hence, has to operate at off design condition during dry season resulting in low power generation. Moreover, the fluctuation in energy production from hydropower plants and their inability to meet the demand in peak hours has beckoned a dire need for construction of pumped storage plants [5]. A Pumped-storage plant stores energy by pumping water from a lower reservoir at off peak hours of electric demand by means of surplus power into a high level reservoir, in order to utilize the stored energy at periods when it is most needed [6]. It is probably the best way to compensate for the gap between produced and consumed power [7]. These pumped storage system use a single pump/turbine unit i.e. Reversible Pump Turbine to efficiently and economically store electrical energy during periods of low demand to meet peak load demands [8]. This paper proposes a new design model for application of pumped storage concept in Nepalese hydropower and elaborates the design process of such reversible pump turbine.

II. APPLICATION CONCEPT FOR NEPAL

The pumped storage system take benefit of the variation in electricity price during peak and off demand period. The water is pumped when the electricity price is low and the same water is run down through the turbine during peak demand period when electricity price is high [9]. Since Nepal does not have a concrete tariff plans for electricity consumption and the local electricity demand is always high [10], the idea however is different. Hydropower plants in Nepal during monsoon have an excess amount of water supply while in dry season it is difficult to meet the minimum supply of water required to run all units [11]. But, there are several sites in Nepal with two rivers close enough with different head. RPT units can act as a link between such rivers. As shown in Fig. 1, water can be pumped from level H1 to the upper reservoir during dry season to meet the need to run all the turbine of the main unit. Due to the head difference between H1 and H3, relatively less amount of energy is used to pump a fixed amount of water and a higher amount of energy is generated from the same amount of water using the main turbine unit. While in monsoon when the water supply is more, the excess amount of water is sent through the RPT generating an excess amount of electricity. The technology is thus feasible for country like Nepal where there are a huge number of perennial rivers that flow very close to each other and have different heads [5].

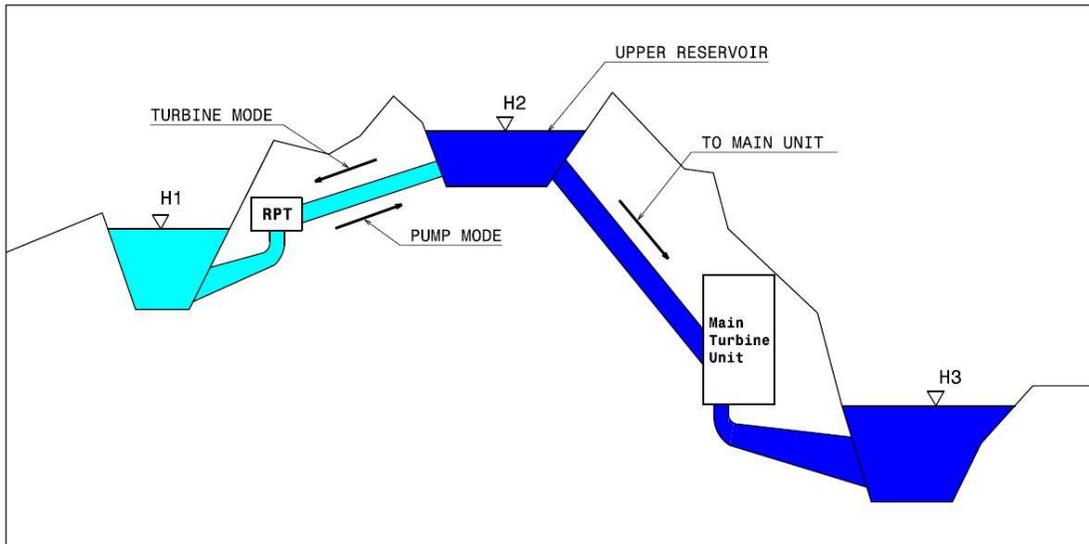


Figure 2: Schematic diagram of pumped storage plant

III. HYDRAULIC DESIGN ISSUES

An RPT acts as a water passageway with a shiftable body component selectively displaceable to achieve alternatively, either an energy generation or an energy accumulation mode [12]. The efficiency of this system is typically between 70% and 85%, making it one of the most efficient methods for storing energy [13]. The design of a pump turbine is similar to the design of a high head Francis turbine. However, there are certain factors that need to be considered while designing an RPT [14].

A. Pump head should be higher than in turbine mode due to loss in the waterways.

According to the Euler's equation for turbine and pump we have,

$$\eta_t = \frac{U_1 C_{u1} - U_2 C_{u2}}{H_t \times g} \quad (1)$$

$$\eta_p = \frac{H_p g}{U_1 C_{u1} - U_2 C_{u2}} \quad (2)$$

Now, we assume frictionless flow i.e. $H_p = H_t$, and no swirl at the outlet during turbine mode i.e. $c_{u2} = 0$. The reduced speed for turbine and pump can then, be calculated as

$$U_{1t}^* = \frac{U_1}{\sqrt{2gH_{nt}}} \rightarrow U_1^* = \frac{\eta_t \cdot \sqrt{0.5gH_{nt}}}{C_{u1t}} \quad (5)$$

$$U_{1p}^* = \frac{U_1}{\sqrt{2gH_{np}}} \rightarrow u_1^* = \frac{\sqrt{0.5gH_{np}}}{\eta_p C_{u1p}} \quad (6)$$

Assuming speed is the same in both pump and turbine i.e. $U_{1t}^* = U_{1p}^*$

$$\frac{\eta_t \cdot \sqrt{0.5gH_{nt}}}{C_{u1t}} = \frac{\sqrt{0.5gH_{np}}}{\eta_p C_{u1p}} \quad (7)$$

$$\therefore C_{u1t} = \eta_t \cdot \eta_p \cdot C_{u1p} \quad (8)$$

This means, $C_{u1t} < C_{u1p}$

Therefore, equation 8 shows that the pump turbine has to be designed for a higher head than the theoretical head such that $H_{nt} < H_{np}$. This ensures that the pump head should be greater than the turbine head. But, the function of the RPT defines it using as both pump and turbine which means the design head should be compatible with both modes ensuring highest efficiency delivered. The solution can be met by having fewer and longer blades than the traditional Francis runner.

B. The pump should be stable pump and not oscillating.

For stability of the pump, the inlet angle β_1 should be less than 90° such that for higher value for flow (Q) the power stabilizes. With β larger than 90° , the slope will be positive. When the value of U_1 is increased the inlet angle β_1 gets smaller which is preferable considering pump characteristics.

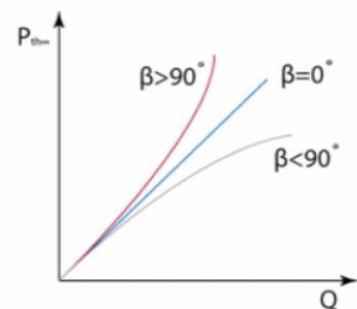


Figure 3: Effect of β angle on stability

C. The system should deliver high efficiency in both modes.

The higher efficiency in both modes can be achieved by designing the system for best efficiency head rather than the required head at the site. Adjustment of the best efficiency head for pump is possible by varying its rotational speed as head produced is dependent on the rpm of the impeller in the pump mode. High specific speed pumps have relatively steep head-discharge curves so that they are able to operate at wide variation of head. However, the allowed variation of operating head range is narrow for RPT than in case of real turbine such that the head range is only allowed between 65% to 125% of the design head.

D. The relative velocity should remain almost constant.

Acceleration through the runner is undesired since it turns into deceleration when shifting operation mode. A decelerated flow is more vulnerable to secondary flow effects and separation. Thus, a small difference between the magnitudes of relative velocity at the inlet and the outlet should be the goal of the design, which can be achieved by increasing U_1 . To increase U_1 , Brekke [15] suggests that while designing, the value of U_1 reduced should be chosen near to 1. This value gives steep pump characteristics and just a small increase of W_1 through the runner channel.

IV. DESIGN PROCESS

The first choice in the design process is to find a suitable existing plant site that can be used as a starting point. The power plant should have a turbine with a speed number between 0.27 and 0.35. After analyzing the available data, Chilime Hydropower plant in Central region of Nepal was taken as the reference site for design. The available head and flow at the site is 270 m and 4 m³/s respectively.

The design for RPT is done at best efficiency point. The design procedure starts with calculating the outlet diameter, D_2 , number of poles in the generator and synchronous speed. With these values known, the dimensions at the inlet are calculated. These comprises of diameter, D_1 , inlet angle, β_1 , and height, B_1 [14-16].

A. Main Dimensions

The dimensioning of the outlet starts with assuming no rotational speed at best efficiency point (BEP) i.e $C_{u2} = 0$. In addition, the values for outlet angle, β_2 , and peripheral speed, U_2 , are chosen from empirical data:

$$13^\circ < \beta_2 < 22^\circ \quad \text{Lowest value for highest head}$$

$$35 \text{ m/s} < U_2 < 42 \text{ m/s} \quad \text{Highest value for highest head}$$

The outlet diameter and the speed are found by reorganizing the expressions for flow rate and rotational speed, respectively. C_{m2} is obtained from the known geometry in the velocity triangles. The number of poles, Z , in the generator depends on the rotational speed and net frequency. With a net frequency of 50 Hz, the number of poles is calculated using equation 12.

$$D_2 = \sqrt{\frac{4Q}{\pi C_{m2}}} \text{ [m]} \quad (9) \quad n = \frac{U_2 \cdot 60}{\pi D_2} \text{ [rpm]} \quad (10) \quad c_{m2} = U_2 \cdot \tan \beta_2 \text{ [m/s]} \quad (11) \quad Z_{\text{poles}} = \frac{50 \cdot 60}{n} \quad (12)$$

Since the number of poles is an integer, the value obtained from equation 11 must be round up. With the correct number of poles, equation 9 is used to find the synchronous speed, $n_{\text{corrected}}$, which in turn, is again used to calculate the corrected diameter at the outlet, $D_{2\text{corrected}}$ (see equation 13).

$$\tan \beta_2 = \frac{C_{m2}}{U_2} = \frac{C_{m2\text{corrected}}}{U_{2\text{corrected}}}$$

$$n_{\text{corrected}} D_{2\text{corrected}}^3 = n D_2^3$$

$$D_{2\text{corrected}} = \sqrt[3]{\frac{n D_2^3}{n_{\text{corrected}}}} \text{ [m]} \quad (13)$$

To avoid cavitation at the runner outlet, high head turbines usually need to be submerged. The level of submergence is calculated using equation 14. The $NPSH_{\text{required}}$ is calculated from equation 15 [15].

$$h_s = h_b - h_{va} - NPSH \quad (14) \quad NPSH_{\text{required}} = a \cdot \frac{C_{m2}^2}{2g} - b \cdot \frac{U_2^2}{2g} \quad (15)$$

The next step in the design is to calculate the inlet parameters, diameter, D_1 , height of the inlet, B_1 , and inlet angle, β_1 . In order to find these values, the Euler Equation i.e. equation 1 is used. By introducing reduced dimensionless values and assuming no rotation at the outlet, the equation 1 can be rewritten as

$$\eta_h = 2 \underline{u}_1 \cdot \underline{c}_{u1} \quad (16) \quad U_1 = \underline{U}_1 \cdot \sqrt{2gH} \text{ [m/s]} \quad (17)$$

The efficiency, η_h , is set to 0.96. This value accounts for the friction in the runner and draft tube. For the high head Francis Turbine, \underline{U}_1 is chosen in the interval of 0.7 to 0.75. However, in case of RPT, the \underline{U}_1 is taken to be nearly equal to 1. U_1 is obtained from equation 16.

The inlet diameter can now be found by using equation 18. From the velocity triangle, the expression for the inlet angle can be derived (equation 19). The value for C_{m1} in equation 18 is calculated by using the continuity equation i.e. equation 20. Assuming minimal acceleration of 10% in the runner, the inlet height is calculated by using equation 21.

$$D_1 = \frac{U_1 \cdot 60}{\pi n} \text{ [m]} \quad (18) \quad \tan \beta_1 = \frac{c_{m1}}{U_1 - c_{u1}} \quad (19) \quad C_{m1} \cdot A_1 = C_{m2} \cdot A_2 \quad (20) \quad B_1 = \frac{1.1 D_2^2}{4 D_1} \text{ [m]} \quad (21)$$

After the main dimensions of the runner are known, the shape of runner blade can be designed. The procedure starts by determining the shape of the blade in axial view, then the radial view is established, and finally, the runner blade can be plotted in three dimensions [15].

B. Guide vanes

Since the flow from the guide vanes outlet to the runner inlet is not affected by the runner blades, free vortex theory is used to define the velocities in the guide vane path. In general, longer the guide vane, better the directed path of water but it also results in more friction losses. Hence, suitable length with overlapping of about 12% need to be selected. Afterwards, the number of guide vanes is selected such that no water enters the runner in its full closed condition. For the RPT design, appropriate number of guide vanes was chosen to be 17 and NACA 2412 profile was selected for guide vane shape. The guide vane shaft was fixed at 2/3 of the guide vane length from guide vane outlet.

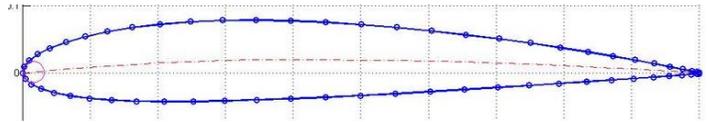


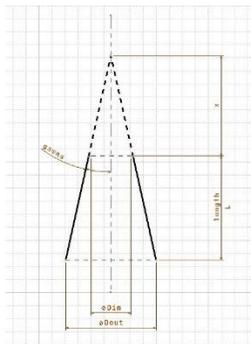
Figure 4: NACA 2412 profile

C. Design of Spiral Casing

For the spiral casing design, the C_m component of velocity remains same throughout the sections of the spiral casing. The flow of the turbine is 4 m³/s and C_m velocity at inlet is about 10.84 m/s. The section of the spiral casing is selected such that it is slightly more than the number of stay vanes, which results in even flow inside the casing. For our design case, we have selected 20 sections for spiral casing where there are 17 stay vanes. Hence, each section is at an angular interval of 18°. Now the diameter of each section of spiral casing is calculated using equation 22. The flow in the next section is then calculated using equation 23. Equation 22 and 23 are used to calculate diameter and flow for respective sections.

$$d = \sqrt{\frac{4Q'}{\pi \cdot C_{m1}}} \quad (22) \quad Q' = \frac{360 - \theta}{360} \cdot Q \quad (23)$$

D. Draft tube



The draft tube recovers kinetic energy at the outlet of the turbine to pressure energy. It allows the turbine outlet pressure to be lower than the atmospheric pressure by gradually increasing the cross section area of the tube. A cone type draft tube was used for the design of RPT. To avoid unfavorable flow patterns as backflow, the angle Y between centerline and the wall was chosen to be 3°. Inlet diameter of the draft tube cone $D_{cone i}$ is equal to the outlet turbine diameter D_2 . Equation ... Gives the outlet diameter of the draft tube cone which depends on the length, which is selected to be little larger than suction head of the turbine to minimize cavitation effect.

$$D_{cone o} = D_{cone i} + 2 \cdot L_{cone} \cdot \tan Y \text{ [m]} \quad (24)$$

Figure 5: Draft tube cone

V. DESIGN PARAMETERS AND OUTPUTS

The design of RPT was performed with the procedure described in chapter 4. In order to simply the design process, a Graphic User Interface (GUI) program to create and modify design of Francis runner has been developed in MATLAB [17]. The program is capable of creating 3-D runner profile based on given basic design data. Since the design of RPT is almost similar to design of Francis runner, the same program was used for designing the RPT with variation in certain input parameters. The parameters used in the design and its outputs are listed in table 1 and table 2. The velocity triangle obtained from the MATLAB program is

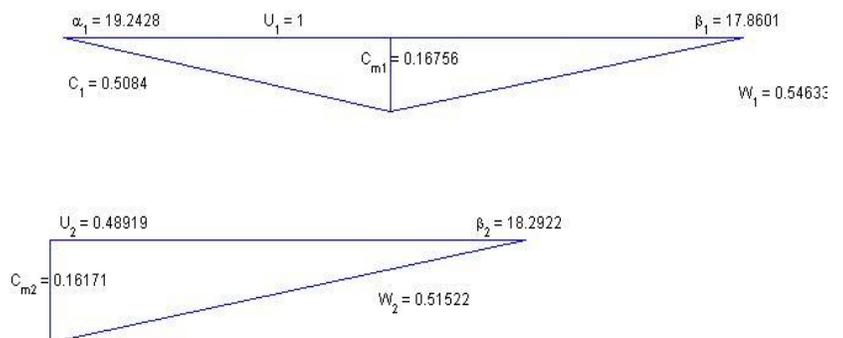


Figure 6: Velocity triangle obtained from the program

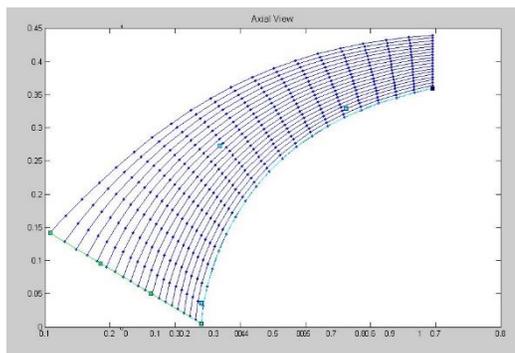
shown in fig. 5. Fig. 6(a) and Fig 6(b) show the axial and radial view of the runner blade developed. The 3-D profile obtained from the program was modelled and modified in 3D CAD software and the final design was prepared as shown in Fig. 6(c).

Table I: Design parameters

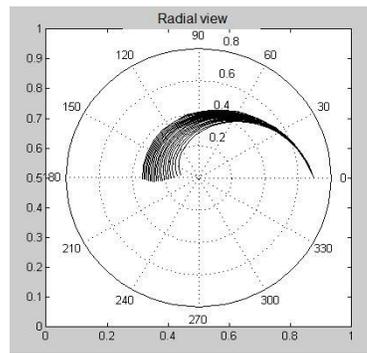
Symbol	Parameter	Unit	Value
H	Head	m	270
Q	Discharge	m ³ /s	4
Z _{poles}	Number of poles in generator	-	3
H	Efficiency	-	0.96
\underline{U}_1	Reduced velocity at inlet	-	1.00

Table II: Design outputs

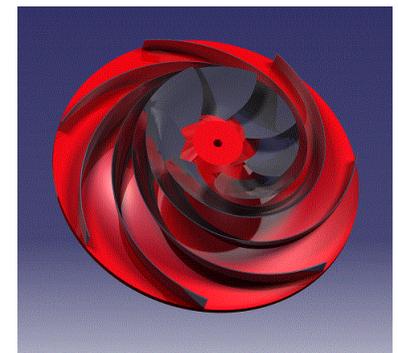
Symbol	Parameter	Unit	Value
D ₂	Outlet Diameter	M	0.68
Ω	Speed Number	-	0.337
NPSH	Net Positive Suction Head	m	11.46
D ₁	Diameter at inlet	m	1.39
B ₁	Breadth at inlet	m	0.09
N	Number of blades	-	7
Ω	Angular Velocity	rad/s	104.72
R.R.	Reaction Ratio	-	0.73
P	Power output	MW	10.17



(a)



(b)



(c)

Figure 6: (a) Axial view of blade (b) Radial view of blade (c) CAD model of runner

VI. CFD ANALYSIS

The CFD analysis of the RPT was carried out inside the premises of ANSYS Workbench 14.0. The code uses finite volume approach to solve the governing equations of fluid motion numerically on a user-defined computational grid. In this simulation, there are in total four different domains which were meshed separately in ANSYS meshing. In this study, all the simulations have been performed in turbine mode and the setups were done for the same condition. The details of the numerical models for each of the domains are described below.

A. Spiral Casing

Spiral Casing was discretized with tetrahedral mesh with total node count of 241929. The discretization was made finer towards the interface between the casing and the guide vane, with mapped mesh property. The inlet of the spiral casing is the inlet of the whole domain, which have mass flow rate of 4000 kg/m. Towards the outlet of this casing, an interface was defined with the guide vane inlet. Other regions were defined to be no slip wall. The roughness of the wall was not included in this analysis.

B. Guide Vane

Guide vane was meshed with a total node count of 1038232. In this case, the size of the mesh is uniform throughout the domain, whereas inlet and outlet of the domain was considered to be mapped in order to have proper mapping with neighboring domains. The inlet of the domain was interfaced with spiral casing outlet and the outlet was interfaced with the runner inlet. The mixing model between the stationary and rotating domain was done through Stage averaging between the blade passages. Other boundaries in this domain were considered to be no slip walls, including the blades.

C. Runner

As runner is the most important region of the whole domain, it was meshed with finest discretization. The total node count of 5635095 was used to mesh the runner with finer mesh towards the leading and trailing edges. All boundaries except the interfaces with stage mixing model were considered to be no slip walls.

D. Draft tube

Draft tube consists of hexahedral mesh with total node count of 832477. The outlet of the domain was taken as outlet with average static pressure of 1atm. The inlet of the domain was interfaced with the runner having stage mixing model. Other boundaries were

considered to be no slip wall without roughness. The type of mesh selected for all the cases is defined in Fig 7. A total of 7747733 mesh nodes were used for the analysis.

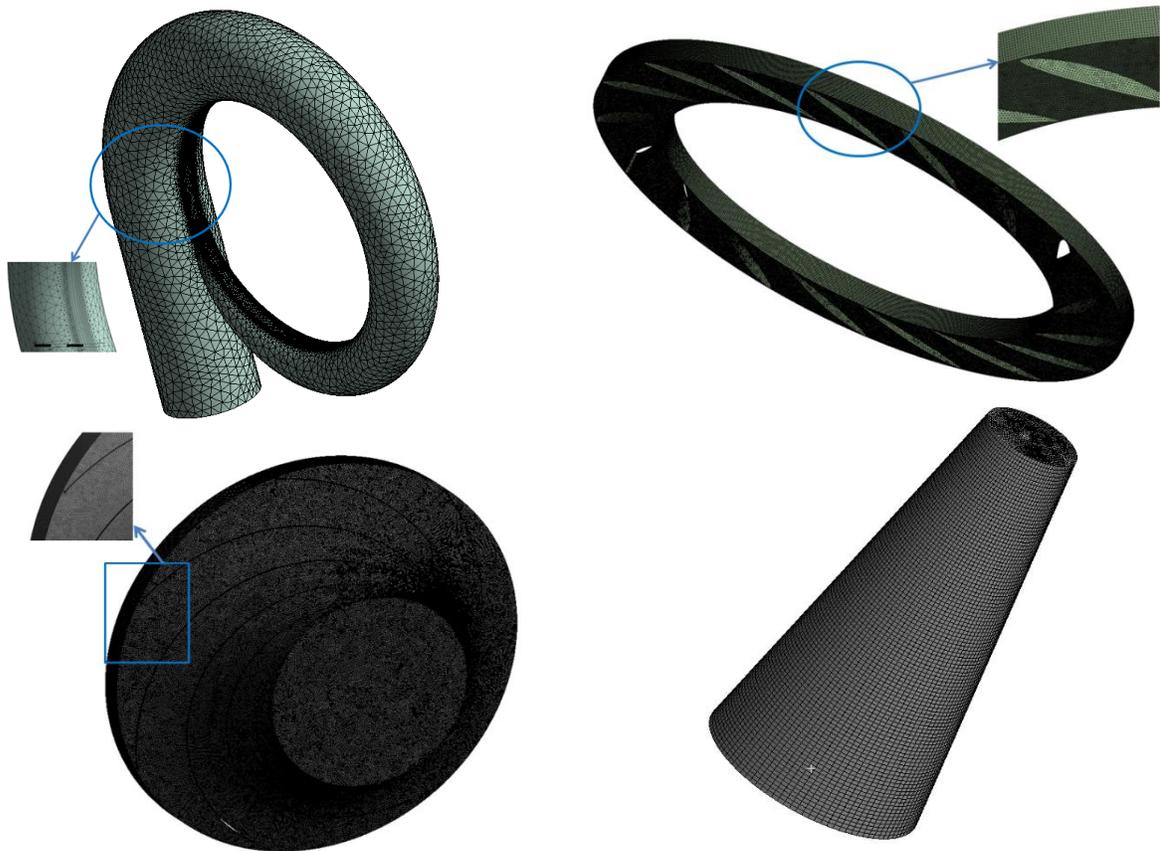


Figure 7: Mesh selected for all domains

E. Results of CFD analysis

The velocity streamlines with the above setup is shown in Fig 8. The efficiency of this turbine was measured based on the output power obtained from the torque produced on the runner and the input power based on the available head. The efficiency of the turbine was found to be 88.71%. Fig 8 also shows the streamlines in the draft tube region. From the runner, the water flows towards the draft tube with high velocity. This velocity head is converted into the pressure head generating more power and efficiency. The diverging passage of the draft tube allows for the decrease in the velocity at the outlet from the equation of continuity. As it can be seen, the maximum velocity of the flow in the draft tube is around 17 m/s towards inlet, which is reduced to less than 1 m/s towards the outlet boundary.

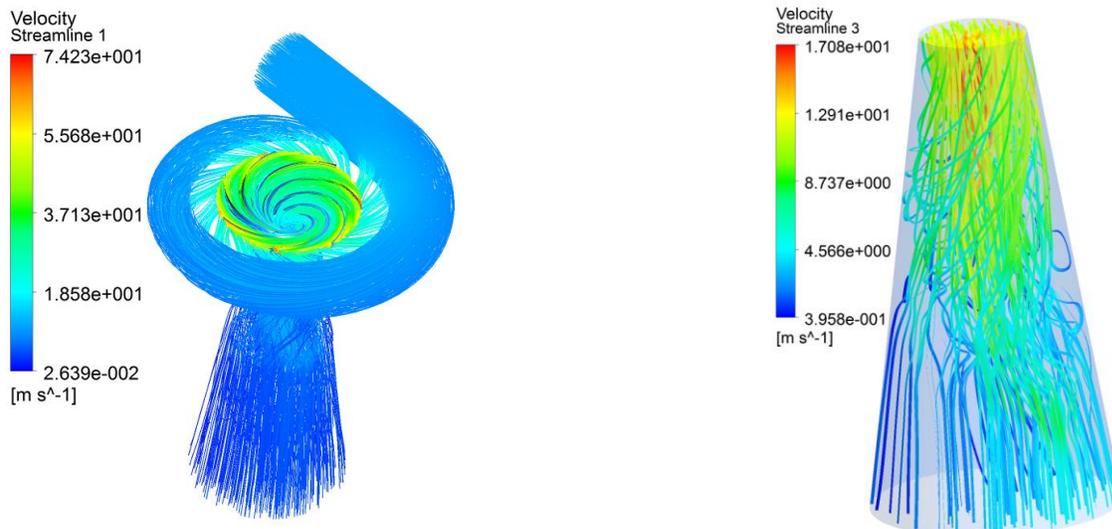


Figure 8: Velocity Streamline in the turbine mode

VII. ANALYSIS AND INTERPRETATION

When designing a high head RPT, there are certain variations than when designing a high head Francis. The main changes are that the water flows in both directions and the dimensioning pressure height gets larger because of friction losses in the conduct system. In order to avoid the losses in the system, the UC_u distribution is flattened at both ends, which can be achieved by using longer blades. This also results in good cavitation performance and flow characteristics at off design operating points [16]. Therefore, it is common to choose the reduced velocity U_1 to be approximately equal 1. However, the longer blades will lead to more stability problems due to decelerated flow and backflow as indicated by the drop in relative velocity, W at the middle of the blade. This risk increases when low relative velocities occurs through the runner. To avoid this, one have to “stretch” the blades, and the UC_u distribution as well [15]. Basic calculations for a high head Francis runner was also done for the same site using same parameters and conditions using the MATLAB program. The output was a runner of 0.99 m inlet diameter, which is almost 71% smaller than its RPT counterpart. Thus, the RPT is quite larger with longer and less number of blades than a Francis runner of same capacity. This is justifiable since it has to operate as pump as well for which larger blade size would result in more output.

VIII. CONCLUSION

The RPT can be used as a secondary unit to supplement the existing main plant so that it can operate at best efficiency point for most part of the year. A RPT for Chilime Hydropower plant in central region of Nepal has been designed and the CFD analysis of the RPT in turbine mode of operation has been completed. The RPT is a hybrid of centrifugal pump and Francis runner with speed number 0.337. It has an inlet diameter of 1.39 m and outlet diameter of 0.68 m with inlet height 0.09 m. Model test of the RPT will be performed at Turbine Testing Lab in Kathmandu University to learn more about the performance of the unit. Despite the simple design techniques involved in the design, the runner performance is quite satisfactory with a numerical computed efficiency above 88 percent at BEP.

IX. FURTHER WORKS

The design of runner has already been completed. Now, the next task is to analyze the competence of the designed runner by combining CFD simulations and laboratory measurements. Proper model design and test rig installation with up-to-date measuring instruments will be required to get the accurate data on its performance.

APPENDIX

Nomenclature

- B – Runner height [m]
- C – Absolute velocity [m/s]
- D – Runner diameter [m]
- U – Peripheral velocity [m/s]
- W – Relative velocity [m/s]
- N – Synchronous speed [m/s]
- Z_p – Number of poles in generator [-]
- C_m – Meridian component of C [m/s]
- C_u – Tangential component of C [m/s]
- h_{va} – Vapour Pressure [m]
- h_b – Barometric pressure [m]
- h_s – Submergence [m]
- β – Angle between the relative and peripheral velocity [degree]
- ₁ – Inlet
- ₂ – Outlet
- _t – Turbine mode
- _p – Pump mode
- η – Efficiency

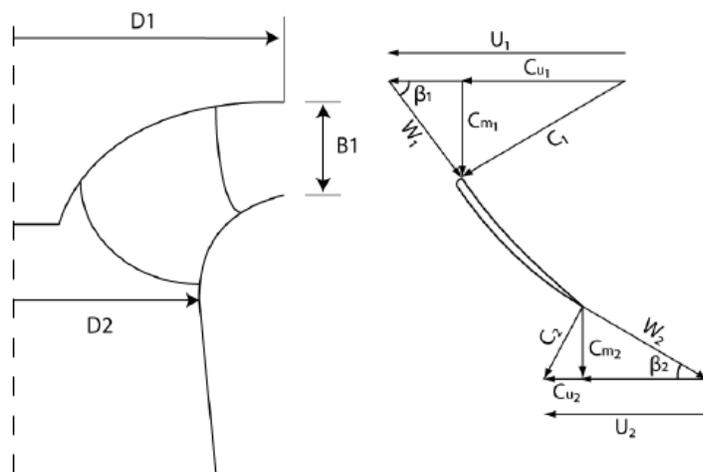


Figure 10: Main dimensions and velocity triangle in turbine mode for RPT

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Study and Analysis of various preprocessing approaches to enhance Offline Handwritten Gujarati Numerals for feature extraction

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Abstract- Since last many years Optical character recognition has been an area attracting many researchers. Due to wide range of applications and advancement of digital technology offline and online handwritten character recognition for regional script is becoming fascinated area of research. In any character recognition system feature extraction phase requires input of image which is noise free, binary and having only region of interest. Main objective of Enhancement of image (EOI) phase is to process image in a way which gives more appropriate result than original acquired image for further steps in character recognition. This phase has high influence and hence plays a vital role in any character recognition system. Wide choices are available for digital image enhancement for enhancing visual quality of image. Choosing appropriate approach for image enhancement is a significant step. This paper discusses various image enhancement approach, analyzes them on the basis of result obtained by experimenting on sample handwritten image dataset at every step so as to provide suitable input for feature extraction for recognizing Offline Handwritten Gujarati Numerals.

Index Terms- Image Preprocessing, Preprocessing handwritten images.

I. INTRODUCTION

Pattern recognition is a branch of artificial intelligence where an objective is to recognize pattern or an identification of faces, objects, words, character etc. Character recognition is an area which can be categorized into two ways as: (1) Online and Offline (2) Machine printed and Handwritten (Figure 1). In online character recognition characters are recognized as soon as user writes using digitizer or PDA where as in offline character recognition characters are recognized from images acquired by camera or digitized using scanner. Digitized document may contain handwritten character or characters printed using computer font and is classified accordingly.



Figure 7 Classification of Character Recognition

Offline Handwritten character recognition is an area attracting many researchers. Six important steps are employed in any character recognition task these are: Preprocessing, Segmentation, Feature extraction, Classification and Post processing. Preprocessing step is a preliminary step to be performed on acquired image, which involves certain operations to be performed and hence providing a necessary base to perform further tasks of character recognition. If image is noisy or it is not in a proper format then it directly affects the performance of character recognition. Preprocessing does the task of enhancing image making it suitable input for segmentation or feature extraction. In this paper authors have presented analysis of various approaches for image enhancement. Paper is divided into various sections as Previous work, Image Enhancement approaches, Prototype sequence for image enhancement followed by conclusion.

II. PREVIOUS WORK

Hsin-Chia Fu et.al. [1] have employed series of image preprocessing steps that includes smoothing of boundary, removing noise, normalization of space, thinning of stroke.

To eliminate noise and for simplified procedure of feature extraction N.AZIZI et. al. [2] have proposed some preprocessing approach which is script independent such as Normalization, Contour smoothing, base line detection etc. in order to extract structural features.

To remove salt and pepper noise median filter is used by J. R. Prasad et.al.[3] in their work and have to reduce character to minimum one pixel thickness thinning is applied.

For converting image to binary image N.Shanthi et. al.[4] have applied Otsu's global thresholding method on image and for skeletonization hilditch algorithm is applied.

Apurva A. Desai[5] has presented his work to recognize Gujarati numerals where some preprocessing approaches employed includes Contrast limited adaptive histogram equalization for contrast adjustment, smoothing boundaries using median filter and for making all scanned images in uniform size nearest neighbor Interpolation algorithm is used. For removing skew numerals are rotated upto 100 about center point and created five patterns rotating numeral images in both direction ie. Clock wise and anti-clock wise.

R. Kannan et. al.[6] in their work of recognizing Tamil handwritten characters have applied preprocessing techniques where to extract foreground ink from background image thresholding is used, to remove noise median filtering and wiener filtering is used and for detecting skew angle, calculation of cumulative scalar product of windows of text blocks using gabor filters at different orientation and have employed on all possible 50X50 windows and skew angle was found as median of all angles obtained.

Normalization process in which slant correction, width normalization and normalizing height of three zones using vertical scaling is utilized by R.Kannan et. Al.[7]

III. ANALYSIS OF VARIOUS IMAGE ENHANCEMENT APPROACHES

This section discusses various image enhancement approaches and analyzes them on the basis of result obtained.

A. Handwritten Image Dataset

For experimental work 750 handwritten isolated Gujarati numerals were collected and digitized using Brother DCP-7030 scanner at 300 dpi in png format. Figure 2 shows variation in handwriting Gujarati numeral five (pronounced as 'panch') also variation arise as writers have used their pen.

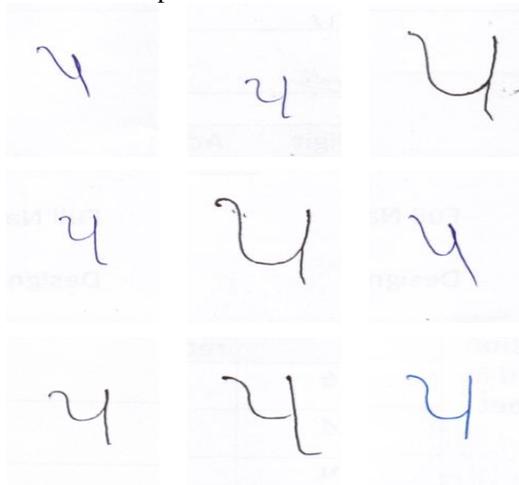


Figure 8: Variation in writing Gujarati Numeral 'five'

For demonstrating result on applying various approaches one sample image from Figure 2 is used.

B. Convert rgb image to grayscale

Color of a pixel in RGB image is determined by amount of Red, Green and Blue, which is a stack of three matrices representing color proportion of RGB. Hence for every pixel one can trace three value. Converting this image into Grayscale where every pixel will have shade of gray. In a conversion process of RGB to grayscale hue and saturation is eliminated and luminance is retained. Grayscale occupies less memory space as compare to RGB image as each pixel is representing eight bits information. $V1 * R + V2 * G + V3 * B$ equation is used to converting RGB image to Grayscale where R,G and B represents Red, Green and Blue value of a pixel and V1, V2 and V3 are real values, variation in which yields following result as shown in figure 3. The process will be repeated for every pixel of a image to obtain Grayscale image.

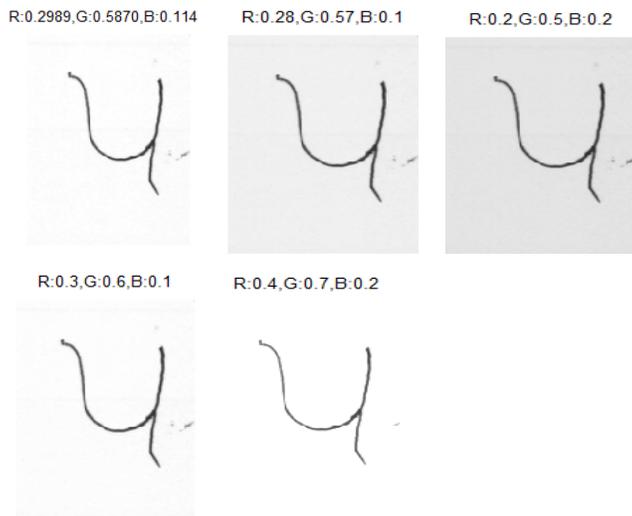


Figure 9 Grayscale Images with variation in for R,G and B

C. Contrast adjustment

Histogram Equalization is a method used to enhance contrast of an image. `histeq` enhances the contrast of images by transforming the values in an intensity image, or the values in the colormap of an indexed image, so that the histogram of the output image approximately matches a specified histogram. [8] as per figure 4(a)

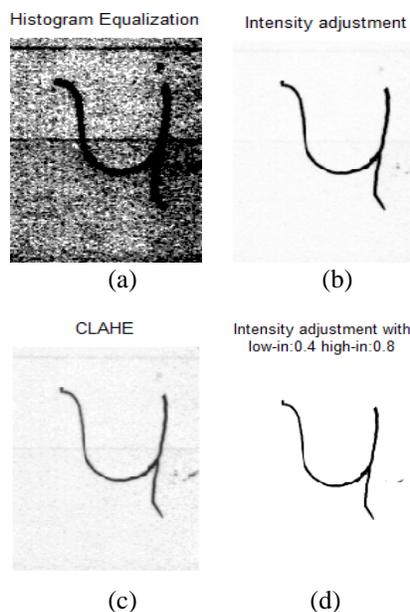


Figure 10 (a) Histogram Equalization (b) Intensity adjustment (c) Contrast Limited Adaptive Histogram Equalization (d) Intensity Adjustment with `low_in:0.4` and `high_in:0.8` parameter values

Another approach is to adjust image intensity values here by 4 values are define i.e. `low_in`, `high_in`, `low_out`, `high_out` and values below `low_in` and `high_in` are clipped. Resultant image

obtained will have values between `low_in` and `high_in` map to values between `low_out` and `high_out`. Variation in limits yields results as show in figure 4(b) and 4(d). Contrast limited adaptive histogram equalization (CLAHE) is a method in which entire image is divide into smaller parts and histogram equalization is applied to all small parts and then interpolates the result as shown in figure 4(c).

D. Sharpening and Reducing Noise

For sharpening image predefine 2D filter 'unsharp' is used which is also known as unsharp contrast enhancement filter which creates filter from the negative of Laplacian filter with default alpha value 0.2. this filter is applied to contrast adjusted image result obtained is as per figure 5(a) . To remove noise and preserve edges Median filter is applied as shown in figure 5(b).

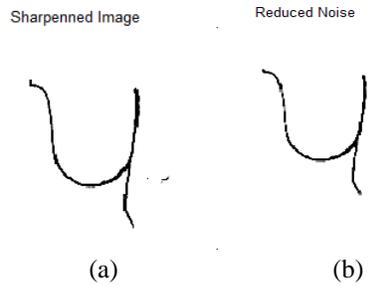


Figure 11 (a) Sharpened image (b) Reduced noise in image

E. Binarization of Image

To convert an image to binary image requires determining appropriate threshold value. In binary image pixel will have value either 0 or 1. When grayscale image is converted to Binary image luminance value above threshold value will be converted to 1 and below it will be converted to 0. Figure 6 shows result obtained as a result of variation in threshold value.

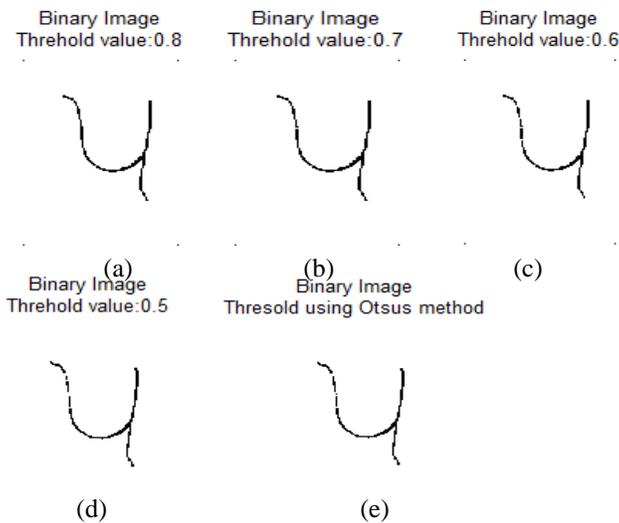


Figure 12 (a) Threshold Value:0.8 (b) Threshold value:0.7 (c) Threshold value:0.6 (d) Threshold value:0.5 (e) Global threshold using Otsu's method.

F. Morphological Operations

To fill the gaps in binary image so features can be extracted accurately 'line' structuring element is created and morphological close operation is applied. Figure 7(a) shows output of the same. To remove small objects morphological open operations is used components connected less than 8 components are removed as shown in figure 7(b).

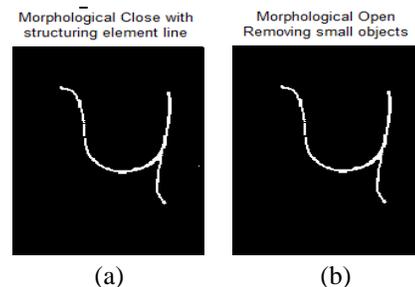


Figure 13 (a) Structuring element line and morphological close operation (b) Removing small objects with morphological open

G. Detecting Boundary

To extract region of interest boundary needs to be framed for which edges needs to be detected. To crop region top-left and bottom-right values are identifies by row wise scanning pixel values for its value 1. After identify boundaries image is clipped as per identified coordinates, as per figure 8.

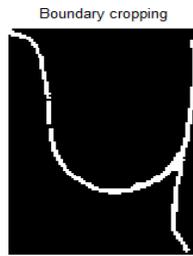


Figure 14 Detecting boundary and cropping region to obtain desirable region for feature extraction

H. skeletonizing and Thinning

Skeletonizing is removing pixel on the boundaries of object without breaking object. Result of skeletonizing is shown in figure 9(a). Thinning reduces lines to single pixel thickness as shown in figure 9(b).

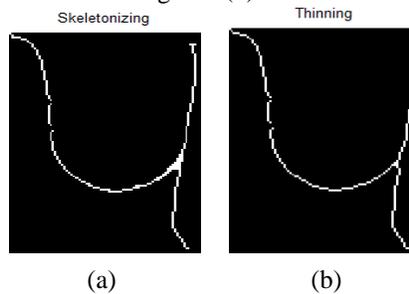


Figure 15 (a) Skeletonizing image (b) Thinning operation on image

IV. PROTOTYPE SEQUENCE OF STEPS FOR IMAGE ENHANCEMENT

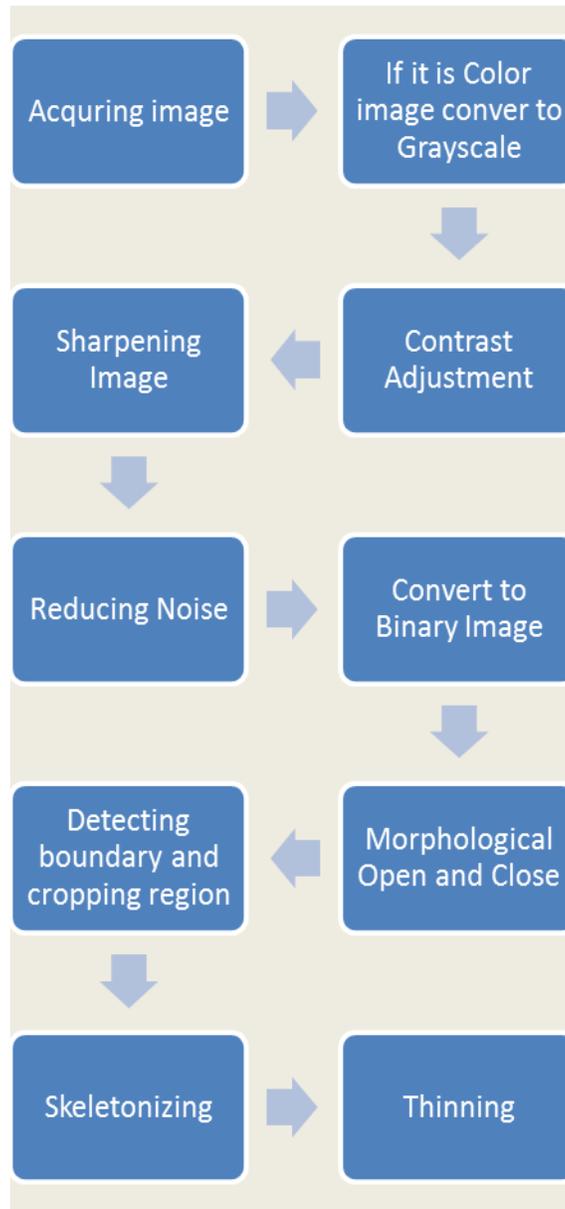


Figure 16 Series of steps for enhancing image

Figure 10 represents series of steps where input will be acquired scanned image and output will be an image suitable for feature extraction. Principal goal of this processing flow is to have an image which is highly suitable for character recognition task. Accuracy of feature extraction highly depends on the image given as input if image is noisy and clumsy it will be very difficult to obtain precisely features from character and hence this complexity is carry forward to classify it and as a result sometimes correct output cannot be obtained. It becomes mandatory to choose correct sequence so as to obtain desired image for feature extraction.

Figure 11 shows some sample handwritten numbers written in Gujarati script where series of steps from prototype modal is applied.

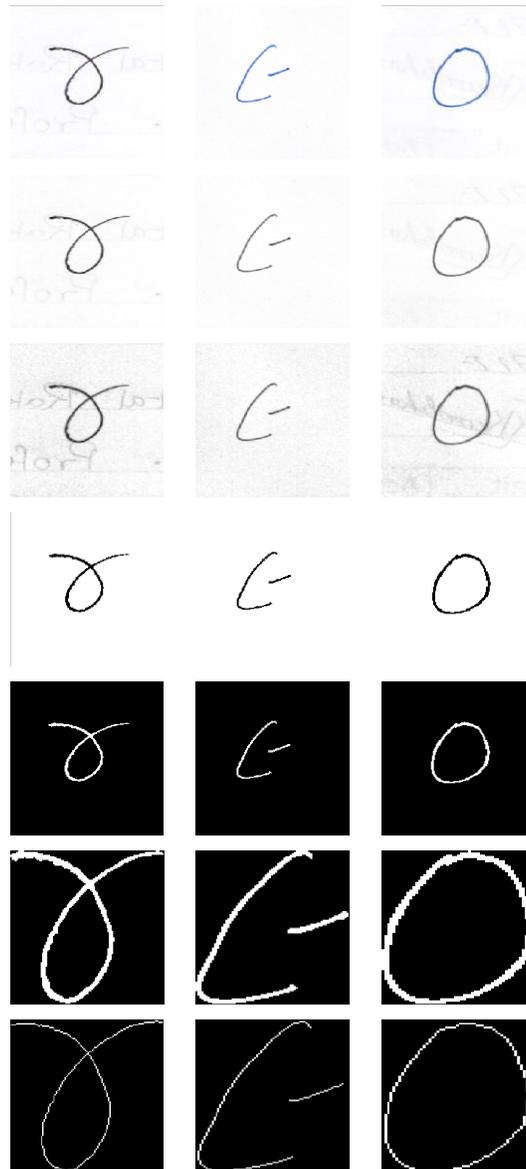


Figure 17 : Enhancement of sample handwritten images for feature extraction

V. CONCLUSION

Converting RGB image to Grayscale requires right blend of weighted sum for R, G and B in pixel. Higher value gives darker shade and lower value gives lighter shade. For contrast adjustment intensity can be set by choosing appropriate parameter values and depends on nature and source of an image. To remove salt and pepper noise median filter yields better result. If threshold value is higher than some pixels are lost. It is better to determine graythresh level of an image as a threshold value to convert image into binary image. Boundaries can be extracted accurately if image is noise free. To obtain structural features from image such as cross point, end point it requires image to be skeletonized or thinned. Thinning yields better result than skeletonizing approach. Both operations can be applied turn by turn to achieve better result. Depending on nature of image and task at hand prototype sequence of steps presented in this paper can be included or excluded to obtain desired result.

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Mobile Cloud Traffic Control and Maintenance

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Abstract- As we all know that our country is second largest in terms of population just after China. And as the population is increasing the number of vehicles too are and so is the number of accidents. During high traffic on roads with no traffic police officials to manage and automation is the only way to control the traffic it is difficult to take decisions. For overcoming this problem we have sensors in all directions of a junction and based on the traffic level we allow the passage of vehicles and stop the rest of the vehicles in all the other directions. This paper also deals with the payment of entire taxes at one toll gate which allows it to pass through the other toll gates. We implement this solution using the CLOUD approach.

Index Terms- Cloud, Sensor

I. INTRODUCTION

Efficiently projecting the state of the traffic lights using the images captured by the sensors in all directions and ensuring no accidents and traffic jam is one of the main objectives of this paper. We can also keep a track of vehicles and in which direction they are heading towards. This is accomplished by maintaining sensors in all directions and capturing images which covers some portion of the road ahead. This images are sent to the server and the server analyses the traffic and manages the traffic accordingly. This paper also deals with tracing of criminals and people who break traffic rules. This can be done by sending the image captured by the sensor to the server which broadcasts the same information to all the devices connected to it. This is beneficial for the public and police as the crime can be controlled easily and more efficiently with less man power.

Another important issue dealt by this paper is payment of taxes of all the toll gates in the path leading to the destination at one point and allowing the vehicle to pass through the other toll gates using his number plate which is broadcasted to other toll gates by the first toll gate. This will save time of both drivers and toll gate authorities. He can also find resting stops near to him by connecting to social networking website and getting reviews from his/her friends. He can also send requests to the other vehicle drivers in and around him. If they accept the request then he can enquire about best and cheapest accommodations and food nearby. We use mobile cloud approach because, mobile cloud is a set of protocols that enable interoperability among distributed clients. The cloud protocols do not dictate the implementation details such as programming language or operating system. Instead, they offer a high level map to guide implementations. Cloud details the standard services without limiting the implementation possibilities for a service.

As shown in the diagram, all the sensors will be sensing the traffic load of the particular lane and a report will be generated and submitted to base station. The base station allows the

passage of vehicles in a lane whose traffic is more. This base station forwards the information to the server which later broadcasts to all the base stations connected to the cloud network. This enables the other base stations to predict the traffic which will appear in near future. This kind of approach will also be useful for tracing the criminals because the images generated by sensor will be sent to the other stations which will be useful in stopping the trespassers. The sensor will identify the vehicle using the number plate of the vehicle. When an ambulance or a higher authority vehicle comes, the sensor will identify it according to the information given to it and clears the path by making the signals in the other directions red. During the night time when it will be seen that whether the traffic is less or more then accordingly the distance of the sensors will be decreased or increased from the red light via base-station.

II. RELATED WORKS

This paper includes a rapid and accurate classification-based detection technique is proposed for the Pedestrian Detection System (PDS). Experimental results on urban traffic videos show that the proposed method has a high detection speed with an acceptable detection rate and a false-alarm rate for on board detection; moreover, the training procedure is very fast. [1] In this paper a hierarchical approach to detecting various network attacks using a two-tiered system of image analysis. In a first tier, random attacks are detected by analysing the global traffic and can also discover semi-random attacks by examining the local traffic images in second tier. The proposed method can effectively detect small scale attacks like scanning attacks as well as large-scale attacks such as DDos, Worm and etc. [2] This paper presents an application of the moving target detection by focusing technique (MTDF) in civil traffic monitoring. The experimental results based on simulations show that the basic civil traffic monitoring can be solved using MTDF using a single-channel airborne SAR system. With an assumption of known moving directions of vehicles, MTDF allows detecting, estimation of speed, and finally reconstructing a SAR image of the vehicles of interest. In this study, the focusing approach of MTDF is based on ultra wideband chirp scaling (UCS) algorithm. [3] This paper presents a passive camera based pipeline for traffic light state detection, using (imperfect) vehicle localization and assuming prior knowledge of traffic light location. First, it introduces a convenient technique for mapping traffic light locations from recorded video data using tracking, back-projection, and triangulation. In order to achieve robust real-time detection results in a variety of lighting conditions, they have combine several probabilistic stages that explicitly account for the corresponding sources of sensor and data uncertainty. In addition, their approach is the first to account for multiple lights per intersection, which yields superior results by probabilistically

combining evidence from all available lights. [4] In this paper, a stochastic multiclass vehicle classification system which classifies a vehicle (given its direct rear-side view) into one of four classes: sedan, pickup truck, SUV/minivan, and unknown is presented. A feature set of tail light and vehicle dimensions is extracted which feeds a feature selection algorithm to define a low-dimensional feature vector. The feature vector is then processed by a hybrid dynamic Bayesian network to classify each vehicle. [5] This paper presents an unsupervised abnormality detection method using a multi camera system with clustering in real time. The proposed work addresses anomaly detection by means of trajectory analysis based on single support vector machine (single-SVM) clustering. The main problem associated with vehicle tracking is the occlusion effect. They have used a hybrid scheme of scale invariant feature transform (SIFT) to detect and recognize vehicles in multi view system, so behaviour extraction is done more accurately and conveniently. The main focus of this paper is to extract traffic flows which assists in regulating traffic lights based on smart cameras. [6].

This paper presents the results of a set of extensive experiments carried out under both daytime and night time real traffic conditions. The data is captured using an enhanced or extended Floating Car Data system (xFCD) that includes a stereo vision sensor for detecting the local traffic ahead. The collected information is then used to propose a novel approach to the level-of-service (LOS) calculation. This calculation uses information from both the xFCD and the magnetic loops deployed in the infrastructure to construct a speed/occupancy hybrid plane that characterizes the traffic state of a continuous route. In the xFCD system, the detection component implies the use of previously developed monocular approaches in combination with new stereo vision algorithms that add robustness to the detection and increase the accuracy of the measurements corresponding to relative distance and speed. In addition to the stereo pair of cameras, the vehicle is equipped with a low-cost Global Positioning System (GPS) and an electronic device for controller-area-network bus interfacing. [7] The proposed system works by detection of vehicles in video frames acquired by cameras installed on roads and then perform accurate counting of vehicles at the same time. Dynamic background subtraction technique and morphological operations for vehicle detection have been used to achieve better detection efficiency. [8] In this paper, we propose a cooperative localization algorithm that combines the hybrid time of arrival (TOA) / angle of arrival (AOA) measurements of all identified line-of-sight (LOS) base station (BS) - mobile station (MS) links with the TOA measurements of MS-MS links. Different cost functions are described according to the NLOS detection results based on existing identification methods. We also present a NLOS correction model which can be carried out when the destination MS to be located is completely in NLOS propagation, whereas some BS - cooperative MS links are in LOS conditions. [9] In this paper, they have mainly discussed the BP neural network traffic information fusion method and procedures based on the existing research results and Beijing traffic situation. The development of traffic detection technique makes it possible for people to get the traffic flow foundation information. Information fusion technology can remove redundant, overcome the ambiguity and get more comprehensive, more accurate and more reliable

information than any individual data sources[10]. This study proposes a new approach to video-based traffic surveillance using a fuzzy hybrid information inference mechanism (FHIIM). The three major contributions of the proposed approach are background updating, vehicle detection with block-based segmentation, and vehicle tracking with error compensation. During vehicle detection, the proposed approach detects the vehicle candidates from the foreground image, and it resolves problems such as headlight effects. The tracking technique is employed to track vehicles in consecutive frames. First, the method detects edge features in congested scenes. Next, FHIIM is employed to determine the tracked vehicles. Finally, a method that compensates for error cases under congested conditions is applied to refine the tracking qualities. [11] To aid in the screening of vehicles, they proposed to examine traffic patterns at checkpoints using burst detection algorithms. They also found that such bursts in suspicious traffic can be attributable to increases in vehicular traffic associated with certain kinds of criminal activity. This information can be used to specifically target vehicles searches during primary screening at ports and in the surrounding areas. [12] Like other security solutions, this scheme employs digital signature to guarantee the identity authentication, data integrity and non repudiation. The difference to most of other existed solutions is that an evaluation mechanism is proposed, which can detect malicious nodes that drop or tamper routing data. This mechanism has been proved efficient and has better security and network performance by comparing with the hybrid signature routing scheme via NS2 simulation. [13].

III. PROPOSED METHODOLOGY

1- In the following figure, all the vehicles are linked with the CLOUD server and the entire traffic is controlled through the base station. Situated near by. Sensors are present on all the roads along with the cameras. The sensor distance will vary according to the traffic and following cases.

3.1 CASE-1: PEAK HOURS (Maximum Rush)

This case is considered to be as top priority as the rush is expected to be the maximum in this case because it includes office hours and school hours i.e. morning hours 8:00a.m. till 10:00a.m. and evening hours 6:30p.m. till 9:00p.m.

SOLUTION: In this we will increase the sensor node distance to control the traffic. This will be done through base station via CLOUD SERVER. The signals will be regulated on priority basis as the maximum traffic in particular lanes will be allowed to go first.



Fig 1: Peak hours

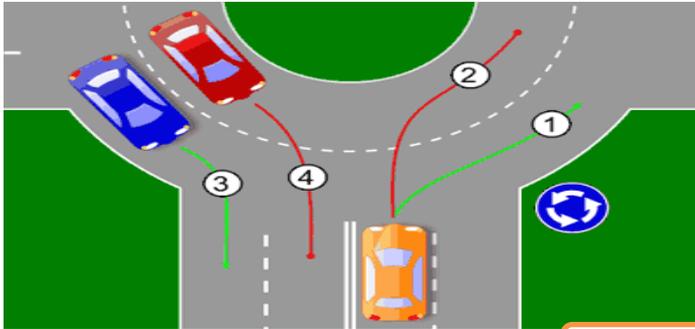


Fig 2: Sensor Traffic Architecture Sensors

3.2 CASE-2: NORMAL HOURS (Smooth Traffic)

This case is considered to be as normal one as the rush is less, so proper rules are needed to be followed by the people. In this the sensor distance is the default one. As this is the time in the afternoon hours i.e. 1:30p.m.till 4:30p.m. and morning hours 4:30a.m. till 6:30a.m.

SOLUTION: In this we don't need to make any changes as everything will be default only and will be directly controlled by the CLOUD SERVER through base station.the distance of the sensor nodes are 100metres for such hours.

3.3 CASE-3: NIGHT HOURS(More Accidents)

This case is considered to be important as most of the accidents takes placer at time of night due to drunk driving or rash driving specially after 11:00p.m. till 4:00a.m.(INCLUDING CRIME).

SOLUTION: So to stop the accidents and the crime rate we will not only use the sensors but also police patrol jeeps will be present after certain distance. As soon as a person breaks the traffic rules or crosses a speed limit of 80kmph during the time of night will be caught by the police as snapshot of the car along with its number will be sent to the police via CLOUD SERVER.

3.4 CASE-4 EMERGENCY CASES OR V.I.P MOVEMENT(Police Van,V.I.P movement)

This case is considered to be of utmost importance as in this during the time of some emergency like fire break out or criminal activity etc and also like V.I.P movement for example chief minister's movement. For these cases we need a clean passage for them.

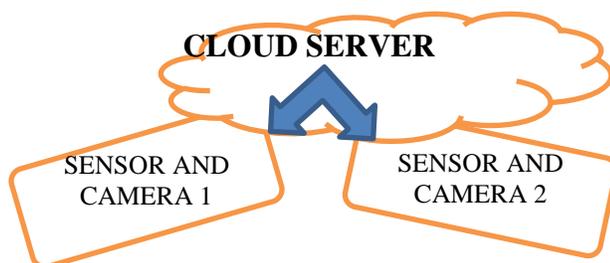
SOLUTION: In this cases an entire route map has to be provided by the police vans, ambulance, fire brigade and V.I.P's secretary to the base station before starting and immediately after receiving the information all the signals route will be made green and others will be turned red during this time using CLOUD SERVER).



Fig 3 Capturing image



Fig 4: Vehicle's stopped at lane



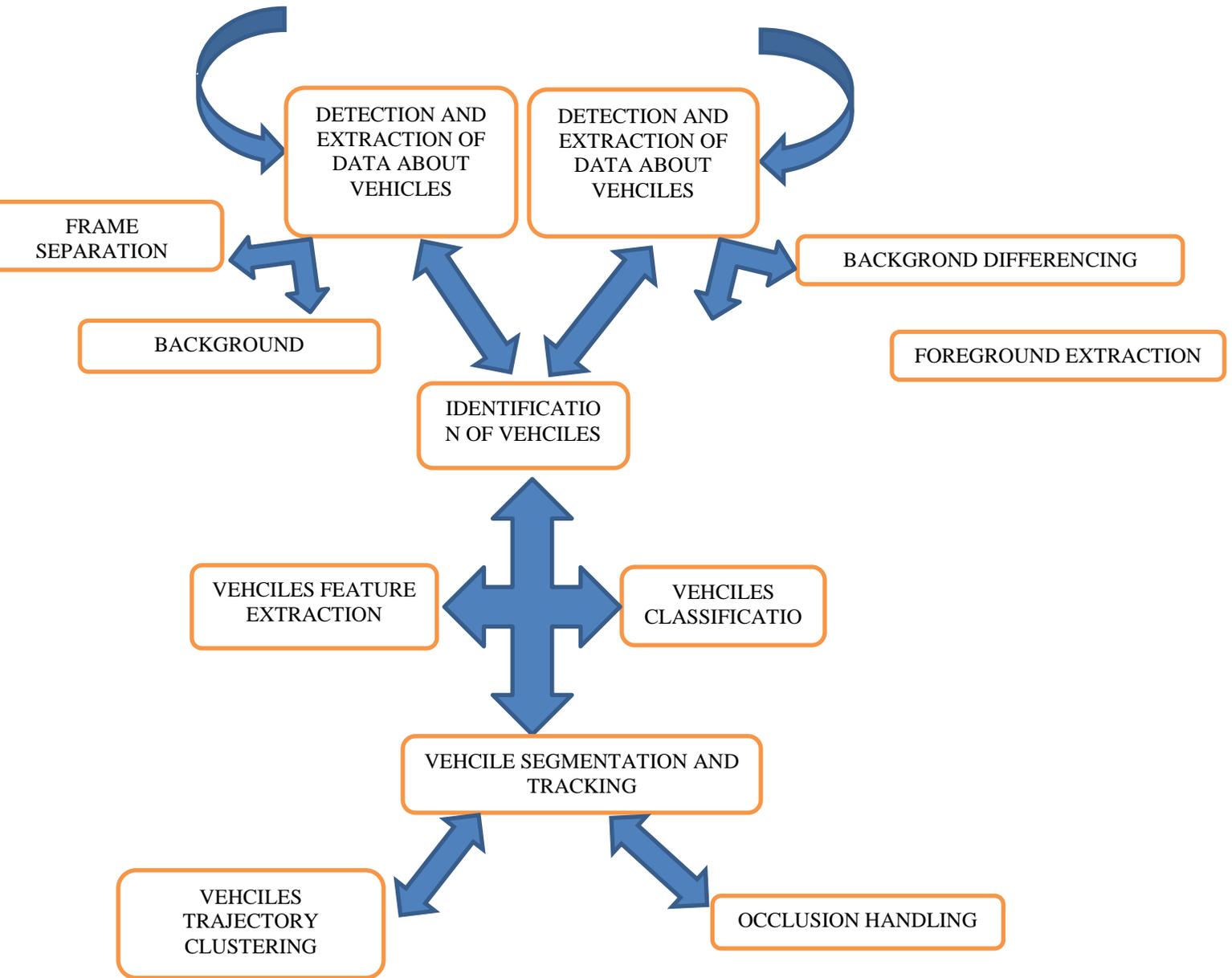


Fig 5: Process flow chart



Fig 6 : Regulation of Traffic on Priority basis



Fig- 7 Architecture for traffic detection mechanism

ROAD GRADE	TIME(IN HRS)	SENSOR DETECTORS (metres)	CAMERA 1 (metres)	CAMERA 2 (metres)	REMARKS
TRUNK ROAD	PEAK HOURS	100	120	80	SATISFACTOR Y
	NORMAL HOURS	50	80	40	MODERATE
	NIGHT HOURS	30	40	15	ACCURATE
	VIP MOVEMENT	5	15	0	ACCURATE

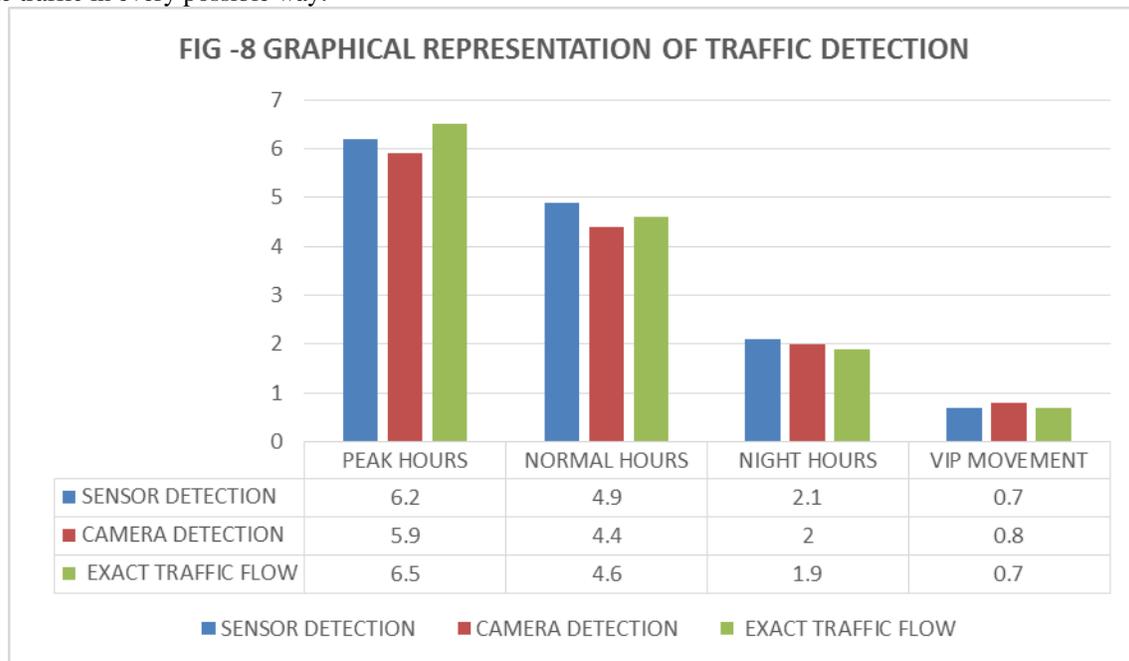
Table no. -1 :Experimental values for traffic detection

IV. EXPERIMENTAL EVALUATION

The above table represents the working mechanism of the proposed project. The above mentioned case is of a trunk road where the sensors are placed along with the cameras. The sensors and cameras are placed in such a way that during the time of

peak hours the sensor will cover the area of 100metres and the camera 1 will cover up a distance of 120metres along with camera 2 that will cover up upto 80metres. As soon as the traffic reaches near about a range of (90-110)metres the , a message will be sent to the cloud base station and the traffic will be regulated accordingly. The experiments were performed for all the possible cases and the outputs were obtained accordingly

.The remarks were given based upon the experimental outcomes which proves that the proposed mechanism can serve best in controlling the traffic in every possible way.



The above bar graph represents the experimental outcomes of the proposed traffic detection policy in graphical form. All the possible cases have been taken into consideration for carrying out the experimental analysis. The blue bar represents the sensor detection i.e. during all the four cases, the sensor will identify the traffic along with the camera detection (orange bar) and they will regulate the traffic on priority basis. The grey bar represents the actual flow of traffic in all the cases. From the above graph it is clear that the experimental values and actual values are very close to each other. It means that the proposed mechanism can serve best for the traffic regulation.

V. RESULT

The observations recorded were carefully analysed and critically viewed by the observers. The above proposed mechanism is better than the current mechanism in India. In the current mechanism more number of traffic officials are required and still it is not working properly. Most of the police officials are busy in cutting the chalans and checking driving licences, vehicle's papers etc. whereas public is busy in breaking them, which leads to accidents and traffic jams. Current system involves lots of corruption and crime rate is also not controlled. But with this proposed mechanism all the problems can be controlled and this system can serve best to reduce the accidents and the crime rate to a great extent.

VI. CONCLUSION

The proposed solution with different cases provides efficient and easy approach for vehicle's at the signal. The sensor detection methods used are more accurate and error prone. This cloud based solution can be controlled and monitored at a single

point in case of emergency situations. This system also provides solutions for different cases in every possible way, with proper traffic regulation methods. This system can help in controlling and reducing the crime rate to a great extent. The experiments were performed and the outcomes were represented in bar graph form which clearly shows its success. The proposed mechanism can ought to be improved further in future with the intelligent and much more accurate and appropriate cloud based solutions.

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Fracture Toughness and Mechanical Properties of Aluminum Oxide Filled Chopped Strand Mat E-Glass Fiber Reinforced–Epoxy Composites

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Abstract- The knowledge of load bearing characteristics and failure of material is very important for mechanical engineers. Various metallic, non metallic and composite materials are used in different application. In view of this, the main objective of the present work is to analyze the influence of Aluminum Oxide filler on Fracture Toughness properties of Chopped Strand Mat (CSM) E-Glass Fiber reinforced Epoxy Resin Matrix Composites was evaluated using a Compact Tension (CT) specimen according to ASTM D5045 standard. Fracture toughness was conducted at six different compositions of composites. Three samples have to be tested for each composition of the composites. The entire specimens used have satisfied plain strain condition. The each composition of composites is fabricated by using hand layup technique. The epoxy resin and hardener are mixed in the weight ratio of 10:1. The result showed that the tensile strength for 4wt% aluminum oxide filled composite is more compared to 2wt%, 6wt%, 8wt%, 10wt% and neat composite. The fracture toughness of random-chopped mat E-Glass fiber composite material systems (GE, GEA4, GEA6, GEA8 and GEA10) were determined and reported in this manuscript. The fracture toughness of the GEA4 composite was found to be the highest fracture toughness followed by GEA2, GE, GEA6, GEA8 and GEA10 in the order of decreasing fracture toughness. It can be concluded that by the addition of small percentage of aluminum oxide filler there is marginal improvement in fracture toughness of glass fabric reinforced epoxy matrix up to 4wt%.

Index Terms- Chopped Strand Mat (CSM) E-Glass Fiber, Aluminum Oxide, Epoxy Resin, And Compact Tension Specimen.

1. INTRODUCTION

In material science, Fracture toughness is a property which describes the ability of a material containing a crack to resist fracture and is one of the most important properties of any material for many design application. During last decades, there has been a tremendous growth in the use of composite materials in various field of application, ranging from sporting goods to structural component for the automotive and aerospace industries, where the long term properties are of primary importance. High performance polymer based composite materials are being used increasingly for engineering application under hard working condition. Polymer based composite materials play an important role in much industrial application. Because of their favorable properties such as high specific tensile and compressive strength, good electrical conductivity, good fatigue resistance, low coefficient of thermal expansion and suitability for the production of complex shape materials[1]. The main disadvantages of composite material system is their inability resist blemish initiation and propagation is characterized by the fracture toughness of the materials [2]. So many researchers have been investigated the fracture toughness behavior in different continuous fiber reinforced composites. But there is a limited literature available on fracture toughness behavior of randomly oriented Chopped Strand Mat E-Glass fiber reinforced composites [3]. In this study, fiber glass fiber mat or chopped strand mat is used because of their very good properties such as excellent performance in coating and performing, high strength, excellent flexibility, high dry and wet tensile strength and good transparency for end product.

Many researchers have been investigated the Mode-I interlaminar fracture toughness behavior of polymer composite materials Naveed, Siddique.et.al. [4] Investigated Mode-I interlaminar fracture toughness behavior and mechanical properties of carbon fiber reinforced with nanoclay filled epoxy matrix. The test was performed by using compact tension specimen on universal testing machine at a cross head speed of 5mm/min. The result showed that. Depending on the loading rate fracture toughness increased up to 60% with addition of 3wt% clay. Daniel and Coworker [5, 6] investigated the effect of loading rate on Mode-I fracture toughness properties of carbon/epoxy and carbon/elastomer modified epoxy at a displacement rate of 0.0075mm/sec to 460 mm/sec, they observed that fracture toughness increased for carbon and epoxy composites. But decreased in fracture toughness in elastomer epoxy composite with increasing loading rate. Gillespie. Jr. [7] investigated the effect of loading rate on Mode-I fracture toughness behavior of carbon/epoxy and carbon/PEEK at a cross head speed of 0.25mm /min to 250mm/min. the result showed that fracture toughness of carbon/PEEK decreases with increased loading rate and carbon /epoxy insensitive. Kusaaka et.al. [8] Studied the fracture toughness of carbon/epoxy at a displacement rate of 0.01mm/sec to 20m/sec. He observed that fracture toughness was rate independent. P.Karge-

Kocis and Friedrich et.al. [9] Investigated fracture toughness of short glass / PEEK composite material. The test was performed at displacement rate of 0.1mm/min to 100mm/min. the result showed that fracture toughness decreased with increasing the loading rate. Many researchers have studied the Mode - II fracture toughness behavior of polymer composite materials interns of loading rate. Davies et.al. [10] Investigated the influence of fiber volume fraction on Mode-II interlaminar fracture toughness of glass/epoxy using end notched flexure (ENF) specimen. The test was performed at displacement rate of 1mm/min and 10KN capacity. He observed that G_{IIC} increases with decreased with fiber content. Smiley and Pipes et.al. [11] Investigated the effect of loading rate on Mode- II fracture toughness properties of carbon/epoxy and carbon/PEEK. The test was performed at displacement rate of 0.042m/sec to 0.092m/sec. They observed that decreased in fracture toughness with increasing loading rate. Composton et.al. [12] Investigated Mode-II fracture toughness of glass/vinyl ester and glass/polyester at displacement rate of 1mm/min to 3m/sec. they observed that fracture toughness decreased with increasing loading rate.

Many scientists have investigated the mixed mode fracture toughness properties of polymer composite interns of loading rate. Blackman et.al. [13] Investigated fracture toughness behavior of carbon / epoxy and carbon / PEEK composite interns of loading rate of 1mm/min to 5m/sec. He found that fracture toughness to be invariant. Kusaaka et.al. [14] Studied the fracture toughness behavior of carbon / epoxy composites interns of loading rate of 10^{-6} m/sec to 10m/sec. He observed that fracture toughness decreases with increasing loading rate.

The main objective of the present work is to fabricate E-Glass chopped strand mat and Epoxy composite using Aluminum Oxide filler varying weight percentage using hand layup technique and to study the fracture toughness and mechanical behavior. The main reason why alumina is most commonly used material because of their good properties such as hard and wear resistance, excellent dielectric properties, good thermal conductivity, excellent size and shape capability, high strength and stiffness and epoxy resin is widely used because of their favorable properties such as high strength, low viscosity and low flow rates, low volatility during curing and low shrink rates which reduce tendency gaining large shear stress of bond epoxy and reinforcement.

2. MATERIALS AND EXPERIMENTAL DETAILS

2.1. Material Selection and Composition

Chopped Strand Mat (CSM) E-Glass Fabric (Density 2.54 g/cm^3 and Modules 70GPA) having fiber thickness 0.45 to 0.50mm were used as the reinforcement material supplied by Suntech Fiber Private, Limited, Bangalore India. The Matrix material used is a general purpose epoxy resin (Lap ox L-12 3202, Hardener K-6 and Density 1.120 g/cm^3) supplied by Yuje Enterprises Bangalore, India. Filler material used were Aluminum Oxide (Density 3.54 g/cm^3 and Melting Point 2000°C) active neutral white odorless powder having particle size 230 mesh (57 Micron) is supplied by Dutta Scientific Works Bangalore, India. All materials used in this study were fabricated by using hand layup technique. The detail of six different composition of composite are made shown in Table (1.1) for Fracture toughness test and tensile test

SL.No	Sample Code	Epoxy (Wt %)	Glass Fiber (Wt %)	Alumina (Wt %)	Specimens
1	GE	40	60	0	3
2	GEA2	38	60	2	3
3	GEA4	36	60	4	3
4	GEA6	34	60	6	3
5	GEA8	32	60	8	3
6	GEA10	30	60	10	3

Table -1.1 Composition of E-Glass Fiber-Reinforced with Aluminum Oxide particles.

2.2. Fabrication of the Specimen

The composite materials used in this study were manufactured by using hand layup technique. Before layup, Mold release sheet is placed to the granite plate to insure that the part will not adhere to the mold. Epoxy resin and hardener are mixed in the weight ratio of 10:1 and kept for a minute. Then, this mixture is mixed with the alumina and applied to the release sheet. Then, reinforcement kept and again this mixture is applied to the mat. Then, the brush, roller and squeeze can be used to eliminate air bubbles. The same procedure carried out up to desired thickness is obtained and another granite plate is kept on this to remove air bubbles. And then, the part is allowed to cure at room temperature for 18 hour and then, finally part is release from the plate.

2.3. Specimen Design for fracture toughness test and tensile test

A compact tension specimen is a notched sample and is a standard dimension in accordance with ASTM D5045. The purpose of using a notch sample is to create a fatigue crack by cycling the maximum and minimum load. Compact tension specimen used extensively in the area of fracture mechanics and corrosion testing. In order to establish fracture toughness values for a material. According to the standards the constraining dimension of the CT specimen is the thickness of the material. Compact tension specimens are used for experiment where there is a shortage of material available due to their compact design. Fracture toughness test has to be carried out using a compact tension specimen having thickness $B=5\text{mm}$, crack length from loading point $A=20\text{mm}$, width= 40mm , Length= 50mm and breadth = 48mm in accordance to ASTM D5045 standard.

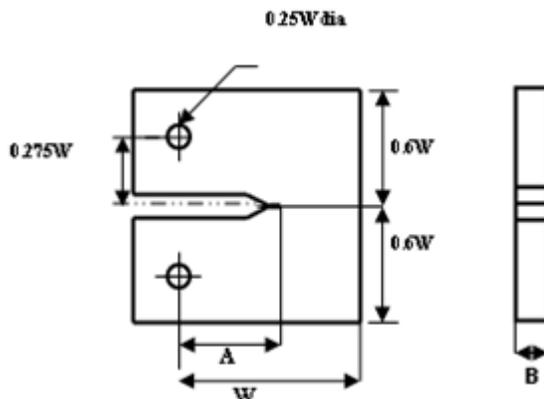


Fig 2.1. Compact Tension specimen according to ASTM D5045

2.4. Calculation of Mode – I stress intensity factor

The mode-I stress intensity factor (Fracture Toughness), K_{IC} , At the point of fracture initiation was determined using equation 1.the load - displacement curve was recorded from the experiment to determine P_Q As explained in ASTM D5045 standard. In order to establish a valid stress intensity factor K_{IC} , a conditional result K_Q was calculated using equation 1

$$K_Q = P_Q / (B)^{1/2} f(x) \text{----- (1)}$$

Where

B = Specimen thickness, W = Specimen Width and

$$f(x) = \frac{(2+x) (0.866x+4.64x-13.32x^2+14.72x^3-5.64x^4)}{1-x^{3/2}} \text{--- (2)}$$

P_Q is determined by Load- displacement graph, In order to ensure plain strain condition. The size criteria are validated by the above equation.

$$B, a, (W-a) > 2.5 (K_Q / \sigma_{ys}) \text{----- (3)}$$

Where $(W-a)$ the ligament and σ_{ys} is the yield stress of the specimen. K_Q satisfies equation 2 and then K_Q is equal to K_{IC} .three samples have to be tested for each composition of composites. The entire specimens used have satisfied the plain strain condition.

2.5. Determination of Fracture Toughness

Stress intensity factor, K_{IC} is one of the most important properties of a material. It is used to design for dynamic application where the material must encounter many mechanical shocks and vibration. The toughness of a material is defined as the energy absorbed by a material before fracture, and expressed as impact energy. Fracture toughness describes the resistance of a material with a crack to fracture. Because it is almost impossible to make material for practical purpose free from crack defects.

Fracture toughness analysis is extremely important for many design application. The fracture properties of a thermo set material are determined using compact tension specimen accordance to ASTM D5045 standard. The critical stress intensity factor and impact energy are determined. Test is carried out with a universal testing machine (UTM) using compact tension or bending mode. An initial crack machined in a rectangular specimen and natural crack generated by tapping on fresh razor blade placed in the notch. The thickness of the specimen should be higher than the critical value below which the material shows plain stress behavior. The K_{IC} and G_{IC} of a given material are function of testing speed and temperature. The value may be different under cyclic load. Therefore, K_{IC} and G_{IC} in the design of service component should be made considering different that may exist between test condition and field condition.

2.6. Density and Fiber Volume Fraction

Density is a physical property of matter, as each element and compound has unique density associated with it. The density of a material varies with temperature and pressure. The density of a composite material is measured according to ASTM D792-98 standard [15].the specimen from each composite was tested, the volume of a fiber in a cured composite. The fiber volume of a composite material may be determined by ignition loss or burnout method. commonly used for glass fiber reinforced composite in the resin burn-off method described in accordance to ASTM D2584-94 standard[16].the specimen from each composite was tested

2.6. Tensile Test

Tensile test is most commonly used to assess the performance of a material or identify the material for particular application. The test indicates that the ability of a material withstand full out of force and is used to determine extent of stretching before break. The test is carried out by universal testing machine using dog bone shape specimen according to ASTM D683 standard. The tensile test specimen of different size as specified by the standard can be used. Depending upon the nature of the sample different speed of the testing can be used. The most commonly used speed of testing is 5mm/min. in this study, tensile test was conducted at six different compositions of the composites.

3. RESULT AND DISCUSSION

3.1. Density and Fiber Volume Fraction

The theoretical and measured densities of the composites along with the corresponding volume fraction of voids are presented in table 3.1 The composite density values calculated theoretically by using equation are not equal to the experimentally determined values. This difference represents the void and pores present in the composites.

Sample Code	Measured Density(g/cm ³)	Theoretical Density(g/cm ³)	Volume fraction of void
GE	1.6403	1.6853	2.6704
GEA2	1.6714	1.7224	2.9610
GEA4	1.7015	1.7612	3.3897
GEA6	1.7373	1.8018	3.7126
GEA8	1.7750	1.8443	3.7575
GEA10	1.8144	1.8889	3.9940

Table 3.1 Tabulation of results for physical properties of density and volume fraction

The density of a composite depends on the relative proportion of matrix and reinforcing material and this is one of the most important factors for determining the properties of the composites. The void content is the cause for the difference between actual density and the theoretical density. The voids significantly affect the mechanical properties and the performance of the composites at the work place. Higher void content mean lower fatigue resistance, greater susceptibility to water penetration and weathering. The knowledge of void content is desirable for estimation of the quality of composites. A good composite should have fewer voids. However presence of voids is unavoidable in hand layup process.

In the present investigation it was noticed that the Aluminum Oxide filler filled composites have higher void contents than that of the neat composites

3.2. Tensile Test

Sample Code	Maximum Load in KN	Tensile Strength (MPa)	Young's Modulus (MPa)	Elongation %
GE	5.41	111.21	7524.27	3.51
GEA2	4.89	148.42	7819.11	4.33
GEA4	4.19	158.26	8692.06	4.53
GEA6	5.05	120.67	4155.26	4.37
GEA8	4.77	127.55	5517.65	4.14
GEA10	4.65	125.18	5661.37	4.22

Table 3.2.Tabulation of results for tensile test

The ASTM D638 standard test method for tensile properties of fiber resin composites is used. The tensile test is performed in universal testing machine KIC-2-1000-C at the cross head speed of 5mm/min. The results are analyzed to calculate the tensile strength of composite samples. The table 3.2 gives the tensile properties of various samples.

The aluminum oxide filled composite showed max tensile strength compared to neat composite. Increasing the percentage of fillers to 2 wt % resulted in increasing the tensile strength. Further increase in filler content (up to 10% Wt) resulted in decreased tensile strength. This is due to increased filler percentage in the composites resulting in improper distribution. Composite filled 4wt% aluminum Oxide showed maximum value of Young’s modules compared to unfilled composite. Further addition of filler reduce the same, this can attributed the increased brittleness of the composites with higher percentage of the filler the filler content. It can also be observed that these variations are very significant. Composite filled with 4wt% of aluminum oxide filler showed max percentage elongation compare to unfilled composite. Increased percentage of filler deteriorated the situation. Increased filler content make the composites brittle which could result in early brittle fracture. In tensile test result, the tensile properties of tensile strength, young are modules and percentage elongation values are increases marginally up to 4wt%.

3.3. Fracture Toughness Test

The fracture toughness test has to be carried out in universal testing machine KIC-2-1000-C using compact tension specimen at the cross head speed of 5mm/min. The table 3.3.gives the fracture properties of various samples. The standard deviation of the results was a little higher than expected – possibly due to cracks in certain samples that led them to fracture more easily

Sample Code	Maximum Load in KN	Stress intensity factor in MPa(mm) ^{1/2}	Maximum Displacement in mm
GE	4.19	16.47	3.51
GEA2	4.89	19.95	4.33
GEA4	5.41	20.38	4.53
GEA6	5.05	17.57	4.37
GEA8	4.77	17.32	4.14
GEA10	4.65	17.45	4.22

Table 3.3 Tabulation of results for Fracture toughness test

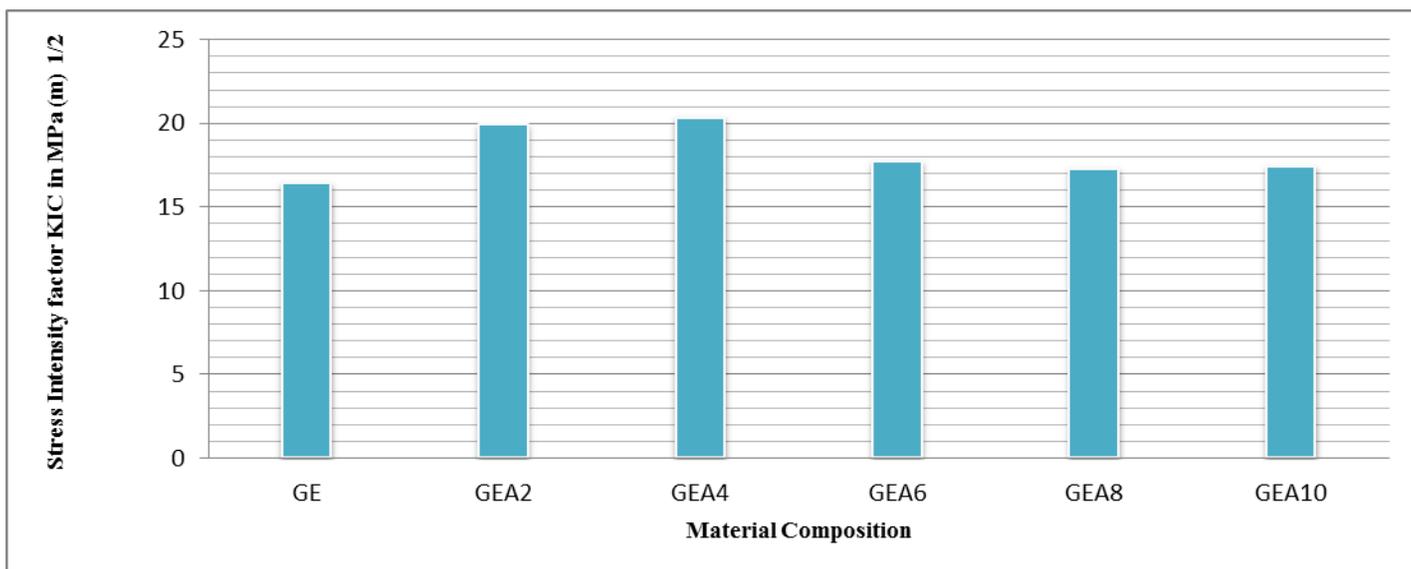


Figure 3.1 Shows graph plotted between stress intensity factor and material composition

The result table showed that the fracture toughness properties of various parameter such as stress intensity factor, maximum load and displacement. Stress intensity factor usually expressed in MPa (m)^{1/2}. From the above table, we found that the maximum value of stress intensity factor found at 20.38MPa (m)^{1/2}. Table 3.3 shows the obtained results. The 4wt% aluminum oxide filled composite had a significantly higher fracture toughness compared to the neat composite (K_{IC} = 16.47 MPa (m)^{1/2}). The obtained results were K_{IC} = 19.95 MPa (m)^{1/2} [GEA2], K_{IC} = 20.38 MPa (m)^{1/2} [GEA4], K_{IC} = 17.57 MPa (m)^{1/2}, K_{IC} = 17.32 MPa (m)^{1/2} and K_{IC} = 17.45 MPa (m)^{1/2} surprisingly, the sample contain 4wt% alumina filled composite showed a higher fracture than all other samples, besides containing numerous void. Therefore, achievable fracture toughness marginally up to 4wt%. Then, increases the filler content resulting in decreases in fracture toughness due to improper distribution of filler and brittleness of the composite with higher percentage of filler which could results in early fracture.

LOAD – DISPLACEMENT GRAPH

The average values of load versus displacement curve of the fracture toughness behavior of neat composite and aluminum filled chopped strand mat E-Glass fabric and epoxy composites are shown in figure 3.2. In the load displacement graph. The load drops sharply at several points after the peak load, corresponding to unstable or fast crack propagation. Fiber bridging and breaking behind the crack tip are not observed macroscopically in crack propagation during the test. Due to relatively thick matrix inter laminar layer. The peak load much higher for the 4wt% aluminum oxide filled composite than for the neat composite, the maximum displacement and peak load observed in 4wt% aluminum oxide filled composite compare to others. Further, increases in filler content resulted in load drops slowly at several points after the specimen break at maximum load. This is mainly due to manufacturing flaw and improper distribution of filler.

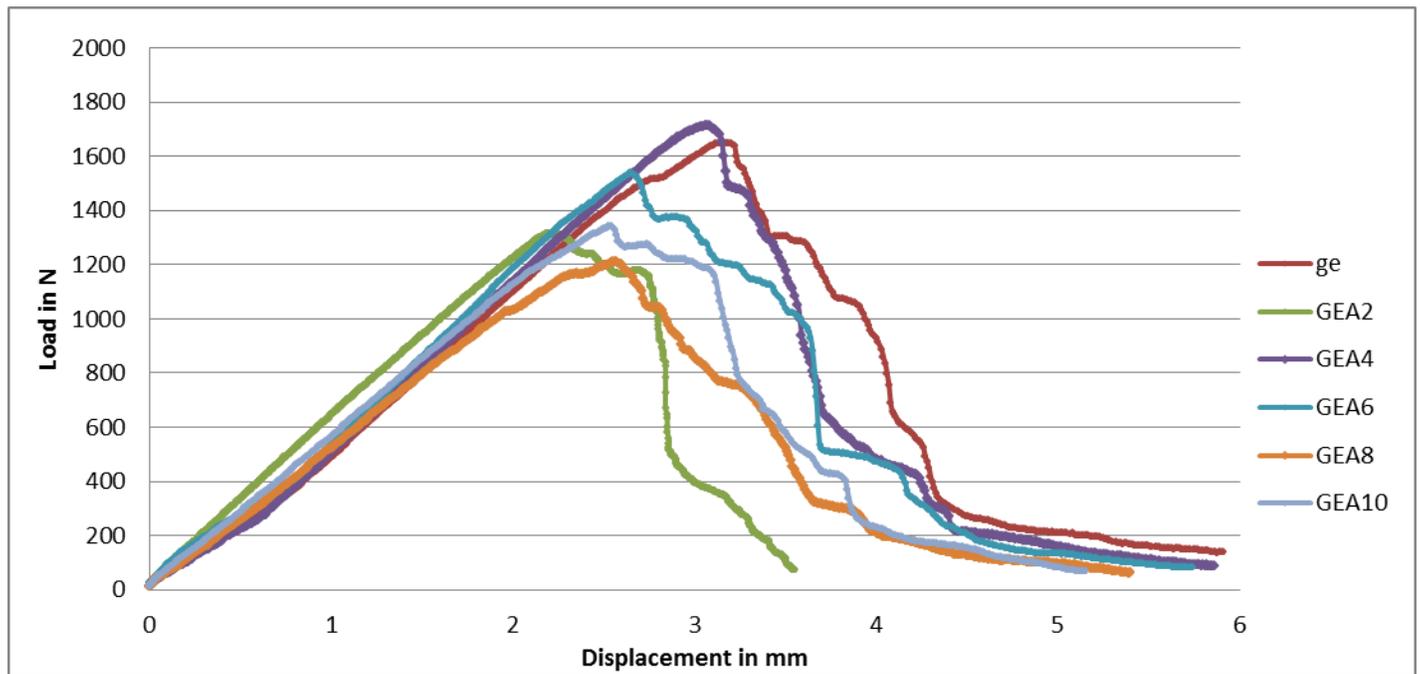


Fig 3.2 shows load – displacement graph for GEA4 and GEA6 composition

4. CONCLUSION

Chopped strand mat E-glass fiber and epoxy composite of aluminum oxide is prepared with six different wt% of aluminum oxide viz 0wt%, 2wt% , 4wt% , 6wt% , 8wt% and 10wt%. From the study, following observations were made:

1. The voids significantly affect the mechanical properties and the performance of the composites at the work place. Higher void content mean lower fatigue resistance, greater susceptibility to water penetration and weathering.. However presence of voids is unavoidable in hand layup process. In the present investigation it was noticed that the Aluminum Oxide filler filled composites have higher void contents than that of the neat composites.
2. The result obtained from the tensile test, the tensile properties such as tensile strength, young's modules and percentage of elongation for 4wt% aluminum oxide filled composite is more compared others. Further increases in filler contents up to 10wt% resulted decreases in tensile strength. This is due to increased filler percentage in the composites resulting in improper distribution and poor manufacturing process.
3. Fracture toughness values were determined using compact tension sample. The fracture toughness values were increases with addition of 2wt% and 4wt% aluminum oxide filler. The presence of aluminum oxide filler provide crack tip blunting by shear deformation process near the crack tip. However at high percentage of aluminum oxide filler the particle matrix adhesion is reduced which reduces the toughness. It can be concluded that by the addition of small percentage of aluminum oxide filler there is marginal improvement in fracture toughness of glass fabric reinforced epoxy matrix marginally up to 4 wt%.

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Role of Phosphorous Solubilizing Microorganisms to Eradicate P- Deficiency in Plants: A Review

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Abstract- Phosphorus is the second most important macro nutrient required by the plants for its optimum growth and yield. But it is considered to be a most limiting factor of many crop production systems, due to its unavailability of soluble forms in the soils. About 80% of applied P fertilizers are immobilized due to the formation of complex with Al or Fe in acidic soils or Ca in calcareous soils. An alternative way to circumvent P deficiency in soil and to improve crop production is through the utilization of microorganisms as biofertilizer. Rhizospheric microorganisms play a vital role in the transformation of unavailable form of P into available form which will be a boon to the agrarian communities to remove P deficiency in plants.

Index Terms- Phosphorous, deficiency, solubilization, microorganisms, organic acid.

I. INTRODUCTION

Phosphorus (P) is one of the major essential macro-nutrients required for maximizing crop growth and production. It plays a significant role in plant metabolism and is important for the functioning of key enzymes that regulate the metabolic pathways (Theodorou and plaxton, 1993). Therefore, P deficiency is considered to be the most important chemical factor that restricts plant growth because of its vital role in physiological and biochemical functions of the plant.

In India, P content in an average soil is 0.05%. Only 0.1% from the total P forms is available to plant, rest of the P forms become insoluble salt (Bhattacharya and Jain, 1996). The use of chemical fertilizers to circumvent the P deficiency in soil also becomes unavailable to the plants due to the rapid immobilization of P soon after application (Dey, K.B., 1988; Sanyal, S.K & De Datta, S. K., 1991; Yadav, K. S & Dadarwal, K. R., 1997). This immobilization is due to the high reactivity of phosphate anions through precipitation with cations such as Fe³⁺ and Al³⁺ in acidic soils (Norrish and Rosser, 1983) or Ca²⁺ in calcareous soils (Sample *et al.*, 1980). In these forms P is highly insoluble and unavailable to plants (Rdresh *et al.*, 2004).

In Tamil Nadu most of the agricultural soils are calcareous in nature. P mineral present in the calcareous soil become unavailable to plants due to the immobilization of phosphate anions by forming a complex with Ca (Sample *et al.*, 1980). Thus P deficiency in soil always remains as a major challenge to agriculturist.

Application of microorganisms solubilizing phosphate will be a promising approach to increase P availability in agricultural soil. The major mechanism involved in the P solubilization is the

production of organic acids and chelating oxo-acids from sugars (Antoun and Kloepper, 2001; Peix *et al.*, 2001).

II. PHOSPHORUS IN SOIL

Phosphorus is a vital nutrient available to plant roots only in soluble forms that are in short supply in the soil (Malviya *et al.*, 2011). It is estimated that about 98% of Indian soil contains insufficient amount of available phosphorus, which is necessary to support maximum plant growth (Padmavathi and Usha, 2012). There are two types of phosphorus present in soil, that are organic and inorganic (Rasoolkhatibi, 2011). Organic form of phosphorus is available as soil humus, which is taken up by plants from soil and utilized by animals that consume plants. They are returned to soil as organic residues which will get decayed in soil. These organic phosphates will slowly release inorganic phosphate. The release of inorganic phosphate from organic phosphate is called "mineralization" which is caused by micro organism by the breakdown of organic compounds (McGrath *et al.*, 1995). The level of inorganic phosphorus is very low in the soil (Adarsh *et al.*, 2011), which is either adsorbed to soil mineral surfaces or occur as sparingly available precipitate form (Richardson *et al.*, 2011).

The greater part of soil phosphorus, approximately 95-99 % is present in the form of insoluble phosphates (Vessileva *et al.*, 1993). It means that soil contain high amount of total phosphorus, but it's availability to plant is very low and it is often a limiting factor for the plant growth (Mikanova and Novakova, 2002).

III. ROLE OF PHOSPHORUS IN PLANT DEVELOPMENT

Phosphorus is the "King Pin" in Indian agriculture and occupies a unique position both in conventional as well as in alternative agriculture (Karunaiselvi *et al.*, 2011). It is one of the essential mineral macronutrients, which are required for maximum yield of agriculturally important crops (Islam *et al.*, 2007) and also it helps for plant growth and reproduction (Mahantesh and Patil, 2011). Without adequate phosphorus supply the yield of the crops cannot reach the economic level (Balamurugan *et al.*, 2010).

An adequate supply of phosphorus in the early stages of plant helps to promotes growth and productivity of the crops. It plays a vital role in many physiological activities such as cell division, photosynthesis and development of good root system and utilization of carbohydrates (Mahantesh and Patil, 2011). It plays an indispensable biochemical role in respiration, cell

enlargement and several other processes in living plant (Sagervanshi *et al.*, 2012). The most essential function of phosphorus in plant is energy storage and transfer of Adenosine di and tri phosphate (ADP and ATP) which act as energy currency in the plants (Kaviyarasi *et al.*, 2011). Phosphorus also helps in development of meristematic tissue, in stimulation of early root growth (Sonam Sharma *et al.*, 2011).

Phosphorus is an important constituents of nucleic acid, phytin and phospholipids (Sagervanshi *et al.*, 2012). Phosphorus helps plant to survive winter rigors and also improve the quality of many fruits, vegetables and grain crops (Sagervanshi *et al.*, 2012). Ahmanalikhhan *et al.*, (2009) reported that phosphorus occupies major factor in stalk and stem strength, flower and seed formation, crop maturity and production, nitrogen fixation in legumes, crop quality and resistance to plant disease. But due to the unavailability of phosphorus in soil, its deficiency is major constraints for crop production (Aadarsh *et al.*, 2011) and it can severely limit plant growth and productivity (Alikani *et al.*, 2006).

IV. PHOSPHORUS DEFICIENCY IN PLANTS

Phosphorus deficiency in plants leads to chlorosis, weak stem and slow growth (Mahantesh and Patil, 2011).

A mild P deficiency results in stunted crop growth, which will be insignificant visibly. In severe cases of P deficiency, symptoms include characteristic stunting, purpling or browning, appearing first on the lower leaves and base of the stem and working upward on the plant, particularly on cereal crops. The effect is first evident on leaf tips, and then progresses toward the base. Eventually, the leaf tip dies. However, visual diagnosis of P deficiency is very difficult and must be confirmed with soil tests and possibly with the aid of plant tissue analysis. Symptoms are most pronounced in young plants because their more rapid growth makes greater demands on the available supply (Ross H. McKenzie, 2003).

V. AVAILABILITY OF PHOSPHORUS IN SOIL

Phosphorus is a major growth limiting nutrient and unlike the case of nitrogen, there is no large atmospheric source that can be made biologically available (Ezawa *et al.*, 2002). In soil phosphorus is sequestered by adsorption of surface soil particles and through precipitation with soil cations, particularly iron, aluminium, and calcium (Harries *et al.*, 2006) and these phosphate anions are extremely reactive and immobilized through precipitation (Keneni *et al.*, 2010). Rodriguez and Fraga, 1999; Fernandez *et al.*, 2007 also reported that both phosphorus fixation and precipitation occurs in soil, because of the large reactivity of phosphate ions with numerous soil constituents and these phosphorus ions adsorbed as Fe – oxides, Al- oxides, Al-silicates and Ca-carbonates depending on the particular properties of soil (Karunaiselvi *et al.*, 2011). These forms of phosphorus are highly insoluble and unavailable to plants.

Mostly phosphate is predominantly present in the form of Inorganic phosphate (IP) which belongs to two groups; (i.e.) of calcium and those of iron and aluminium (Selvi *et al.*, 2011). In acidic soil phosphorus is fixed by free oxides and hydroxides of

aluminium and iron, while in alkaline soils, phosphorus fixed by calcium (Goldstein, 1994; Jones *et al.*, 1991).

A recent estimation revealed that 49.3% of cultivated lands are deficient in available phosphorus (Patil *et al.*, 2012). The uptake of phosphorus by the plants is only a small fraction, which is actually added as phosphate fertilizer (Vassilev and Vassileva, 2003). The remaining phosphorus from total phosphorus content is converted into insoluble form of phosphates and lost in the soil due to the adsorption, precipitation or conversion of organic phosphates (Holford, 1997).

VI. FACTORS AFFECTING THE AVAILABILITY OF PHOSPHORUS IN THE SOIL

Different parameters such as soil pH, calcium concentration, proportion of organic matter and its type, soil moisture, soil texture, root density and exudates can affect the availability of soil phosphorus to the plants (Tisdale *et al.*, 1993; Barber, 1995). In case of acidic soil, free oxides and hydroxides of Al and Fe play a key role in fixing phosphorus, while alkaline soil it is fixed by Ca (Toro, 2007). Regular applications of phosphorus fertilizer also decrease the high total phosphorus content in soil (Borling *et al.*, 2001; Hao *et al.*, 2002).

The availability of soil phosphorus is also influenced by nature and content of clay, active sesquioxides, lime content and organic matters (Karunaiselvi *et al.*, 2011).

VII. IMPACT OF CHEMICAL FERTILIZERS ON SOIL

Due to the unavailability of phosphorus in soil, plants cannot meet their requirement which lead to the large utilization of phosphorus chemical fertilizers by farmers (Islam *et al.*, 2007).

Using phosphorus fertilizer, especially superphosphate, as very common method of providing plant phosphorus requirement, is not very efficient in calcareous and alkaline soil. The amounts of phosphorus applied were turned into insoluble products and becomes unavailable to the plants and only about 20% of the fertilizers is soluble in the first year of use (Tisdale *et al.*, 1993). To rectify the effect of chemical fertilizer and to maintain the soil fertility status, solubilization of insoluble phosphorus in the soil is made available to crops by sustainable agricultural methods (Rodriguez and Fraga, 1999; Vessey, 2003; Thakurai *et al.*, 2004).

VIII. BIOFERTILIZERS

Use of biological alternatives (Biofertilizer) radically been increased due to the increasing prices of synthetic fertilizers and concurrently threat of agro chemicals to the environment (Socolno, 1999; Vance, 2001).

IX. ROLE OF MICROORGANISMS IN PHOSPHORUS SOLUBILIZATION

Microbial inoculants have provided their worth as biological alternative to compensate agro chemicals and to sustain environment friendly crop production (Dobbelaere *et al.*, 2003).

Phosphorus solubilizing microorganisms was more effective approach for providing balanced nutrition (Gupta *et al.*, 1998; Martins *et al.*, 2004) and recently, these phosphorus solubilizing microorganisms have attracted the attention of agriculturalists as soil inoculums to improve the plant growth and yield (Yung, 1994; Yung *et al.*, 1998; Goldstein *et al.*, 1999; Fasim *et al.*, 2002).

X. RHIZOSPHERE MICROORGANISMS

Microorganisms are integral to the soil phosphorus cycle and as such play an important role in mediating the availability of phosphorus to plants (Richardson *et al.*, 2011). The role of microorganism in solubilization of inorganic phosphates in soil and making them available to plants is the well known mechanism (Bhattacharya and Jain, 2000) and such organisms are called as phosphate solubilizers. High proportion of phosphate solubilizing microorganisms is concentrated in the rhizosphere, and they are metabolically more active than other sources (Vazquez *et al.*, 2000).

Both the group of microorganisms such as phosphate solubilizing bacteria and phosphorus solubilizing fungi are equally important to enhance plant growth by means of solubilization mechanism and their acquisition to plant production through the synthesis of organic acid and plant growth promoting substance (Yadav *et al.*, 2011).

XI. PHOSPHORUS SOLUBILIZING BACTERIA

Among the soil bacterial community's ectorrhizospheric strains such as *Pseudomonas*, *Bacillus* and endosymbiotic rhizobia have been served as effective phosphate solubilizers (Igual *et al.*, 2001). Whitelaw, (2000) also reported that *Pseudomonas*, *Bacillus*, *Rhizobium* and *Enterobacter* are the most powerful solubilizers.

Villegas and Fortin, (2002) identified that bacteria belonging to *Mesorhizobium*, *Rhizobium*, *Klebsiella*, *Acinetobacter*, *Enterobacter*, *Erwinia*, *Achromobacter*, *Micrococcus*, *Pseudomonas* and *Bacillus* isolated from different soils were the efficient P solubilizing strains.

XII. PHOSPHORUS SOLUBILIZING FUNGI

Most of the fungi were non-solubilizer of phosphorus but species of *Aspergillus* and *Penicillium* were identified to have more phosphate solubilizing capabilities (Sagervanshi *et al.*, 2012).

XIII. MECHANISM INVOLVED IN PHOSPHORUS SOLUBILIZATION

Major mechanism of mineral phosphate solubilization is the action of organic acid synthesized by soil micro organisms. Production of these organic acid results in acidification of the microbial cell and its surroundings (Halder *et al.*, 1990; Duff and Webley, 1959; Salih *et al.*, 1989).

In particular soil microorganisms are effective in releasing phosphorus from organic pools of total soil phosphorus by mineralization (Abd-Alla, 1994; Bishop *et al.*, 1994) and from inorganic complexes through solubilization (Kucey *et al.*, 1989; Richardson, 1994). Such, beneficial microorganisms in the soil convert insoluble phosphorus into soluble form for plant growth (Rodriguez and Fraga, 1999) by acidification, chelation and exchange reactions (Gerke, 1992). During the solubilization, microorganisms secrete different types of organic acids, thus lowering the pH in the rhizosphere (He and Zhu, 1988) and consequently dissociate the bond form of phosphates like $\text{Ca}_3(\text{PO}_4)_2$ (Tri Calcium Phosphate) in calcareous soil.

Organic acid such as acetic, citric, lactic, propionic, glycolic, oxalic, melonic, succinic acid, fumaric, tartaric etc. have also been involved in phosphorus solubilization (Ahmad and Shahab, 2011) but GLUCONIC acid was reported as the principal organic acid in the solubilization of inorganic phosphate compound *Pseudomonas* sp, *Erwinia herbicola*, *Pseudomonas cepacia* and *Burkholderia cepacia* are phosphorus solubilizing bacteria, which produce more amount of gluconic acid (Goldstein *et al.*, 1993).

XIV. CONCLUSION

By employing microbial inoculants to the soil, P can be made available to plants that shall improve the crop production. Such use of microbial inoculants as a biofertilizer will reduce the use of chemical fertilizers which in turn shall reduce the cost but enhance soil fertility.

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Improvement of Power Quality Using PWM Rectifiers

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Abstract- The paper presents the modeling, simulation and analysis of an AC-DC converter based PWM rectifier. It provides a suitable control algorithm for a pulse width modulation rectifier which reduces ripple from the DC output side as well as shapes the input current properly. The basic objective of a PWM rectifier is to regulate the DC output voltage and also ensure a sinusoidal input current and unity power factor operation. This is implemented by high speed IGBT switches connected in anti parallel mode across the rectifier diodes. The output voltage is controlled by switching these IGBTs and higher order ripples at the output can be easily eliminated with the help of passive filters. Lower order harmonics are eliminated using PWM technique. The control subsystem generates gating pulse to the universal bridge by passing the output voltage through a network consisting of comparator, discrete PI controller and discrete PWM generator. The output of this generator are the gating pulses to be applied to the universal bridge. By this control method, we have tried to reduce the input current harmonic distortion and bring the input current and voltage in same phase as well as make it sinusoidal. The control of modulation index(m) and phi has been shown in the closed loop system. This paper presents the state of the art in the field of regenerative rectifiers with reduced input harmonics and improved power factor. The influence of the discussed modulation methods on the line current distortion and the switching frequency has been examined. The simulation results of the presented techniques have been demonstrated and concluded for various load resistance.

Index Terms- Improvement of Power Quality, PWM Rectifiers

I. INTRODUCTION

The problems that tend to occur due to harmonic distortions and power factor variations are known and are under discussion for quite some time now. Large number of solutions has also been proposed like static VAR compensators passive or active filters which would improve the quality of the power that is delivered to the mains.

A switching power rectifier in the power system converts one level of electrical energy into another level of electrical energy. Converters in the AC to DC conversion field are the most widespread and the operation of a converter can be explained in terms of the input quantities, output quantities and the switching pattern used to obtain the preferred output.

Types of semiconductor devices used in the rectifier are as follows:

- a. Uncontrolled rectifiers - Diodes as switches
- b. Phase-controlled rectifiers - SCR (silicon controlled rectifiers)
- c. Pulse-width modulation rectifiers - IGBTs (insulated gate bipolar transistors) or power MOSFETs (metal oxide field-effect transistors)

The ability to control the system to obtain unity power factor operation of a boost rectifier is an important feature of the rectifier topology. The power factor (PF) is defined as the ratio of working power to apparent power. The power quality problems, such as large values of harmonics, poor power factor and high total harmonic distortion, are usually associated with operations of AC to DC converters. An increase in the current harmonics and a decrease in the displacement power factor in AC power lines produced by diode and thyristors are serious problems.

Pulse width-modulation (PWM) rectifiers in distribution systems represents the best solution, in terms of performance and effectiveness, for elimination of harmonic distortion as well as power factor correction, balancing of loads, voltage regulation and flicker compensation. *Sinusoidal PWM* is a technique employed where the sinusoidal waveform or modulation signal is compared with a very high frequency triangle or carrier signal to obtain the switching pulses for the device. A method of identification of supply current will be developed by using MATLAB/Simulink for elimination of the harmonics of current and to obtain a sinusoidal current of the line.

I.1 Problem Identification

From the study in this paper, there are a large number of switching converter topologies and composite switching converters are possible. The power quality problems, such as large values of harmonics, poor power factor and high total harmonic distortion, are usually associated with operation of AC/DC converters. The other important problem is that the input current and voltage waveforms are not in phase due to the distortions. There have been many approaches to mitigate the harmonics and other problems in the rectifier system.

I.2 Objective of paper

The objective in this paper is to develop and compare in term of method or topology of AC/DC rectifier which more efficient and able to solve the nonlinear problem with optimum way.

- a. To reduce the THD (Total Harmonic Distortion) within 5%.
- b. Input voltage and current should be in the same phase i.e. unity power factor.
- c. The input current should be sinusoidal.

I.3 PWM Rectifier

The PWM bidirectional converter draws a near sinusoidal input current while providing a regulated output dc voltage and can operate in the first and second quadrants of the voltage–current plane. The controlled current is a perfect sinusoidal. So the circuit can work in both the quadrants, so the rectifier is bidirectional.

PWM rectifiers can be divided into two groups according to power circuit connection – the current and the voltage type. For proper function of current a type rectifier, the maximum value of the supply voltage must be higher than the value of the rectified voltage. The main advantage is that the rectified voltage is regulated from zero. They are suitable for work with DC loads (DC motors, current inverters) For proper function, voltage type rectifiers require higher voltage on the DC side than the maximum value of the supply voltage. The rectified voltage on the output is smoother than the output voltage of the current type rectifier. They also require a more powerful microprocessor for their control.

Output voltage lower than the voltage on input side can be obtained only with increased reactive power consumption. The function of the rectifier depends on the supply type of network. There are two types of supply network – “hard” and “soft”. Ordinary rectifiers, which work on a relatively “hard” supply network, do not affect the shape of the supply voltage waveform. Harmonics produce electromagnetic distortion, and the network will be loaded with reactive power. The PWM rectifier aims to consume sinusoidal current and to work with given power factor. A PWM rectifier connected to the “soft” supply network has more potential to affect the shape of the supply voltage network. It can be controlled, so the current consumed by the PWM rectifier will partly compensate the non-harmonic consumption of other devices connected to the supply network.

The basic block diagram of one phase PWM rectifier is shown in Fig 1.

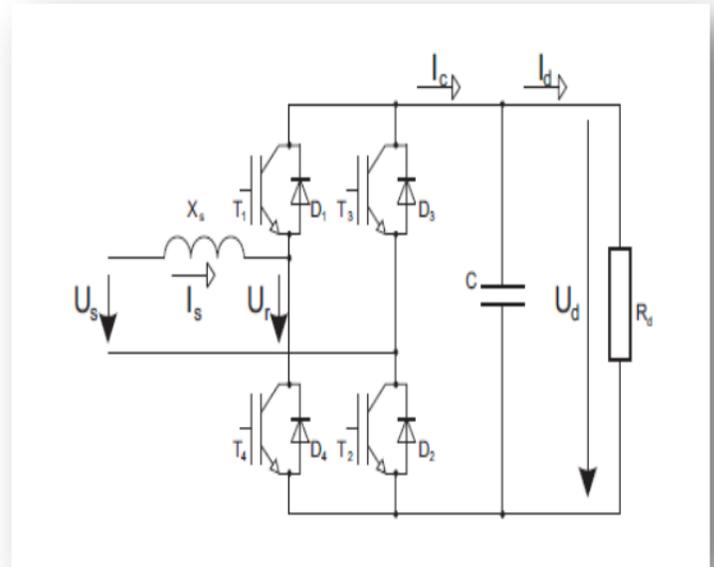


Fig.1 Single Phase Full Bridge Rectifier

The rectifier consists of 4 IGBT transistors, which form a full bridge, the input inductance and the capacitor at the output. It is controlled by pulse width modulation. Supply voltage U_s and the voltage at the rectifier input U_r are sinusoidal waveforms separated by the input inductance. The energy flow therefore depends on the angle between these two phasors. See the phasor diagram below

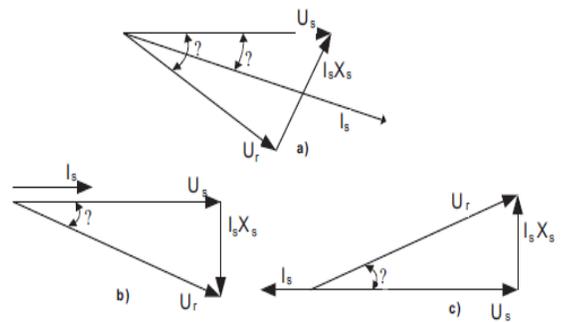


Fig. 2 Phasor diagram

II. PROPOSED WORK

As stated in the objective of the project that our main aim is to reduce the THD and bring input voltage and current in the same phase so we need current control techniques. Basically we have 2 different techniques:-

- a. Hysteresis control
- b. Sinusoidal PWM

But in our paper we have used Sinusoidal PWM control Technique.

II.1 Sinusoidal PWM

In order to suppress these negative phenomena caused by the power rectifiers, use is made of rectifiers with a more sophisticated control algorithm. Such rectifiers are realized by semiconductors that can be switched off IGBT transistors. The rectifier is controlled by pulse width modulation. A rectifier controlled in this way consumes current of required shape, which is mostly sinusoidal. It works with a given phase displacement between the consumed current and the supply voltage. The power factor can also be controlled and there are minimal effects on the supply network.

II.1.1 Control scheme

The classical control scheme is shown in Fig. 3. The control includes a voltage controller, typically a Proportional-Integrative (PI) controller, which controls the amount of power required to maintain the DC-link voltage constant. The voltage controller delivers the amplitude of the input current. For this reason, the voltage controller output is multiplied by a sinusoidal signal with the same phase and frequency than v_s , in order to obtain the input current reference, I_{sref} .

The fast current controller controls the input current, so the high input power factor is achieved. This controller can be a hysteresis or a linear controller with a PWM-modulator. Fig. shows the behaviour of the output voltage and the input current of the PWM rectifier in response to a step change in the load. It can be observed that the voltage is controlled by increasing the current, which keeps its sinusoidal waveform even during transient states.

Fig. 3 Control Scheme

As seen in Fig. 3, a ripple at twice of power supply frequency is present in the DC-link voltage. If this ripple passes through the voltage controller it will produce a third harmonic component in I_{sref} . This harmonic can be reduced with a lowpass filter at the voltage measurement reducing the controller bandwidth.

Fig 4 shows the behaviour of voltage and current delivered by the source. The input current is highly sinusoidal and keeps in phase with the voltage, reaching a very high power factor of PF 0.99.

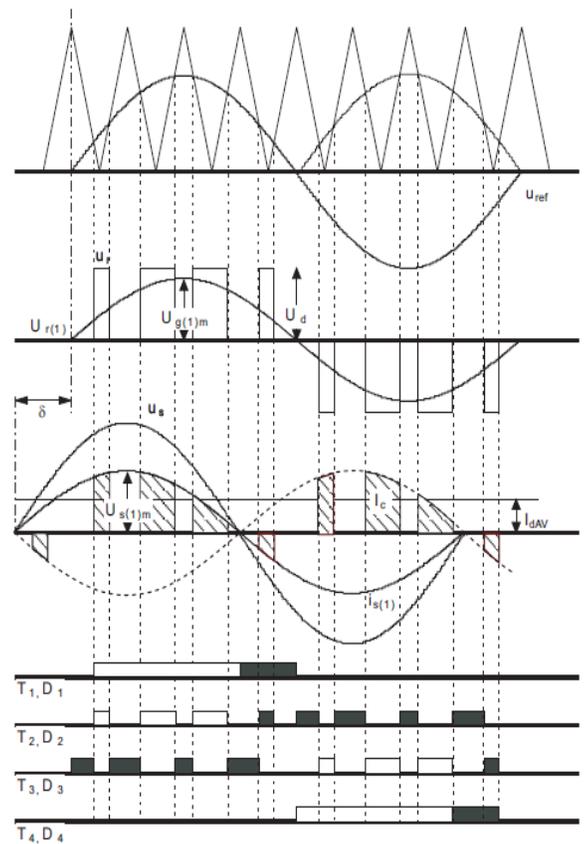
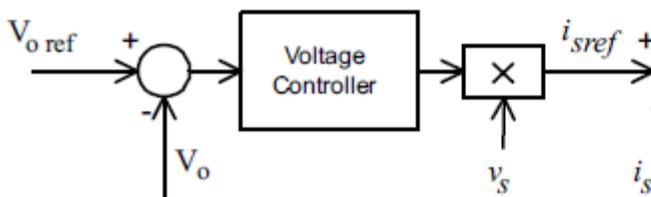


Fig. 4 waveforms

II.2 Modeling of a PWM rectifier

The main aim of this work is to design a controlled rectifier. In order to design a controlled rectifier at first we need to determine the reasons to design such a rectifier. This actually is related to the drawbacks that were faced during the design of a normal uncontrolled rectifier. They are as follows:

- Input current and voltage waveforms are not in phase due to the distortions.
- Large values of harmonics



- Poor power factor
- High total harmonic distortion

The input current should be sinusoidal as well as in phase with the input voltage so that we get a unity power factor which is one of the basic objectives of our paper.

Thus we need to use a controlled rectifier which will give a desired DC output voltage from an AC supply also avoiding the problems arising and eradicating them. Here we are using the method of PWM Rectification.

IV.1 PWM RECTIFICATION

The most efficient method of controlling the output voltage is to incorporate a PWM within the inverter. The output voltage can be controlled without any additional components. Higher order harmonics can be easily eliminated with the help of passive filters. Lower order harmonics are eliminated using PWM technique.

The figure below shows power circuit for a controlled PWM ac-dc converter:-

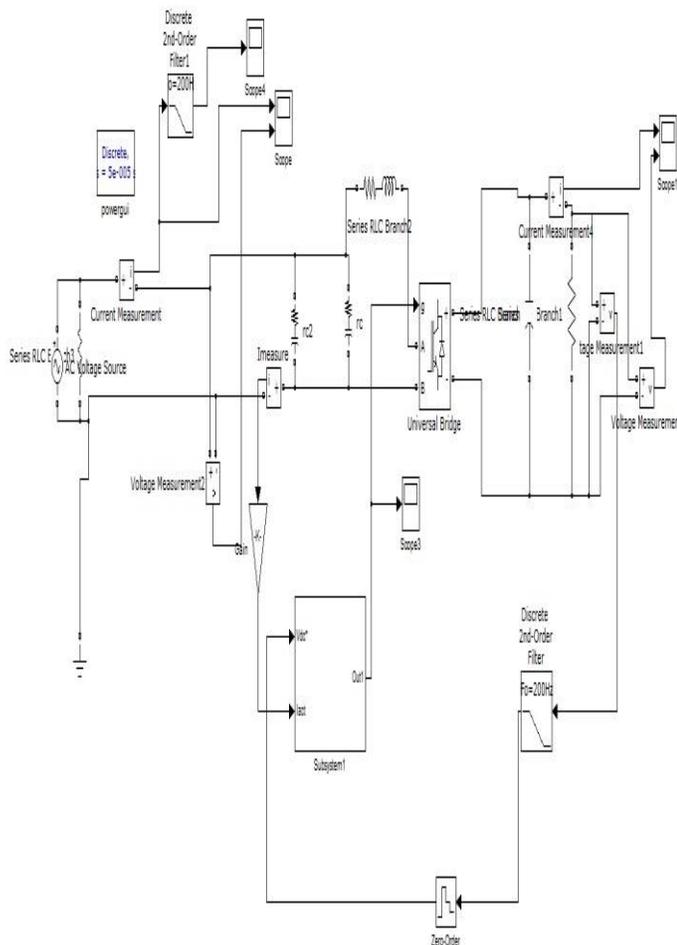


Fig 5 PWM ac-dc converter

Thus, in the design of the controlled circuit using PWM technique, we need the following components and blocks as follows:

i. AC Voltage Source

The AC voltage source is the supply voltage which supplies an AC voltage of 78V rms.

ii. Current Measurement Block

The current measurement block helps in the measurement of the current that flows through the circuit. It has 3 connections. A + side which is kept in the side through which current enters the block. And a side through which the current exits the block. Another port named 'i' which is connected to the scope which shows the measured current. The current measurement block must be connected in series with the circuit in the path where the current has to be measured.

iii. Volatge Measurement Block

The voltage measurement block helps in the measurement of the voltage at a particular part of the circuit. It has again 3 connections. The + side which is connected to the positive part of the circuit and the - side which is connected to the - part of the circuit.. the other port 'v' is connected to the scope which displays the measured voltage curve. The voltage measurement block must be connected to the circuit in parallel while measuring the voltage.

iv. R-C Branch

2 R-C branches are used with a value of $R=1.50\Omega$ and capacitance of $2.5\mu F$.

v. Series R-L Branch

A series R-L branch is used as input impedance with $R= 25\Omega$ and Inductance $=1.76mH$.

vi. Universal Bridge

This block implements a bridge of selected power electronics devices. Series RC snubber circuits are connected in parallel with each switch device. For most applications the internal inductance L_{on} of diodes and thyristors should be set to zero. The

universal bridge block here is implementing a universal single phase power converter. It consists upto 4 switches connected in bridge configuration. This block allows simulation of converters using both naturally commutated(or line commutated) power electronics devices (diodes or thyristors) and forced commutated devices (GTO, IGBT, MOSFET). This is also the basic block for building two level voltage source converters (VSC). The bridge should be set in accordance with the following parameters as follows:

- a. Number of bridge arms
This parameter is set to 2 as we are using a single phase converter. This makes it a 4 switch device.
- b. Snubber Resistance
Snubber resistance value is set to 100kΩ.
This resistance R_s is given as $R_s > 2 \frac{T_s}{R_s}$.
- c. Snubber Capacitance
The capacitance is either set to 0 to provide a high impedance if we are using RC snubber or it is set to infinity if we are using only a resistive snubber circuit. The snubber circuit mainly eliminates the snubber from the device that is the rate of rise of input voltage thus preventing the device getting damaged. It also prevents numerical oscillations when the device is discretized. The snubber capacitance is given by:
$$C_s < \frac{P_n}{1000(2\pi f)V_n^2}$$
- d. Power Electronic Device
Since we are using an IGBT bridge we are selecting the device as IGBT/Diodes.
- e. Ron
The internal resistance R_{on} of the selected device is set to 1mΩ.
- f. Lon
 L_{on} is set to zero according to the convention in most real world applications.

- g. Forward Voltages(Device V_f , Diode V_{fd})

Forward voltage has to be set since we are using IGBT here. The forward voltage is set as 0 thus forming the ideal case.

- h. Fall time (T_f) and Tail time (T_t)

Fall time is set as 1μs and Tail time is set as 2μs.

- vii. Load Capacitor

The load capacitor is set to 1650μF.

- viii. Load Resistance

The load resistance is set to 500Ω.

- ix. Second Order Low Pass Filter

The low pass filter allows to pass the desired low frequency band centered around the set cut off frequency. The cut off frequency is set to 200Hz. The damping factor that is the ξ is set to 0.707 and the sampling time is set to 50μs. The transfer function of a second order low pass filter is given by:

$$H(s) = \frac{s^2}{(s^2 + 2\pi(\frac{f_0}{Q})s + (2\pi f_0)^2)}$$

This attenuates higher frequencies more steeply.

- x. Zero Order Hold

This block samples and holds the input for the sample period specified. We have given a sample period of -1 as this makes the block inherit the sample time. Input to this block can be scalar or a vector. If the input is a vector block it holds all the elements of the vector for the same sample time.

- xi. Powergui Block

The Powergui block is necessary for simulation of any Simulink model containing SimPowerSystems blocks. It is used to store the equivalent Simulink circuit that represents the state-space equations of the model.

The Powergui block allows you to choose one of the following methods to solve your circuit:

- Continuous method, which uses a variable step Simulink solver.
- Ideal Switching continuous method.
- Discretization of the electrical system for a solution at fixed time steps.
- Phasor solution method.

xii. Control Subsystem

The control subsystem generates gating pulse to the universal bridge. During the positive half, switches S1 and S3 are closed thus forming a path. During the negative half, switches s2 and s4 are closed thus forming a path. The various components used in the control subsystem and there functions and role in the control strategy are explained below:

Output voltage generated across capacitive load is compared with a constant 100 to check for any error that might be present in the output voltage. The error obtained from the comparator is used for modulation and is fed into a Proportional-Integral that is, a PI controller which sets the desired modulation index. The saturation block is used after the PI controller to limit the value between -1 and 1. The modulation is mainly based on phase modulation. So besides setting m, we need to set a perfect ϕ (phi or phase) for proper modulation.

So we need to obtain c for that we have used a digital clock and a constant block which is assigned a value of $2\pi f$. Digital clock set the

sampling period at which instant sample must be taken such that the outputs are not stuck at a previous sample. The ϕ is generated through the output of the second PI controller. Reference block actually gives the modulated current equation. This shows any error if present between reference current and the actual input current. And the generated output will be used as a feedback to provide the necessary phi in a closed loop. This closed loop gives a stabilized ϕ . Now the compare Iact and reference I is fed to a discrete PI controller. PI controller gives feedback signal to control phi. Also the output of discrete PI is fed to the discrete PWM generator. The output of the discrete PI controller serves as Uref which is the input for the PWM generator. This generates pulses for carrier band PWM. In this the Uref is compared with triangular carriers to generate two pulses which are then converted into Boolean using Boolean block. The two signals are accordingly connected to form pulses. Pulses 1 and 3 are respectively for the upper switches and pulses 2 and 4 are for the lower switches

The figure below shows the control subsystem:-

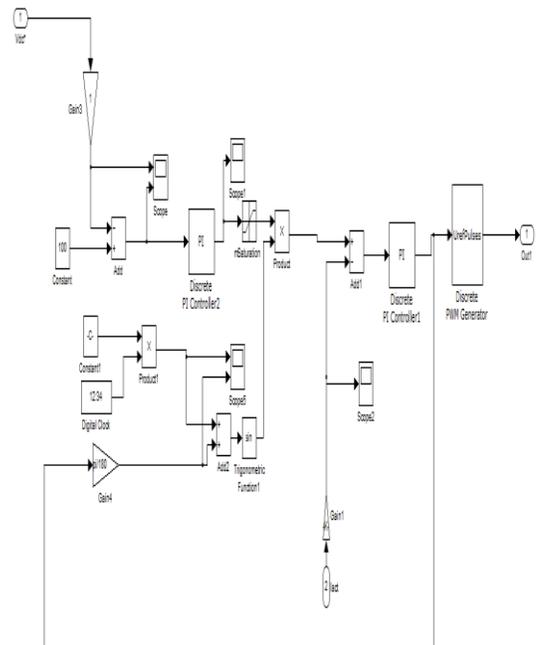


Fig. 6 Control Subsystem

III. SIMULATION RESULTS & DISCUSSIONS

Case I:- R=1000Ohm

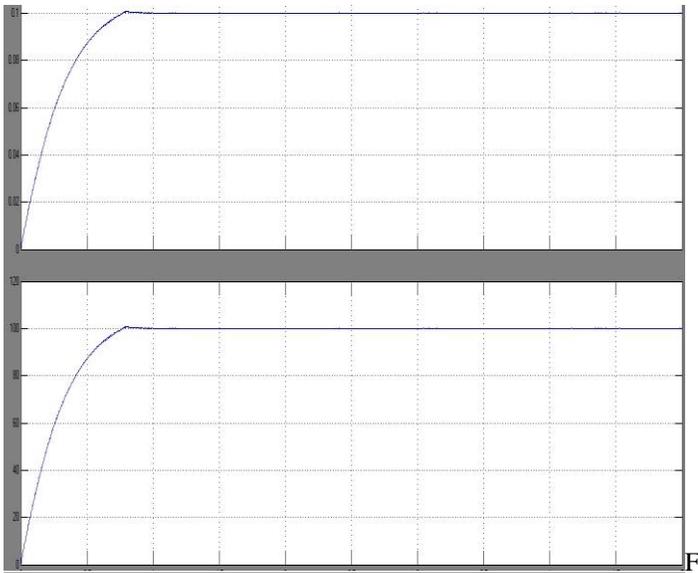


Fig. 7 Load current and voltage

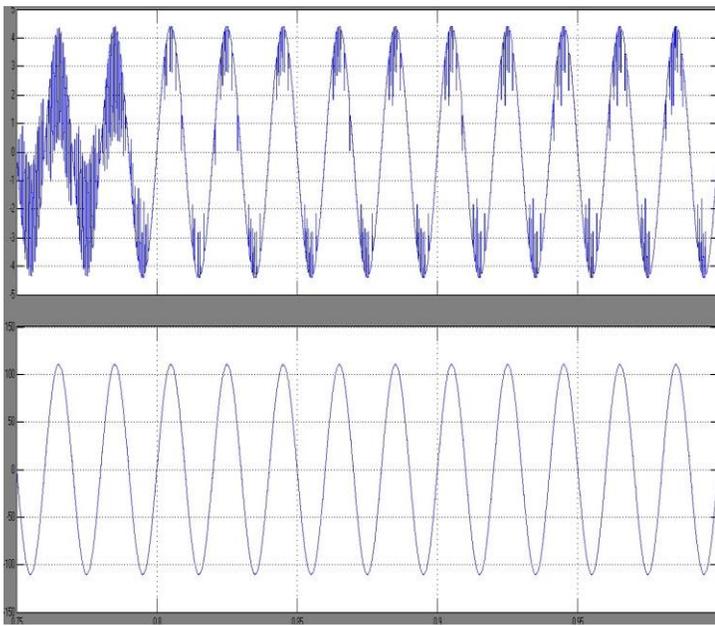


Fig. 8 Input Current and Voltage

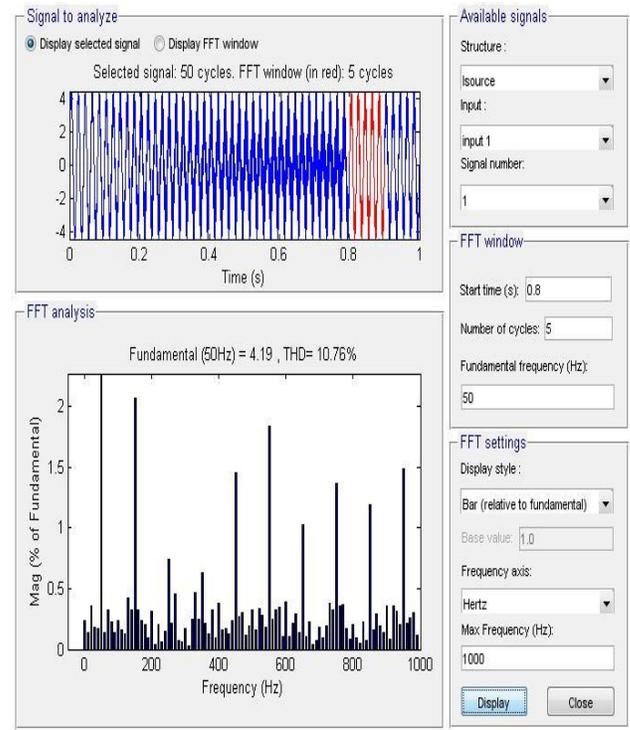


Fig. 9 FFT analysis

As we can see here the THD for this case is 10.76% which needs to be decreased further.

Case II :- R=750Ohm

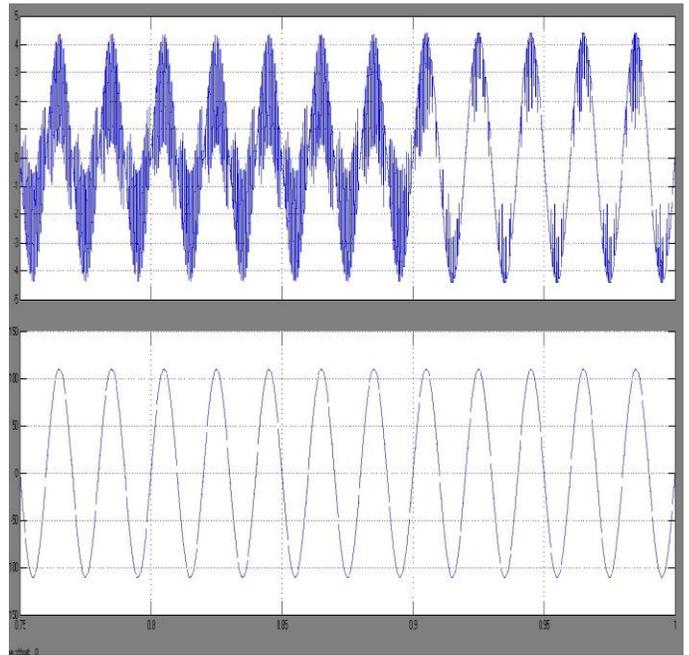


Fig.10 Input current & voltage

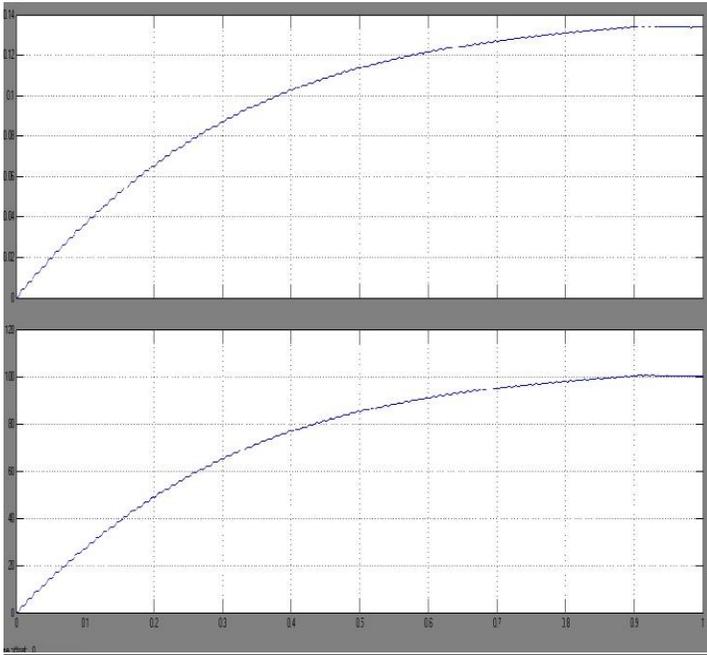


Fig. 11 Load current and voltage

Case III :- R=3000K

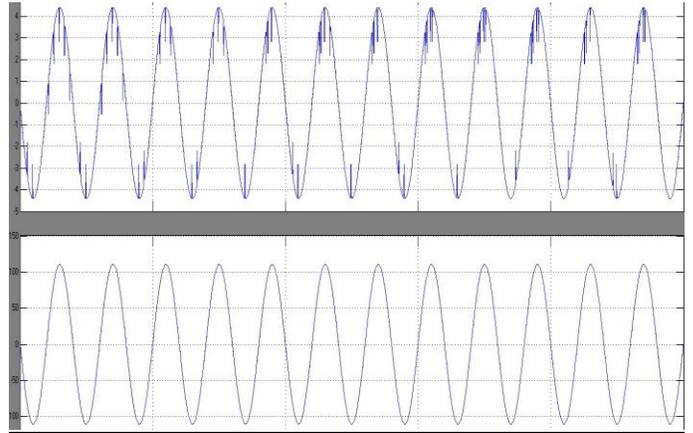


Fig. 13 Input Current & voltage

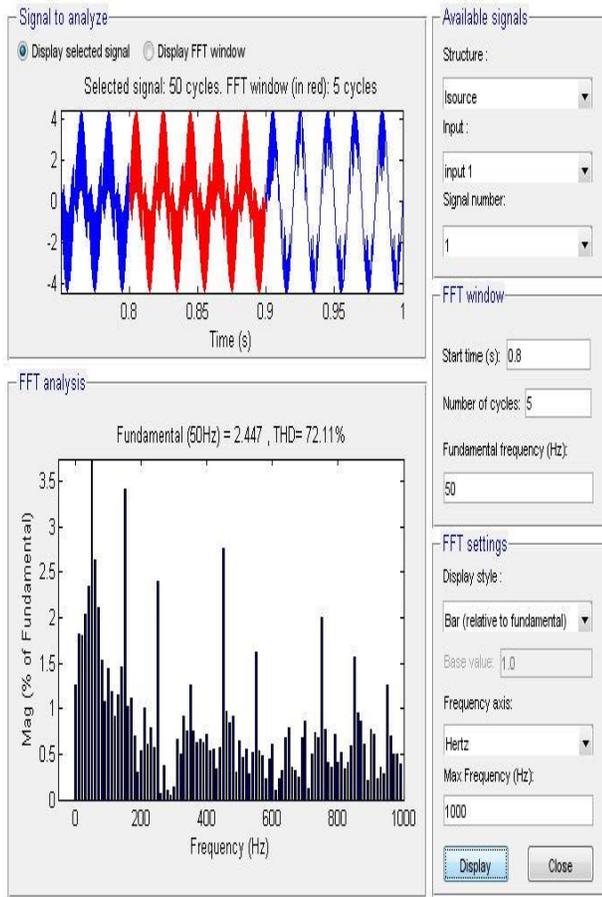


Fig. 12 FFT Analysis

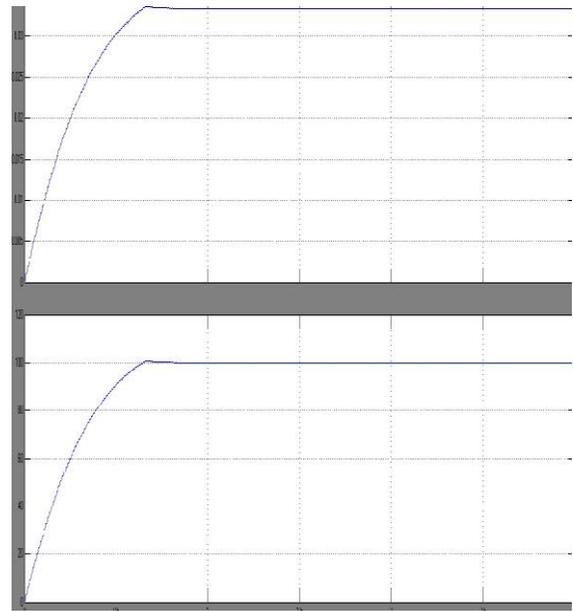


Fig. 14 Load current and voltage

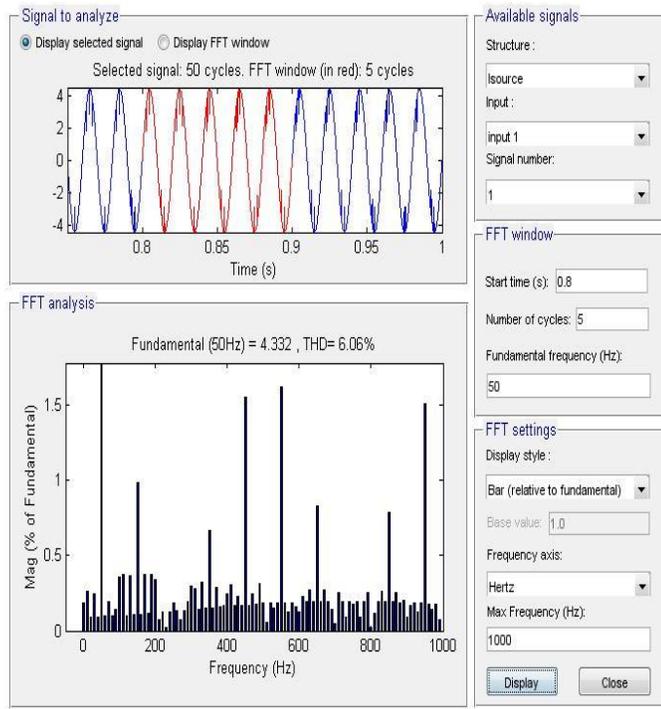


Fig. 15 FFT Analysis

We can see from here that as we increase the value of resistance the harmonic distortion reduces to much lower value.

Case IV:- 5000k

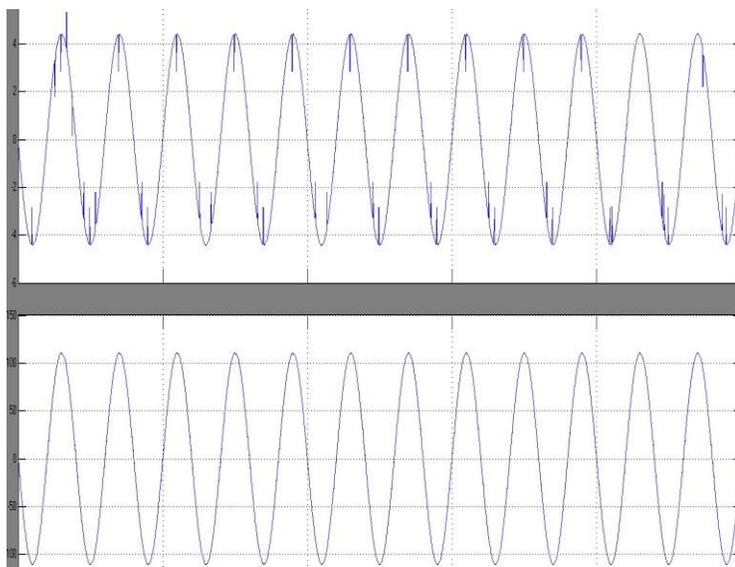


Fig. 16 Input current and voltage

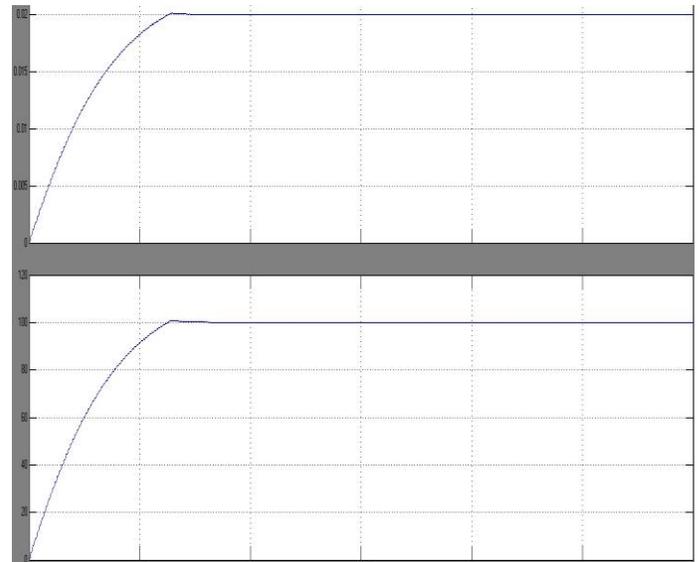


Fig. 17 Load current and voltage

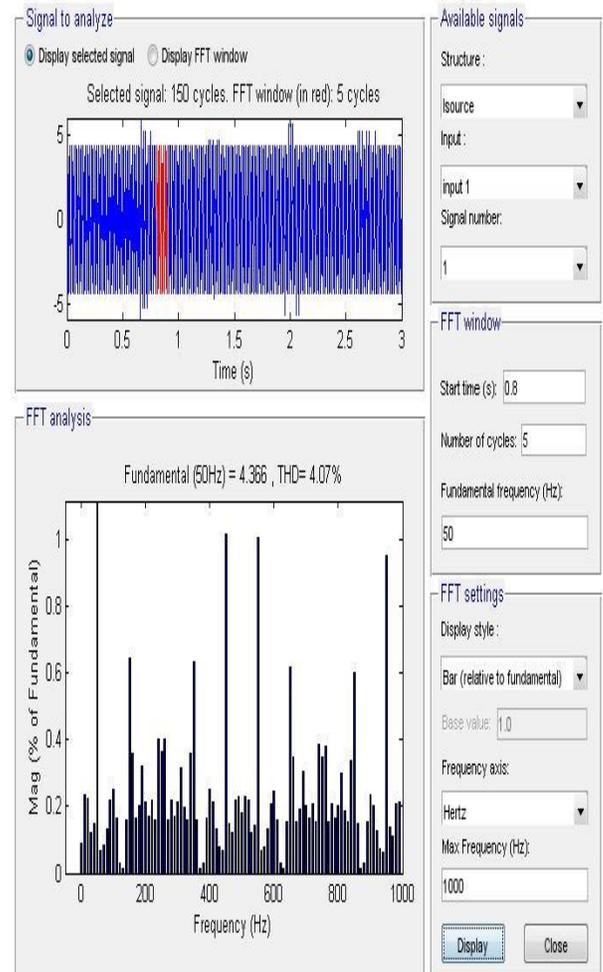


Fig. 18 FFT analysis

Case V :- R=10KOhm

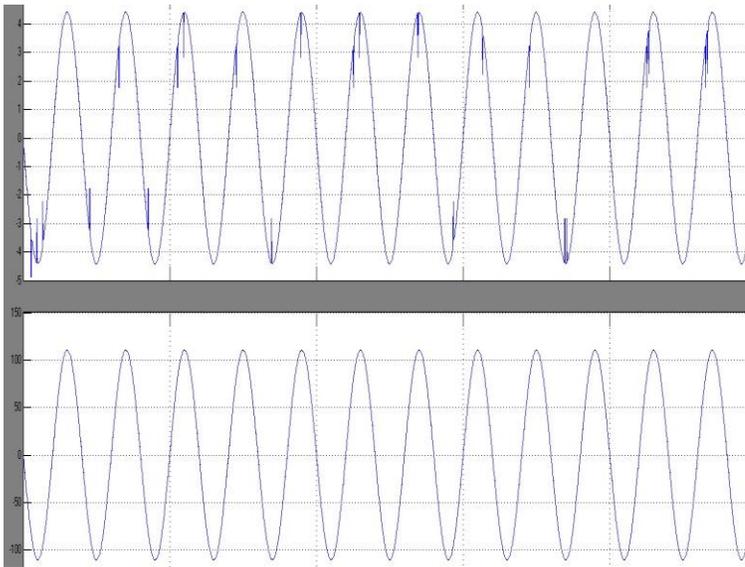


Fig. 19 Input current and voltage

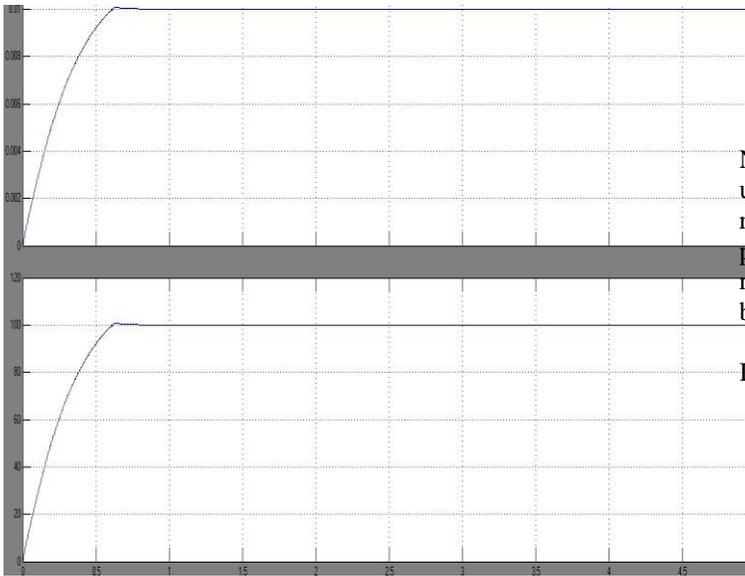


Fig. 20 Load current and voltage

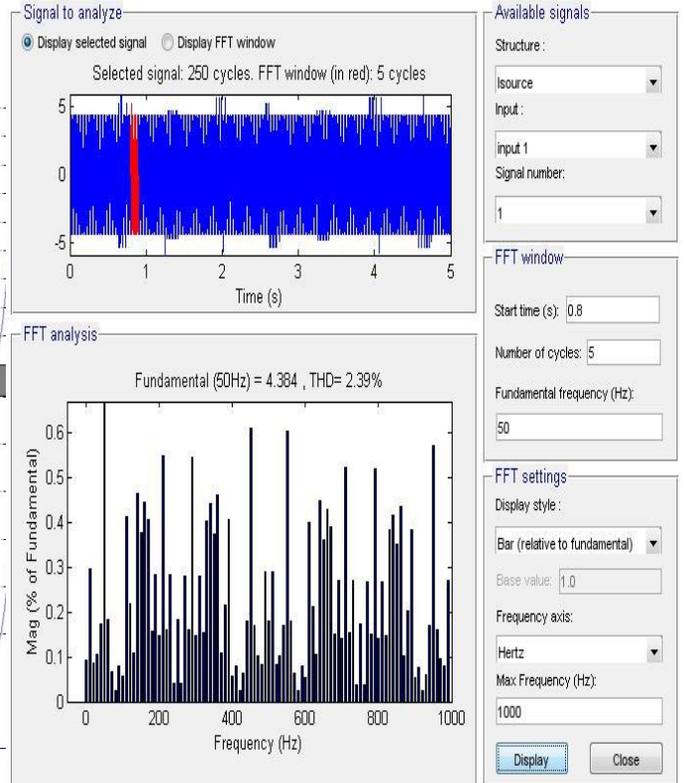


Fig. 21 FFT Analysis

Now we see from the above simulation results that the THD is under control and well below 5% for R=10kΩ which was our requirement and the input current is sinusoidal as well as in phase with the input voltage. Thus our objective is met with these results. For uncontrolled rectifier the THD was 162 % which has been reduced to 2.39 % by the technique proposed.

III.2 Gating Pulses

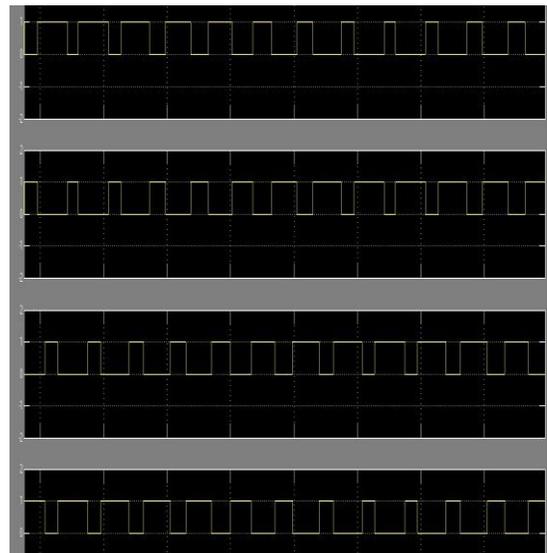


Fig. 22 Gating Pulses

IV. Conclusion

This paper has reviewed the most important topologies and control schemes used to obtain AC-DC conversion with bidirectional power flow and very high power factor. Voltage source PWM regenerative rectifiers have shown a tremendous development from single-phase low power supplies up to high power multilevel units. Current source PWM regenerative rectifiers are conceptually possible and with few applications in DC motor drives. The main field of application of this topology is the line side converter of medium voltage current source inverters. Especially relevant is to mention that single-phase PWM regenerative rectifiers are today the standard solution in modern AC locomotives.

The control methods developed for this application allow for an effective control of input and output voltage and currents, minimizing the size of energy storage elements. The appliance of the Carrier-Based Sinusoidal PWM technique may reduce the higher harmonics content in the line currents since the carrier signal imposes roughly constant switching frequency of the power transistors. Unlike bang-bang current control carrier-based modulation directly enforces adequate converter input PWM voltages to track their reference values.

The simulating and test results have shown that the system based on this control logic has better efficiency and has high dynamic performance and has distortion well under 5% which is quite acceptable. The input current and voltage are in phase and even the input current is sinusoidal which were the basic objectives of our work.

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Influence of form and Concentration of the Osmolytes in Liquid Inoculants Formulations of Plant Growth Promoting Bacteria

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Abstract- Laboratory investigations were conducted to identify suitable form and to determine the suitable dose of application of osmolytes for liquid inoculant formulations of plant growth promoting rhizobacteria (PGPR) viz., *Azotobacter* sp., *Azospirillum* sp., *Acinetobacter* sp., *Bacillus* sp. and *Pseudomonas* sp. Osmolytes such as four grades of polyvinyl pyrrolidone (PVP), four grades of polyethylene glycol (PEG), and glycerol were added to broth at three different concentrations (0.5%, 1.0% and 2.0%). Supplementing the specific media with 2 % Glycerol for *Azotobacter* sp., 2 % PVP K-15 for *Bacillus* sp., 1 % PEG 400 for *Azospirillum* sp., 2 % PVP K-15 for *Pseudomonas* sp., and 2 % PEG 4000 for *Acinetobacter* sp. resulted in the highest population densities.

Index Terms- concentration, liquid inoculants, osmolytes, PGPR

I. INTRODUCTION

Liquid inoculant formulations generally contain certain compounds which serve as cell protectants in addition to all other constituents of specific nutrient media used for the growth of PGPR in laboratory and have been observed to serve as effective inoculants in case of rhizobia (Deaker *et al.*, 2004). The results of several investigations have shown that the performance of liquid rhizobial formulations is comparable to that of peat-based products under field conditions in terms of growth and yield (Hynes *et al.*, 1995, 2001). On the contrary, liquid formulations support high population density of bacteria under varying environmental conditions in pure culture. Hence, the possibility of developing liquid formulations of microbial inoculants is being explored. Liquid formulations typically are aqueous, oil, or polymer-based products. Polysaccharides such as gums, carboxymethylcellulose and polyalcohol derivatives are commonly used to alter the fluid properties of liquid formulations (Paau, 1988). Several liquid formulations available today support high viable rhizobial numbers for extended periods of time. Tittabutr *et al.*, (2007) determined the effectiveness of bradyrhizobial liquid inoculant formulations with gum arabic, sodium alginate, polyvinyl pyrrolidone (PVP), polyethylene glycol (PEG), polyvinyl alcohol (PVA) and cassava starch under field conditions and found that the effectiveness of liquid inoculant was as good as peat based inoculant. Liquid cultures containing cell protectants not only maintain high microbial numbers but also promote the formation of resting cells such as,

cysts and spores which offer higher resistance to abiotic stresses, thus increasing the survivability of bacteria. Liquid formulations containing different concentrations of arabinose, trehalose, glycerol and polyvinyl pyrrolidone (PVP) were devised for *Rhizobium* sp., *Azospirillum* sp. and phosphate solubilising *Bacillus megaterium*.

II. MATERIAL AND METHODS

Plant growth promoting bacteria and Media used

Five plant growth promoting bacteria were used in this study representing nitrogen fixing (*Azotobacter* sp. and *Azospirillum* sp.), phosphate solubilizing (*Bacillus* sp. and *Acinetobacter* sp.) and growth promoting (*Pseudomonas* sp.).

Okon's N- free semisolid malate media was used to grow nitrogen fixing bacterium, *Azospirillum* sp. and its chemical composition was malic acid, 5.0 g, KOH/NaOH, 3.0 g, K₂HPO₄, 0.5 g, FeSO₄.7H₂O, 0.05 g, MnSO₄, 0.01 g, MgSO₄.7 H₂O, 0.1 g, NaCl, 0.02 g, Na₂MoO₄. 2H₂O, 0.002 g, agar, 3 g, distilled water, 1000 ml, pH, 6.6-7.0, BTB (0.5% alcohol), 2 ml.

Azotobacter sp. was grown on media recommended by Senior *et al.*, (1972), Solution A containing glucose, 20.0, MgSO₄.7H₂O, 0.4, CaCl₂, 0.11, FeSO₄.7H₂O, 0.012 and Na₂MoO₄.2H₂O, 0.01(g/l) and Solution B containing K₂HPO₄, 2.0 and NaCl, 0.4 (g/l) were prepared. These two solutions were autoclaved separately and mixed in equal proportions after cooling. For solid medium 2% agar (w/v) was added.

Phosphate solubilizing bacteria, *Bacillus* sp. and *Acinetobacter* sp. were grown on modified Sperber's medium. This medium contained glucose, 10.0 g, yeast extract, 0.5 g, MgSO₄ 7H₂O, 0.25 g, North Carolina Rock Phosphate (NCRP), 1.57% (w/v), distilled water, 1000 ml and agar, 20.0 g. *Pseudomonas* sp. was grown on media which contained peptone 20.0 g, K₂HPO₄ 1.5 g, MgSO₄.7H₂O 1.5 g, glycerol 10.00 ml, distilled water, 1000 ml and agar, 20.0 g.

Four grades of polyvinyl pyrrolidone (PVP) such as, PVP K-15, PVP K- 25, PVP K- 30, and PVP K- 90, four grades of polyethylene glycol (PEG), such as PEG 400, PEG 600, PEG 4000 and PEG 6000 and glycerol were used at three different concentrations (0.5 %, 1.0 % and 2.0 %). Media unamended with osmolyte served as standard control. Media were inoculated with a day old culture of bacteria. The incubation time varied with different species of bacteria, 15 hours for *Azotobacter* sp., 48 hours for *Azospirillum* sp., 24 hours for *Bacillus* sp., 12 hours

for *Acinetobacter* sp. and 10 hours for *Pseudomonas* sp. The population density of bacteria was determined by SPC. Petri plates were incubated at 30° C for 48 hours and data on number of colonies were recorded.

III. RESULT AND DISCUSSION

Attempts have been made to develop liquid inoculant formulations of *Rhizobium* sp. and *Bradyrhizobium* sp. by amending media with some polymeric compounds such as polyvinyl pyrrolidone (PVP), polyethylene glycol (PEG), polyvinyl alcohol (PVA), gum arabic, sodium alginate and tapioca flour or with diluents (Tittabutr *et al.*, 2007; Rice *et al.*, 2000 and Somasegaran, 1985). In most of these studies, concentrations selected were based on the population density of bacteria rather than the effectiveness of bacteria. Research on effect of such polymeric additives on population density of

PGPB, such as those used in this study is rare. Further, the effect of polymeric additives, such as PVP and PEG formulations differing in molecular weight has not been assessed. In order to define the optimum concentration and appropriate form of polymeric additives this study was conducted by employing four formulations of PVP and four formulations of PEG depending on molecular weight at three different concentrations on growth of PGPB such as *Azospirillum* sp., *Azotobacter* sp., *Pseudomonas* sp., *Bacillus* sp. and *Acinetobacter* sp.

In general, the population density of *Azotobacter* sp. was 3-4 times higher than control in all PVP formulations (Fig 1). Application of PEG 400 did not influence population density of *Azotobacter* sp. irrespective of its concentration. Further, amending medium with 0.5 % of PEG 600, PEG 6000 and glycerol did not influence population density. Application of glycerol at 2% resulted in highest population density.

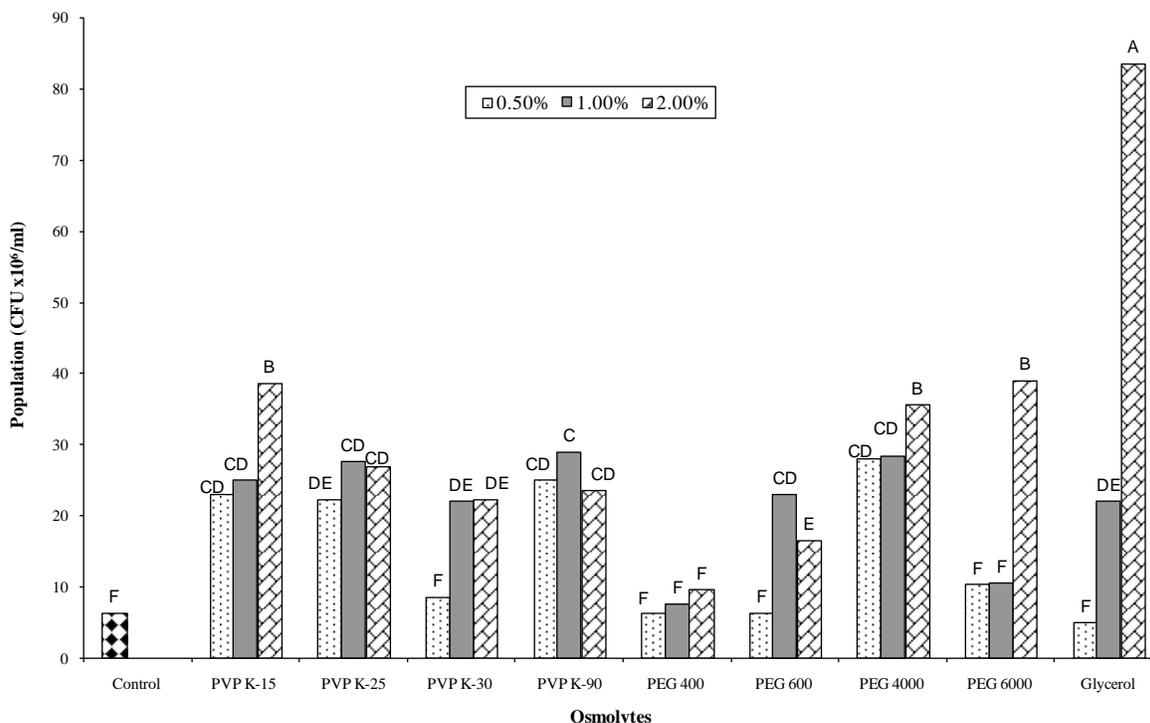


Fig. 1. Population density of *Azotobacter* in N- free minimal medium as influenced by the addition of osmolytes

Means with same letter do not differ significantly at the 5% level of significance

Control-without any osmolytes; PVP- Polyvinyl pyrrolidone; PEG- Polyethylene glycol

In contrast, the population density of *Bacillus* sp. was not influenced by the incorporation of glycerol into the medium (Fig 2). The addition of PVP K-15 caused significant increase in

population density at all concentrations compared to control. Media amended with 2 % PVP K-15 contain the highest number of CFU of *Bacillus* sp. In general, the effect of PVP formulations was more pronounced than that of PEG formulations.

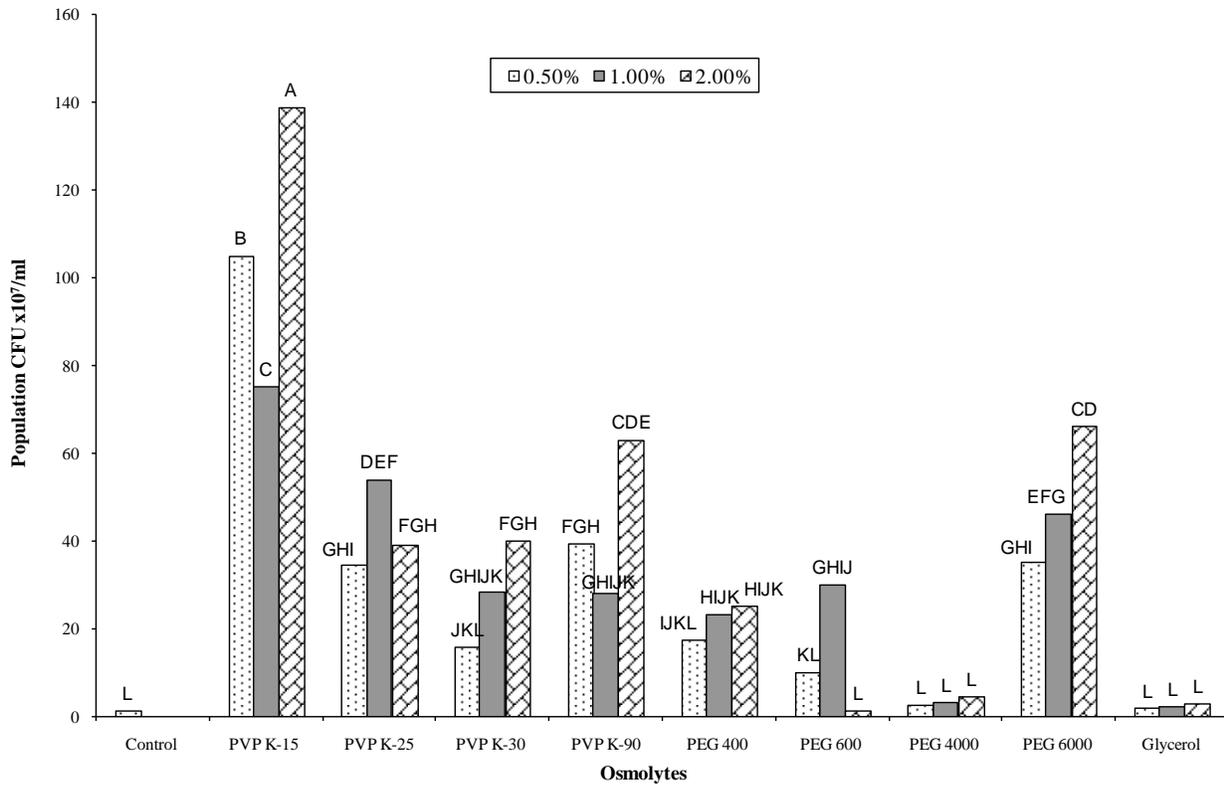


Fig.2 Population density of *Bacillus* in modified Sperber's Medium as influenced by the addition of osmolytes

Means with same letter do not differ significantly at the 5% level of significance
 Control-without any osmolytes; PVP- Polyvinyl pyrrolidone; PEG- Polyethylene glycol

Data on changes in population density of *Azospirillum* sp. as influenced by the incorporation of osmolytes in N free malate medium are presented in **Fig 3**. The addition of osmolytes, PVP K-25, PVP K-30, PVP K-90 and PEG 4000 caused a significant reduction in population density when added at the 0.5 % level. The population density increased nearly 4 times than control by

the addition of PVP K-25, PVP K-30, PEG 6000 and glycerol at the 2% level and by the application of PVP K-30, PEG 400 and PEG 600 at the 1 % level.

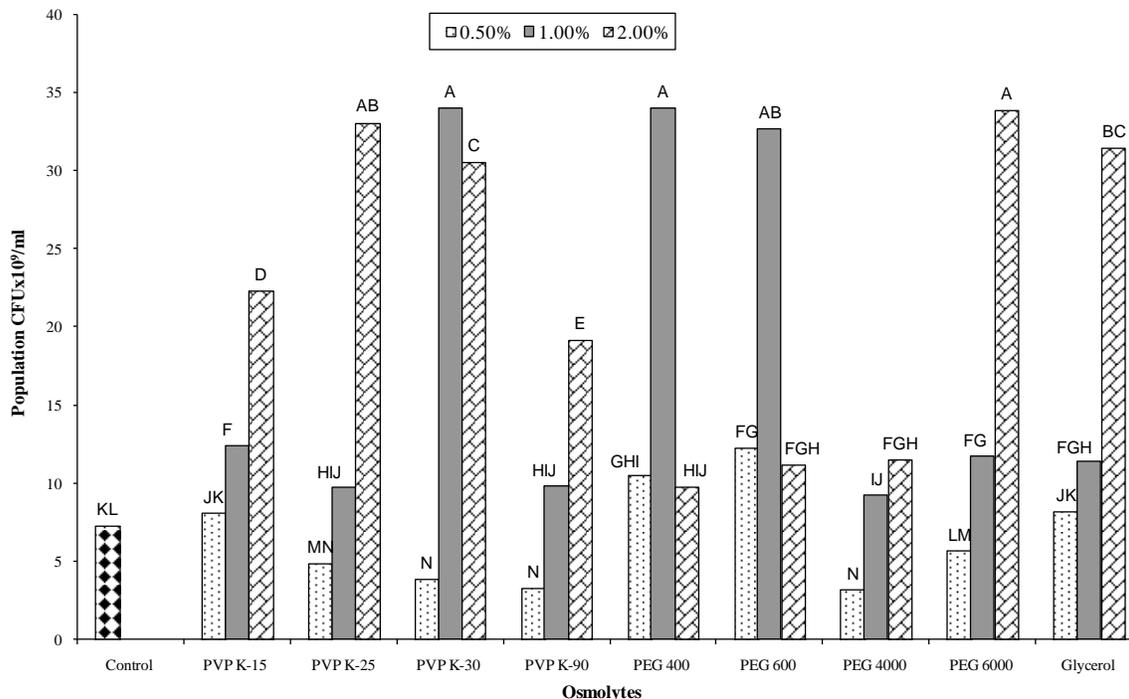


Fig. 3. Population density of *Azospirillum* in N-free malate medium as influenced by the addition of osmolytes

Means with same letter do not differ significantly at the 5% level of significance
 Control-without any osmolytes; PVP- Polyvinyl pyrrolidone; PEG- Polyethylene glycol

The population density of *Pseudomonas* sp. significantly increased by the addition of PVP K-15 at all concentrations and the extent of increase was almost seven times by the addition of PVP K-15 at the 2 % level (Fig 4). The addition of PVP K-25, PVP K-30, PEG 400 and glycerol at the 2% level also caused an increase in population density but the magnitude of increase was lower than that was noticed with PVP K-15. The amendment of media with all other formulations, in general, caused marked reduction in population density compared to unamended control.

Among PGPB used in this study, the response of *Acinetobacter* sp. to the addition of osmolytes was unique (Fig 5). In general, PVP formulations did not influence the population density of *Acinetobacter* sp. at all concentrations. The addition of PEG 4000 at the 2 % level increased the population density of *Acinetobacter* sp. significantly to the extent of 9 times compared to control. Further, amending media with PEG 400 at all concentrations, PEG 600 and PEG 6000 at the 2 % level and glycerol at the 0.5 % level increased population density substantially.

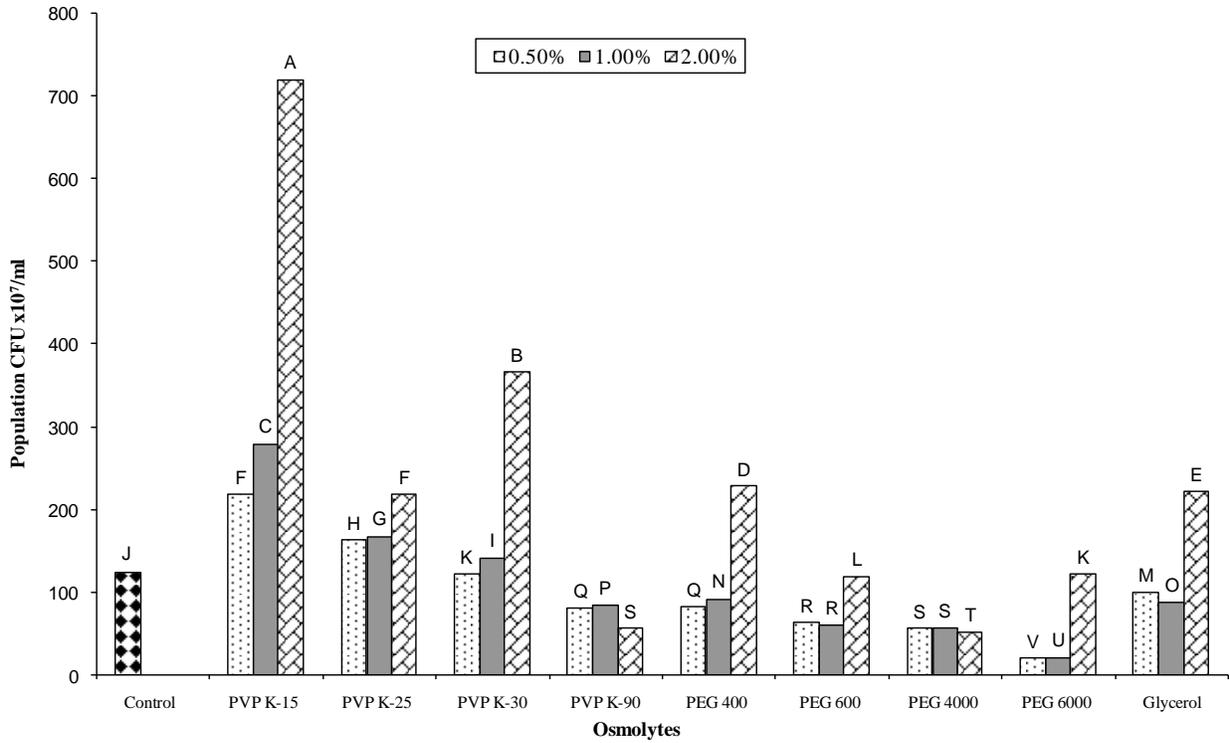


Fig. 4. Population density of *Pseudomonas* in King's B medium as influenced by the addition of osmolytes

Means with same letter do not differ significantly at the 5% level of significance
 Control-without any osmolytes; PVP- Polyvinyl pyrrolidone; PEG- Polyethylene glycol

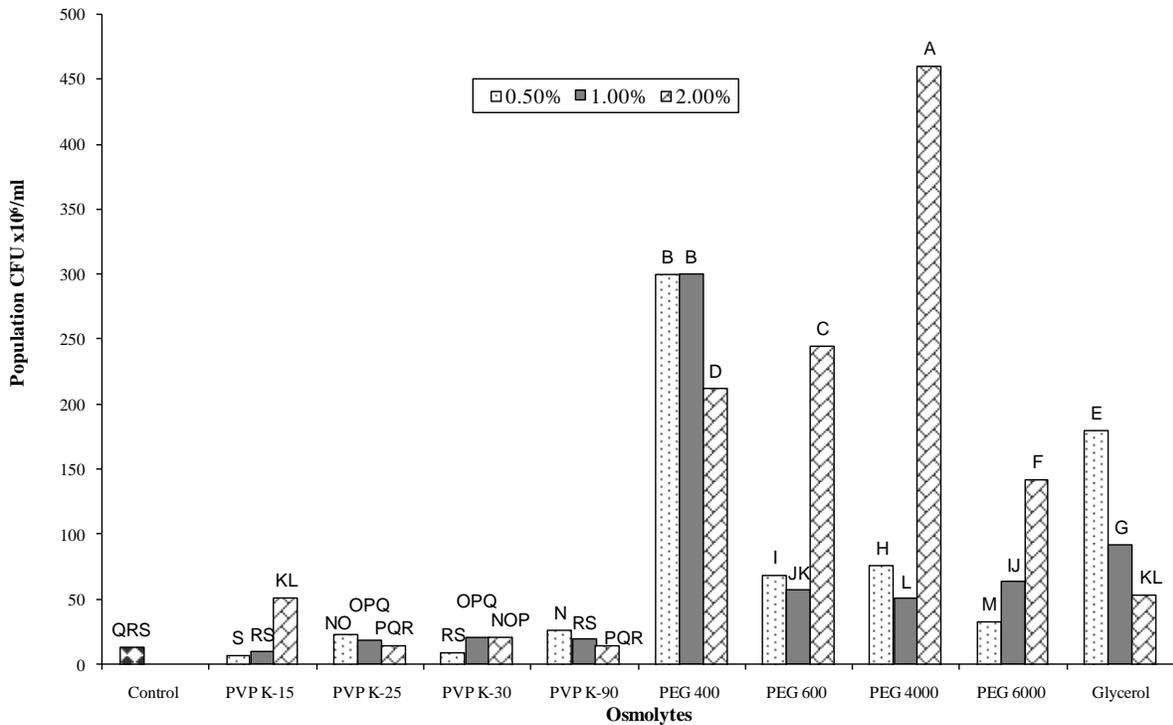


Fig 5. Population density of *Acinetobacter* in modified Sperber's medium as influenced by the addition of osmolytes

Means with same letter do not differ significantly at the 5% level of significance
 Control-without any osmolytes; PVP- Polyvinyl pyrrolidone; PEG- Polyethylene glycol

Although the mechanism of action is not clear, PVP amendment maintained higher population density in the medium and to permit the survival of higher number of bacteria per seed (Tittabutr *et al.*, 2007 and Singleton *et al.*, 2002). These formulations, PVP and PEG cannot be used as either carbon source or energy source by the PGPB, hence it can be concluded that other properties of these additives are responsible for maintaining higher population density in the respective media, particularly with *Azotobacter* sp., *Bacillus* sp. and *Azospirillum* sp. Both these polymeric additives are soluble in water and in other polar solvents. Further, they have the capacity to bind polar and hydrophobic molecules, function as complexing agents reducing the toxicity of compounds and could be used to create high osmotic potential in liquids (Errington, *et al.*, 2002; McAneney *et al.*, 1982 and Coiffer *et al.*, 2001). It is possible that these compounds influence population density level of these three PGPB, either by one of these or by a combination of these mechanisms.

The positive response pattern of two gram-negative proteobacterial members, *Pseudomonas* sp. to application of PVP and that of *Acinetobacter* sp. to PEG, particularly to low molecular weight of these formulations is interesting as well as intriguing. However, the findings of Mugnier and Jung (1985) on the effect of solutes at different water activity levels on population density of gram negative bacteria suggests that the number of viable cells was positively correlated with molecular weight of polyalcohols. Their research results also suggest that viability could also be related to stearic and structural properties of these solutes. The only important variation between this study and that of Mugnier and Jung (1985) is the solutes used by them could be used by organism as a source of carbon and energy but PVP and PEG used in this study cannot be used by these bacteria as source of carbon and energy. Hence, it is possible that the effect of PVP / PEG is modulated by altering water activity of media, more favourably when the formulation of low molecular weight were present compared to formulation of higher molecular weight. These compounds may also be influencing the movement of solutes in medium as well as across the cell membrane.

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Total Lipid, Triglyceride and Cholesterol Contents in *Oecophylla smaragdina*, Fabricius Consumed in Upper Assam of North East India.

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Abstract- Edible insects are important dietary component that consumed as food in many developing countries. The edible insects are the rich sources of high quality proteins, fat, vitamins and minerals. Different species of edible insects contribute to variation in nutritional value which depends on the host plant, season and geographic location. The present study was aimed to assess the amount of lipid, cholesterol and triglyceride of *Oecophylla smaragdina*, Fabricius (the weaver ant) in different developmental stages, castes and in different seasons of the year collected from Upper Assam, North East India. Significant differences ($p < 0.05$) were observed among all the groups and between same caste of queen and worker. The total lipid content in this particular species *Oecophylla smaragdina* of present study was from 10-25% in queen larva, 10-23% in queen pupa and 10-20% in queen adult in different seasons of the year. However, the amount was found to be higher during peak period of availability. Similar trend was observed in case of worker caste but with lower magnitude which ranges from 10-13% in almost all the stages of worker caste. In case of triglyceride, amount was found maximum with 166.81 mg/gm in pupal stage of queen ant in the month of March - April and in pupal stage of worker minimum of 47.75mg/gm in the month of January. Cholesterol content was found relatively higher in pupal stage in both the caste with 15.22 mg/gm in worker pupa and 10.95 mg/gm in queen pupa. Differences in developmental stages, caste and impact of season are quite evident in the study.

Index Terms- Weaver ant, *Oecophylla*, lipid, cholesterol, triglyceride, nutrients.

I. INTRODUCTION

Edible insects are an important food resource as a part of human nutrition in many regions such as Africa, Asia and Latin America (Aletor, 1995). More than one thousand insect species are reported to be edible as traditional foods at some stages of their life cycle. Over recent decades, edible insects have been used in value-added products such as canned foods or even snacks on a commercial scale (Siriamornpun and Thammapat, 2008). Although a number of insect species are available throughout the year, some are available only for a short season depending on weather and other environmental condition. In India also large numbers of many species of edible insects are used as food. North East India with diverse ethnic groups possesses differences in culture of food intake. Insect eating is

mostly prevalent amongst rural people. Rural communities of Eastern India have a long cultured history of eating insects.

Species of edible insects have been and are prominent items of commerce in the town and village markets of Africa, tropical and semi tropical regions of the world (Defoliart, 2002). In some areas of Zimbabwe, South Africa, Zambia and Nigeria, many families for their good living, do the practice of selling insects (Chavunduka, 1975; Fazoranti and Ajiboye, 1993; Mbataand Chidumayo, 2003; Adeduntan and Bada, 2004). Alamu et al. (2013) reported the diversity of edible insects in Nigeria, their nutritional value, host plants, collecting techniques and the processing methods. They suggested the importance in giving attention on management of this sustainable food source in the interest of food security and wealth creation. Swaminathan (1986) reported that lipid quality varies widely in plants and animal foods. Dunkel (1998) reported good fatty acid content and low cholesterol level and suggested that edible insects may be a better nutritional source to man. Adeolu (2003) demonstrated relatively higher content of phospholipid and cholesterol in insects.

In Assam, although a number of insect species is available throughout the year, some can only be obtained for a short season, dependent either on weather or other natural circumstances. The species, *Oecophylla smaragdina* Fabricius, the weaver ant (in Assamese: Amroli porua) is found available in this area only during March to May. But in other seasons though observed, it is scarce and small in size and during rainy seasons the insect species is not available. In some areas of Assam (N. E. India) the custom of eating this insect during festive season (March- April- May) is still a traditional practice but there is a dearth of information regarding the nutritional composition specially the lipid content. Their utilization, role of host plants and seasonal impact on *Oecophylla smaragdina* in this particular area.

The present study therefore attempts to determine the total lipid, cholesterol and triglyceride content of *Oecophylla smaragdina* of Assam, the North East India and to compare these values with reports on other insects and same insects from other locality and from different host plants.

II. MATERIALS AND METHODS.

Different stages as adults, larvae and pupae from both queen and worker caste of the weaver ant, *Oecophylla smaragdina* were taken for experimental purpose. The ants were collected from

mango tree in different seasons of the year from Upper Assam of North East India. Total Lipid, Triglyceride and Cholesterol contents were estimated in this insect at different times of the year.

Total lipid was estimated by following the method of Frings and Dunn's Modified Method (1970) methods. Triglyceride and Cholesterol content were measured by the method of Enzymatic method of Fossenti and Principle (1982) and Allain's modified method (1974) of Richmond (1973) and Flegg's enzymatic Method respectively.

III. STATISTICAL ANALYSIS

The results obtained were statistically analyzed by student's 't' test and $p < 0.05$ was considered statistically significant.

IV. RESULTS AND DISCUSSION

The interest in the use of insects as food item is reported by various workers (Bukkens, 1997; Finke, 2012; Victor, N. Goka and Diane Julien-David, 2012). But reports suggest different amount of lipid fractions in same insect. It is due to host plant effect and other environmental conditions. The present study which was aimed to determine the total lipid, triglyceride and cholesterol content exhibited relatively higher values in *Oecophylla smaragdina*. However, impact of seasonal variation was observed to be quite distinct in all the stages of life cycle in both queen and worker ants. Highest amount of total lipid was observed in queen larva in the month of March/ April with a mean value of 249.21 mg/ gm (Table- I & II). The total lipid content in this particular species *Oecophylla smaragdina* was ranges from 10-25% in queen larva, 10-23% in queen pupa and 10-20% in queen adult in different seasons of the year. Triglyceride amount was found in maximum amount 166.81 mg/gm in pupal stage of queen ant (Table: V & VI) in the month of March- April and in pupal stage of worker minimum of 47.75mg/gm in the month of January. Cholesterol content was relatively higher in pupal stage in both the caste, 15.22 mg/gm in worker pupa and 10.95 mg/gm in queen pupa. (Table: III & IV). The most interesting point noted in the study as higher amount of cholesterol during winter period (from November to February) (Table: III & IV) in all the stages of both castes. Comparison of mean values showed significant ($p < 0.05$) differences between some stage of queen and worker caste. In case of cholesterol content seasonal impact was not so prominent but caste wise and stage wise differences were quite notable.

In the present study highest amount of total lipid was recorded as 249.21 mg/gm in queen larva and 129.86 mg/gm in worker larva in the month of March. Yang et al. (2006) reported slightly lower values of lipid in some Thai edible insects as Terri-colous and Aquicolous insects.

Significantly higher values of ($p < 0.01$) triglyceride and total lipid was observed in all the three stages of Queen caste than those of the worker caste during the peak seasons of availability (March to June) of the year. However, the increase was also exhibited in some parts of other seasons of the year (November to February) with lower magnitude. Similar findings were observed in case of cholesterol content though magnitude of

difference was not so high and uniform increase or decrease was not depicted in the present study. Impact of seasonal variation was also not clearly observed in case of cholesterol content as the results showed some amount of fluctuation throughout the experiment. But it can be opined from the present study that *Oecophylla smaragdina* can be a rich source of fat with higher amount of total lipid and triglyceride

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Table-I: Mean and ±SD of Total lipid (mg/gm) in different developmental stages of *Oecophylla smaragdina*, Fabricius

		March	April	May	June	November	December	January	February
Queen larva	Mean	249.21	230.51	228.81	217.81	112.61	98.56	98.76	111.71
	±SD	56.79	51.30	51.88	49.42	25.30	22.11	22.12	25.09
Queen pupa	Mean	228.93	213.93	209.13	165.28	107.76	95.66	95.06	10.11
	±SD	52.16	47.96	47.37	36.81	24.07	21.09	21.29	24.00
Queen adult	Mean	203.06	207.25	203.56	120.86	102.06	90.66	91.96	105.16
	±SD	46.14	46.61	45.75	26.87	23.04	20.12	20.35	23.45
Worker larva	Mean	129.86	123.26	119.36	115.01	104.61	104.96	102.86	96.36
	±SD	29.04	27.55	26.71	25.74	23.62	23.71	23.05	21.46
worker pupa	Mean	133.06	128.06	116.31	117.66	108.46	99.91	98.96	90.66
	±SD	29.62	28.37	26.03	26.36	24.33	22.42	21.96	20.21
Worker adult	Mean	123.21	118.71	113.21	105.96	98.61	89.21	84.21	73.21
	±SD	27.18	26.31	25.45	23.56	22.18	19.90	18.75	16.51

Table -II: Showing significance of differences in the mean values of Total lipid (mg/gm) between the different developmental stages of two castes of *Oecophylla smaragdina* Fabricius

Months	Differences	Queen			Worker			Queen Larva and Worker Larva	Queen Pupa and Worker Pupa	Queen Adult and Worker Adult
		Larva and Pupa	Larva and Adult	Pupa and Adult	Larva and Pupa	Larva and Adult	Pupa and Adult			
March	t	1.18	2.82	1.66	-0.35	0.75	1.10	8.37	7.15	6.67
	p	>0.05	<0.05	>0.05	>0.05	>0.05	>0.05	<0.05	<0.05	<0.05
	df	38	38	38	38	38	38	38	38	38
April	t	1.05	1.49	0.45	-0.54	0.39	0.80	8.18	6.89	6.17
	p	>0.05	>0.05	>0.05	>0.05	>0.05	>0.05	<0.05	<0.05	<0.05
	df	38	38	38	38	38	38	38	38	38
May	t	1.25	1.63	0.38	0.37	0.75	0.38	8.39	7.68	7.72
	p	>0.05	>0.05	>0.05	>0.05	>0.05	>0.05	<0.05	<0.05	<0.05
	df	38	38	38	38	38	38	38	38	38
June	t	3.81	7.71	4.36	-0.04	1.16	1.48	8.25	4.70	1.86
	p	<0.05	<0.05	<0.05	>0.05	>0.05	>0.05	<0.05	<0.05	<0.05
	df	38	38	38	38	38	38	38	38	38
November	t	0.62	1.38	0.77	-0.51	0.83	1.34	1.03	-0.09	-0.48
	p	>0.05	>0.05	>0.05	>0.05	>0.05	>0.05	>0.05	>0.05	>0.05
	df	38	38	38	38	38	38	38	38	38
December	t	0.42	1.14	0.72	0.69	2.28	1.60	-0.88	-0.62	0.28
	p	>0.05	>0.05	>0.05	>0.05	<0.05	>0.05	>0.05	>0.05	>0.05
	df	38	38	38	38	38	38	38	38	38
January	t	0.54	1.01	0.47	0.55	2.81	2.22	-0.57	-0.57	1.25
	p	>0.05	>0.05	>0.05	>0.05	<0.05	<0.05	>0.05	>0.05	>0.05
	df	38	38	38	38	38	38	38	38	38
February	t	0.59	0.85	0.26	0.86	3.82	2.99	2.01	2.34	4.98
	p	>0.05	>0.05	>0.05	>0.05	<0.05	<0.05	<0.05	<0.05	<0.05
	df	38	38	38	38	38	38	38	38	38

Table- III: Mean and ±SD of Cholesterol (mg/gm) in different developmental stages of *Oecophylla smaragdina*, Fabricius

		March	April	May	June	November	December	January	February
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Queen larva	Mean	4.66	5.12	9.83	8.87	6.29	8.79	8.12	8.37
	±SD	0.77	0.72	1.71	1.57	1.06	1.63	1.42	1.49
Queen pupa	Mean	10.95	8.75	11.34	9.26	8.21	8.56	8.58	9.19
	±SD	2.05	1.65	2.02	1.72	1.49	1.53	1.59	1.66
Queen adult	Mean	6.22	4.79	8.89	6.59	5.25	5.75	5.63	7.71
	±SD	1.06	0.84	1.55	1.07	0.83	0.97	0.95	1.33
Worker larva	Mean	7.28	6.23	7.45	7.89	6.92	8.97	8.97	6.61
	±SD	1.20	1.08	1.25	1.37	1.15	1.67	1.67	1.14
worker pupa	Mean	15.22	8.21	9.51	10.12	7.79	9.33	8.29	7.52
	±SD	8.91	1.50	1.78	1.86	1.36	1.72	1.50	1.36
Worker adult	Mean	3.97	5.69	6.63	6.33	4.57	4.79	4.98	5.55
	±SD	0.66	0.85	1.09	1.01	0.70	0.75	0.79	0.88

Table -IV: Showing significance of differences in the mean values of Cholesterol (mg/gm) between the different developmental stages of two castes of *Oecophylla smaragdina* Fabricius

Months	Differences	Queen			Worker			Queen Larva and Worker Larva	Queen Pupa and Worker Pupa	Queen Adult and Worker Adult
		Larva and Pupa	Larva and Adult	Pupa and Adult	Larva and Pupa	Larva and Adult	Pupa and Adult			
March	t	-12.84	-5.20	9.10	-3.96	11.03	5.64	-8.29	-2.09	7.95
	p	>0.05	>0.05	<0.05	>0.05	<0.05	<0.05	>0.05	>0.05	<0.05
	df	38	38	38	38	38	38	38	38	38
April	t	-8.80	1.25	9.33	-4.80	1.71	6.51	-3.70	1.08	-3.32
	p	>0.05	>0.05	<0.05	>0.05	<0.05	<0.05	>0.05	>0.05	>0.05
	df	38	38	38	38	38	38	38	38	38
May	t	-2.59	1.84	4.33	-4.20	2.19	6.14	7.16	3.05	5.33
	p	>0.05	<0.05	<0.05	>0.05	<0.05	<0.05	<0.05	<0.05	<0.05
	df	38	38	38	38	38	38	38	38	38
June	t	-1.47	5.37	6.78	-4.21	4.03	7.90	2.09	-0.88	0.78
	p	>0.05	<0.05	<0.05	>0.05	<0.05	<0.05	<0.05	>0.05	>0.05
	df	38	38	38	38	38	38	38	38	38
November	t	-5.33	3.93	7.64	-2.51	8.86	8.78	-2.10	1.21	1.89
	p	>0.05	<0.05	<0.05	>0.05	<0.05	<0.05	>0.05	>0.05	<0.05
	df	38	38	38	38	38	38	38	38	38
December	t	0.45	6.97	6.82	-0.67	10.14	10.70	-0.34	-1.48	3.39
	p	>0.05	<0.05	<0.05	>0.05	<0.05	<0.05	>0.05	>0.05	<0.05
	df	38	38	38	38	38	38	38	38	38
January	t	-0.96	6.65	7.15	1.33	9.68	8.55	-1.74	0.58	2.46
	p	>0.05	<0.05	<0.05	>0.05	<0.05	<0.05	>0.05	>0.05	<0.05
	df	38	38	38	38	38	38	38	38	38
February	t	-1.64	1.48	3.09	-2.35	3.35	5.46	4.27	3.48	5.99
	p	>0.05	>0.05	<0.05	>0.05	<0.05	<0.05	<0.05	<0.05	<0.05
	df	38	38	38	38	38	38	38	38	38

Table-V: Mean and ±SD of Triglyceride (mg/gm) in different developmental stages of *Oecophylla smaragdina*,Fabricius

		March	April	May	June	November	December	January	February
Queen larva	Mean	127.07	130.62	129.59	107.69	81.72	74.43	58.77	61.31
	±SD	28.60	29.20	6.07	24.00	18.24	16.48	13.04	13.57
Queen pupa	Mean	166.81	145.13	97.81	136.47	79.98	75.56	62.49	64.66
	±SD	37.22	32.35	21.77	30.60	17.77	16.63	13.19	14.32
Queen	Mean	100.44	98.57	98.54	79.63	63.67	64.53	58.69	59.52

adult	±SD	22.30	21.70	21.78	17.50	14.12	14.09	13.03	13.12
Worker larva	Mean	74.78	75.27	73.88	71.59	72.33	60.47	59.59	58.49
	±SD	16.44	16.43	16.16	15.69	15.97	13.29	13.21	12.93
worker pupa	Mean	81.59	78.69	82.39	87.15	69.51	64.23	63.27	62.29
	±SD	17.86	17.19	17.95	19.24	15.28	14.09	14.01	13.79
Worker adult	Mean	78.58	70.33	66.86	67.29	62.75	59.89	47.75	57.59
	±SD	17.06	15.46	14.35	14.76	13.79	13.29	10.48	12.76

Table -VI: Showing significance of differences in the mean values of Triglyceride (mg/gm) between the different developmental stages of two castes of *Oecophylla smaragdina* Fabricius

Months	Differences	Queen			Worker			Queen Larva and Worker Larva	Queen Pupa and Worker Pupa	Queen Adult and Worker Adult
		Larva and Pupa	Larva and Adult	Pupa and Adult	Larva and Pupa	Larva and Adult	Pupa and Adult			
March	t	-3.79	3.28	6.84	-1.25	-0.72	0.54	7.08	9.24	3.48
	p	>0.05	<0.05	<0.05	>0.05	>0.05	>0.05	<0.05	<0.05	<0.05
	df	38	38	38	38	38	38	38	38	38
April	t	-1.49	4.05	5.48	-0.64	0.98	1.62	7.39	8.12	5.00
	p	>0.05	<0.05	<0.05	>0.05	>0.05	>0.05	<0.05	<0.05	<0.05
	df	38	38	38	38	38	38	38	38	38
May	t	3.92	3.83	-0.11	-1.58	1.45	3.02	6.29	2.44	5.43
	p	<0.05	<0.05	>0.05	>0.05	>0.05	<0.05	<0.05	<0.05	<0.05
	df	38	38	38	38	38	38	38	38	38
June	t	-3.31	4.23	7.21	-2.80	0.89	3.66	5.63	6.10	2.41
	p	>0.05	<0.05	<0.05	>0.05	>0.05	<0.05	<0.05	<0.05	<0.05
	df	38	38	38	38	38	38	38	38	38
November	t	0.31	3.50	3.22	0.57	2.03	1.47	1.73	2.00	0.18
	p	>0.05	<0.05	<0.05	>0.05	<0.05	>0.05	<0.05	<0.05	>0.05
	df	38	38	38	38	38	38	38	38	38
December	t	-0.22	2.04	2.26	-0.87	0.14	1.00	2.95	2.77	1.07
	p	>0.05	<0.05	<0.05	>0.05	>0.05	>0.05	<0.05	<0.05	>0.05
	df	38	38	38	38	38	38	38	38	38
January	t	-0.87	0.02	0.89	-0.86	0.83	3.97	-0.20	-0.18	2.93
	p	>0.05	>0.05	>0.05	>0.05	>0.05	<0.05	>0.05	>0.05	<0.05
	df	38	38	38	38	38	38	38	38	38
February	t	-0.76	0.42	1.18	-0.90	0.22	1.12	0.67	0.53	0.47
	p	>0.05	>0.05	>0.05	>0.05	>0.05	>0.05	>0.05	>0.05	>0.05
	df	38	38	38	38	38	38	38	38	38

Students' Writing Regarding Choice of Subjects: A Perceptible Study Focusing on Student's Image about Science and Scientist

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Abstract- Students have different perception about science and scientist. How do students view science and scientists? And is this perception important to science educators in any way? Finding out answer to these questions would pave new insights in science education. This study tries to elucidate upon the choice of subjects students state when told to write about 'scientist at work' and 'me as a scientist.' Results indicate drift towards choice of astronomy and chemistry. . The subjects mentioned rarely in the passages were ecology, earth-science, education, mathematics, sports, genetic engineering and the social sciences.

Index Terms- scientific work, science education

I. INTRODUCTION

Development of science has been the result of man's inquiry of puzzling natural phenomena and situations with a view to satisfy his innate curiosity and to subdue the environment for enhancing his physical comforts. For this purpose, he built up a body of scientific knowledge by utilising his intellect and applying his ability for engaging in thinking and reasoning. This shows that even in ancient times science was really the product of a precise method of thinking rather than mere acquisition of readymade facts. But when body of scientific knowledge expanded, this spirit of inquiry gave way to mere information mongering in the hands of incompetent teachers. The unscientific system of examination calling for mere reproduction of this information added momentum to this degeneration. Thus the true spirit of science which is built upon the real process of thinking and learning was lost sight of. It is under these circumstances a rethought of the issue was taken up by modern educationists and those interested in augmenting the quality of science education. Students' perception about science and scientist play a vital role towards molding this inclination towards science teaching.

With reference to science and scientists, Chambers (1983), states that in the eighteenth and nineteenth century, there were varied visual and verbal images of scientists which are rarely seen now. Though these images were stereotypic, their range was large.

Sir Peter Medawar (1979) says in his Advice to a Young Scientist "There is no such person as the scientist..... Scientists are people of very dissimilar temperaments doing different things in very different ways."

The classic work by Margaret Mead and Rhoda Metraux (1957) with high school students in the United States showed that

students view science as natural science and the scientist as 'a man' who wears a white coat and works in the laboratory. He is elderly or middle aged and wears glasses.

Beardslee and O'Dowd (1961) explored college students' beliefs about scientists. After preliminary interviews students had been provided with a questionnaire in which students were asked to indicate the appropriateness of a series of terms. The terms were arranged on a two-ended seven point rating scale. This rating was done for 15 occupations including that of a scientist. A well-defined stereotype of a scientist emerged in the ratings of students. The scientist emerged as a highly intelligent individual devoted to his studies and research at the expense of interest in art, friends and family. No gender differences existed in the views of students.

Studies of the views of school teachers about science have also been conducted. Ramphal (1992) in a study of Indian school teachers reported that most teachers stated that they had never met a scientist, yet a large proportion of them felt that no formal qualifications were necessary to be a scientist, if the appropriate qualities of 'discovery' were present. Patience/commitment was stated to be a prominent characteristic of scientists, more often than creativity or logical thought. Most teachers held that scientists are truly objective and are not influenced by factors such as pressures from external sources or need for personal gain, they also felt that the scientific temperament was reflected in everything about the scientists. More than half the teachers regarded scientists as unemotional. Scientists according to them do not even look like ordinary persons but appear 'serious and in thought' or 'brilliant but somewhat lost'. The last is indicating the stereotype of the absent-minded professor.

The "Draw-a-Scientist" task has been used in research for a long time in different formulations and with slight modifications. (Mead and Metraux 1957, Krajcovich and Smith 1982, Chambers 1983, Kahle 1987, Kjærnsli 1989, Matthews 1996). The purpose of this item is to elicit the image of scientists held by the learner. It may be argued that this item simply begs the stereotype to be presented; the respondents may concentrate on what distinguishes a "stereotype" of a researcher from other "normal" people. In the research, different approaches are used to counteract this. (Like drawing two scientists, or by sorting cards with drawings etc.), the pupils were asked to draw a scientist *at work*. This is a qualitatively oriented task and the phrase "at work" is deliberately added, to draw attention to the thing scientists actually do - and not only how they may look. In the second part of this item, the pupil is invited to elaborate on the same aspect by writing something about it. This may be a story or just a list of key words.

II. OBJECTIVE OF THE STUDY

To study the perception students have in their mind regarding science and scientists through the choice of subjects.

III. METHODOLOGY AND DESIGN OF STUDY

The students were asked to write about ‘scientist at work’ and ‘Me as a scientist’. This is a qualitative oriented task and the phrase ‘at work’ is deliberately added, to draw attention to the things scientists actually do and not only how they may look. After going through the writings, the choices of subjects stated were categorized.

IV. SAMPLE OF THE STUDY

The sample consisted of 443 students of class IX (mean age 14 years) from four schools of Mumbai. The schools selected were scholastically average.

V. ANALYSIS AND DISCUSSION

Many subjects were stated by students in their responses to the two questions. The subject written about most in the passages about ‘scientist at work’ was Chemistry and astronomy. It was followed by radio-physics, physics, biology, technology in that order. The subjects mentioned rarely in the passages were ecology, earth-science, education, mathematics, sports, genetic engineering and the social sciences. See table 1.1 for the various responses of students for the subjects mentioned for ‘scientists at work’.

Table 1.1: Percentage responses of students for the subjects mentioned for ‘Scientists at Work’

Subject written about ‘scientist at work’	Percentage scores
astronomy	22
radio physics	11
biology	16
technology	15
Chemistry	18
Earth science	3
ecology	3
education	1
social science	2
sports	0
genetic engineering	2
mathematics	1
others	2

Regarding ‘Me as a scientist’, overall the subject medicine and health was stated most often. The subjects which followed were biology, chemistry, technology and astronomy respectively. See table 1.2 for the various responses of students for the subjects mentioned for ‘Me as a scientist’.

Table 1.2: Percentage responses of students for the subjects mentioned for ‘Me as a Scientist’

Subject written about ‘me as a scientist’	Percentage scores
astronomy	11
radio physics	19
medicine	20
biology	15
technology	11
Chemistry	14
Earth science	2
ecology	2

education	1
social science	1
sports	1
genetic engineering	0
mathematics	1
others	2

Some of the representative responses especially from the writings of students for “Me as a scientist’s” regarding various subjects are presented below:

- ❖ Make chemistry interesting for teaching children
- ❖ I would like to prepare different useful chemicals

Biology

- ❖ Field of biology (rather human biology)
- ❖ Old fossils, different types of organs in human body
- ❖ Killing of animals-concerned & like to stop it
- ❖ Hormones, DNA structure
- ❖ Nature and plants
- ❖ Human brain & cell, processes
- ❖ Dinosaurs and methods by which they can appear again
- ❖ Cure for Diseases like AIDS, HIV and cancer
- ❖ Clone of humans

Astronomy

- ❖ Space & creation of atmosphere on moon for living
- ❖ Space ships, learn more about space
- ❖ Artificial atmosphere, spaceship with speed of light, parallel universe
- ❖ Creation of universe, its expansion
- ❖ Travel in space in search for new life
- ❖ Prove that Mars has life (seen by the student via telescope)

Physics

- ❖ Make systems with highly developed electronics
- ❖ About time (go to the future or past)
- ❖ Electricity and current
- ❖ How we feel in space
- ❖ Physics-optics (optical fibers, protons)
- ❖ Nuclear power plant, bombs
- ❖ Invent something to save electricity
- ❖ Study magnetism, electricity, weight, laser
- ❖ Radioactivity

Medicine & Health

- ❖ Prepare more new medicines
- ❖ Remedies or operations for cancer and aids
- ❖ Medicine that will destroy the hunger of people
- ❖ Vaccines for all diseases to be given at birth
- ❖ Medicines that are not bitter, to be injected and not swallowed
- ❖ Medicine to make man immortal, energetic and powerful
- ❖ Cure for plague
- ❖ Medicines without side effect, medicine for eye disorders

Chemistry

- ❖ Ozone layer
- ❖ Strong fertilizers
- ❖ Find a substance which alchemists couldn't
- ❖ Chemicals and their properties, make new chemicals

Technology

- ❖ Mechanical equipment to make man's life more comfortable
- ❖ Cameras to record & analyze voice, shoes to make travel fast
- ❖ Vehicles-more power, comfort, less pollution, equipment for easy life
- ❖ House which can be run on remote
- ❖ Time machine-the future will be progressive phase of the country
- ❖ Modern weapons-do not kill or destroy the surroundings

- ❖ Gadget for car-check pollution by filtering smoke & giving fresh air
- ❖ Robot which will fight as soldiers or will go places where humans can't go
- ❖ Cheaper electricity and power

Environment

- ❖ Bio fuels
- ❖ Global warming
- ❖ Ozone layer depletion
- ❖ Reducing emission from vehicles

VI. CONCLUSION AND REVIEW

The results reveal limited choices regarding subjects written and a wide spectrum regarding writing about sub topics /branches in every subject. But an overall positive and enterprising role gets reflected regarding the choice of subjects suggesting a positive image towards science and scientist.

The study was conducted with ninth standard students who are approximately 14 year old. This is a crucial year for many reasons. In Mumbai where the data was collected, the weightage of science in terms of marks in schools increases this year. Practical sessions for students are also introduced in the syllabus around this time. Students are approaching the stage where they will have to make decisions about the future, in terms of continuing studies and the choice of specialization. These decisions will determine whether students continue in science or not. At this stage of life image of a subject may play an important role in decision-making. The study was conducted in scholastically average schools. The results of the study are more specifically related to the Indian context.

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Oxidative Chlorination of Aromatic Compounds in Aqueous Media

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Abstract- An efficient method for the synthesis of chlorinated arenes is disclosed. The method involves the use of NaClO₃ as oxidant and HCl as chlorinating agent in aqueous medium under mild conditions to chlorinate the aromatic compounds in good to excellent yields (75-96%). The reagent system is efficient, organic solvent-free and easy to handle.

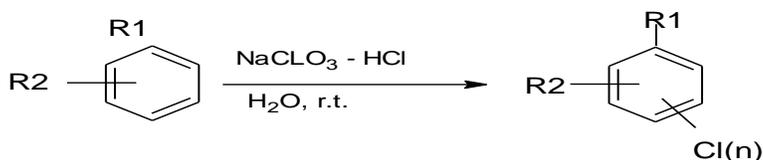
Index Terms- Halogenation, Chlorination, Arenes, Sodium Chlorate, Aqueous medium, Oxidative Chlorination.

I. INTRODUCTION

Chlorination of arenes is a prominent organic reaction with wide laboratory use and industrial applications. The introduction of chlorine onto aromatic ring is an important synthetic transformation because chlorinated compounds are recognized as versatile starting materials and additives in the production of high quality insecticides, fungicides, herbicides, dyes, pharmaceutical etc. therefore, there are several known methods available in the literature that have been developed for the chlorination of aromatic compounds. A common method to introduce chlorine atom into organic substrates, whether they are free radical processes or polar additions to olefinic groups or electrophilic substitution on aromatic ones, involves the use of molecular chlorine which has high vapor pressure or are gasses at room temperature and 1 atm pressure. The dihalogens are corrosive, poisonous, and can be dangerous to handle, methods that require their transport and manipulation are difficult. Generally, the chlorination of arenes can be accomplished by using chlorinating agents such as t-butyl hypochlorite in presence of zeolites, metal chloride-H₂O₂ in acid aqueous medium, m-chloroperbenzoic acid/HCl/DMF. Sulfuryl chloride, acetyl chloride in presence of ceric ammonium nitrate, SnCl₄/Pb(OAc)₄, HCl-H₂O₂ under microwave conditions, N-chlorosuccinimide, etc.

Analyzing these literature data, one can see that the most promising example of chlorination include a one pot synthesis where elemental chlorine is generated in-situ by the use of haloacids in the presence of an oxidizing agent. Oxidative chlorination has emerged as an environmentally-benign process via the in-situ formation of molecular chlorine from the oxidation

of chloride with suitable oxidants. Therefore, mono and biphasic oxidative process based on generating the chlorine from concentrated HCl in presence of oxidant has been developed. Chlorination of aromatic rings by HCl using H₂O₂, t-BHP and sodium perborate as oxidizing agents have already been attempted. However, these methods involved the use of organic solvents which have serious environmental impacts and also having disadvantages of long duration, high temperature and use of catalyst. Also, recently Podgorsek et al. have used HCl/H₂O₂ to transform aryl iodides into aryl iodine (III) dichlorides in the presence of trifluoroethanol which act not only as reaction medium but also as activator of hydrogen peroxide for oxidation of HCl into molecular chlorine. But, trifluoroethanol which is used in this system is toxic and harmful solvent and is recommended to avoid the long term contact with skin. One of the key principles of green chemistry is the elimination of solvent in chemical processes or the replacement of hazardous solvent with environmentally-benign solvents. Water is the most promising solvent because it is readily available, non-flammable, non-toxic and could offer the easy separation of reagents or catalysts from many organic products. Earlier the chlorination of substituted acetanilide (aromatic compounds) in acid-aqueous medium was carried out by Jerzy et al. by using metal chloride-hydrogen peroxide system. The drawbacks of this method are use of large amount of acid (HNO₃) and chlorinating agent (NaCl) with poor yield and selectivity. Our present method overcomes all above limitations. Also, NaClO₃ is low cost, easy to handle than H₂O₂, t-BHP and has better solubility in water than sodium perborate, thus, making it a useful reagent for carrying out reaction in water. By considering these advantages of NaClO₃ it has been successfully employed as a convenient oxidant for oxidative chlorination in water. Also a perusal of the literature revealed that earlier Moon et al. have used NaClO₃/HCl in aqueous acetic acid to chlorinate activated arenes and α -position of ketones. The earlier system has limitations of use of acetic acid as solvent, poor selectivity, low yield and long reaction time (20 h). However, our present method is free from use of organic solvent, have low reaction time (upto 3 h) and good yield (75-96%) of chlorinated product (Scheme 1).



R¹ = OH, NH₂, NHCOMe, NHCOPh, CHO, COOH, CN

R² = H, OH, Cl, Br, NO₂

Scheme 1. Oxidative chlorination of aromatic substrates in water

Objective:

Chlorination is an important reaction of organic chemistry because of wide variety of uses of chloro-substituted organic compounds in fine chemicals and pharmaceutical intermediates. Therefore, large number of methods are available in the prior art for chlorination of organic compounds. However, most of these methods involved the use of organic solvents which have serious environmental impacts and also having disadvantages of long duration, high temperature and use of catalyst, so there is need for the development of a method which is efficient, free from organic solvent, cost effective and easy to handle. Also, one of the key principles of green chemistry is the elimination of solvent in chemical processes or the replacement of hazardous solvent with environmentally-benign solvents. Water is the most promising solvent because it is readily available, non-flammable, non-toxic and could offer the easy separation of reagents or catalysts from many organic products. Therefore, in our present study, a method has been developed for the chlorination of aromatic compounds using NaClO₃/HCl in aqueous medium. The present system uses the water as reaction media and also provides the chlorinated aromatic products in good to high yields (75-96%) under the mild conditions. Also, this system is cost effective, efficient and easy to handle.

II. MATERIALS AND METHODS

Materials and instrumentation

Starting materials and other reagents were obtained from commercial suppliers and used without further purification. Granular and scaly substrates were crushed to fine powder using mortar and pestle. HPLC analyses were concluded using Waters 2695 instrument with PDA detector, column C₁₈ (250 mm x 4.6 mm x 5 μ), solvent system 70% CH₃OH + 30% H₂O, flow rate 1 ml/min. HPLC purity is reported by area% NMR spectra were obtained in DMSO and CDCl₃ on a Bruker Avance II 400 NMR

spectrometer; the chemical shifts were reported in ppm, ¹H NMR (relative to TMS referenced as 0.00 ppm) and ¹³C NMR (relative to DMSO referenced as 39.50 ppm). GC/MS analyses were carried out using Agilent GC (Model 5893) with Chemstation software; column-HP5-MS, 30 m x 0.25 mm x 0.25 micron; detector- mass range- 14 amu to 650 amu; flow- 2 ml/min (constant flow); injector temp- 270 °C; detector temp-300 °C; injection volume-1 microliter of 5 % solution in methanol. Mass spectra were recorded on Micromass uattro Micro APCI ion source. Quattro Micro API triple quadrupole MS equipped with a standard APCI ion source.

General procedure for the chlorination of aromatic compounds

Monochlorination:

An aqueous solution of NaClO₃ (0.005 mol) in water (8-10 ml) was added to a fine powder of aromatic substrate (0.01 mol) taken in a 10-0 ml round-bottom flask equipped with a magnetic stirring bar at room temperature. After that HCl (2 ml) was added dropwise for 15 minutes. The reaction completion was monitored with thin layer chromatography (TLC). After completion of the reaction, 5 ml of water was added to separate the product; product was filtered, and dried in oven. The structures of products were confirmed by ¹H NMR, mass spectra and were compared with authentic samples.

Dichlorination

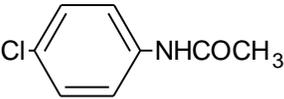
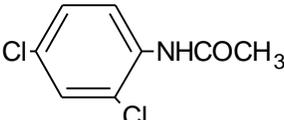
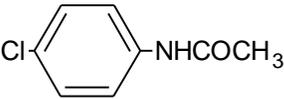
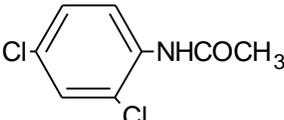
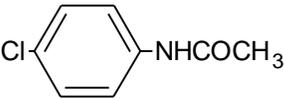
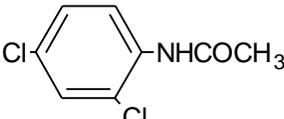
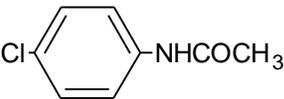
Process for the synthesis of dichlorinated product was same as that given in monochlorination, except 0.01 mol of NaClO₃ and 4 ml of HCl was used wrt 0.01 mol of substrate.

Results and Discussion:

In present work, the chlorination was first tried on 4-chloroacetanilide by using NaClO₃ (0.01 mol), NaCl (0.03 mol) and H₂SO₄ (1 mL) in water (Table 1, Entry 1). The chlorinating reagent is thus generated in-situ in the reaction mixture by oxidizing NaCl using NaClO₃ as an oxidizing agent in acidic medium.

Table 1. Screening of optimum reaction conditions for oxychlorination using different reagent systems in aqueous media.

Entry	Reagent System	Reaction Conditions	Starting Material	Product	Yield ^a (%)
1.	NaCl/NaClO ₃ / H ₂ SO ₄ ^b	2 h at r.t.			87

2.	HCl/NaClO ₃ ^c	2 h at r.t.			95
3.	HCl/NaIO ₄ ^d	4 h at r.t.			16
4.	HCl/H ₂ O ₂ ^e	4 h at r.t.			22
5.	HCl/ NaBO ₃ .3H ₂ O ^f	4 h at r.t.		-----	---

^a Isolated yields

^b Conditions: Substrate, 0.01 mol; NaCl, 0.03 mol; NaClO₃, 0.005 mol; H₂SO₄, 1 ml; H₂O, 8 ml

^c Conditions: Substrate, 0.01 mol; NaClO₃, 0.005 mol; HCl, 2 ml; H₂O, 8 ml

^d Conditions: Substrate, 0.01 mol; NaIO₄, 0.005 mol; HCl, 2 ml; H₂O, 8 ml

^e Conditions: Substrate, 0.01 mol; HCl, 2 ml; H₂O₂, 3 ml; H₂O, 8 ml

^f Conditions: Substrate, 0.01 mol; NaBO₃.3H₂O, 0.01 mol; HCl, 2 ml; H₂O, 8 ml

Later on, HCl was tried instead of NaCl and H₂SO₄, which acts as a chlorine source as well makes the reaction mixture acidic (Table 1, Entry 2). Results of table 1 show that the chlorinated product obtained in better yield when HCl was used in place of NaCl and H₂SO₄. Chlorination was also tried in water but using various oxidants such as sodium periodate, H₂O₂ (30%) and sodium perborate (Table 1). The results suggest that very little amount of product is formed in case of NaIO₄ (13%) and H₂O₂ (21%) and no product was formed with sodium perborate. Therefore, it is found experimentally that sodium chlorate and HCl gave the best results in aqueous medium.

Effect of surfactant:

Ionic and non ionic surfactants were used to study the effect of surfactant on the yield and reaction time. It was observed that surfactant improves the dispersion of aromatic substrates in water and also improves the texture of product but there was no effect on yield and reaction time.

Effect of concentration of HCl

The amount of HCl from 2 ml to 1.5 ml, the yield of 2,4-dichloroacetanilide get decreased upto 70%. Also, depression in melting point reveals that underchlorinated product was formed due to decrease in the amount of HCl. On further decreasing the amount of HCl from 1.5 ml to 1 ml, no product was obtained. It was observed that the yield and melting point of 2,4-dichloroacetanilide became stagnant on increasing the amount of HCl from 2 ml to 2.4 ml. hence, the ideal amount of HCl is 2 ml.

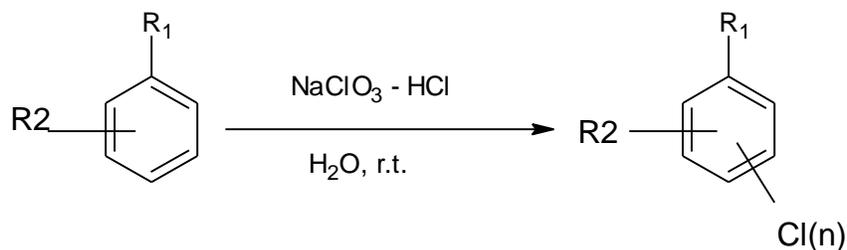
Effect of concentration of NaClO₃

Decreasing in sodium chlorate (NaClO₃) concentration from 0.005 mol to 0.0033 mol resulted in decrease of the yield of 2,4-dichloroacetanilide. Melting point of product was also not within

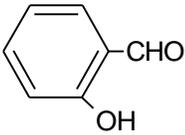
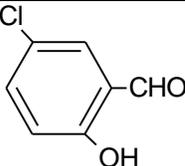
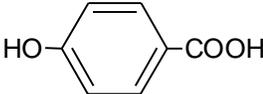
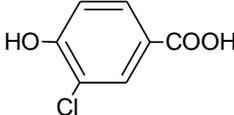
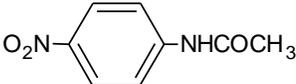
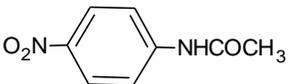
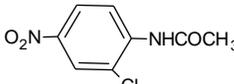
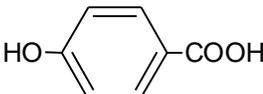
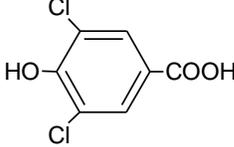
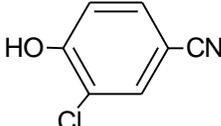
the desired range due to underchlorination of 4-chloroacetanilide in the presence of 0.0033 mol of NaClO₃. While increasing the concentration of NaClO₃ from 0.005 to 0.015 mol, there was no effect on these both parameters. Therefore, it was concluded experimentally that 2 ml of HCl and 0.005 mol of NaClO₃ afforded the best yield of chlorinated product. The dichlorination can also be performed by increasing the amount of HCl along with the amount of NaClO₃.

To show the general application of the method, it was applied to a variety of aromatic compounds to give corresponding chlorinated products in good yields. The results of this investigation are tabulated in table 2. It is evident from the results that all aromatic substrates were chlorinated within 1.5-3.0 h in good yields. 2,4-dichloroacetanilide (Table 2, Entry 1) was obtained in best yield (95%) from 4-chloroacetanilide within 2 h at room temperature and having an HPLC purity of 96.8% (Table 3, Entry 1). 4-Nitroacetanilide showed no reactivity up to 4 h at room temperature (25°C) while at slightly higher temperature (45°C), 2-chloro-4-nitroacetanilide was obtained in good yield (75%) within 3 h of reaction (Table 2, Entry 3,4). Earlier Jerzy et al. has synthesized 2-chloro-4-nitroacetanilide from 4-nitroacetanilide in poor yield (32%) along with formation of 2,6-dichloro-4-nitroacetanilide (68%) at 50°C. 3-chloro-4-hydroxybenzaldehyde which is used as an intermediate in organic syntheses was obtained in 86% yield (Table 1, Entry 13) with an HPLC purity of 98.38%. 5-chlorosalicylic acid (Table 1, Entry 14) which is used as intermediate of pesticide, medicine and dyes was obtained in 82% within 1.5 h at room temperature from salicylic acid. This compound was also synthesized by H.A.Muathen using SnCl₄/Pb(OAc)₄ in ethyl acetate in 77% yield.

Table 2. Oxidative chlorination of aromatic compounds in aqueous medium.



Entry	Starting Material	Reaction Conditions	Product	Yield ^a (%)	Mp °C (lit.)
1.		2 h, r.t.		95 ^b	145(143-146)
2.		2 h, r.t.		93 ^b	152(151-152)
3.		4 h, r.t.		82 ^b	130(128-132)
4.		2 h, r.t.		83 ^c	222(221-224)
5.		2 h, r.t.		90 ^b	107(107-110)
6.		2 h, r.t.		84 ^b	83(85-87)
7.		3 h, r.t.	-----	Complex Mixture	---
8..		1.5h, r.t.		93 ^b	190(192-193)

9.		1.5h, r.t.		85 ^b	100(99-103)
10.		1.5h, r.t.		82 ^b	166(168-170)
11.		4 h, r.t.	----	---	---
12.		3 h, 45 °C		75 ^b	138(138-139)
13.		4 h, r.t.		86 ^c	264(264-266)
14.		1.5h, r.t.		82 ^b	149(150)

^a Isolated yields

^b Monochlorination: Substrate, 0.01 mol; NaClO₃, 0.005 mol; HCl, 2mL; H₂O, 8-10 mL.

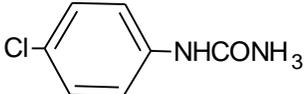
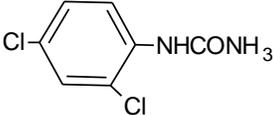
^c Dichlorination: Substrate, 0.01 mol; NaClO₃, 0.01 mol; HCl, 4mL; H₂O, 8-10 mL.

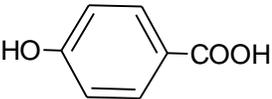
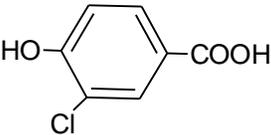
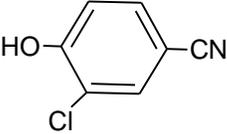
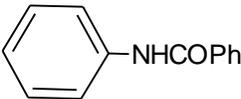
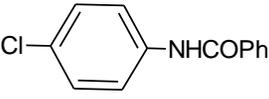
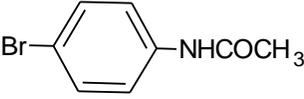
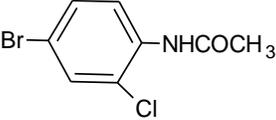
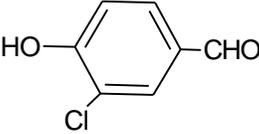
In case of benzanilide, a mixture of substrate and product (underchlorinated product) was formed at room temperature within 3 h (Table 1, Entry 7) but at slightly higher temperature (40 °C), para-substituted product was obtained within 1.5 h (Table 1, Entry 8) with an HPLC purity of 95.23% which is an industrially-important compound.

3-chloro-4-hydroxybenzoic acid (Table 1, Entry 10) was obtained in 82 % yield and purity of 98.01%. Mukhopadhyay et al. prepared this compound with poor conversion (53%) at 45 °C in 4 h using H₂O₂ and aqueous HCl. An important pharmaceutical

intermediate 3-chloro-4-hydroxybenzonitrile (Table 1, Entry 14) was prepared from 4-hydroxybenzonitrile within 1.5 h in 82% yield (98.8% purity by HPLC). 3,5-dichloro 4-hydroxybenzonitrile was synthesized from the dichlorination of 4-hydroxybenzonitrile in 85% yield at room temperature within 2 h, which is widely used as a pesticide. Highly activated aromatic compounds like aniline and phenol undergo oxidation rather than chlorination by this method. However, the substituted anilines and phenols were chlorinated in good yields at room temperature.

Table 3. Selectivity of products in the chlorination of various aromatic substrates

Entry	Substrate	Product	Yield ^a (%)	Product Purity ^b (%)	
				Main Product	Others
1.			97	96.90	3.10

2.			83	98.30	1.70
3.			85	98.50	1.50
4.			93	97	3.00
5.			95	96.35	3.65
6.			82	98.20	1.80

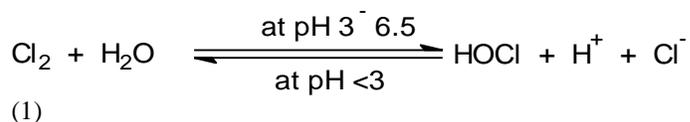
^a Isolated yield

^b Purity determined by HPLC

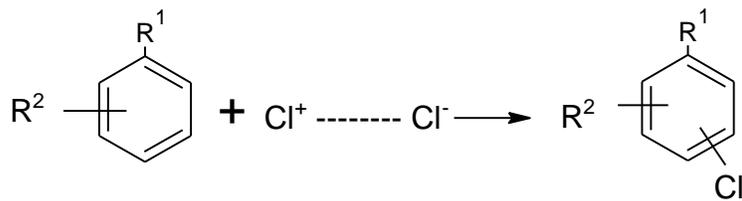
Encouraged by the results of activated arenes, same system, i.e., NaClO₃/HCl using water as reaction media was also tried for the chlorination of deactivated arenes such as benzoic acid and nitrobenzene. However, the present system failed to chlorinate the deactivated aromatic compounds at 60°C and 80°C even after 20 h. Therefore, this system can be used to chlorinate activated arenes in good yield under mild conditions.

Mechanism:

It is evident from literature that in case of oxychlorination it is possible to oxidize the chloride under acidic conditions to obtain HOCl and/or Cl₂; these oxidized species then react in-situ with substrates such as arenes to yield chlorinated product. Therefore, under certain conditions either Cl₂ or HOCl can be main chlorinating agents or both can act concurrently to yield chlorinated product. However, it has been reported recently that at very low pH (Ph < 3) Cl₂ serves as an active chlorinating agent while at higher pH (3-6.5) HOCl is the active chlorinating species.



The Ph of our reaction medium is very low (Ph < 1) so the active chlorinating species may be Cl₂ rather than HOCl. Also, from rate data and relative reactivities studies it has been identified that Cl₂ is much more reactive chlorinating agent than HOCl and addition of large amount of acid or lowering the Ph of the reaction will suppress the hydrolysis of Cl₂ to HOCl (eq.1). Therefore, it can be concluded that NaClO₃ will oxidize the chloride to form chlorine and due to higher reactivity of Cl₂ it will serve as an active chlorinating species which furnishes the Cl⁺ ion to accomplish a rapid chlorination of substrates (Scheme 2). Theoretically, one equivalent of chlorate generates three equivalents of chlorinating agent; however, this was not accorded precisely by experimental results.



Scheme 2. Plausible Mechanism of Oxidative Chlorination

Characterization of Representative Chlorinated Aromatic Compounds:

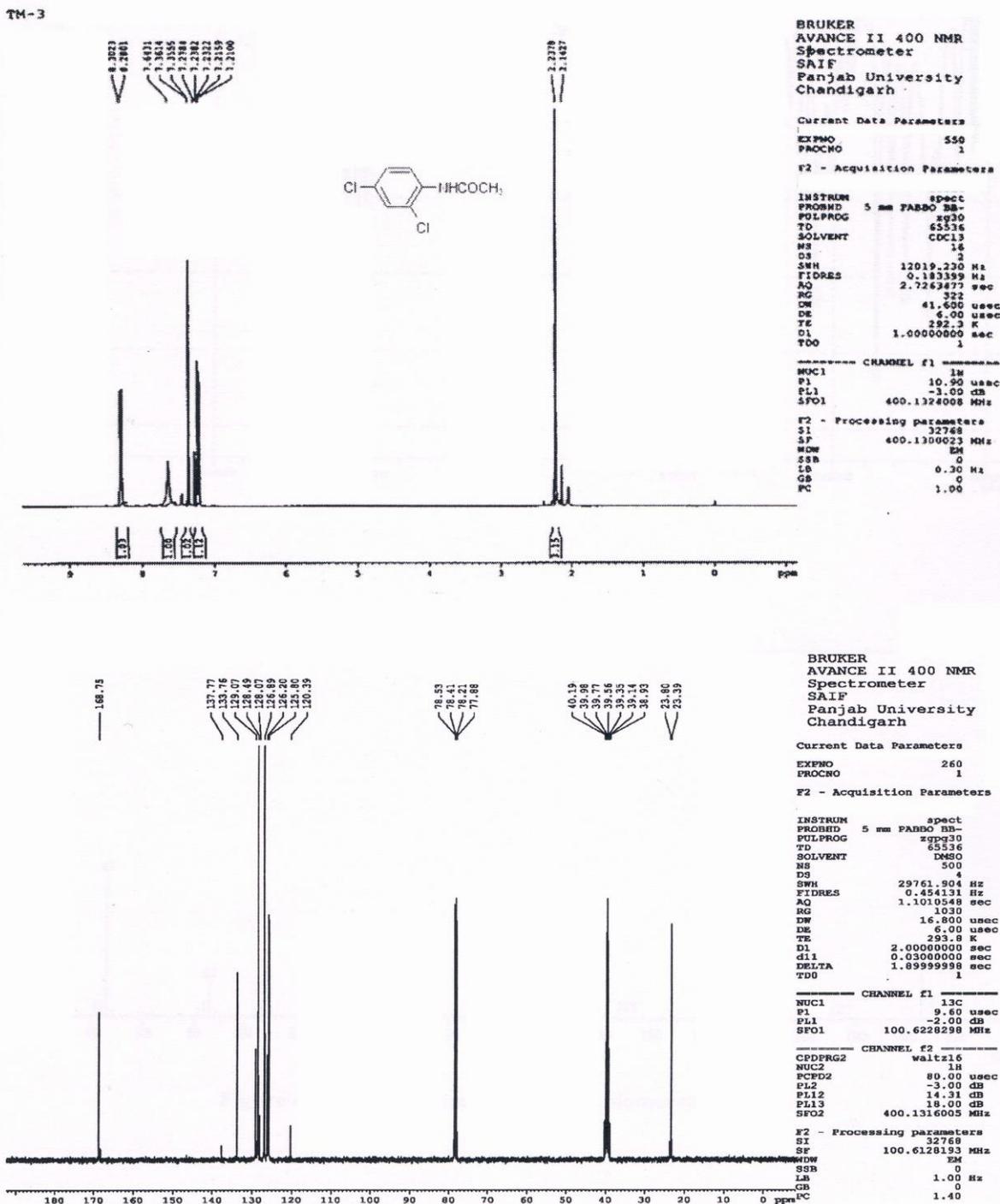


Figure 1. ¹H and ¹³C-NMR spectra of 2,4-dichloroacetanilide (1)

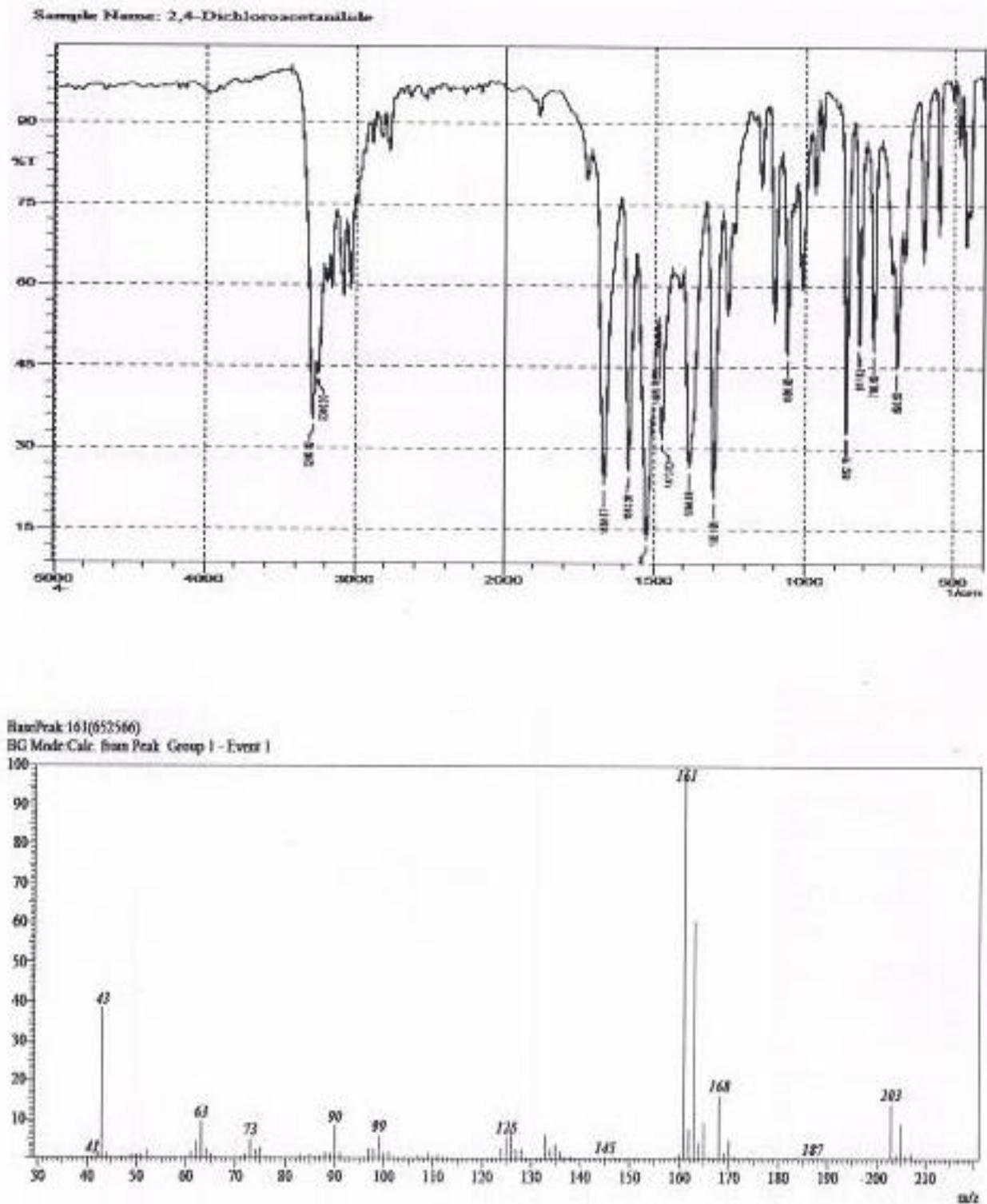


Figure 2. IR and mass spectra of 2,4-dichloroacetanilide (1)

Analysis Name: 23012011000005.D **Instrument:** PDL/ARD-062
Operator: PDL
Sample Name: TM5
Analysis Info:

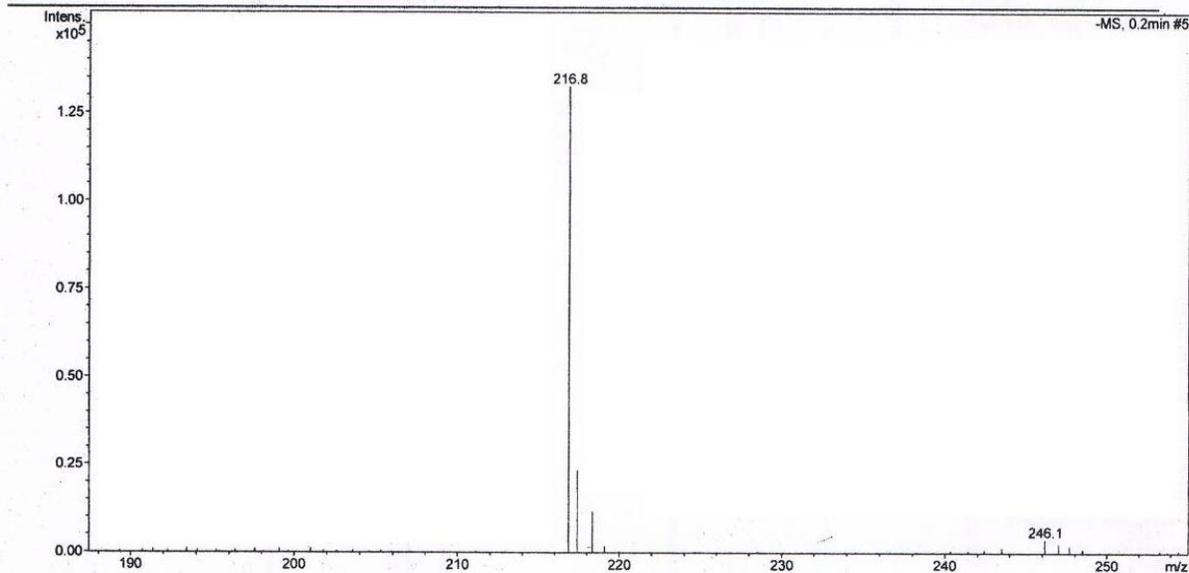


Figure 5 Mass spectra of 2-chloro-4-nitroacetanilide (4)

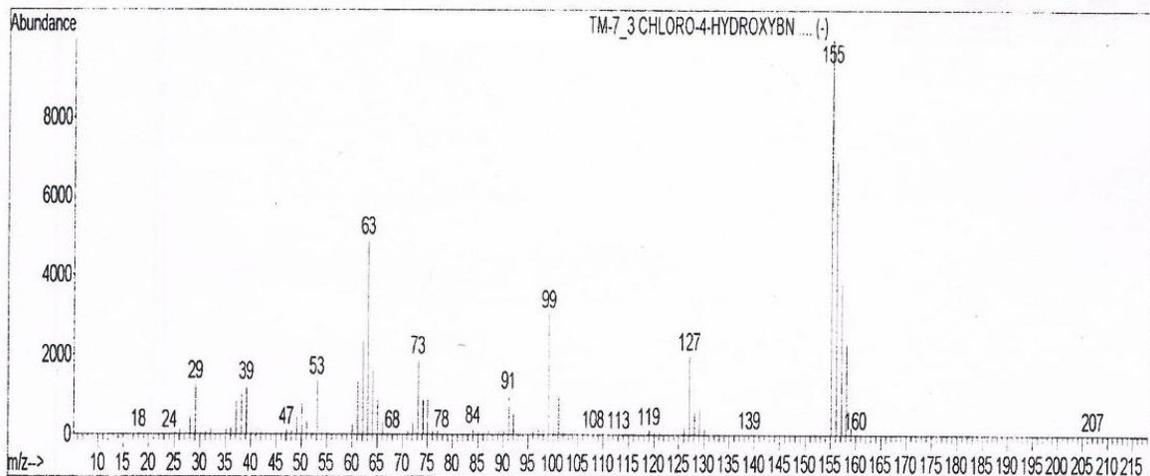


Figure 6. Mass spectra of 3-chloro-4-hydroxybenzaldehyde (5)

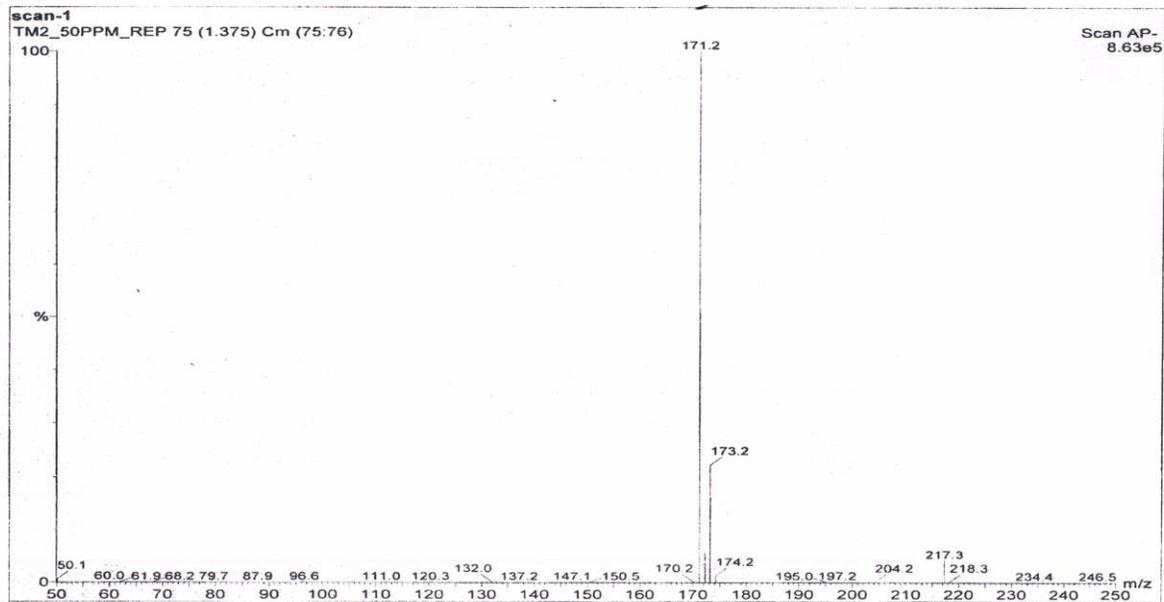
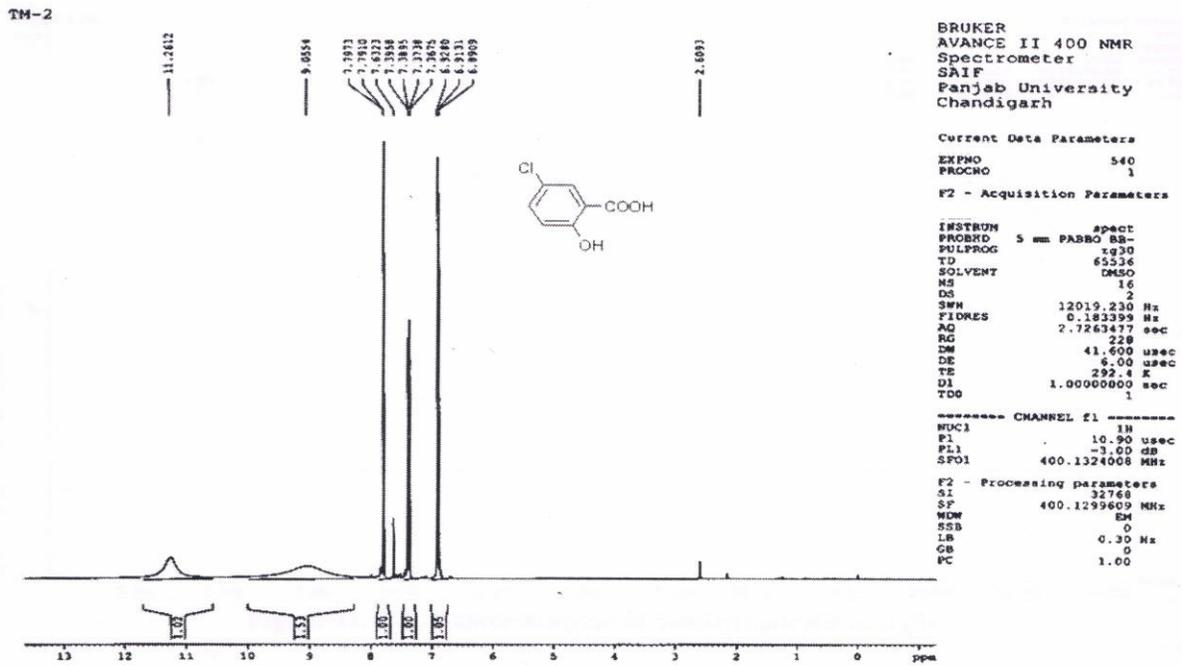


Figure 8. ¹H-NMR spectra and mass spectra of 5-chlorosalicylic acid (6)

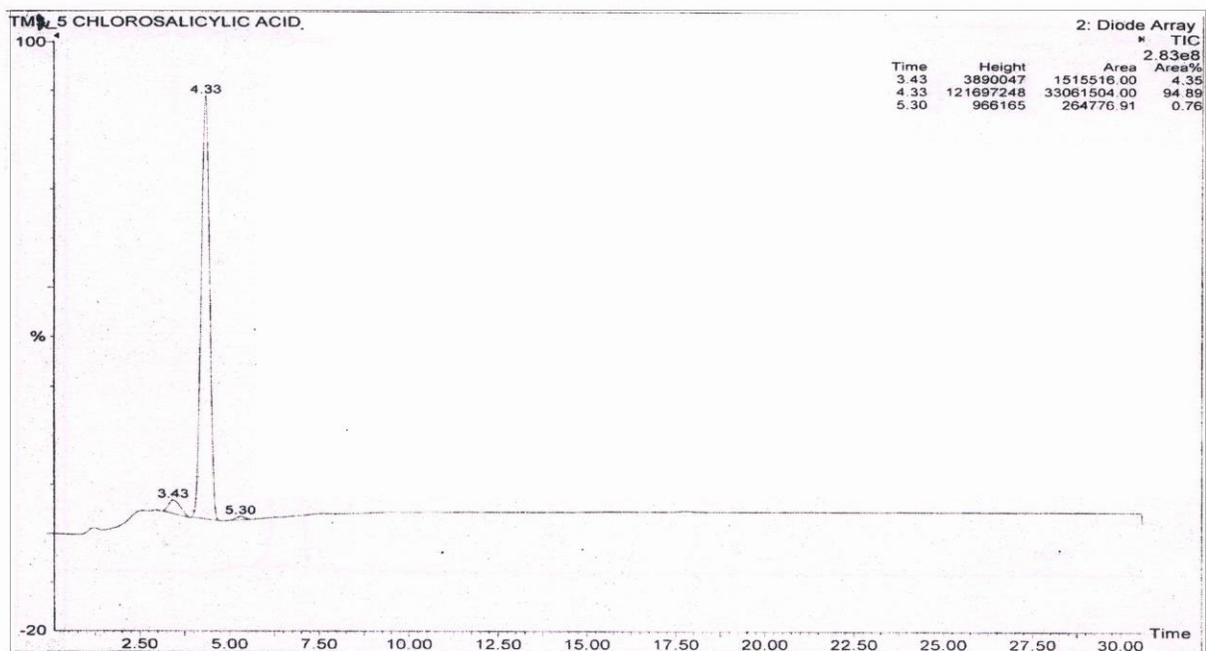


Figure 6 HPLC chromatogram of 5-chlorosalicylic acid (6)

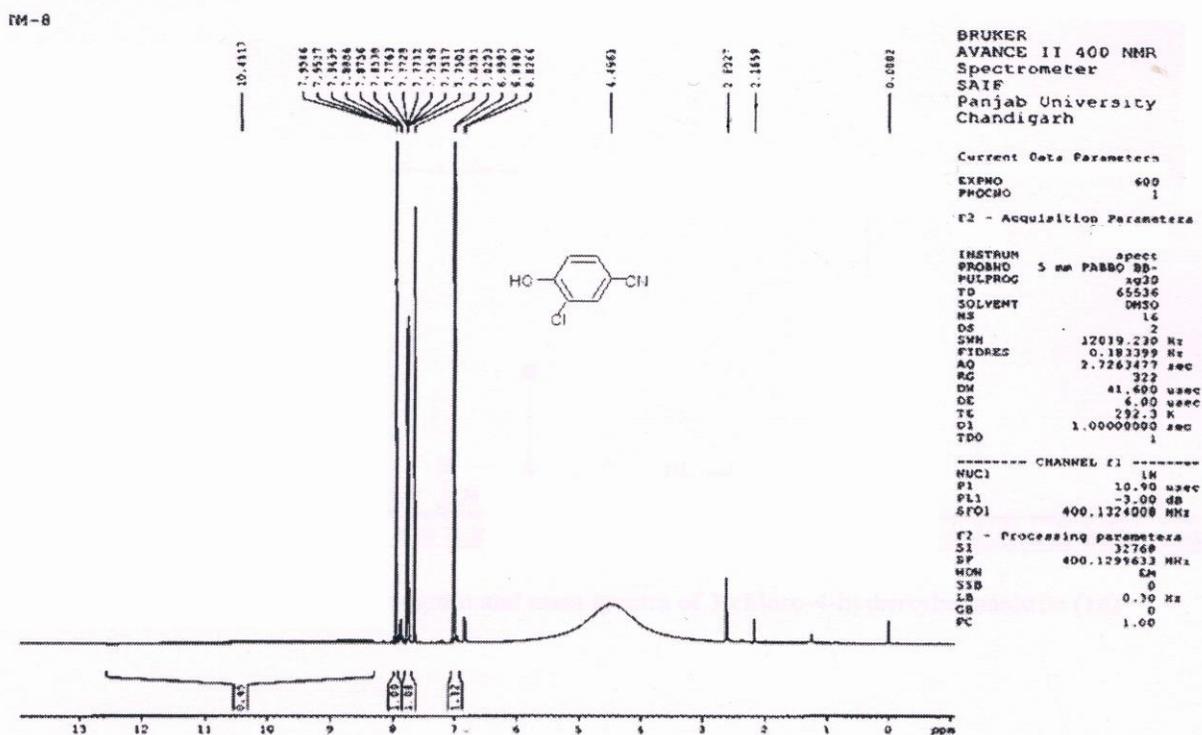


Figure 9. ¹H-NMR of 3-chloro-4-hydroxybenzonitrile (16)

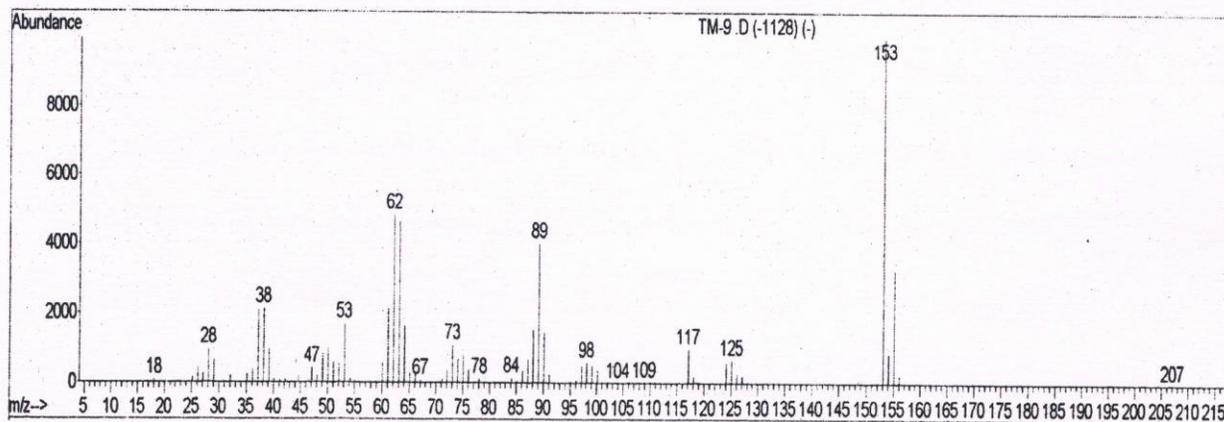
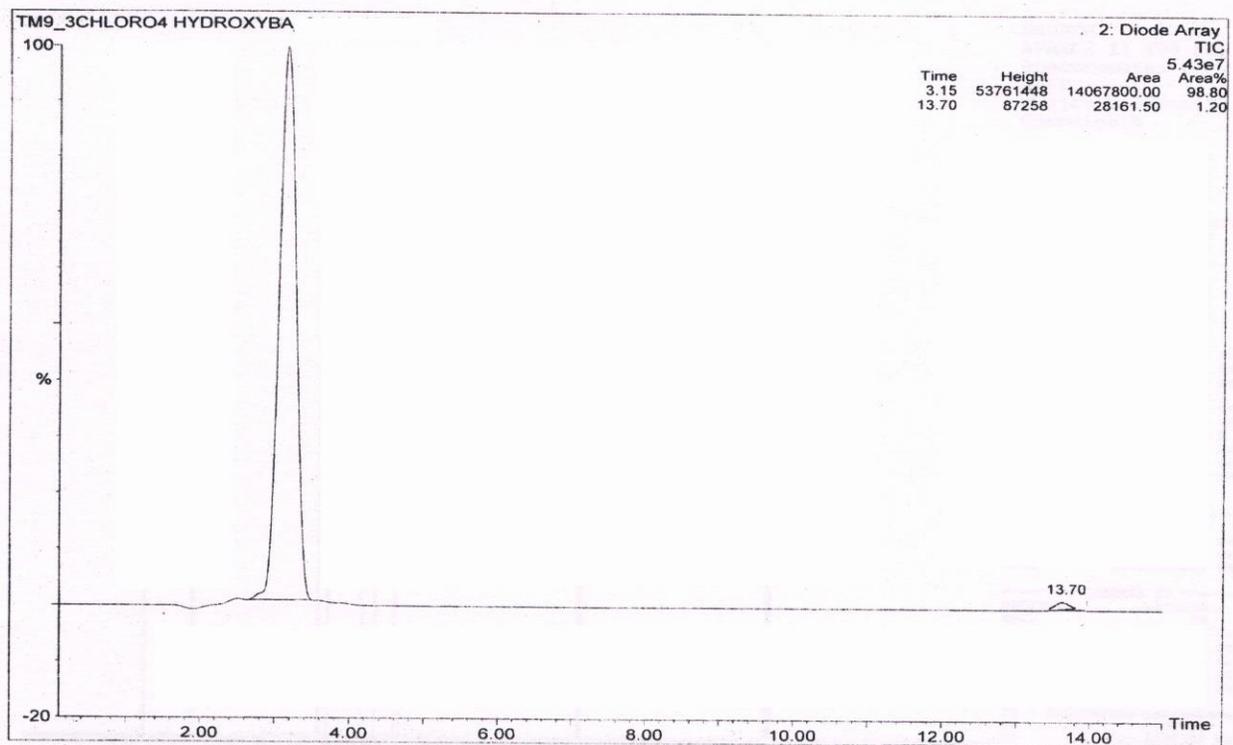


Figure 10. HPLC chromatogram and mass spectra of 3-chloro-4-hydroxybenzamide (16)

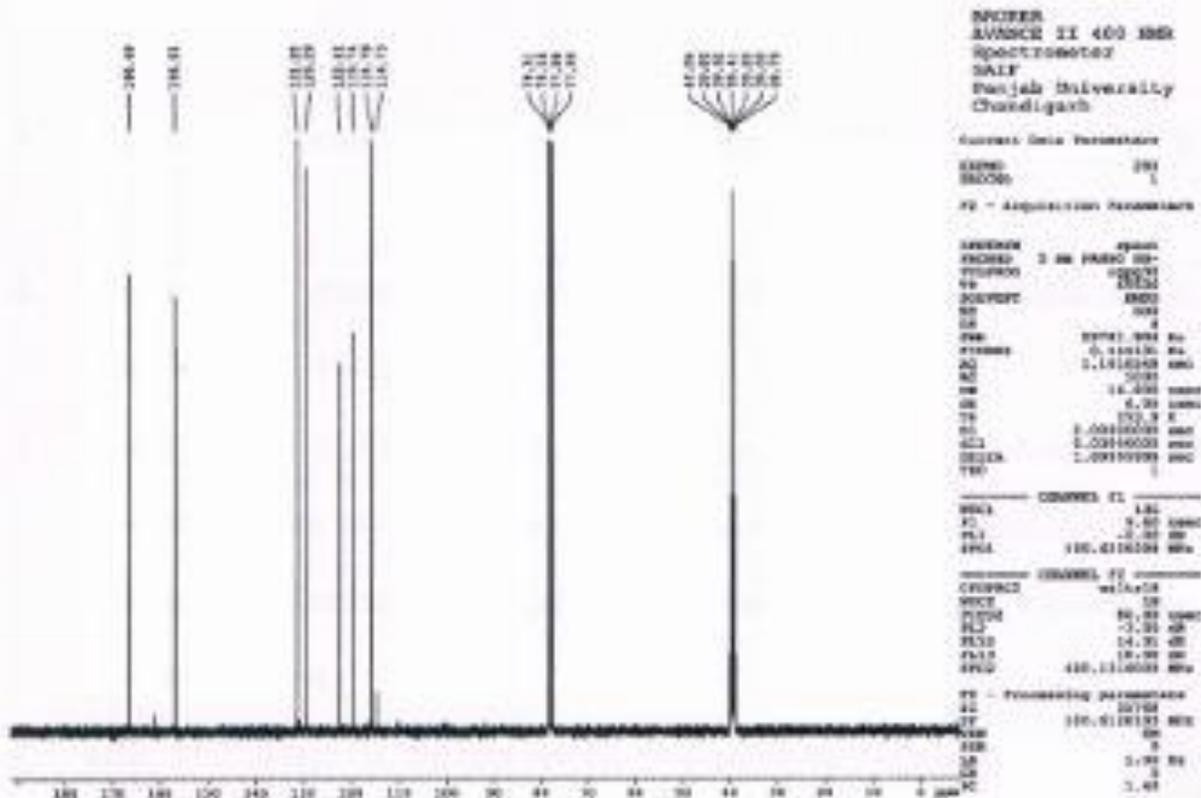


Figure 11. ¹³C-NMR spectra of 3-chloro-4-hydroxybenzonitrile (16)

III. CONCLUSION

In conclusion, we have developed a practical method using sodium chlorate as an alternative to sodium periodate, sodium perborate and hydrogen peroxide in the oxidative chlorination of arenes using HCl in aqueous medium. The advantages of this method involves no use of organic solvent, mild reaction conditions and good yield of chlorinated product.

SPECTROSCOPIC DATA OF SOME CHLORINATED AROMATIC COMPOUNDS

2,4-Dichloroacetanilide (1): White needles; ¹H NMR (400 MHz, CDCl₃) δ 2.23 (s, 3H, CH₃), δ 7.36 (d, j = 2.36 Hz, 1H, Ar), δ 7.23 (dd, j = 8.88, 2.36 Hz, 1H, Ar), δ 7.64 (brs, 1H, NH), δ 8.30 (d, j = 8.88 Hz, 1H, Ar) ppm; ¹³C NMR (100 MHz, DMSO): 168.75, 133.76, 129.07, 128.49, 126.89, 126.20, 125.80, 23.39 ppm; MS: calcd. for C₈H₇Cl₂NO [M]⁺ 204.26, found 203.0 [M-1]⁺.

4-Bromo-2-chloroacetanilide (2): White needles; ¹H NMR (400 MHz, CDCl₃) δ 2.23 (s, 3H, CH₃), δ 7.51 (d, j = 2.20 Hz, 1H, Ar), δ 7.39 (dd, j = 8.84, 2.20 Hz, 1H, Ar), δ 7.59 (brs, 1H, NH), δ 8.27 (d, j = 8.84 Hz, 1H, Ar) ppm; MS: calcd. for C₈H₇BrClNO [M]⁺ 249, found 250 [M+1]⁺.

2-Chloro-4-nitroacetanilide (4): Yellow powder; ¹H NMR (400 MHz, CDCl₃) δ 2.24 (s, 3H, CH₃), δ 8.68 (d, j = 9.24 Hz, 1H, Ar), δ 8.29 (d, j = 2.56 Hz, 1H, Ar), δ 8.16 (dd, j = 9.24, 2.56

Hz, 1H, Ar), δ 7.91 (brs, 1H, NH) ppm; MS: calcd. For C₈H₇ClN₂O₃ [M]⁺ 214.61, found 216.8 [M+2]⁺.

3-Chloro-4-hydroxybenzaldehyde (5): Light brown powder; ¹H NMR (400 MHz, DMSO) δ 9.78 (s, 1H, CHO), δ 7.81 (d, j = 1.80 Hz, 1H, Ar), δ 7.64 (dd, j = 8.40, 1.80 Hz, 1H, Ar), δ 7.12 (d, j = 8.32 Hz, 1H, Ar) ppm; MS: calcd. For C₇H₅ClO₂ [M]⁺ 156.5, found 155 [M-1]⁺.

5-Chlorosalicylic acid (6): White crystals; ¹H NMR (400 MHz, DMSO) δ 9.05 (s, 1H, OH), δ 7.79 (d, j = 2.52 Hz, 1H, Ar), δ 7.38 (dd, j = 8.80, 2.52 Hz, 1H, Ar), δ 6.91 (d, j = 8.88 Hz, 1H, Ar) ppm; MS: calcd. for C₇H₅ClO₃ [M]⁺ 172, found 171.

3,5-Dichlorosalicylic acid (7): White crystals; ¹H NMR (400 MHz, DMSO) δ 7.90 (d, j = 2.40 Hz, 1H, Ar), δ 7.79 (d, j = 2.40 Hz, 1H, Ar), ppm; MS: calcd. for C₇H₄Cl₂O₃ [M]⁺ 207.01, found 206 [M-1]⁺.

4-Chloro-2-nitroaniline (8): Yellow Orange powder; ¹H NMR (400 MHz, DMSO) δ 7.90 (d, j = 2.42 Hz, 1H, Ar), δ 7.28 (dd, j = 9.20, 2.24 Hz, 1H, Ar), δ 7.06 (d, j = 9.22 Hz, 1H, Ar) δ 7.55 (bs, 1H, NH₂) ppm; MS (APCI): calcd. for C₆H₅ClN₂O₂ [M]⁺ 172.57, found 172 [M]⁺.

2-Chloro-4-nitroaniline (9): Yellow powder; ¹H NMR (400 MHz, DMSO) δ 7.78 (d, j = 2.56 Hz, 1H, Ar), δ 7.65 (dd, j = 9.24, 2.56 Hz, 1H, Ar), δ 7.60 (d, j = 9.20 Hz, 1H, Ar) δ 3.85 (bs, 2H, NH₂) ppm; MS (APCI): calcd. for C₆H₅ClN₂O₂ [M]⁺ 172.57, found 172 [M]⁺.

4-Chloro-2-nitrophenol (10): Yellow needles; ¹H NMR (400 MHz, CDCl₃) δ 8.28 (d, j = 9.20, 1H, Ar), δ 7.86 (dd, j = 9.34, 2.44, 1H, Ar), δ 7.20 (d, j = 2.42, 1H, Ar) δ 10.82 (s, 1H, OH) ppm; MS (APCI): calcd. for C₆H₄ClNO₂ [M]⁺ 173.56, found 173 [M]⁺.

4-Chlorobenzanilide (12): White powder; ¹H NMR (400 MHz, CDCl₃) δ 7.26-7.81 (m, 9H, Ar), ppm; MS (APCI): calcd. for C₁₃H₁₀ClNO [M]⁺ 231, found 232 [M+1]⁺.

5-Chlorosalicylaldehyde (13): White powder; ¹H NMR (400 MHz, CDCl₃) δ 9.80 (s, 1H, CHO), δ 10.80 (s, 1H, OH), δ 6.90 (d, j = 8.84, 1H, Ar) δ 7.38 (dd, j = 8.84, 2.42, 1H, Ar) δ 7.48 (d, j = 2.42, 1H, Ar) ppm; MS (APCI): calcd. for C₇H₅ClO₂ [M]⁺ 156.56, found 156 [M]⁺.

3,5-Dichloro-4-hydroxybenzoic acid (15): White needles; ¹H NMR (400 MHz, DMSO) δ 11. (s, 1H, OH), δ 7.85 (s, 2H, Ar), ppm; MS: calcd. for C₇H₄Cl₂O₃ [M]⁺ 207.01, found 206 [M-1]⁺.

3-Chloro-4-hydroxybenzoxazole (16). White needles; ¹H NMR (400 MHz, DMSO) δ 7.12. (d, j = 8.48 Hz, 1H, Ar), δ 7.77 (dd, j = 8.44, 1.92 Hz, 1H, Ar), δ 7.95 (d, j = 1.88 Hz, 1H, Ar) ppm; ¹³C NMR (100 MHz, DMSO): 166.49, 156.91, 131.25, 129.29, 122.41, 119.74, 115.79 ppm; MS: calcd. for C₇H₄ClNO [M]⁺ 153.56, found 153.

3,5-Dichloro-4-hydroxybenzoxazole (17): White needles; ¹H NMR (400 MHz, DMSO) δ 7.91 (s, 2H, Ar), ppm; MS: calcd. for C₇H₃Cl₂NO [M]⁺ 187, found 187 [M]⁺.

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NH₄Br – Br₂ Catalysed Oxidative Bromination of Aromatic Compounds

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Abstract- A facile, efficient, simple, environmentally safe, regioselective, controllable and economical method for the oxybromination of aromatic compounds using NH₄Br-Br₂ system. The electrophilic substitution of bromine generated in situ from NH₄Br as a bromine source and molecular bromine as an oxidant.

Index Terms- Halogenation, Oxidative bromination, Molecular bromine, Aqueous medium.

I. INTRODUCTION

Previous studies of organic transformation shows, organic ammonium bromides are becoming a small yet important group of reagents. Because of their ease of formation, mildness, immense versatility, these reagents have become quite popular and a number of reports are available discussing the importance of these reagents in various types of transformations. The effects of pH, electrolyte, and surface preparation on the surface excess and adsorption kinetics are reported. At all other concentrations and even at the Critical Surface Aggregation Concentration when electrolyte is present, the adsorption is complete within minutes. Halogenated organic compounds form an important class of intermediates as they can be converted efficiently into other functionality by simple chemical transformations. The manufacture of a range of bulk and fine chemicals including flame retardants, disinfectants and antibacterial and antiviral drugs, involve bromination. Bromoaromatics are widely used as intermediates in the manufacture of pharmaceuticals, agrochemicals and other speciality chemical products. Selective bromination of aromatic compounds is investigated in view of the importance of the brominated compounds in organic synthesis. Consequently, a variety of methods for the bromination of aromatics have been reported in the literature. Brominated aromatic compounds are widely used as building blocks for pharmaceuticals, and other specialty chemicals. Most of the aromatic compounds are poorly soluble in water, and this has been a major limitation in the preparation of industrially-important brominated compounds under aqueous conditions. Classical nuclear bromination of aromatic compounds involves the use of: (a) Bromine; (b) A catalyst like FeCl₃, FeBr₃, iodine, thallium acetate etc; (c) Absence of light, often yielding undesired Co-products. The direct bromination of an aromatic system presents an environmental problem in large-scale operations. Besides, the bromination is wasteful as one half ends up as hydrogen bromide and this renders the process more expensive. Oxybromination using HBr is highly toxic and

corrosive and is as harmful as molecular bromine to the environment.

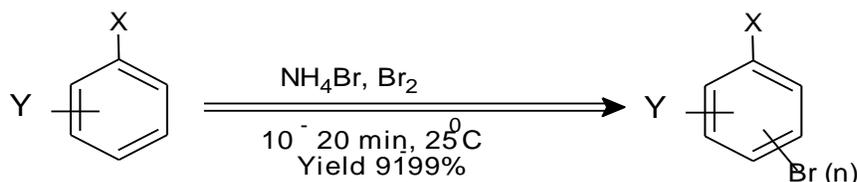
Cherchelli et al. studied the bromination of anilines in aqueous suspension of 1-hexadecylpyridinium tribromide (CPyBr₃). The drawbacks include an additional step for the formation of tribromide reagent prior to bromination, complex workup procedure in which brominated product was extracted using diethyl ether and that molecular bromine is required for the preparation of tribromide. Currie et al. have performed the bromination of phenols and anilines in a dodecyltrimethylammonium bromide (DTAB) based microemulsion. The process uses excess amount of hazardous HNO₃ and volatile halogenated organic solvent (CH₂Cl₂). Firouzabadi et al. have disclosed a double catalytic system for the bromination of phenol derivatives using Br₂/Cetyltrimethylammonium bromide (CTAB)/Tungstophosphoric acid cesium salt (Cs_{2.5}H_{0.5}PW₁₂O₄₀) reagent system. The drawbacks are the use of excess amount of reagent (Br₂: substrate, 1.1:1 for mono- and 2.2:1 for dibromination) and expensive tungstophoric acid cesium salt. Also, filtration and evaporation of the excess amount of halogenated volatile organic solvent is cumbersome during large scale operations.

The reported methods on bromination of aromatic compounds in water are rare and limited to only few examples such as NaBr-H₂O₂/scCO₂ biphasic system and H₂O₂-HBr/“on water” system, albeit low conversions, high temperature (40 °C) and a very long reaction time (from 8 h to 28 h) are some of the concomitant shortcomings. There are also some other reagents that have been developed as a substitute for Br₂, including, but not limited to, N-bromosuccinimide/1-butyl-3-methylimidazolium bromide, ZrBr₄/diazene, [K. 18-crown-6]Br₃, 1-butyl-3-methylpyridinium tribromide [BMPy]Br₃, 3-methylimidazolium tribromide [Hmim]Br₃, 1-butyl-3-methylimidazolium tribromide [Bmim]Br₃, pentylpyridinium tribromide, ethylene bis(N-methylimidazolium) ditribromide. However, no such reagent is commercialized to date, because of their expensive nature, poor recovery and recycling of spent reagent, disposal of large amounts of HBr waste and that the reagents are also not so stable and weaken during long periods of storage, hence they are meant only for laboratory-scale preparations with limited applications. Preparation of all these reagents involve liquid bromine at some stage, thereby, increases the cost of the end-product. All the above reported methods suffer from using not easily available compounds and others use highly-corrosive or expensive reagents and toxic organic solvents. Examples are: Br₂/Ag₂SO₄, Br₂/SbF₃/HF, Br₂/SO₂Cl₂/Zeolite, Br₂/Zeolite, Br₂/H₂O₂, Br₂/H₂O₂/Layered

Double Hydroxide-WO₄, Br₂/tetrabutylammonium peroxydisulphate etc. Therefore, the bromination reaction has been still attracting attention to develop the more practical method suitable for industrial-scale synthesis. These observations enhance the versatility of bromine as an inexpensive, readily

available starting material. A wide range of solvents have been employed in these reaction including, carbon tetrachloride, hexane, methanol, acetonitrile, and acetic acid.

Scheme 1. Ammonium bromide catalyzed oxybromination of aromatic compounds in water using molecular Br₂



X = OH, NH₂, NHCOMe, NHCOPh, CHO, COOH

Y = H, OH, NO₂, SO₂, NH₂

II. OBJECTIVE

In the face of demands for sustainable and ecologically-friendly organic synthesis, clean organic reaction processes which do not use harmful organic solvents are encouraged and are in great demand today. The direct bromination of aromatic compounds with molecular bromine in solution often results in polybromination, and when brominated in the presence of oxidants, they also get oxidized rather than undergoing substitution. Although bromination of aromatic compounds by elemental bromine is a well-known organic reaction, bromination using elemental bromine usually results in a complex mixture of mono-, di-, tri-, and even tetra-brominated products. Hence to date, there has been no simple, inexpensive, instant, easily available, and high yield method developed that can be commercialized for the said purpose. A variety of new bromination techniques have been employed along with the conventional reagent "bromine" to increase the efficiency and selectivity. Still, the use of toxic and expensive reagents, catalysts, VOSs, low yields and discharge of corroding HBr waste circumvent these processes from industrial application. Oxybromination, on the other hand, can be a good alternative. yet these reactions require a great excess of the reagents, strongly acidic conditions, expensive dangerous pollutant to the environment. Alternative analogues of bromine such as organic tribromides and various tribromide-ionic liquids have also been used for the bromination of aromatic compounds. Nevertheless, these brominating agents are saddled with various drawback including their low atom economy, disposal of toxic and corrosive HBr byproduct waste, poor recycling of spent reagent, and the molecular bromine required for their preparation. Hence, to eliminate a two-step bromination wherein these reagents are first prepared using molecular bromine prior to bromination of aromatic compounds, we have effectively utilized molecular bromine at the first place along with an environmental-friendly reagent NH₄Br for an instant and facile bromination for industrially important compounds. Due to the above reasons, molecular bromine is still a target alternative for industrial

chemists to develop an environmental-friendly brominating system which works under ambient conditions, keeping this in mind, we find an aq NH₄Br-Br₂ system to be a better alternative.

III. EXPERIMENTAL SECTION

Materials and Methods

Analytical reagent grade starting material and reagents were obtained from commercial suppliers and were used without further purification. Granular and scaly substrates were grinded in mortar and converted into fine powder prior to reactions. Doubly distilled water was used all through the study. HPLC analyses were conducted using waters 2695 instrument with PDA detector, column C₁₈ (250 mm x 4.6 mm x 5 μ), solvent system 70% CH₃OH + 30% H₂O, flow rate 1 ml/min. HPL purity is reported by area%. NMR spectra were obtained in DMSO and CDCl₃ on a Bruker Avance II 400 NMR spectrometer, the chemical shifts were reported in δ ppm, ¹H NMR (relative to TMS referenced as 0.00 ppm) and ¹³C NMR (relative to DMSO referenced as 39.50 ppm). GC/MS analyses were carried out using Agilent GC (Model 5893) with Chemstation software; column-HP5-MS, 30 m x 0.25 mm x 0.25 micron; detector temp-30°C; injection volume- 1 microliter of 5% solution in methanol. Mass spectre were recorded on Micromass Quattro Micro API triple quadrupole MS equipped with a standard APCI ion source. IR spectra were recorded on a shimadzu prestize 21 FT-IR Spectrometer (KBr, 3500-440 cm⁻¹). The yields were calculated by weight.

Typical procedure for the synthesis of 3,5-Dibromosalicylic acid (1)

To a mixture of salicylic acid (1.38g, 10 mL SLS micellar solution at its CMC (8.1 X 10⁻³ M) was added bromine (3.2 g, 20 mmol) utilizing a pressure-equalizing funnel and the resulting mixture was stirred at room temperature. The bromine colour disappeared at once and white thick precipitates of 3,5-dibromosalicylic acid were obtained within 5 min (monitored by TLC) of reaction time at 25°C. After 15 min, the precipitated

reaction mass was separated from mother liquor by vacuum filtration and then washed with Na₂S₂O₅ solution (10%, 10 ml x 3) and dried in oven at 100°C to get white crystalline powder of 3,5-dibromosalicylic acid. The total isolated yield was 2.902 g (98.06%) with an HPLC purity of 99.3%. The characteristic data recorded for the isolated product were mp 226-229°C (lit.⁴¹225-229°C); ¹H NMR (400 MHz, DMSO): δ7.79 (d, 1H, J=2.4 Hz, ArH), 7.94(d, 1H, J=2.4 Hz, ArH), 10.36 (s, 1H, OH), 12.04 (s, 1H, COOH); ¹³C NMR (100 MHz, DMSO): 170.65, 157.20, 139.67, 131.54, 115.01, 111.29, 109.71; IR(KBr): 3215, 3092, 3057, 2839, 2583, 2519, 1663, 1595, 1452, 1425, 1385, 1300, 1229, 1180, 1130, 876, 789, 714, 681, 658, 600, 552, 471 cm⁻¹; MS m/z calcd. for C₇H₄Br₂O₃: 295.9, FOUND 295.

Recycling of HBr

Molecular bromine carries significant industrial advantages, including low price, low favourable E-factors¹⁴ and high productivity. This last factor (the amount of substance produced per unit reactor volume per unit time) which is often ignored in laboratory studies, is crucial in all large-scale processing. As these advantages of Br₂ cannot be matched by other bromine sources. Viable industrial oxybromination reagents must feature alternative benefits. The aqueous filtrate obtained after the separation of bromination product was neutralized by adding

Ca(OH)₂ (0.7409 g, 10 mmol). Initially, the pH of the aqueous filtrate was <3. When Ca(OH)₂ was added in small lots to the aqueous filtrate, the Br₂⁻ of HBr was transformed into CaBr₂ (at Ph 7). After the separation of CLS (22.6 mg), the aqueous mixture thus obtained containing CaBr₂ was concentrated to precipitate CaBr₂ (1.997 g) as a crystalline solid.

IV. RESULTS AND DISCUSSION

Our initial exploratory studies probed the best reaction conditions and for that we choose salicylic acid (10 mmol) as a typical compound which was first reacted with molecular bromine (20 mmol) in CH₃CN (10 ML) at room temperature for 50 minutes. Workup of the reaction resulted under-brominated off-white 3,5-dibromosalicylic acid (3,5-DBSA) which melts over a range 190-221 °C (Table 1, entry 1). Other solvents such as CH₃COOH, CH₃OH, CAN, H₂O and CH₂Cl₂ were also tested but the results were unsatisfactory, yielding 3,5-dibromosalicylic acid in lower yields with low melting points where the crude product is contaminated by significant quantities of impurities particularly the monobrominated salicylic acid or decarboxylated brominated phenol.

Table 1. Optimization of reaction conditions for the bromination of salicylic acid (10 mmol) using molecular bromine (20 mmol) to afford 3,5-dibromosalicylic acid.

Entry	Reagent System	Reaction Condition	Yield (%) ^a	Mp/°C(lit. 225-229°C)	Appearance
1.	Br ₂ /CH ₃ CN ^b	50 min at rt	87	190-221	Off-white granular powder
2.	Br ₂ /CH ₃ CN/H ₂ O ^c	60 min at rt	89	200-220	Off-white powder
3.	Br ₂ /CH ₃ CN/NH ₄ Br/H ₂ O ^d	25 min at rt	94	221-228	White crystals
4.	Br ₂ /NH ₄ Br/H ₂ O ^e	20 min at rt	92	221-223	White crystals
5.	Br ₂ /NH ₄ Br/H ₂ O ^f	15 min at rt	96	226-229	White-shining crystals
6.	Br ₂ /H ₂ O ^g	65 min at rt	83 ^h	190-200	Off-white granules

^aYield of isolated end-product

^bReaction conditions: CH₃CN 10 ml

^cReaction conditions: CH₃CN 10 ml, H₂O 5 ml

^dReaction conditions: NH₄Br 5 mg, CH₃CN 10 ML, H₂O 5 ml

^eReaction conditions: NH₄Br 5 mg, H₂O 10 ml

^fReaction conditions: NH₄Br 23mg, H₂O 10 ml

^gReaction conditions: H₂O 10 ml

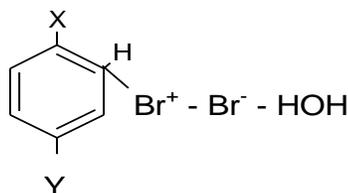
^hUnderbrominated product was obtained.

Then we carried out the above reaction in CH₃CN-H₂O mixture (2/1 by volume) under same reaction conditions. The results show that 3,5-DBSA was synthesized in fair yield but the mixture, color and melting point of the product were not within the required standards (the melting point should be >225 °C and appearance should be white-crystalline as per international standards). The presence of water during the reaction dramatically affects the solubility of the desired 3,5-DBSA, causing it to precipitate immediately upon formation. Next, we performed the bromination of salicylic acid (10 mmol) with molecular Br₂ (20 mmol) in CH₃CN (10 ml) by adding aqueous solution of NH₄Br (5 mg in 5 ml water) into the reaction media at

room temperature. This reaction proceeded well and the bromine color disappeared immediately resulting an instantaneous synthesis of 3,5-DBSA within 25 min of reaction time. The product was obtained in 94% yield with a melting point 221-228 °C. This reaction has cleared that the reactivity of bromine can be enhanced in aqueous reaction media. Then we decided to run the above reaction in the absence of CH₃CN under the same conditions. The workup yielded the product in almost same yield (89%) but the melting point was slightly depressed (Table 1, entry 4). We observed an immediate disappearance of reddish-brown color in the flask and whole of the bromine get consumed within 2-3 minutes of stirring indicating that an instant interaction between the bromine and aromatic substrate has

occurred in the aqueous catalytic system. White-shining crystalline powder of 3,5-DBSA was obtained in 96% yield (HPLC purity was 98.3%) having melting point 226-229 °C (Table 1, entry 5).

Since we had observed large increase in the ring bromination rate using $\text{NH}_4\text{Br}-\text{Br}_2$ system, we decided to study the behavior of aromatics in order to determine whether the $\text{NH}_4\text{Br}-\text{Br}_2$ system could achieve ring bromination without competition from benzylic bromination. Moreover, electrophilic aromatic bromination which involves the ionization of bromine-ring charge transfer-complex is extremely fast in aqueous media in which the formation of the bromonium ion is strongly assisted by electrophilic solvation of the leaving bromide ion (scheme 3).



Scheme 3. Bromination transition state

It is assumed that molecular bromine oxidizes the Br^- (NH_4Br) to Br^+ , which reacts in the presence of bronsted acid with organic substrate to give brominated compounds.

Effect of nature of ammonium bromide on the yield and melting point of 3,5-DBSA

Table 2 clearly indicates that anionic micelles accelerate the rate of bromination; cationic micelles inhibit bromination while non-ionic micelles show no appreciable effect on the bromination of salicylic acid. Using SLS at its CMC, white-shining crystals of 3,5-DBSA were obtained in 96% yield having melting point 226-229 °C with an HPLC purity of 98.8% that also conform to the required standards of pharmaceutical grade 3,5-DBSA.

Table 2 Effect of nature of ammonium salt used for the bromination of salicylic acid to yield 3,5-dibromosalicylic acid^a

Entry	Parameter	Ammonium bromide	CTAB	Triton X-100 (TX-100)	International standard
1.	Appearance	White-crystalline powder	White-grayish powder	White-powder	White crystal
2.	Melting point (°C)	226-229	200-223	212-225	>225
3.	HPLC purity (%)	98.6	94.9	96.2	99 minimum
4.	Yield (%)	96	83	91	98 maximum

^aReaction conditions: Salicylic acid 10 mmol, Br_2 20 mmol, NH_4Br 23 mg, CTAB 3.35 mg, TX-100 15 mg, water 10 ml, temp 25 ± 1 °C, time 15 min

Cationic micelles produced less-brominated 3,5-DBSA in poor color and yield and the reaction was accompanied with the evolution of bromine fumes which makes the handling of the reaction for the large-scale operation uneasy. Triton X-100, however, improves the color and purity of 3,5-DBSA but the yield and melting point were comparatively low. The higher rate of bromination in anionic as compared with cationic micelles was ascribed to a favorable interaction of the incipient bromonium ion (Br^+) with the anionic sulphate head group and unfavorably with a cationic head group. The slow reaction in CTAB was ascribed to the formation of less reactive tribromide ion as the cationic micelles strongly modify both the $\text{Br}_2/\text{Br}_3^-$ equilibrium towards the formation of tribromide ion. The inhibition of the reaction by cationic micelles in water was explained on the basis that Br_3^- (the only brominating agent assumed to be in the micellar phase) is 5-6 orders of magnitude less reactive than Br_2 and in presence of cationic micelles of CTAB, we can assume that Br_2 is virtually completely in the Br_3^- form.

Effect of amount of ammonium salt on the yield and melting point of 3,5-DBSA

The quantity of ammonium salt plays a key role in the quality of product. The optimum yield (96 %) and the desired melting point (226-229 °C) of 3,5-DBSA are obtained when 23 mg of NH_4Br was employed in the bromination of salicylic acid (10 mmol) using molecular Br_2 (20 mmol) as a brominating agent. At 5 mg and 10 mg of NH_4Br , the yield of 3,5-DBSA were 91 and 93% respectively. If we increase the amount of NH_4Br upto 50 mg and 100 mg, there is no marked effect on the yield, melting point and quality of the product.

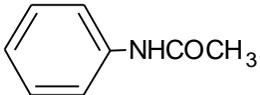
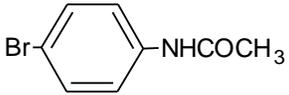
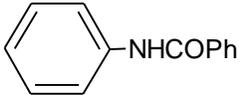
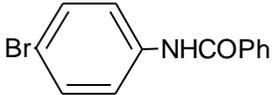
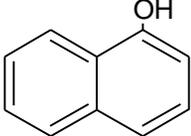
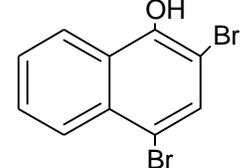
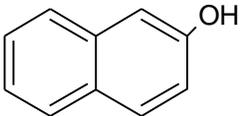
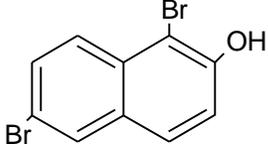
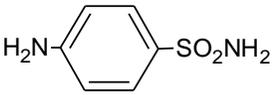
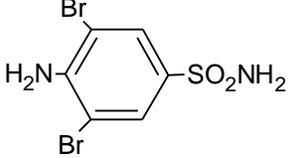
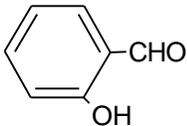
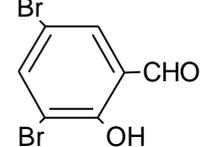
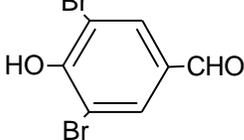
To investigate the scope of present bromination method, we, therefore, applied similar reaction conditions to a variety of phenol and aniline derivatives with strong electron-withdrawing groups such as carboxylic, nitro and formyl as examples of pharmaceutical intermediates (Table 3). The different aromatic substrates brominated may have different solubilization sites in the micellar aggregate as indicated by their log P values. However, in the present system the rate of reaction is very fast and the lipophilicity of aromatic substrate does not play any significant role. The consumption of bromine in the reaction is immediate and most of the reactions are completed within 10-15 min of reaction time followed by the addition of bromine into the

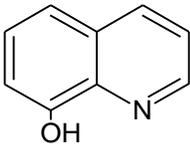
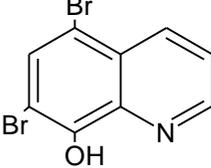
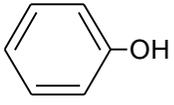
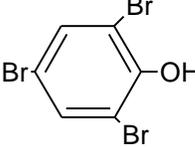
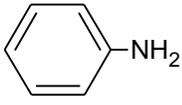
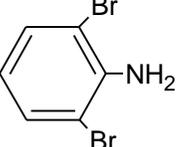
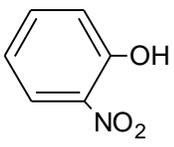
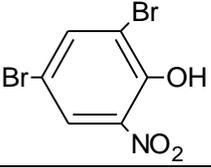
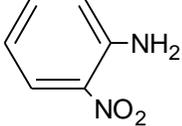
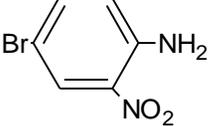
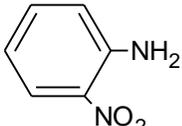
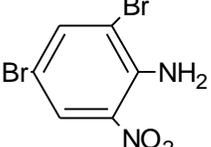
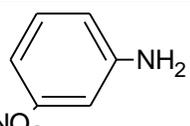
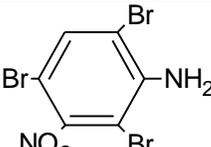
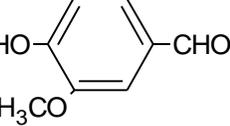
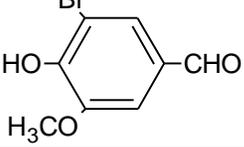
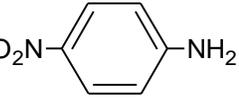
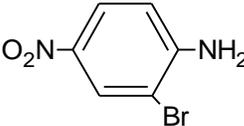
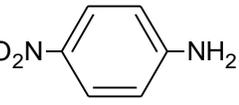
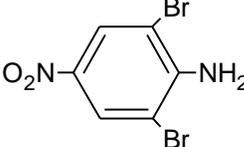
round-bottom flask, affording the brominated products in >99 HPLC purity.

Acetanilide **2** and benzanilide **3** were efficiently brominated to their corresponding para-brominated products in excellent yields. This indicates that the position of the electrophilic attack as well as the number of entering bromine atoms can be regulated by controlling the ratio of Br₂: substrate, i.e. 1:1 for mono-, 2:1 for di- and 3:1 for tribromination of aromatic compounds. Conventional bromination using molecular bromine in organic solvent or concentrated HBr is not very selective and often results in a complex mixture of mono-, di-, tri-, and even tetra-brominated products. 2,4,6-Tribromoaniline (table 3, entry 4), an intermediate for agrochemicals and pharmaceuticals, and 2,4,6-tribromophenol (table 3, entry 9), a reactive flame retardant were obtained in good yields utilizing 3 molar equivalents of molecular Br₂. 1-Naphthol **6** and 2-naphthol **7** proceeded with good reactivity affording clean synthesis of 2,4-dibromo-1-naphthol

(93%) and 1,6-dibromo-2-naphthol(91%) after 15 minutes, respectively. It has been found that sulphanilamide **8** and oxine **9** could also be instantaneously dibrominated affording 3,5-dibromosulphanilamide and 5,7-dibromooxine (a potent antifungal and antiamebic) in yields of 97 and 99%, respectively. Pharmaceutically-important aromatic aldehydes were instantaneously brominated at room temperature in excellent yields (table 3, entries 6, 7 and 15). Another anthelmintic or antibacterial, 2,4-dibromo-6-nitrophenol was obtained in excellent yield within 20 min from 2-nitrophenol (table 3, entry 11). The bromination of 2-nitrophenol is difficult using binary catalytic system (Br₂/CTAB/Cs_{2.5}H_{0.5}PW₁₂O₄₀). The regioselective bromination of anilines containing deactivated groups is not an easy task and in most of the methods, it proceeded under harsh reaction conditions with low yields.

Table 3. Bromination of various aromatics with molecular Br₂ in NH₄Br at room temp.^a

Entry	Substrate	Product	Time/min	Yield (%) ^b	Mp/°C (lit.)
1.			10	98	167(165-169)
2.			25	92	200(200-202)
3.			15	93	105(105-107)
4.			20	95	104(105-107)
5.			20	95	235(235-237)
6.			15	96	80(80-84)
7.			20	90	183(181-185)

8.			15	98	200(198-200)
9.			15	91	92(92-94)
10.			25	93	120(120-121)
11.			20	95	114(116-117)
12.			15	94	108(110-113)
13.			20	97	127(127-130)
14.			20	96	102(100-103)
15.			15	92	166(164-166)
16.			15	90	102(102-104)
17.			20	94	204-208 (206-208)

^aConfirmed by comparison with authentic samples. All reactions were carried out on 10 mmol scale, Br₂ 10 mmol (for mono-), 20 mmol (for di-) and 30 mmol (for tribromination), NH₄Br 23 mg, water 10 mL, temp 25±1 °C

^bYield of isolated pure product

The absence of organic solvent in reaction enabled simple isolation procedure comprised of filtration of solid brominated product and the aqueous liquid mixture thus obtained containing HBr by product was neutralized by adding powdered $\text{Ca}(\text{OH})_2$. Since the present method avoided the use of any expensive brominating agents, organic solvents, strong acids; hazardous

oxidants and metal catalysts, and operates completely in water, it seemed valuable to extend this system for the bromination of other industrially-important compounds. Scaling-up of the reaction should not give any significant problem for the micellar route because of the rapid and facile bromination and easy to handle workup procedure.

Characterization of Representative Brominated Compounds:

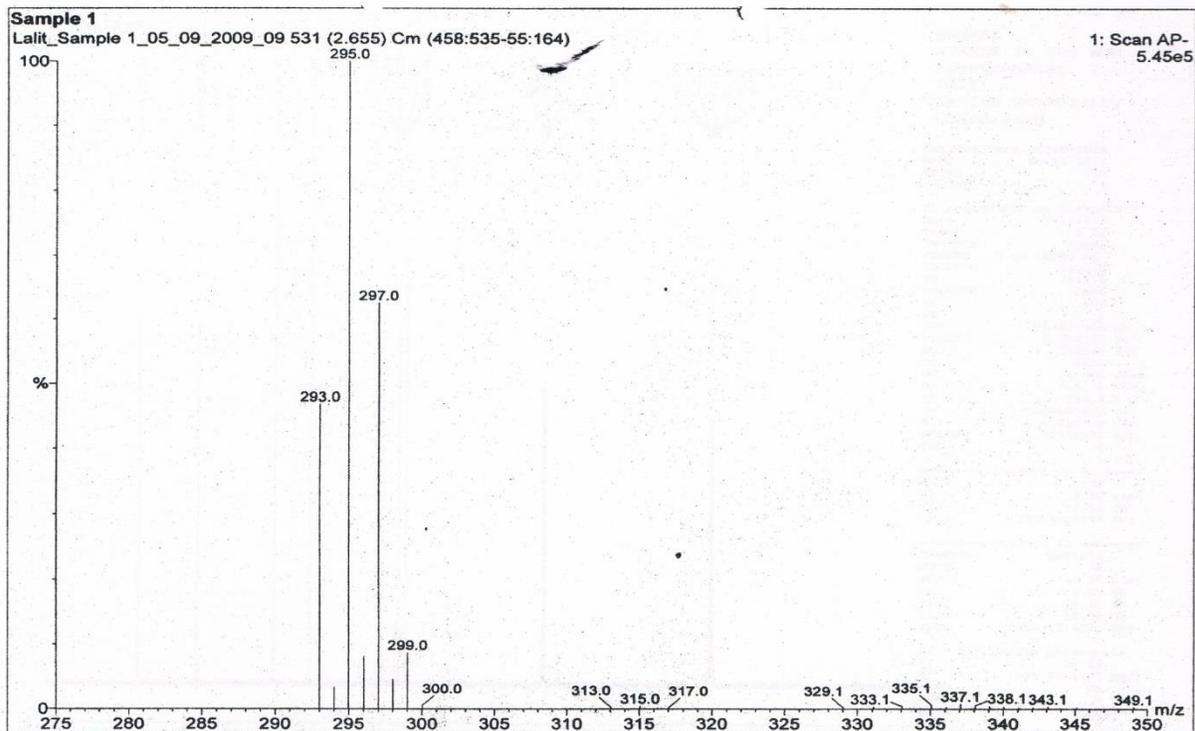
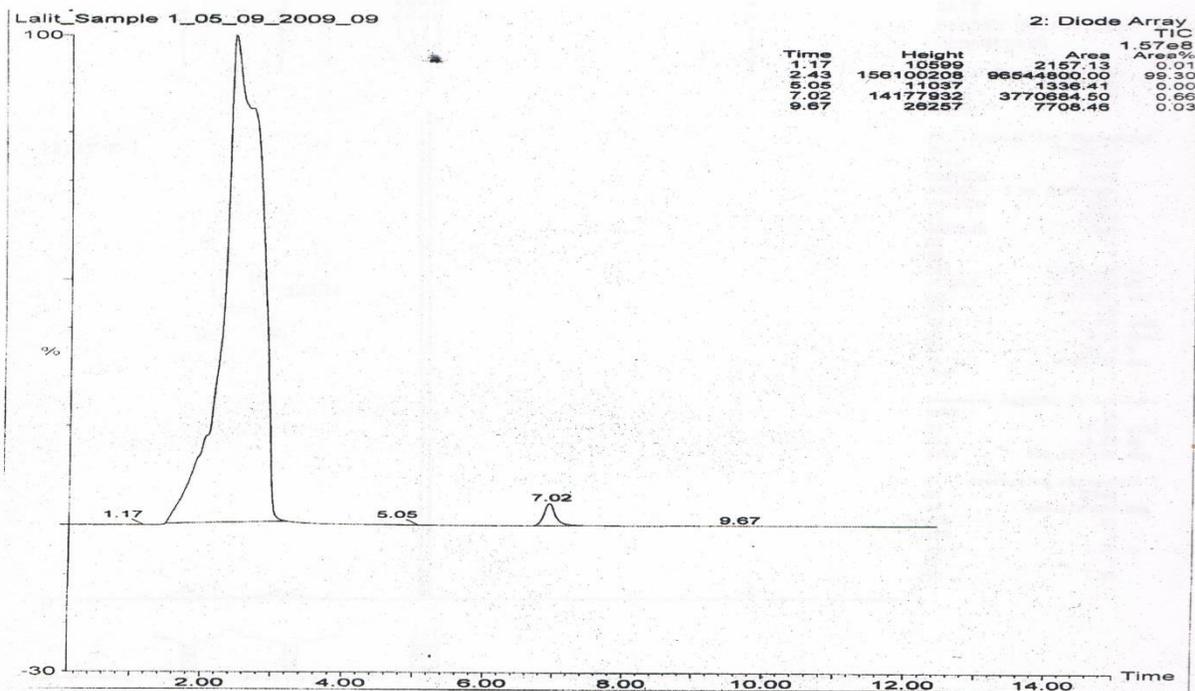


Figure 1. LC-MS of 3,5-dibromosalicylic acid (1)

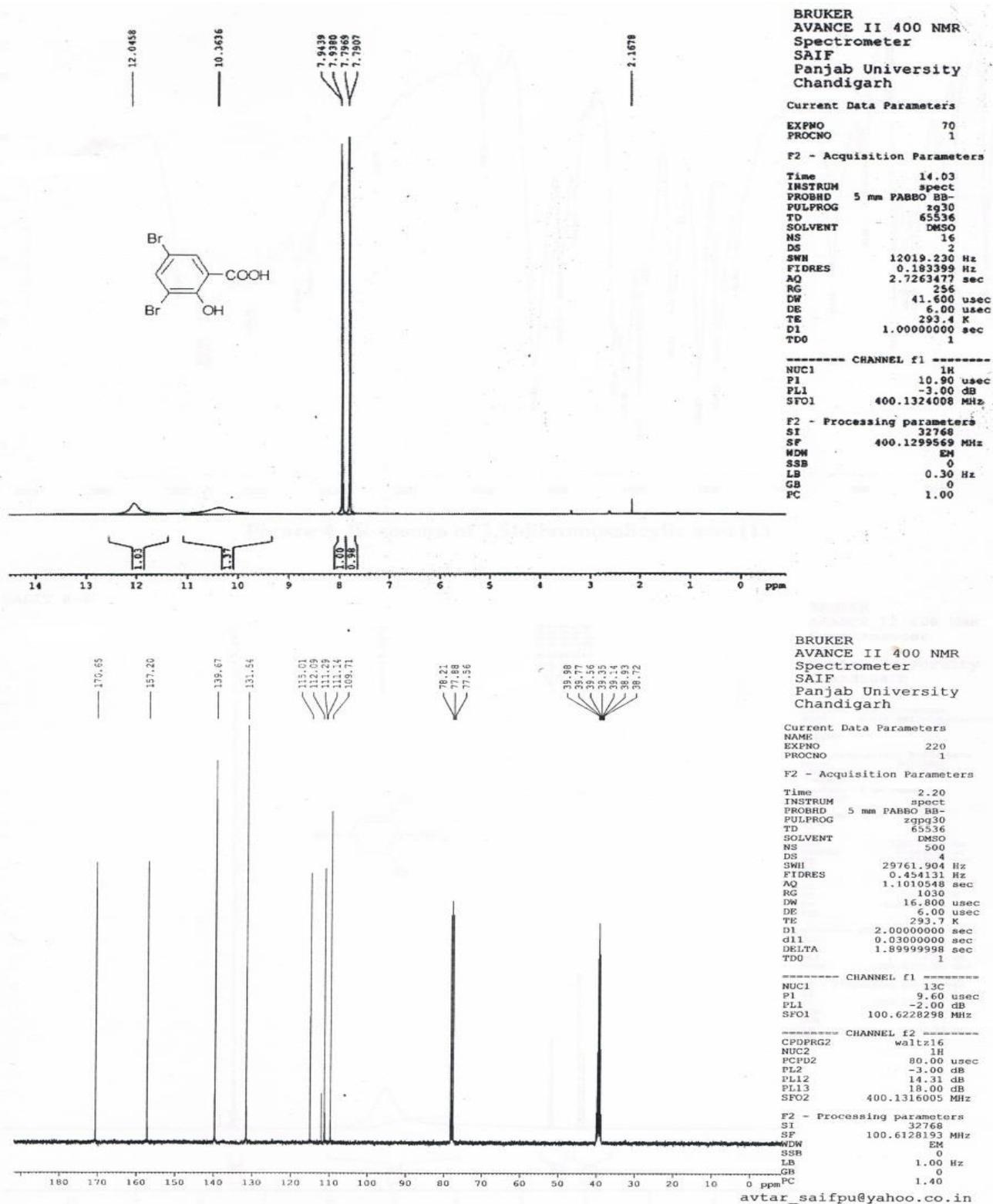


Figure 2. ¹H and ¹³C-NMR spectra of 3,5-dibromosalicylic acid (1)

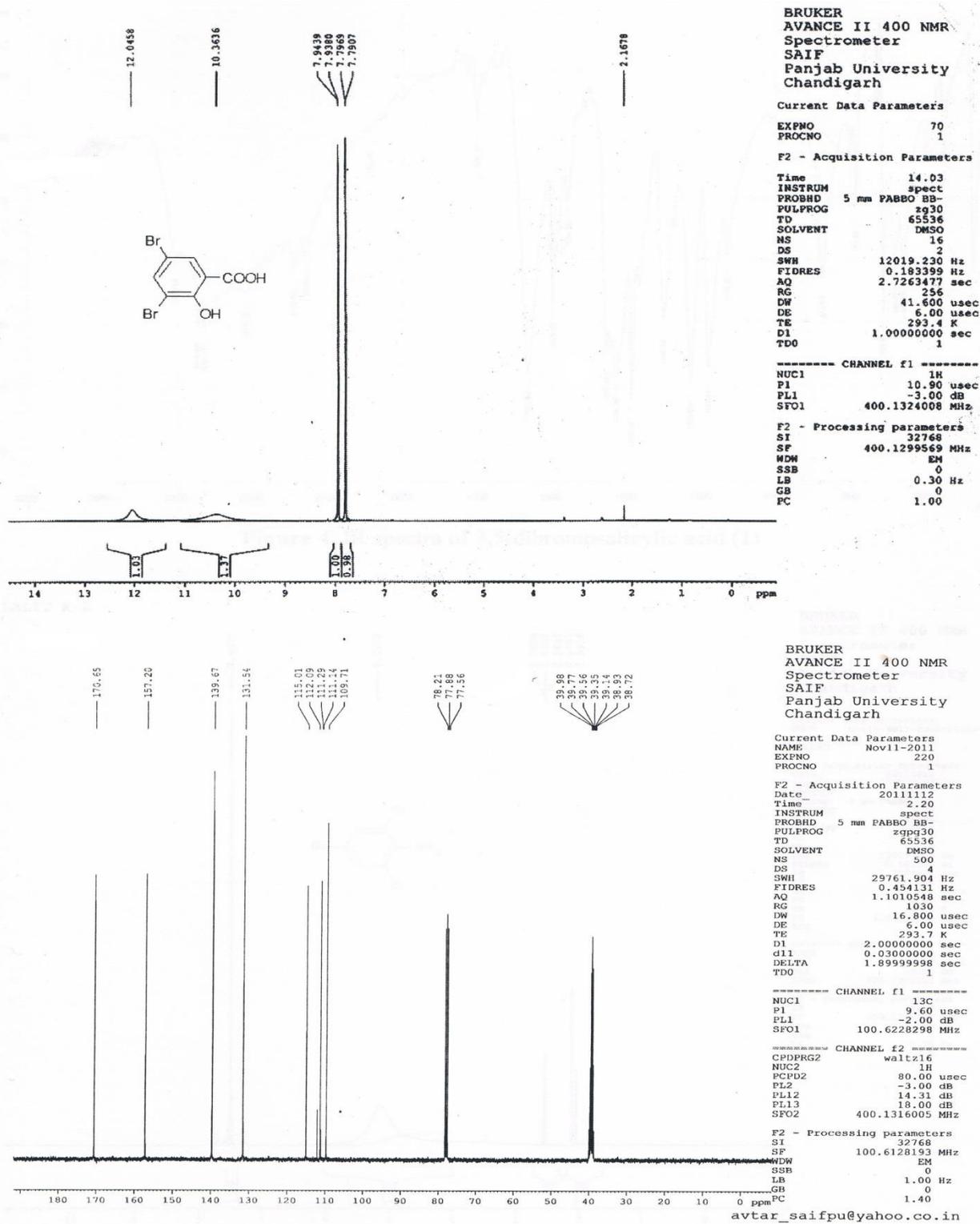


Figure 3. ¹H and ¹³C-NMR spectra of 3,5-dibromosalicylic acid (1)

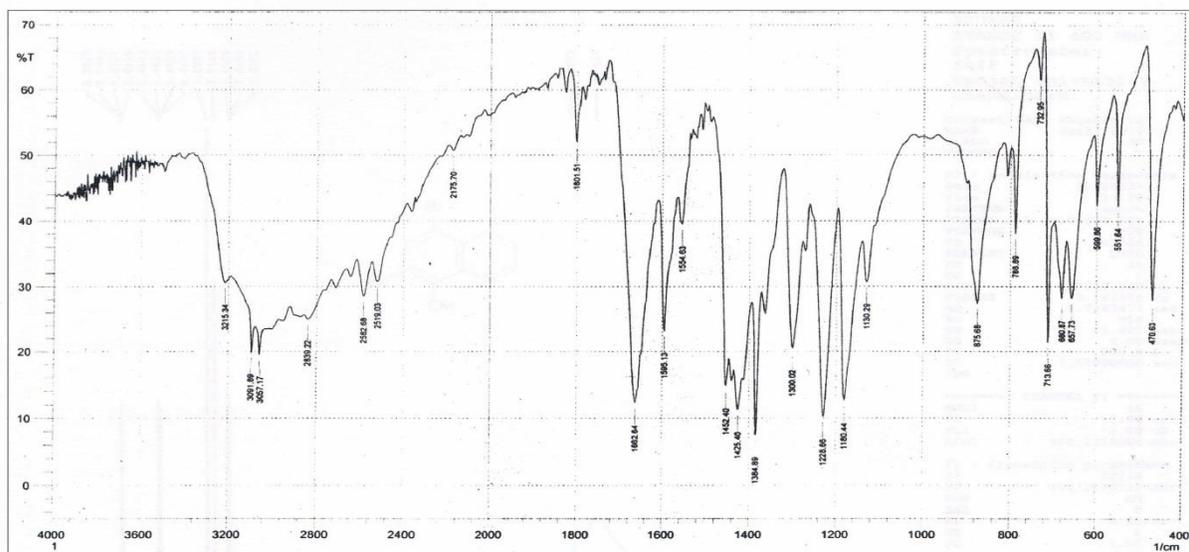


Figure 4. IR spectra of 3,5-dibromosalicylic acid (1)

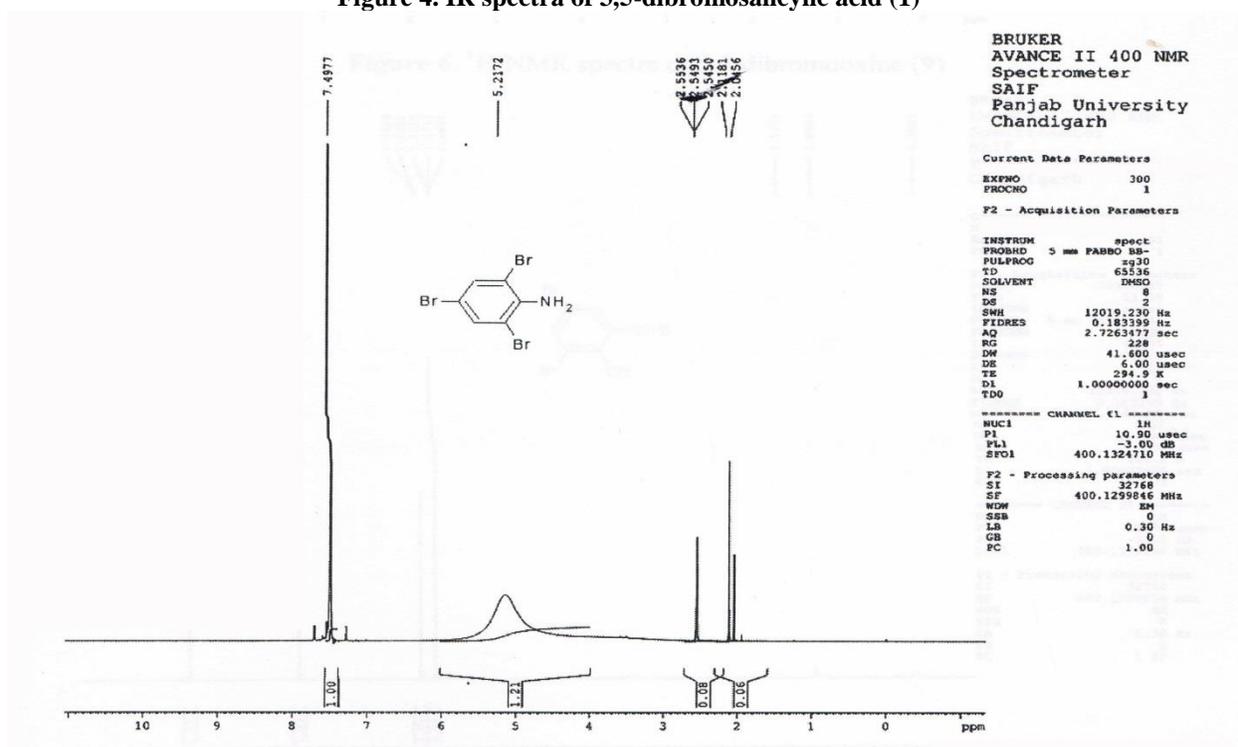


Figure 5. ¹H-NMR spectra of 2,4,6-tribromoaniline (4)

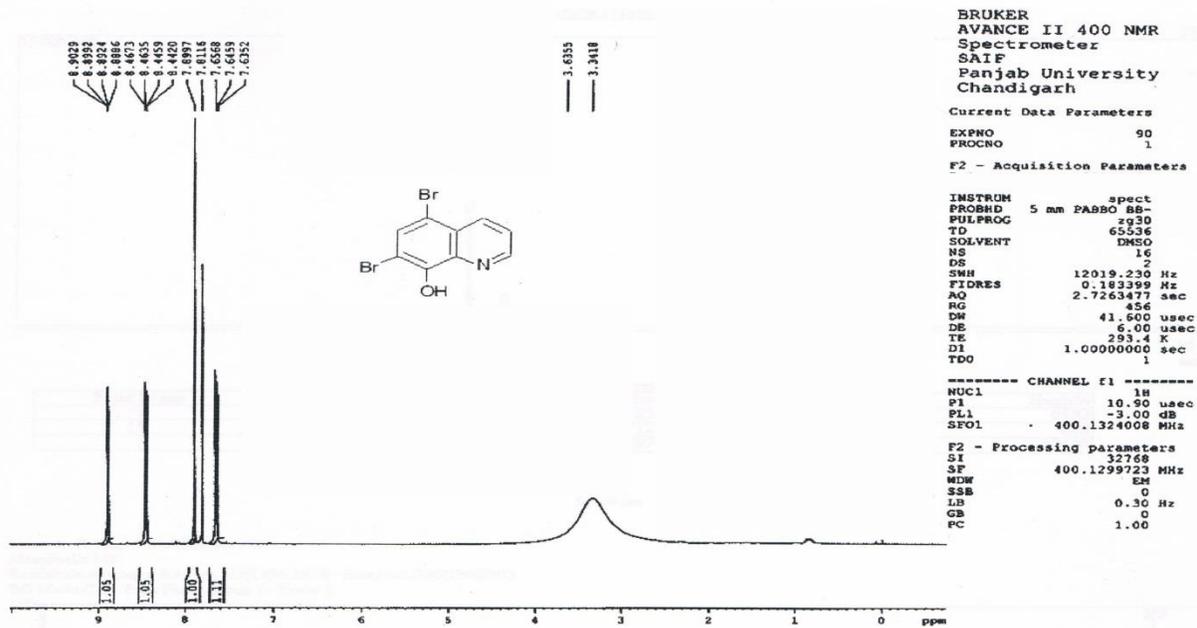


Figure 6. ¹H-NMR spectra of 5,7-dibromooxine (9)

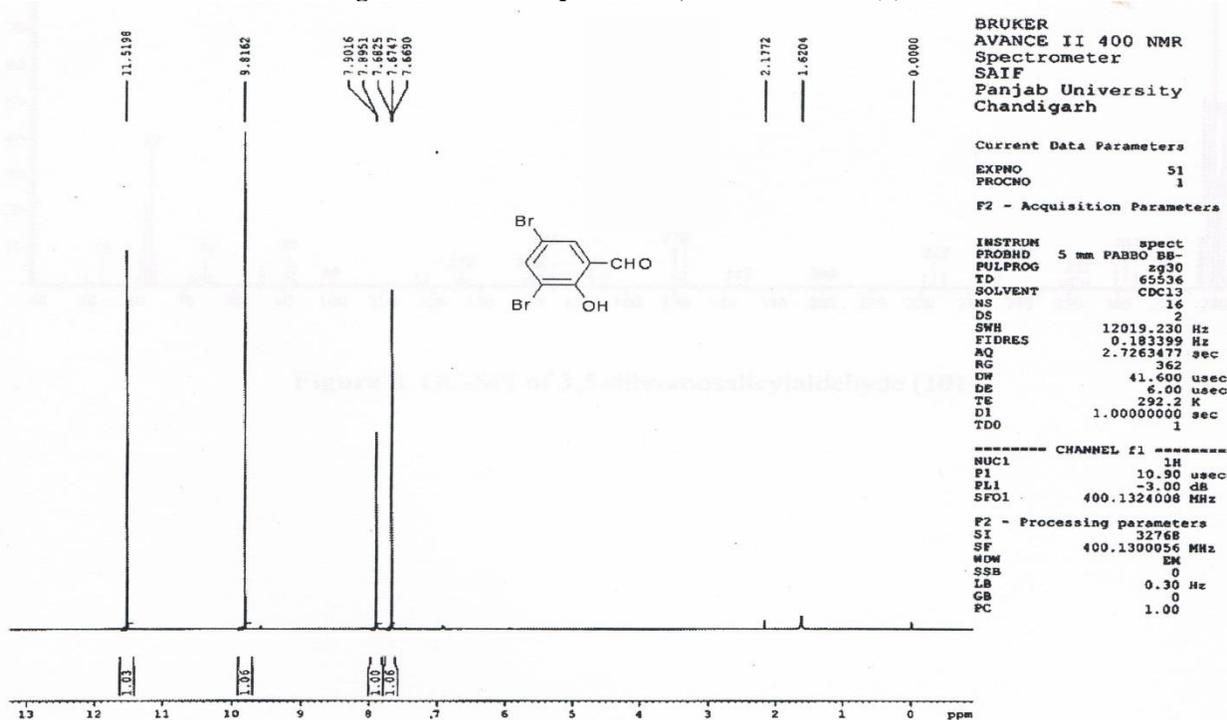
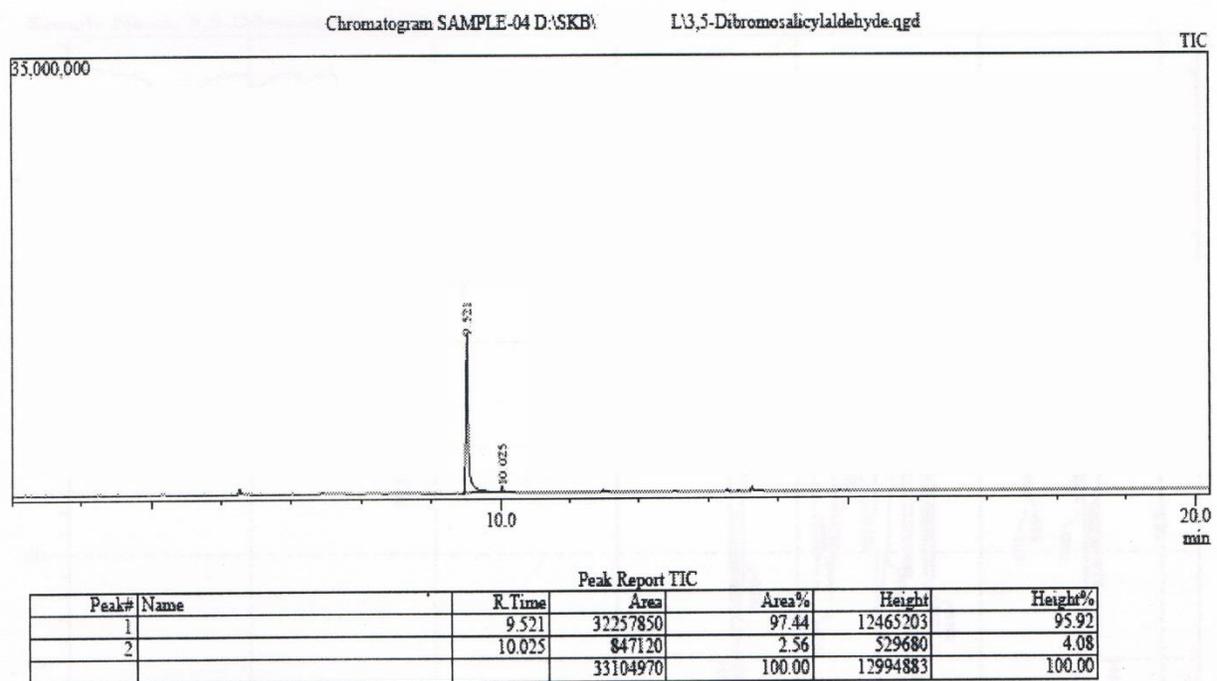


Figure 7. ¹H-NMR spectra of 3,5-dibromosalicylaldehyde (10)



Spectrum

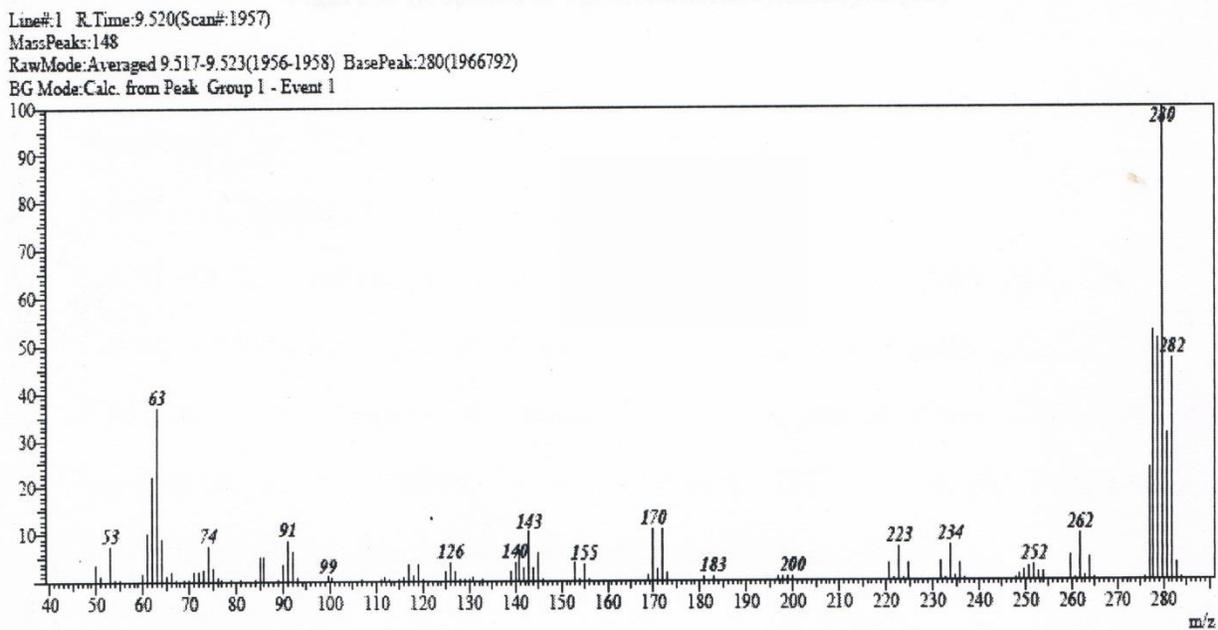


Figure 8. GC-MS spectra of 3,5-dibromosalicylaldehyde (10)

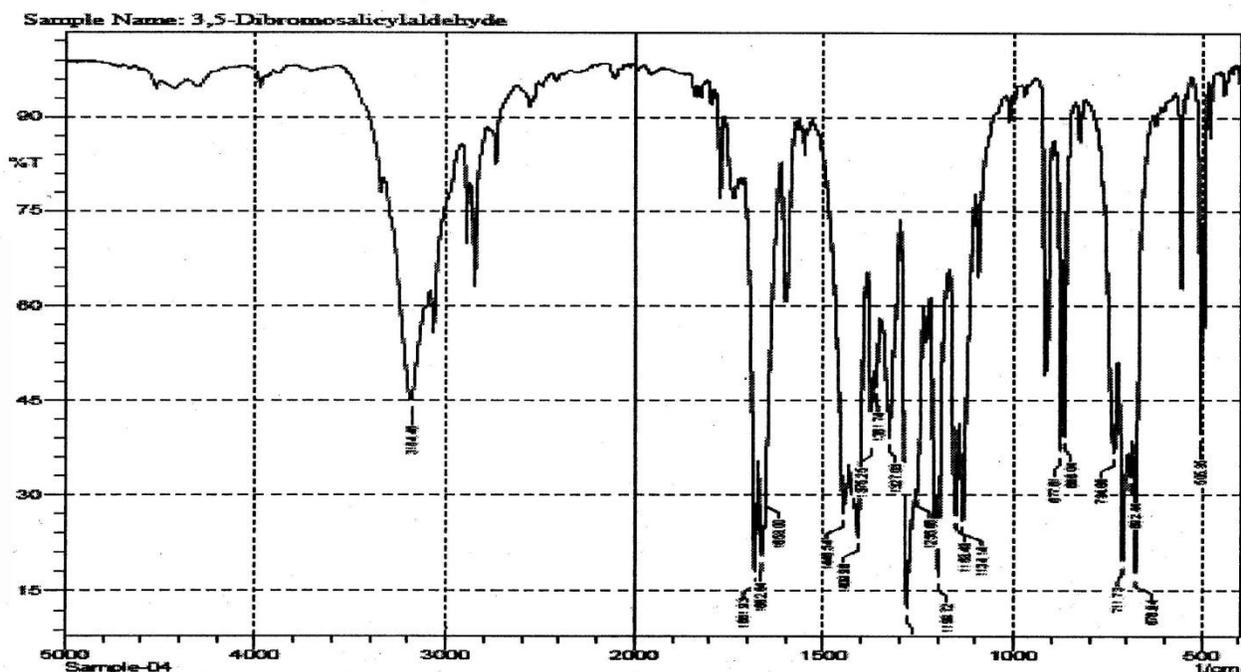


Figure 9. IR spectra of 3,5-dibromosalicylaldehyde (10)

V. CONCLUSIONS

In an effort to eliminate the use of toxic and expensive organic solvents used in conventional bromination techniques, we have exploited the aqueous solution of NH_4Br for a fast synthesis of industrially-important brominated compounds quantitatively and qualitatively under ambient conditions using inexpensive molecular Br_2 as a brominating agent. This method proceeded purely in water providing a new procedure for the synthesis of brominated compounds of industrial importance. A comparison of the brominating ability of the present system with those of published methods shows that the present protocol is inexpensive, simpler, faster and more efficient than other catalytic bromination systems used for this purpose. The present method which is more attractive than the earlier methods, offers the additional advantages such as the commercial availability of the reagent, simple reaction conditions, no evolution of HBr , high yield, economical easy setup and workup, selective monobromination with high regioselectivity, inexpensive, and environmentally friendly process makes our method valuable from preparative point of view.

Spectral data (^1H NMR, IR and MS) of of brominated compounds is given below:

4-bromoacetanilide (2): White crystals; ^1H NMR (400 MHz, DMSO): δ 2.1 (3H, s), 7.25 (2H, d, $J=8.4$ Hz), 7.52 (2H, d, $J=8.8$ Hz), 9.73 (1H, s); IR (KBr): 3293, 3260, 3186, 3115, 3052, 1668, 1644, 1601, 1586, 1532, 1487, 1394, 1309, 1290, 1255, 1007, 831, 819, 740, 687, 504 cm^{-1} ; MS m/z calcd. for $\text{C}_8\text{H}_8\text{BrNO}$: 216.07, FOUND 216.

4-Bromobenzanilide (3): Light grayish powder; ^1H NMR (400 MHz, CDCl_3): δ 7.29-7.74 (9H, m); IR (KBr): 3339, 3054, 1661, 1589, 1411, 1196, 946, 893, 750, 714, 509 cm^{-1} ; MS m/z calcd. for $\text{C}_{13}\text{H}_{10}\text{BrNO}$: 276.132, FOUND 276.

2,4,6-Tribromoaniline (4): White-shining fine needles; ^1H NMR (400 MHz, CDCl_3): δ 7.49 (s, 2H, ArH), 5.21 (bs, 2H, NH_2); IR (KBr): 3414, 3293, 1452, 1383, 1285, 1225, 1063, 858, 729, 706, 673, 546, 486 cm^{-1} ; MS m/z calcd. for $\text{C}_6\text{H}_4\text{Br}_3$: 329.816, found 327.

2,4-Dibromo-1-naphthol (6): Grayish-brown powder; ^{13}C NMR (100 MHz, CDCl_3): 148.02, 131.73, 130.93, 127.97, 126.97, 126.74, 124.92, 122.66, 113.27, 103.09; IR (KBr): 3412, 3075, 1961, 1934, 1720, 1616, 1583, 1548, 1502, 1449, 1374, 1330, 1266, 1230, 1209, 1146, 1057, 1030, 966, 870, 851, 766, 716, 671, 646, 602, 580 cm^{-1} ; MS m/z calcd. for $\text{C}_{10}\text{H}_6\text{Br}_2\text{O}$: 302, found 300.

1,6-Dibromo-2-naphthol (7): Light brown solid; ^1H NMR (400 MHz, CDCl_3): δ 6.20 (1 H, brs), 7.40-7.78 (2H, dd, $J=66$ and 9 Hz), 8.15-8.36 (2H, dd, $J=33$ and 9 Hz), 8.76 (1H, s); IR (KBr): 3485, 3444, 1617, 1586, 1381, 1210, 1183, 928, 871, 805, 645, 536, 512 cm^{-1} .

5,7-Dibromo-8-hydroxyquinoline (9): Light beige powder; ^1H NMR (400 MHz, DMSO): δ 8.90 (dd, 1H, arom), 8.46 (dd, 1H, arom), 7.89 (s, 1H, arom) 7.65 (t, 1H, arom); IR (KBr): 3071, 1738, 1583, 1491, 1459, 1389, 1333, 1273, 1202, 1138, 1045, 934, 868, 808, 787, 725, 686, 652, 617, 594, 563, 500 cm^{-1} ; MS m/z calcd. for $\text{C}_9\text{H}_5\text{Br}_2\text{NO}$: 302.95, found 302.2.

3,5-Dibromosalicylaldehyde (10): Pale-yellow crystalline powder; ^1H NMR (400 MHz, CDCl_3): δ 7.68 (d, 1H, $J=2.12$ Hz, ArH), 7.90(d, 1 H, $J=2.60$ Hz, ArH), 9.81 (s, 1h, COOH), 11.51 (s, 1H, OH); IR(KBr): 3184, 1682, 1662, 1653, 1449, 1410, 1375, 1362, 1327, 1281, 1255, 1200, 1153, 1134, 877, 866, 735, 712, 692, 679, 505 cm^{-1} ; MS m/z calcd. for $\text{C}_7\text{H}_4\text{Br}_2\text{O}_2$: 279.9, found 280.

2,6-Dibromo-4-nitroaniline (18): Yellow powder; ^1H NMR (400 MHz, DMSO): δ 8.21 (2h,s), 6.79 (1H,s); IR(KBr): 3480, 3372, 3084, 2922, 2666, 2363, 1605, 1501, 1474, 1383, 1300,

1270, 1126, 943, 897, 821, 737, 695, 575, 532, 457 cm^{-1} ; MS m/z calcd. for $\text{C}_6\text{H}_4\text{Br}_2\text{N}_2\text{O}_2$: 295.9, found 295.2.

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Smoke and Fire Detection

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Abstract- This paper present a system which can efficiently detect fire after the image of the area has been captured by a camera. Fire has destructive properties which cannot be tolerated in any work areas. Fire is the rapid oxidation of a material in the exothermic chemical process of combustion, releasing heat and light. The light parameter and color of flame helps in detecting fire. The system first detects smoke and then fire. When smoke is present in the area it displays a message on the Security terminal. When a fire breaks in the area under consideration, the corresponding fire region in the input video frame will be segmented which covers the fire. If the area of the flame increases in the subsequent frames then an alarm is sounded.

Index Terms- Fire detection; Smoke detection; YCbCr model; Image seperation

I. INTRODUCTION

Nowadays different types of fire and smoke detectors are available in the market. Smoke detectors are used to detect smoke which indicates that fire is present. Fires with high availability of oxygen burn at high temperature and with small amount of smoke produced; the particles are mostly composed of ash, or with large temperature differences, of condensed aerosol of water. Smoke detectors works mainly on two principles: Optical and Ionization. In optical smoke detectors, LED acts as a light source and at a distance from LED we have a photo detector. In absence of smoke, light reaches the detector without any decrease in intensity. When smoke enters the room, some light is scattered by smoke particles and hence light intensity reaching the detector is less and thus the alarm is triggered. Optical smoke detector has a very high response time. Ionization smoke detector uses radioactive isotope americium-241 to detect smoke. But Ionization smoke detector is rejected as it is more prone to false alarm. All these are not a reliable tool to detect fire and smoke. Even when fire is detected, it is detected in a very late stage where any precautionary measures will prove futile. In [1] spectral and spatial features of fire is used. In [2] and [3] both YCbCr and RGB models are used. In [4] motion detection principle is used for smoke detection. In [5] image separation based method is used. In [6] L^*a^*b and YCbCr color spaces are used. In [7] wavelet based method is used for fire detection. In [8] and [9] YCbCr model is used. In [10] DFBIR model is used. Every method solved some or the other problem but some drawbacks existed in each of them. We will use YCbCr model in this model. The justification is given in Secion III-C The paper is organized as follows: Goal of the project is discussed in Section II. The method that we

propose is explained in Section III. The working of the project is described in Section IV. The results of our project is put together in Section V and finally the conclusion in Section VI.

II. GOAL OF THE PROJECT

In this paper, the main objective is to develop an automatic system which will warn when fire breaks in the area under consideration. We propose a method which first detects smoke and then the potential fire region. Then again the area of the potential fire region is observed. If it keeps on varying then it is confirmed as a fire region and an alarm is sounded. The method is applied to each frame in the captured video and hence the response time is very less. The CCTV camera used here will capture the frame and will provide the computer for processing which will be based on MATLAB. The processing will comprise of the detection of smoke and fire. Detecting smoke and then fire reduces the false alarm rate to a great extent

The traditional approach for fire detection is based on using Smoke detector, Temperature Induction or Light Intensity. But all these methods have got limitations. They are not sensitive and the response time is high. The results of these methods depend solely on the performance of the sensors which require frequent maintenance. In Ionization smoke detector if the smoke reaches the ionization chamber then only it can be detected. These available techniques are slow and cannot detect the fire in the early stage. The application of Image processing in fire detection will make use of high brightness and color characteristic of fire flame. The recent captured frame will be compared with the reference frame to obtain a value and is compared with the threshold value and results are produced. The use of this mentioned technique will also help to detect even the small fire, whereas the conventional techniques fail at these places.

III. PROPOSED METHOD

A. Fire Detection

Fire has distinctive features such as color, motion, shape, growth, and smoke behavior. For this project we focused on feature such as color and smoke [8]. In this project the high brightness characteristic of the flame of fire, combining the image subtraction method and the saturation and brightness method to extract the flame will be used and even the area growth of the flame are taken into account, greatly reducing the false rate. In normal circumstances the frame would not contain fire. In order to improve the image processing speed of the system, the method of the current image and reference image for subtraction is used. Only those regions which have moved as compared to the reference frame will be used to detect fire,

hence reducing the amount of computations. The determination of flame or fire edges is the process of identifying a boundary between the area where there is thermochemical reaction and those without. It is a precursor to image-based flame monitoring, early fire detection, fire evaluation, and the determination of flame and fire parameters.

B. Smoke Detection

Smoke detection can be used for early warning of fire events. One of the distinguishing properties of smoke is transparency. When smoke is heavy enough, it is totally opaque and no visual information of the original frame is available. Even though smoke is present a slight translucent view of the background is still available [5]. Even if the difference in light intensity between the current frame and reference frame is calculated, still it would not be sufficient to detect smoke as the intensity of smoke could be different in different regions. Thus such features could not be very reliable for detection of smoke. In this paper a novel image separation-based method is proposed to detect smoke in image sequences captured by fixed video cameras.

C. Color Space Selection

There are various color spaces such as RGB, HSV, HIS, YCbCr, YIQ, YUV and so on. There are some following characteristics using the YCbCr as the color space: 1) Separates the brightness and chrominance effectively; 2) We can directly get the YCbCr through linear transformation from RGB space, hence the computational efficiency is relatively high [11]; 3) Color characteristics are confined to 2 values: Cb and Cr, hence computations are reduced.

D. Flowchart

The flowchart of our proposed method is shown in Fig. 1

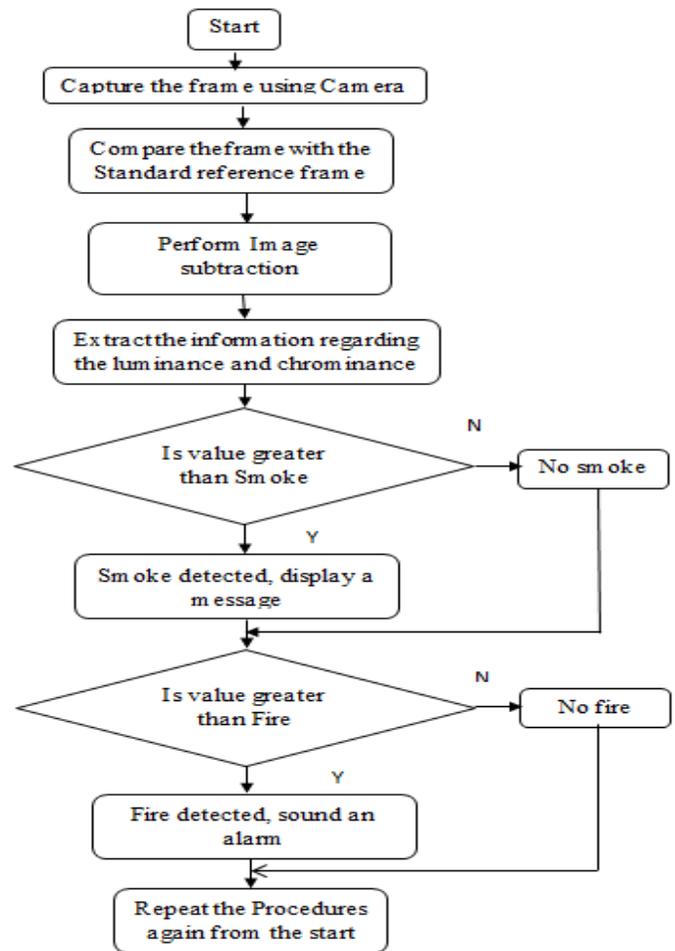


Fig. 1. Flowchart

IV. WORKING

As we selected YCbCr model, we have to calculate values of brightness and saturations. The steps involved are:-

A. RGB Band Separation

Each pixel is represented by three values, the amount of red, green and blue. Thus an RGB color image will use three times as much memory as a gray-scale image of the same pixel dimensions. RGB image consists of 3 matrices overlapping each other. First one determines the red value, second determines the green value and third determines the blue value.

B. Brightness and Saturation Calculation

In the image-based fire detection system, the interference of the background image can be regarded as an important factor that causes the ultimate false alarm. Therefore, accurately extracting the flame image from the scene image is particularly important. The color in the image can be expressed in three- color components including R (red), G (green) and B (blue). The Red saturation is $Cr = R / (R + G + B)$, Blue Saturation is $Cb = B / (R + G + B)$ and the average brightness is $Y = 0.22 * R + 0.587 * G + 0.114 * B$

C. Smoke detection

Smoke detection is a very important step in fire detection. Generally, methods for detecting fires using cameras combine smoke detection methods and flame detection methods. Smoke detection method use color and motion information to detect smoke from digital images [12]. As most of the objects that catch on fire first starts giving a smoke, if we are able to detect smoke in an early period, we could prevent fire. Also smoke detection will help us curbing false alarm situation. Smoke has a peculiar color, high in blue saturation. Hence we use YCbCr color model [5]. The histogram of test images of smoke is shown in Fig. 3 and Fig. 4 Through a large number of experiments, it is been found that when the blue saturation of a point is between 126 to 138 and the red saturation is between 112 to 128, it can be regarded as a smoke region. Thus we get the image of the smoke segmented region. A message will be displayed at the terminal and will help in preventing fire.



Fig. 2. Smoke Image

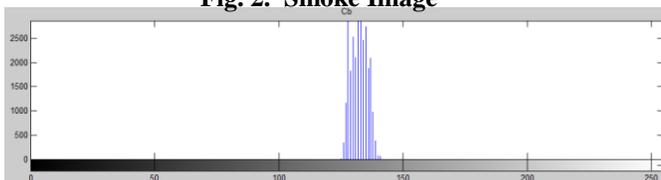


Fig. 3. Histogram of Cb

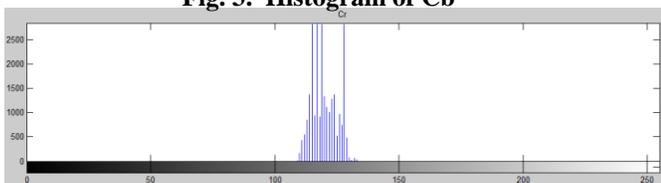


Fig. 4. Histogram of Cr

D. Detection of Potential Fire regions

Because there is no fire in the most time, the background image of the camera is usually consistent. In order to improve the image processing speed of the system, the paper introduces the method of the current image and reference image for subtraction [8]. In order to achieve the purpose of detecting fire, a threshold is set for Cb and Cr values. Studying various test images, a range of values are selected for Cb and Cr which are possibly fire

regions. All those pixels which satisfy the threshold are termed as suspicious regions. This segmented image also consists of some noise.

E. Extracting FireFlames

The flame color and color distribution is the basis for the identification of fire. Through the analysis of a large number of test images, it is found that humans observe an image and determine whether there is a fire, mainly based on the color of the image. Any flame can be divided into part 3 including the outer flame, the inner flame and the flame core. According to the temperature, the one of outer flame is the highest, followed by the inner flame, and the flame core is the lowest, this result in the gray of the flame image shows a certain distribution law. From the inside to outside, the color of the flame the trend which it change from white to red; from the edge to the outside, the red of the flame fades continuously [8]. Therefore, the flame color features can be used to determine and extract whether there are suspicious areas in the surveillance system, it is the most original features of the fire. A fire is an image can be described by using its color properties. This color pixel can be extracted into the individual elements as R, G and B, which can be used for color detection. In terms of RGB values, this fact corresponds to the following inter-relation between R, G and B color channels: R greater than G and G greater than B. The combined condition for the fire region in the captured image is R greater than G greater than B. Besides, R should be more stressed than the other components, because R becomes the dominating color channel in an RGB image of flames. This imposes another condition for R has to be over some pre-determined threshold. However, lighting conditions in the background may adversely affect the saturation values of flames resulting in similar R, G and B values which may cause non flame pixels to be considered as flame coloured. Therefore, saturation values of the pixels under consideration should also be over some threshold value. Fire flame has the feature of the high brightness and reddish color, these two points is reflected in the average brightness and the red saturation. The histogram of test images of fire is shown in Fig. 6 and Fig. 7

Through a large number of experiments, it is been found that when the blue saturation of a point is between 87 to 130 and the red saturation is between 127 to 140, it can be regarded as a suspicious sub-flame point.

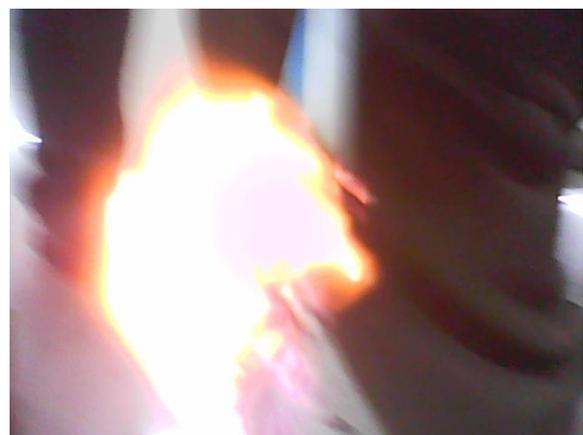


Fig. 5. Fire Image

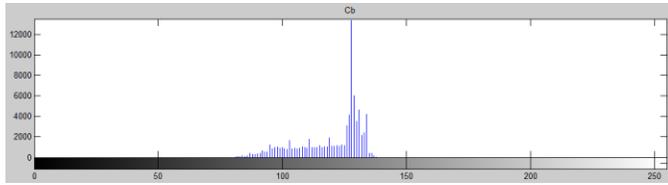


Fig. 6. Histogram of Cb

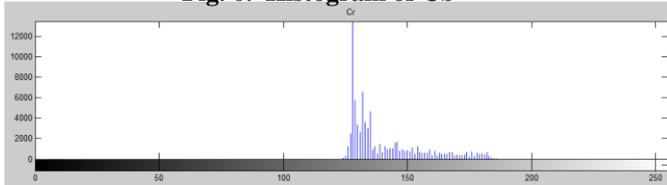


Fig. 7. Histogram of Cr

F. Fire region confirmation

The fire suspicious regions found in Section IV-D may or may not be a fire region. So we need to confirm whether it is a fire region or not. Fire has a peculiar property of continuously changing shape and area. Hence we detect motion of the suspicious fire region and also calculate its area. If the region is displaced in the subsequent frames and the area of the region has changed, we confirm that the region is a fire region and sound an alarm.

V. RESULTS

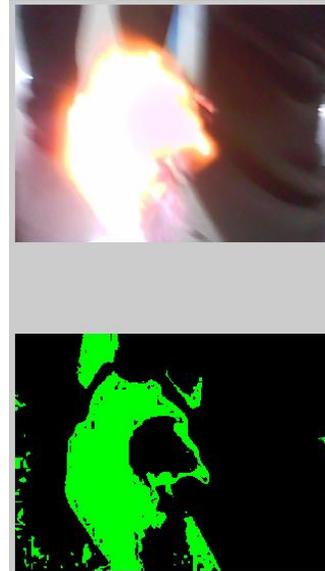
The results of Smoke detection is shown in Fig. 8. If smoke is present a message is displayed "Smoke is detected" and if there is no smoke the process of detection continues as shown in Fig. 9. The results of Fire detection is shown in Fig. 10. The fire area is coloured in green. If the area of this region changes at a fast rate then an alarm is sounded.



Fig. 8. Smoke Output when smoke is present



Fig. 9. Smoke Output when smoke is not present



VI. CONCLUSION

In this paper we used YCbCr color space to detect fire and smoke. We also used spatial feature of fire to decrease false alarm rate. Fire and Smoke were detected however there is a room for environment to this method. If other parameters such as spectral feature and time intensity parameter are also added, the false alarm will be reduced to a great extent. This paper presents a specific process of fire and smoke detection which can be used in work areas like banks, server rooms, data centers etc. to prevent or at least stop fire at an early stage.

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Holistic Approach of Research Work

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Abstract- A Research Design is the arrangement of conditions for collection and analysis of data in a manner that aims to combine relevance to the research purpose with economy procedure. Research Design is needed because it facilitates the smooth sailing of the various research operations. Tools for data collection method, to give the result and testing hypothesis, my paper deals with the steps involve in Research Design, Need of Research Design, and Characteristic of Research Design, Features of Research Design, and the tools and techniques of data collection method. Report writing is a presentation of facts and findings. After collecting and analyzing the data, the researcher has to accomplish the task drawing Interference followed by report writing. This has do very carefully, otherwise misleading conclusion may be drown and the whole purpose of doing research may be violated. In this paper I had clearly sketch the outline of report writing from title to end page and also our sample of title page.

Index Terms- Research Design, Tools and Techniques, Data Collection. Report Writing, Bibliography

I. INTRODUCTION

Research design essentially refers to the plan or strategy of Rshaping the research, “design deals primarily with aim, purposes, intentions and plans within the practical constraints of location, time, money and availability of staff”. Data Collection: Collection of data constitutes the first step in a statistical investigation. Utmost care must be exercised in collecting data as because they form the foundation of statistical method. If data are faulty, the conclusion drawn can never be reliable. A report writing is a presentation of facts and finding, usually as a basis for recommendations, written for a specific readership, and probably intended to be kept as a record. When some people write a report that they do, write But the really successful writers only spend part of that time doing this, and then only towards the end, before that they are planning their report – thinking about this purpose, and who is going to reedit; deciding what to put in it, and fitting it into shape and even when they are finally writing it, they will probably spend just as much as time thinking above how best to present their ideas, as actually putting them onto them onto paper.

II. WHAT IS RESEARCH

The goal of research is to improve the level of living in society. The word research carries an atmosphere of respect. As

every object has got its own pros and cons, so does research. But the advantages of research have outnumbered the disadvantages of research and it has a place of its own in the field of study. In an academic environment, research activity is fivefold i.e. Master Dissertation; M.Phil Dissertation; PhD Thesis; D.Litt Thesis; and Assigned Research Project The research projects are different from that of academic research degree in regards to different scale of time, resources and extent, pioneering qualities and rigor. Research project actually involves a group work on a pre-assigned topic by the funding agency; it has wide scope in regards to the greater resource availability.

Definition of Research

Research is composed of two words “re” and “search”, which means to search again or it is a careful investigation to understand or re-examine the facts or to search for new facts or to modify older ones in any branch of knowledge. The term research is also used to describe an entire collection of information about a particular subject, but it is in general used by the students of higher schools. Research in common parlance refers to search for knowledge; one can also define research as a scientific and systematic search for pertinent information on as specific topic. Some people consider research as a movement, a movement from the unknown to known. It is actually a voyage of discovery. Thus research is an endeavor to discover, develop and verify knowledge. P. M. Cook attributes the research taking the clue from each initial alphabets of the word “**research**”.

R= Rational way of thinking;

E= Expert and exhaustive treatment;

S= Search for solution;

E= Exactness;

A= Analysis;

R= Relationship of facts;

C= Critical observation, Careful recording; Constructive attributes, and Condensed generalization.

H= Honesty and hard working.

The Webster International Dictionary defines research as “a careful critical enquiry or examination in seeking facts for principles, diligent investigation in order to ascertain something”. The Advanced Learner’s Dictionary of Current English lays down the meaning of research as “a careful investigation or inquiry specially through search for new facts in any branch of knowledge”. J. W. Best opined that research is not only specifically problem solving but is also closely associated with verification of truth underlying the observed data”. Thus research is an intellectual act that begins with the asking of

questions and progress through the critical examination of evidence that is both relevant and reliable to the reevaluation of the truth that is generalization and universal. (1)

Need of Research:

- ♣ To discover the truth, which is hidden and which has not been discovered as yet;
- ♣ To discover the solution of a problem;
- ♣ To expand the scope of theoretical knowledge;
- ♣ To discover the new application for old knowledge;
- ♣ To understand, analyze and explore the phenomena;
- ♣ To know the cause effect relationship;
- ♣ To improve the level of living in society;
- ♣ For professional and intellectual development of the researcher by gaining knowledge;
- ♣ To obtain prestige and respect by a person or by the institution;
- ♣ To obtain a research degree;
- ♣ As a means of livelihood by way of obtaining the source of finance.

Characteristic of Research:

- ♣ Research originates with a question or problem;
- ♣ Research requires a clear articulation of a goal;
- ♣ Research is guided by the specific research problem, question, or hypothesis or critical assumption;
- ♣ Research follows a specific plan of procedure;
- ♣ Research requires the collection and interpretation of data in attempting to resolve the problem that initiated the research;
- ♣ Research is, by its nature, cyclical; or more exactly, helical.

Meaning of Research Design:

A research design is an arrangement of the essential condition and analysis of data in a form that aims to combine relevance to research purpose with economy in the procedure. Such man a research design is not a highly specific plan to be followed without deviation, but rather a series of guide posts to keep one handed in the right direction. It is a decision regarding, what when how much by what means concerning an enquiry or a research study contribute a research design. So a research design or a plan is tentative outline of the proposal research work. The plan is not a very specific one. IT is simply a set of guideline to keep the scholar on the right track.

- ♣ Why is the study about
- ♣ Why is the study being made
- ♣ Where will the study be carried out
- ♣ What type of data is required
- ♣ Where can the required data is found
- ♣ What period of time will be required for study
- ♣ What will be the sampling design
- ♣ What are techniques used for data collection
- ♣ How will the data be analyzed
- ♣ Style of report writing

Needs for Research Design:

Research design is needed because it facilitates the smooth sailing of the various operations / it males the maximum information with minimum operations of expenditure, effort, time and money. It is similar that before constructing a house we need the blueprint of it. Which is prepared by the experts (or) architecture? Similarly we need a research design or a plan in advance of data collection and analysis of our research project. Keeping in view the objectives of the research and the availability of staff, time and money, preparation of the research design should be done with a great care as any error in it may upset the entire project, and Research design.

Even then the need for a well thought out research design is at time not realized by many. The importance in which this problem deserves is not given to it As a result many researcher do not serve the purpose of Research which they had undertaken. In fact even they may give misleading conclusion. There are some important points for the Need of Research Design:

- ♣ It may result in the desired type of study with useful conclusion.
- ♣ It reduced In Accuracy.
- ♣ t helps to get optimum efficiency and reliability.
- ♣ It minimize wastage of Time.
- ♣ It minimize certain confusion, practical haphazard associated any research problems.
- ♣ t helps in collection of data and research materials for tasking of hypothesis.
- ♣ It is a guide post for giving research in a right direction.

Features of a Good Research Design:

A good design is often characterized by adjectives like, flexible, appropriate, efficient, economical and so on. The design which minimizes bias and maximizes the reliability of the data collected and analyses in consideration as good design. The design which gives the smallest experimental error is supposed to be the best design in many investigations. A research design appropriate for a particular research problem usually involved consideration of the following points: (2)

- ♣ The means of obtaining information
- ♣ The availability and skills of the researcher and his staff
- ♣ The objective of the problem to be studied
- ♣ The nature of the problem to be studied
- ♣ The availability of time money for the research work.

Characteristic of Research design:

- ♣ Regularity: State character of fact of being regular
- ♣ Verifiability: To ascertain text, the truth or accuracy of any opens for verification
- ♣ Universality: A state or quality of being universal or general.
- ♣ Predictability: To predict or tell before with moderate accuracy.
- ♣ Objectivity: Not subject or unbiased

- ♣ Systematization: In a coherent or orderly manner.

Components of the Research Design:

A practical research has the following steps however these are not independent but rather they are interdependent and overlapping in a sense.

Title of the Study: The title or name of the topic of research should be brief. In order to sharpen the focus if necessary a subtitle may be added to the main title.

Stating Problem: Stating the problem which surrounds the specific problem will provide a focus on the chosen topic for research.

Review of Literature: A review of literature should be made.

Area of scope and study: The area and scope of the study should be stated (3)

Limitations of Research Design:

The following are some of the limitations of research design.

- ♣ Non availability of sufficient data
- ♣ Non availability of resources like Money, Manpower Etc.,
- ♣ In adequate time in the formulation of research design
- ♣ Poor skill and ability of the scholar
- ♣ Un frozen development during the course of design, which are uncontrollable.

Tools for Data Collection:

The data collection begins after a research problem has been defined and research design plan or chalked out. After deciding about the data collection the researcher must keep in mind the two types of data collection: (4) Primary Data Collection, and Secondary data collection

Primary data are those which has collected fresh and first time, and thus happen to be the original character.

Secondary data or those which has already been collected by someone else and which have been passed away through the statistical process.

III. METHODS OF DATA COLLECTION

Primary Source of Data Collection:

1) Observation Method, 2) Interview Method, 3) Questionnaire Method

1. Observation Method: The observation method is most common method specially in studies relating to behavioral sciences. In a way we all observe things around us, but this sort of observation is not a scientific observation. Observation become a scientific tool and the method of data collection for the research when it serves formulated research purpose, is systematically planned and recorded and its subjected to check and controls on validity and reliability under the observation

method the information is sought by way of investigator's own direct observation without asking from the respondent. This method is particularly suitable in studies which deal with subject (i.e. respondents) who are not capable of giving verbal reports of their feelings for one reason or the other. Observation method has various limitations, firstly it is an expensive method, secondly the information provided by this method is very limited, Thirdly sometime unfrozen factor's may interfere with the observation task. At times the fact that some people are rarely accessible to direct observation creates abstract for their method to collect data collectively.

2. Interview Method: This method involves presentation of oral verbal and reply in terms of oral verbal response. It can be used through personal Interview and if possible through telephonic Interviews.

2. 1. Personal Interview: It requires a person known as the Interviewer asking question generally in a face-to-face contact to the other person. This sort of Interview may be in the form of direct person investigation or it may be indirect oral investigation. In the case of direct personal investigation the Interviewer has to collect the information personally from the sources concerned. He has to be on the spot and meet the people from whom data have to be collected. This method is particularly used for intensive investigation.

3. Questionnaire Method: This method of data collection is quite popular, particularly in care of big enquiries, it is adopted by Private, Individuals. Research Workers, Private and Public Organizations, and even by Government. In this method questionnaire is sent usually by post to person concerned with a request to answer the question and return the questionnaire. It contains number of questions printed or typed in a definite order on a form or set of forms. The questionnaire is mailed to respondent who are expected to read and understood the question and write down the reply in the space, meant for the purpose in the questionnaire itself the respondent has to answer the question on its own. (5)

Secondary Data Collection:

Secondary data means the data which is already available, They refer to the data which have been already collected and analyzed by others. When the researcher utilize secondary data then he has to look into various sources from where he has obtain this. In some case he is certainly not confronted with the problems that are usually associated with the collection of original data secondary date may be either be published data or unpublished data.

Usually published data are available in

- ♣ Various publication of the central, state or local Government
- ♣ Various publications of foreign governments/of International bodies organizations.
- ♣ Technical and trade Journals
- ♣ Books Magazines and newspaper

- ♣ Report prepared by research scholars Universities, economists etc., in different fields.
- Secondary data may be unsuitable or may be inadequate in the context of the problem, which the researcher wants to study.

Researcher must be very careful in using secondary data. He must make a minute scrutiny because it is just possible that the

Advantages & Disadvantages for Data Collection Methods:

Methods	Advantages	Disadvantages
Questionnaire	<ol style="list-style-type: none"> 1. Provides answers to a variety of questions 2. Can be answered anonymously 3. Allows time before responding 4. Can be administered to many people, at distant sites, simultaneously 5. Imposes uniformity by asking all respondents the same thing 	<ol style="list-style-type: none"> 1. Are not as flexible as interviews 2. People can often express themselves better orally than in writing 3. Getting people to complete questionnaires can be difficult 4. Good questions take time to develop and test
Interview	<ol style="list-style-type: none"> 1. Can be used for non-native speakers or those who might have difficulty with the wording of written questions 2. Permits flexibility and allows the interviewer to pursue unanticipated lines of inquiry 3. Appropriate to get in-depth information for sensitive topics 	<ol style="list-style-type: none"> 1. Is time consuming 2. Sometimes the interviewer can unduly influence the responses of the interviewee 3. Limits sample size
Observations	<ol style="list-style-type: none"> 1. Can be valuable if self-report measures may not be accurate 2. Can be seen as a report of what actually took place presented by a neutral outsider(s) 	<ol style="list-style-type: none"> 1. Presence of observers may alter what takes place 2. Time to develop the instrument and train observers 3. Time to conduct sufficient number of observations 4. There are usually scheduling problems 5. Limits sample size
Records	<ol style="list-style-type: none"> 1. Often viewed as objective and therefore credible 2. Set down events at the time of occurrence, rather than in retrospect 3. Can be unobtrusive 4. Can have a low impact on staff time and resources if records are already kept for purposes other than the evaluation 	<ol style="list-style-type: none"> 1. May give incomplete data examining them and extracting relevant information can be time – consuming 2. There may be ethical or legal constraints in examining certain records 3. If records are kept only for the purpose of evaluation, may be seen by staff as burdensome
Meetings	<ol style="list-style-type: none"> 1. Good for formative evaluation 2. Can be low cost 3. Permit flexibility 	<ol style="list-style-type: none"> 1. Possible bias if participants feel unable to be candid.

Table 1; Advantages & Disadvantages for data collection methods

Research Supervisor & Evaluation of Research Report:

a) **Research Supervisor:** “Although supervisors want their students to succeed, there are clearly limits to the amount of help which they may provide for their students”. Supervisors’ role includes:-

- ♣ Tutorial about research work in general;
- ♣ Advice on research methodology and design;
- ♣ Advice on structuring the thesis;
- ♣ Reading the thesis and finding out its pitfall;

Supervisors also have the experience of examining other thesis as well, so he/she can have a fair idea about the possible questions regarding the thesis, and will communicate the same to

the scholar, so that he / she can prepare for it in advance. If a supervisor disagrees about some content in the research report, only a little scope is left in the hands of the researcher to discuss it in length to arrive at a definite answer. If such a thing happens it would be better if the researcher tries to explain his/her position in front of the supervisor.

b) **Research Monitoring Agency:** Monitoring means keeping track with the overall progress and achievement of objectives of the ongoing research work and progress in the use of allocated fund to support the management task and timely decision making.

c) Evaluation of Research Report: In case of any research work, evaluation is a process of determining the worth or significance or value of the work in regards to the objectives, the efficacy of design, resource use and the sustainability of results. It should also enable the incorporation of lessons learned, credible and useful thought to help the funding agencies to make correct judgment. Evaluation leads to decision-making process and probable implementation of the research result. The supervisor(s) are not normally involved in the approval process of a thesis. There will usually be both two or three examiners, and at least one from other institutes / organizations to which the thesis was submitted. The role of research evaluator includes the following:

- ♣ **Social Engineer:** The evaluator is a social engineer, and is neutral;
- ♣ **Controller:** They attempt to hold the implementing agencies responsible for their decision and actions.
- ♣ **Advisor:** He / She is the advisor to the researcher;
- ♣ **Mediator:** The research evaluator is the mediator between the research findings and its applicability, between the researcher and the implementer.
- ♣ **Facilitator:** By way of supporting the results.

The evaluator in general judges the value of the thesis in regard to the following:

- ♣ **Inputs:** Human, physical and financial resource that are used to undertake the research;
- ♣ **Outcome:** Consequence / results of an intervention;
- ♣ **Output:** Results for implementation;
- ♣ **Performance:** Whether the results are justified in comparison to different performance indicator;

Before the oral interview, the researcher should read the thesis fully; anticipate the question that may be asked. Once the thesis is approved by the examiners, a copy of the thesis is usually sent to the university / college library. In case of thesis, it is good to see that only two options are left in the hands of the examiners, either he / she have to accept it or otherwise reject it. The degree is only offered to the candidate, who have critically investigated and evaluated an approved topic by using the research methods appropriate to the chosen field, and makes an independent and original contribution to the existing knowledge base and has presented and defended the research work in the oral and verbal examination to the satisfaction of the examiner(s).

IV. SIGNIFICANCE OF REPORT WRITING

Research report is considered as a major component of the research study for which the research task remains Incomplete till the report has been presented or written. As a matter of fact even the most hypothesis, highly well designed and conducted research study, and the most striking generalizations and findings are of little value unless they are effectively communicated to others. The purpose of research is not well served unless the findings are made known to others. Research results must invariably enter the general store of knowledge.

Materials and Structure

Most writer Imagine that their report will be the major event in the reader's day, when, in reality the poor fellow is awash with reading matter, drawing in facts, figures and opinions. What he wants to easily digested is the information and then only enough to help him reach a decision so the content of our report and its structure, must be very carefully planned.

Selection of Material

These are two golden rules to follow when deciding what to put into a report are:

- ♣ Simplify and be ruthless about it , Reject the irrelevant, agonize over the doubt, and make sure you have got the essential.
- ♣ Justify your conclusion with facts, and state their resources. Build the facts into a logical and consistent case, so as to lead the reader to the same conclusion as your own.

Planning the Structure

The facts themselves should therefore be a set of directions, which will lead and guide your reader along a route has to be planned before you write your report, perhaps as follows.

Turn a large sheet of paper sideways, and work across it. Work horizontally, so that you can see the whole plan of your report at one time.

First divide it into major sections every subject can be broken down in this way, and the headings will probably become the headings in your report.

Make a list under each heading of all the points you would like to mention note the information that you will need to support them. Now mark the most important points, the essential steps in your reasoning.

Next mark the least important ones, points your reader would find irrelevant, these you will probably reject.

The points that remain – the unmarked ones, are the doubt files, some you may want to use as examples, or to include in the appendices. But some of these also you may reject.

Lastly arrange the points in a final, logical sequence, so as to meet your objective. Some people write them out on scraps of paper as this stage, and shift them around until they get the order right. A plan like this will show you what information you will need for the body of the report, and what should go in the appendices, once written, you draw out your conclusions. And lastly you add your title page, summary, contents list, and Introduction. These eight terms make up the conventional structure of a report dealt with in more detail below. (4)

Different steps in writing report:

The usual steps involved in writing report are:

- ♣ Logical analysis of subject matter.
- ♣ Preparation of the final Outline
- ♣ Preparation of the rough draft
- ♣ Rewriting and polishing of the rough draft.
- ♣ Preparation of the final bibliography.

Logical Analysis of subject matter:

It is a first step which is primarily concerned with the development of subject. There are two ways to develop the subject first Logically and then Chronologically. The logically development is made on the basis of mental connections and associations between the one thing and another by means of analysis logical treatment often consists in developing the material from one simple possible to the most complex structure. Chronologically development is based on a connection or sequence in time or occurrence. The direction for doing or making sometimes usually follows the chronological order. Preparation of the final outline, It is the next step in writing the research report. "Outlines are the framework upon which long written works are consulted. They are an aid to the logical organization of the material and a reminder of the points to be stressed in the report". (5)

Preparation of rough draft:

It follows the logical analysis of the subject and the preparation of the final outline. This is the most important step for the researcher. Now the researcher has to study the context of the study. He will write down with procedure adopted by him in collecting the material for his study along with various limitations faced by him, the technique of analysis adopted by him, the broad findings and generalizations and the various suggestions he wants to offer regarding the problem concerned.

Rewriting and polishing of the rough draft:

This step to be the most difficult part of all formal writing. Usually this step requires more time than the writing of the rough draft. The careful revision makes the difference between a mediocre and a good pieces of writing. While rewriting and polishing, one should check the report for weaknesses in logical development or presentation. The researcher should also see whether or not the material, as it is presented. Has unity and cohesion; does the report stand upright and firm and exhibit a definite pattern, like a marble arch? In addition the researcher should give due attention to the fact that in his rough draft he has been consistent or not. He should check the mechanics of writing – grammar, spelling and usage.

Preparation of final bibliography:

The task of the preparation of the final bibliography. The bibliography, which is generally appended to the research report, is a list of books in some way patient to the research which has been done, It should contain all those works which the researcher has consulted. The bibliography should be arranged alphabetically and may be divided into two parts: The first part may contain the names of books and pamphlets, and the second part may contain the names of magazines and newspapers articles. Generally, this pattern of bibliography is considered continent and satisfactory from the point of view of reader.

V. RULES AND GUIDELINES

The following rules and guideline relate to conventional structure of a report some organizations lay down their own.

- a) Title page: This normally carries the title, sub-title, date, author's name and position, and distribution

list. It may also carry a reference number or other classification. But don't over crowd the page, a clear simple layout is always the best.

- b) Summary: A necessity if the report is a long one. It gives busy, people the gist of the report without their having to read it all; but if attractively written, it may whet their appetite, and stimulates them to read the whole thing.
- c) Content list: The content of short reports may be shown on the title page, or not at all. More extensive ones should always have a separate page, listing the major sections or chapters, sub-section if any, and appendices, and giving their page numbers. It should be laid out clearly so as to show the relationship between them.
- d) Introduction: This gives the background to the report, and usually shows why it was necessary. It usually states the objectives of the report (in formal terms), who called for it, and the scope and treatment. The shorter it is the better.
- e) Body of the report: This contains your detailed facts and findings, shows how they were arrived at, and indicates the interferences to be drawn from them, all in accordance with your horizontal plan.
- f) Conclusion: Here you draw out the main points of your report and present a considered judgment on them.
- g) Recommendations: Finally, set down any recommendations, relating them clearly to what has gone before. In a good report, the reader is carried along by the arguments, so that by the time he reaches the end, he will need to further convincing.
- h) Appendices: Some reports need detailed supporting information, or perhaps information that only some readers need all this goes in the appendices. In some cases you may also need to include:
 - i) Bibliography and / or References: This lists either the books or articles consulted as a basis for the report or those you want to suggest as further reading or both – Make clear which they are.
 - j) Glossary or Nomenclature: This can be help if your readers include non expert as well as experts. When writing on a specialist subject for non experts alone, define any technical terms as you go along.

TITTLE

By
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Name of faculty advisor, Advisor

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A thesis submitted in partial fulfillment of the requirement for
the

Doctor of Philosophy

In

Library and Information Science

Bharathiar University

Coimbatore (TN) India

DATE

Figure 1; Example of a Thesis Title Page

VI. CONCLUSION

There are several Research design and the researcher must decide in advance of collection and analysis to which design would prove to be more appropriate for his research project. In this paper I had clearly sketch the Research Design its need and characters and also methods utilize for data collection. I had chosen two major steps for data collection which are Primary Data Collection and Secondary Data Collection, and also difference between the techniques utilized for the Data Collection methods. It is become customary to conclude the research report with a very brief summary. Resting in brief the research problem, the methodology, the major findings and the major conclusion drawn from the research results. In this paper I have clearly mention the report writing from Preliminary page to the End page. Even though I want to tell that in spite of all that has been stated above, one should always keep in view the fact report-writing is an art which is learnt by practice and experience, rather than by mere doctriation.

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Papillary carcinoma of Thyroid Presenting as Cystic Subcutaneous Swelling and Discharging sinus - A Case Report

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Abstract- Papillary carcinoma is the most common malignancy of thyroid gland and presents generally as a thyroid nodule. Extra thyroidal extension of papillary carcinoma involving exclusively skin is very rare. We present a case of 65 year old male with papillary carcinoma of thyroid arising from isthmus presenting as a cystic skin swelling with discharging sinus masquerading as adenaxal tumour/minor salivary gland tumour.

I. INTRODUCTION

Papillary carcinoma is the most common type of thyroid malignancy constituting about 85% of the it^[1]. The most common presentation of thyroid carcinoma is solitary thyroid nodule and progressive enlargement of the thyroid gland. Papillary carcinoma can present as cystic swelling accompanied with enlargement of the thyroid gland. But papillary carcinoma presenting as cystic subcutaneous swelling with discharging sinus without clinically palpable thyroid gland is very rare. Here we present an case report of 65 year old male who presented with a cystic subcutaneous swelling with occasional mucoid discharge in midline in the neck.

II. CASE REPORT

A 65 year old male presented with a lobulated cystic swelling in the midline in the neck with complaint of multiple episode of discharge which started and stopped spontaneously. The swelling to start with was small which increased progressively in last 5 years. The neck swelling extended from the thyroid notch upto supra sternal notch. The swelling was non tender, regular, fluctuant with smooth surface and had positive transillumination test. The skin over the swelling was adhered at few points to the swelling. There was a small about 5 mm punctum from which mucoid discharge was oozing. The swelling neither moved with deglutition nor on protruding the tongue. No neck nodes were palpable. Thyroid gland could not be palpated. Laryngeal crepitus was present. Indirect laryngoscopy did not show any abnormality. There were no complaints of change in voice, breathlessness or difficulty in deglutition.

FNAC of the swelling was done which was suggested differential of skin adenaxal tumour or sero-mucinous gland tumour arising from minor salivary gland tumour from larynx. Ultrasonography revealed a multicystic swelling with septations transgressing deep to plane of strap muscles. Keeping these differentials in mind, contrast enhanced CT scan was done

which revealed a multilobulated cystic swelling predominantly present in the subcutaneous plane with extension deep in to the strap muscles upto the area of thyroid gland. Laryngeal framework and tracheal architecture was intact. No other significant finding was seen. We planned a wide local excision of the tumour with local rotation flap to reconstruct the skin defect.

For the surgery, a circumferential incision was taken. The tumour with involved skin was dissected away from the surrounding. The strap muscles were retracted and deeper portion of the tumour was explored. To our surprise, the swelling was arising from the isthmus of the thyroid gland suspicious of malignancy. Hence, total thyroidectomy with central compartment neck dissection was done with wide local excision of skin. The mass was adhered to trachea from which it was shaved off. Closure was done in three layers. Patient was sent for radioiodine uptake scan and ablation. srggher

Histopathology report of specimen showed focally encapsulated tumour composed of thyroid follicular cells arranged in papillae, follicles and small sheets with occasionally trabeculae pattern with presence of psammoma bodies. Cells were enlarged with optically clear nuclei. Section showed epidermis which is focally ulcerated with regions of squamous metaplasia. No abnormality was appreciated in right and left lobes of thyroid.

III. DISCUSSION

Papillary carcinoma of thyroid is the most common malignancy of thyroid gland. Extra thyroidal extension is seen in 4 to 16 percent of cases and carries with it an increased risk of disease recurrence and reduces overall survival rate^[1,2]. Extra thyroidal extension involves invasion of trachea, oesophagus, recurrent laryngeal nerve, strap muscles and skin. Patients with Extra thyroidal extension were more likely to fail treatment and to die of their disease than were patients without Extra thyroidal extension (77% versus 34% and 71% versus 13%, respectively; $P < 0.0001$). Local, regional, and distant failures were more prominent among patients with Extra thyroidal extension than among those without Extra thyroidal extension (48% versus 9%, 41% versus 16%, and 37% versus 11% respectively; $P < 0.0001$). Survival of patients with ETE was adversely affected by nonpapillary histology, distant metastasis, age > 45 , tumor size > 4 cm, and incomplete excision ($P < \text{or} = 0.05$)^[2]. Thyroid malignancy with skin involvement with discharging sinus arising from isthmus with normal thyroid lobes and no lymphadenopathy has never been reported before

this case. There have been only two reported cases^[5,6] of thyroid malignancy involving only skin as extra thyroidal extension and both of them were diagnosed pre-operatively on FNAC as thyroid pathology (one was malignancy^[5] and the other goiter^[6]) and one of them had positive lymph node metastasis^[5].

Most common cystic lesion seen in midline of neck are dermoid cysts, epidermoid cyst, teratoma, cystic hygroma and rarely adenaxal tumours of skin. In such cases, gold standard of management is ultrasonography guided FNAC. The overall sensitivity of FNAC in the diagnosis of neck masses was 83.01% and specificity was 78.94%. Sensitivity was highest (82.14%) for neck nodes^[3]. As for USG guided FNAC, The overall sensitivity of FNAC was 84.6 per cent and specificity was 96.4 per cent. 11 true positive, 54 true negative, two false negative and two false positive results were noted. Positive predictive value for diagnosing malignancy was 84.6 per cent and negative predictive value for malignancy was 96.4 per cent^[4]. Hence, FNAC reports help in indicating the pathology but should not be relied upon completely if clinically not correlating and meticulous observation during surgical exploration is required for correct and complete treatment of the disease.

IV. CONCLUSION

Papillary carcinoma of thyroid presenting as cystic skin swelling with discharging sinus is very rare but should be kept in consideration on assessing such lesion. Though FNAC is not very accurate in diagnosis of cystic lesion of neck but may be helpful in giving a clue about a possible diagnosis. USG and CT scan should be advised for assessing the origin and extent of the lesion. Papillary carcinoma of thyroid with extrathyroidal extension should be given aggressive treatment in form of total thyroidectomy with appropriate neck dissection followed by radioiodine ablation.

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Fig. 1 cystic midline swelling with draining sinus

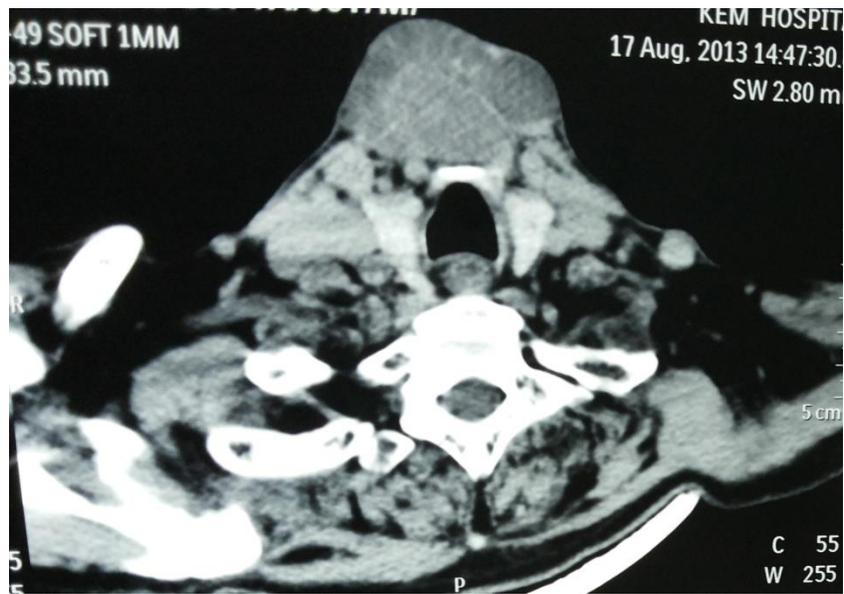


Fig 2.CT scan showing multilobulated cystic mass abutting isthmus of thyroid

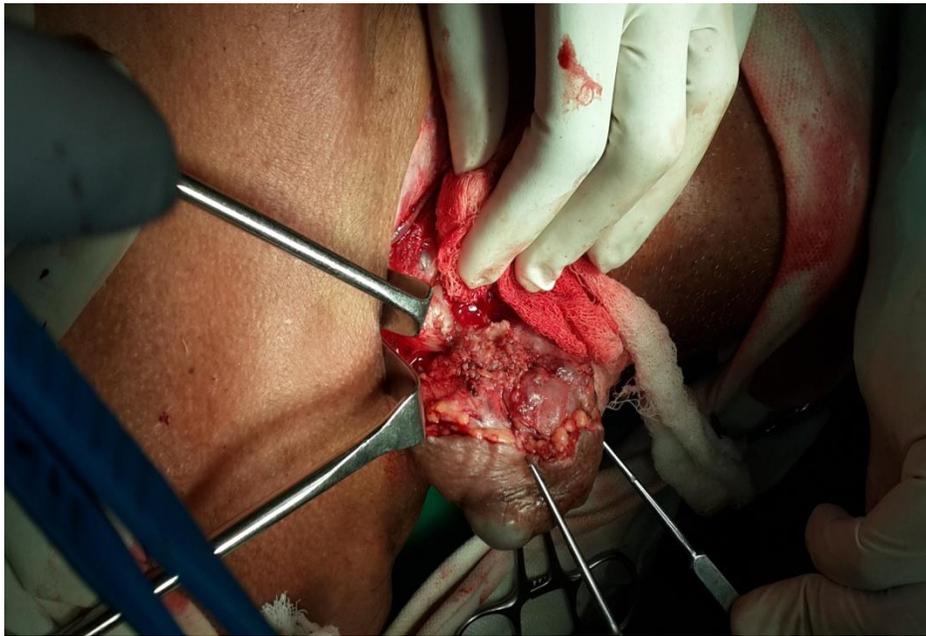


Fig 3.mass being seen arising from isthmus of thyroid and is dissected off the trachea

Probiotic assessment of *Bacillus infantis* isolated from gastrointestinal tract of *Labeo rohita*

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Abstract- The present study was aimed to isolate, characterize and examine the probiotic properties of *Bacillus infantis* (KADR2) from *Labeo rohita*. The total of seven strains isolated from gastrointestinal tract of *Labeo rohita*, one of them KADR2 showed higher antagonistic effect against fish pathogens. The strain was evaluated under *in vitro* intestinal condition based on resistance to bile tolerance, low pH, hydrophobicity, catalase activity and antibiotics susceptibilities. Partial 16S rRNA gene sequence of this strain KADR2 were blasted and showed homology with *Bacillus infantis*(99%) supported by morphological and physiological characterization. Consequently, the positive results of this study suggested that further studies in challenge experiments in fish to explore their probiotic effects having great scope for being used as a potential probiotic in aquaculture.

Index Terms- Aquaculture, Fish pathogens, *Labeo rohita*, Probiotics

I. INTRODUCTION

Aquaculture is emerging as a major enterprise supplementing the needs of animal protein demand for human. Fish are associated with several harmful pathogens produced the emergence of infectious diseases caused by bacteria, fungi, virus, protozoa and parasites present in the aquatic environment. Bacterial diseases are responsible for severe economic losses and high mortality in aquaculture industries (Wang et al. 2008). However, the continuous use of antibiotics in order to manage pathogenic microorganisms results in causing major changes in the normal microbiota in and around the aquaculture systems, increasing resistance to common antimicrobials (He et al. 2010, 2011, 2012; Resende et al. 2012). *Labeo rohita*, *Catla catla* and *Cirrhinus mirgala* are the major carp's production of Indian aquaculture. This carps are frequently affected by *Aeromonas hydrophila* infection that associated with tail and fin rot, hemorrhagic septicemia (MAS) and epizootic ulcerative syndrome (Vivas et al. 2004). This infection decreases the yield to fish cultivators. Hence, it is need of the hour to find and defend harmful pathogens with alternative methods. Probiotics are live cell preparations having beneficial features like improving its feed value, enzymatic contribution to digestion, inhibition of pathogenic microorganism's growth promoting factors and an increased immune response to the host (Verschuere et al. 2000).

The research on the live cell preparations in aquatic organisms is being increased to sustain the aquaculture industry.

The *Lactobacillus* spp., *Bacillus* spp., *Saccharomyces cerevisiae*, and *Lactococcus* spp. are the commonly used probiotics in carps (Ramakrishnan et al. 2008; Harikrishnan et al. 2010; Geng et al. 2012). *Bacillus* species are economically and industrially important strains compare to others, because they produce endospores that tolerant to heat and longer shelf life to produce diverse amount of secondary metabolites (Jock et al. 2002; Puniya et al. 2012). Potential probiotic microorganisms one of the alternatives to antibiotic and chemotherapeutic agents in disease control to sustainable aquaculture production and eco-friendly. Therefore, the aim of this study was to isolate and to select the most promising *Bacillus* strains from fish gut. .

II. RESEARCH ELABORATIONS

Materials and Methods

Isolation and identification

Indian major carp, *Labeo rohita*, (Hamilton) (with average weight >20g) were collected from Cauvery River, Tiruchirappalli District, Tamil Nadu, India and brought alive to the laboratory. Ventral surface sterilization was done using double distilled water followed by 70% ethanol. Under sterile conditions, the fish gut region was dissected out and homogenized with 5 ml of normal saline. The homogenate was kept in a boiling water bath at 80 °C for 20 min and kept in normal tap water immediately. The homogenate was used as inoculums which was serially diluted and plated on *Bacillus* agar medium and incubated at 37 °C for 24 h. Single isolated colonies were picked and purified on another *Bacillus* agar medium. The purified isolates were tested for gram staining, spore staining, catalase activity, oxidase activity, MR-VP, indole production, citrate utilization and carbohydrate fermentation. The nucleic acids of each strain were extracted from the 12 h culture following the phenol-chloroform isolation method (Joseph Sambrook 2001). Universal primers 27F (5' CCAGAATTTCAGAGTTTGATCMTGGCTCA3'), 1492R (5'ACCAAGCTTTACGGYTACCTTGTTAGGACTT-3') were used to amplify 16S rRNA gene sequence of the isolates. The PCR reactions were carried out in a total volume of 50µl (consisting of 5 units Taq DNA polymerase, 400mM each dNTPs, 1.5 mM MgCl₂ and 20ng template DNA). PCR was performed in a Thermal cycler (Eppendorf) under the following condition 95 °C (5min), followed by 34 cycles of 94 °C (1 min), 58 °C (1 min), 72 °C (3 min), followed by a final extension Step at 72 °C (7 min). The PCR products were separated on 1% w/v agarose gels, visualized under UV illumination and photographed with a digital camera (Gel Doc EQ System, Biorad). Amplicons were later sequenced and compared on the

National Center for Biotechnology Information (NCBI) database. The gene sequences of KADR2 then were submitted to NCBI and assigned accession numbers.

Antimicrobial activity

Agar well diffusion method was used to detect the antimicrobial activity of seven isolated strains, against target fish pathogens such as *Aeromonas hydrophila* (ATCC 49140), *Providencia rettgeri* (JX136696), *Aeromonas* sp (JX136697), *Aeromonas* sp (JX136698), and *Aeromonas enteropelogenes* (JX136699). Briefly, 0.1ml of different pathogens was spreader on Mueller Hinton agar plates in which wells with a diameter of 6mm were made and filled with $10^6 - 10^7$ CFU ml⁻¹ of live suspension of probiotic culture. Plates were incubated at 37 °C for 24 h and the zone of inhibition was recorded. The strain shown potent antagonistic activity against test pathogens were assessed for their probiotic properties further.

Acid and bile tolerance

The isolated strain were grown overnight at 37 °C and centrifuged at 8,000rpm for 5 min. The cells were washed twice with sterile Phosphate buffer saline (pH 7.3) and re-suspended in 1ml PBS. Strain were diluted (1:100) in PBS at pH 1, 2, 3 and 4 followed by incubation at 37 °C and the viability of the bacterial cells were determined in terms of CFU ml⁻¹ in *Bacillus* agar plates at different time interval 0, 60, 120 and 180 min. The survivability of the isolates in different pH after 3 h of incubation has also been represented in percentage.

Bile salt resistance of the isolated strain KADR2 were determined by inoculating the growth medium containing 2.5 %, 5.0 %, 7.5 % and 10 % of bile salt followed by incubation at 37 °C for 3 and 6 h. The growth medium with 0 % bile salt served as control. The treated cells were then evaluated by recording absorbance at 595 nm using ELISA reader (BioRad). Survivability of the isolates was represented by percentage.

Hydrophobicity

Hydrophobicity assay was conducted to evaluate the ability of the strain to adhere the solvent (Thapa et al. 2004). Cells were collected by centrifugation (6000g) from overnight culture and washed with PBS, resuspended in 10 ml Ringer's solution and A₆₀₀ was measured as A₀. Cell suspension was mixed with equal volume of solvent and two phases were mixed by gentle vortexing for 2 min. The aqueous phase was removed after 30

min of incubation at room temperature A₆₀₀ of non aqueous was measured as A₁. The Hydrophobicity of bacterial adhesion to solvent was calculated as $(1-A_1/A_0) \times 100$.

Gastric juice tolerance

Gastric juice tolerance was estimated following the protocol described by Ahire et al. (2011). Overnight grown culture (OD₅₉₅ - 0.5) was pelleted by centrifugation and washed twice and suspended in PBS (pH 7.3). The cell suspension was diluted 1:10 in synthetic gastric juice (pH 2.5) and incubated at 37°C. The survival rate of the isolates were measured after 0, 0.5 and 3 h by spreading on *Bacillus* agar plates, which were then incubated at 37°C for 24 h and their growth rate was expressed in colony forming units (CFU ml⁻¹) and represented in percentage

Antibiotic susceptibility

The agar overlay method, as described by Cebeci and Gurakan 2003. Cells were grown over night at 37 °C to obtained OD 0.5. Previously prepared 15 ml of *Bacillus* agar plates and overlaid with 4 ml of soft agar (1%), containing 200 µl of culture. After 1h maintains the plates at room temperature and Antibiotic discs were dispensed on to the plates and incubated at 37 °C for 24 h. The zone of Inhibition was measured (mm).

Statistical analysis

All experiments were performed in triplicates and results were expressed as mean ± standard deviation

III. RESULTS AND DISCUSSION

Isolation and characterization of probiotics from various resources is a challenging task. Nevertheless recently deciphered role of probiotics in overcoming various infectious diseases in both human and veterinary medicine is prompting the researchers to explore newer probiotic species with diverse potent characteristics. Probiotics are commonly used as alternative medicine for chemical antibiotics and supplemented along with feed in many livestock production sectors. Seven bacterial strains were recovered from *Labeo rohita* gut region of healthy fish showed KADR2 strain possessing inhibitory effect against target fish pathogen (Table 1).

Table I: Antibacterial activities of the isolate from *Labeo rohita* against reference fish pathogens

Name of the Fish pathogens	Test probiotic organisms
	KADR2 (JQ312662)
<i>Aeromonas hydrophila</i> (ATCC 49140)	++
<i>Providencia rettgeri</i> KADR11JX136696	+
<i>Aeromonas</i> sp. KADR12 JX136697	+++
<i>Aeromonas</i> sp.KADR13 JX136698	+
<i>A. enteropelogenes</i> KADR14 JX136699	++

Symbols: + - Zone of inhibition between 1 – 2 mm; ++ - Zone of inhibition between 2 – 4 mm; +++ - Zone of inhibition above 4 mm.

The morphological and biochemical data assures that the isolated strain belong to *Bacillus* sp. by comparing characteristic features as given in the seventh edition of Bergey's manual of deterministic bacteriology. The strain KADR2 are found to be spore forming, oval shaped and terminal under microscope while staining with malachite green. The partial 16S rRNA sequences obtained from the amplification products confirmed that *Bacillus*

species. The obtained sequence was submitted to Genbank database and the following deposition number [KADR2 (JQ312662)]. Phylogenetic tree showed close similarity to 16S rRNA gene sequences of *Bacillus infantis* (99%) (Fig.1). 16S rRNA sequencing is the most useful molecular tool to interpret phylogenetic relationships as they are present in the organisms (Woo et al. 2008).

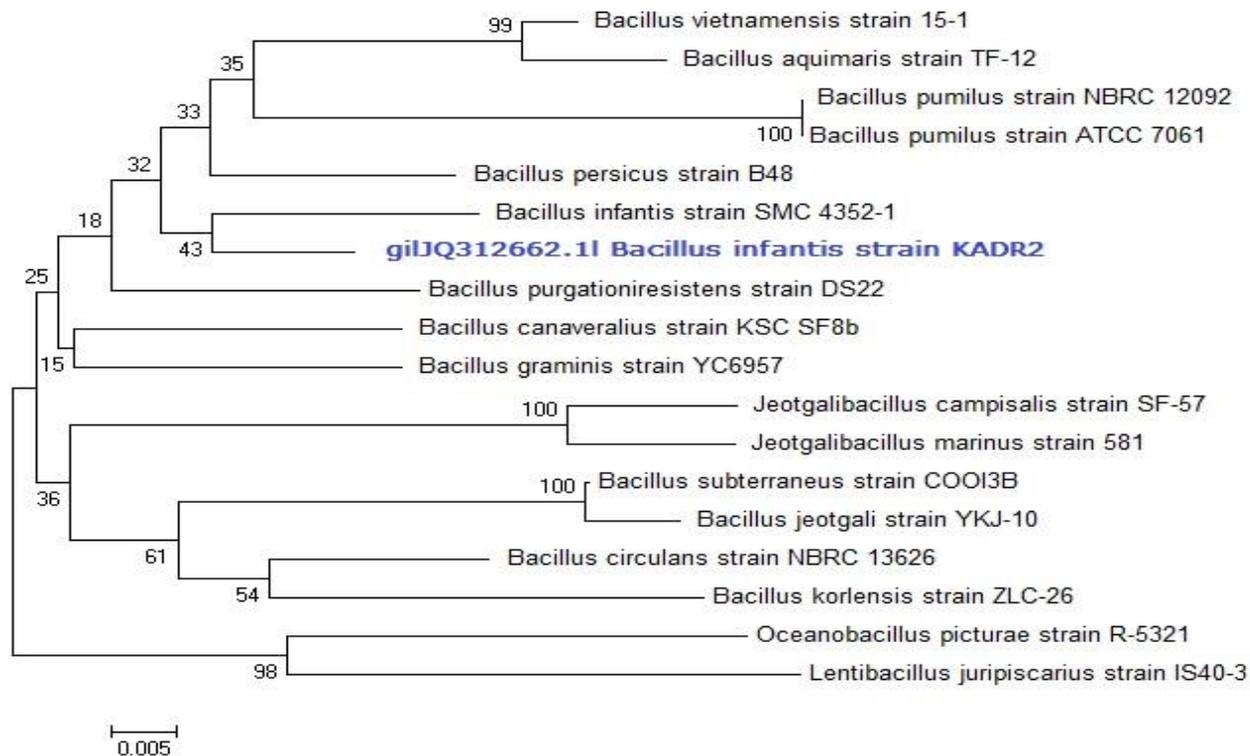


Figure 1: Phylogenetic tree showing species relatedness of *Bacillus* isolates

The tested strain was able to grown at increasing concentration of bile salt (Fig. 2). KADR2 showed survivability of 63.33%, 41.42 %, 38.09 % and 35.71 % at 2.5 %, 5.0 %, 7.5 % and 10 % of bile salt, respectively after 3 h of incubation. However, after 6 h the survivability was reduced to 26.76 %, 21.83 %, 20.19 % and 18.55 %, respectively at increasing concentration of bile salt. An essential trait focusing the beneficial function of strain is their survival in the acidic

condition and tolerance to bile salts [FAO/WHO]. Strain KADR2 are able to survive at the lower pH value of 2.0 and the bile concentration 2.5% indicating that the strain can adapt to the conditions of fish GIT at low pH and bile secretion. These findings assure that the isolated strains are able to withstand in the acidic environment and to tolerate the presence of bile salts. In addition to these, antagonistic property is the essential one to qualify the strains as probiotic.

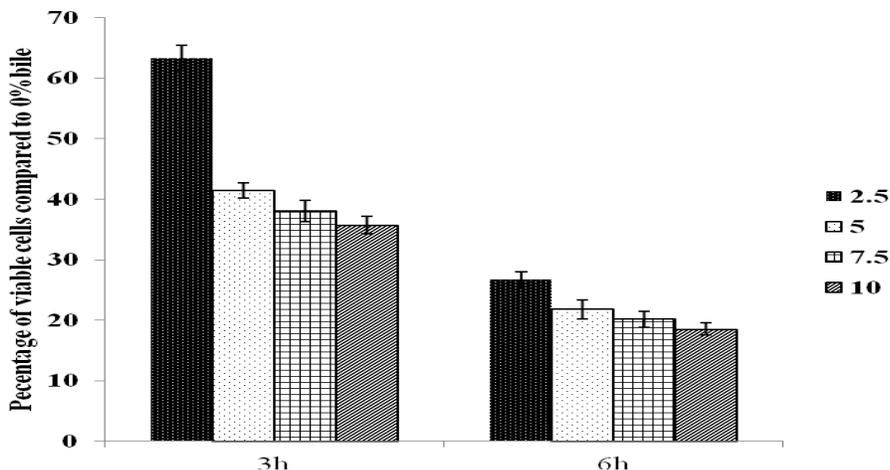


Figure 2: Probiotics isolate bile salt tolerance after 3 and 6h at 37°C. Values are presented as mean ± standard deviation and in terms of percentage

Tolerance of probiotic isolate to gastric juice was evaluated at different time period such as 0.5 and 3 h and was compared to control at 0 min. The viability of the isolate in the presence of gastric juices at different time period is shown in Table 3. KADR2 showed tolerance of 30.76 % after 3 h of incubation when compared to control at 0 min. The hydrophobic cell surface properties of tested strain were examined in xylene, chloroform and ethyl acetate (Fig. 3). The percentages of hydrophobicity were: Xylene at 8.88%; chloroform; 24.14%; ethyl acetate; 21.18%. Adhesion to epithelial cells is another vital parameter to

be a potent probiotic, since it provides the ability to resist the flux of the intestinal content (Guo et al. 2010; Tsai et al. 2008). Colonization in intestinal epithelial cell wall and mucosal surfaces is an important desirable property of probiotic bacteria in order to use its beneficial effects. The surface properties like hydrophobicity ability exhibited by isolates may contribute on its adhesion property (Kos et al. 2003). This property could confer a competition to pathogen and colonization of the isolate in the gastro intestinal tract.

Table 3: Gastric juice tolerance analysis of *Bacillus* isolate in terms of CFU ml⁻¹

Name of the isolates	Viability of bacteria in CFU ml ⁻¹ (×10 ³)			% of survivability after 3 h
	0 h	0.5 h	3 h	
KADR2 (JQ312662)	1.04±0.051	0.52±0.060	0.32±0.020	30.76

Each values is the mean ± standard deviation of three separate experiments

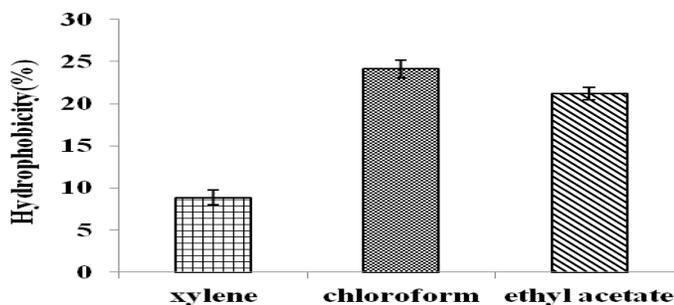


Figure 3: Probiotics isolates cell surface hydrophobicity against various solvents. Each value is the mean ± standard deviation of three separate experiments

The selected isolate was highly susceptible (more than 10 mm of Zone of inhibition) to ampicillin (10µg), erythromycin (10µg) and 5-9 mm of zone of inhibition to amoxicillin (10µg), cephalaxin (30µg), streptomycin (10µg), penicillin (10µg), gentamycin(10µg), Kanomycin(10µg) and rifampicin(5µg), moderate to chloramphenical(30µg) and tetracycline(30µg) (Table 4). These isolate are susceptible to most of the clinically relevant antibiotics including Amoxicillin, Ampicillin, Cephalexin, penicillin-G and streptomycin etc reveals that, these probiotics microbes are safe to use against fish pathogens in aquaculture industry.

These strains were found to be Catalase positive and hemolytic reactions observe to be non- hemolytic on human

blood agar plate after incubation at 37°C for 24 h. The enzyme, catalase is well-known to play a crucial role which reduces the harmful effects of free radicals generated during metabolic process. The probiotic strains in the gut could act as a good antioxidant. (Nishikawa et al. 2009). Absence of haemolytic activity and antibiotic resistance considered one of the good probiotic.

Based on above good attributes, the present study concludes that the identified and characterized the isolate KADR2 are novel, possess notable probiotics properties and thus could be safe to host organism to use as probiotics to enhance livestock production.

Table 4: Antimicrobial susceptibility of the probiotic isolate against the selective antibiotics

Antibiotics (mcg)	Probiotic isolate
	KADR2
Ampicillin (10)	+++
Amoxicillin (10)	++
Cephalexin (30)	++
Streptomycin (10)	++
Penicillin-G (10)	++
Gentamycin (10)	++
Erythromycin (15)	+++
Chloramphenical (30)	+
Kanamycin (10)	++
Tetracycline (30)	+
Rifampicin (5)	++

Symbols: ++ - Zone of inhibition between 2 – 4 mm; +++ - Zone of inhibition above 4 mm

organisms can be used as probiotics either alone or in combination.

IV. CONCLUSION

Aquaculture needs organisms possessing good acid stability, bile salt, gastric juice tolerance, aggregation property which serves as potential probiotic enhancing immunomodulation and inhibiting the growth of other harmful microorganisms. In this study found that isolate KADR2 presented had good essential probiotics properties, having resistance to acid, bile salt, gastric juice condition, as well as a good capacity for adherence to hydrocarbon, to pathogens, and highly antagonistic effect against fish pathogens which survive in gastrointestinal tract. Therefore this strain can act as potential probiotics enhancing the immunity and inhibiting the growth of other harmful microorganisms. Since *Bacillus* spp., isolated from gastro intestinal tracts of fish should withstand low pH, gastric juice bile, lysozyme, and these characteristics may serve as suitable criteria for probiotic culture selection. In this way KADR2 showed the pre requisite characteristics of probiotic. Hence we conclude that these

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A Case Study on Analysis of Face Recognition Techniques

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Abstract- This paper aims to propose a methodology for face recognition using artificial neural networks in dynamic background. The dynamic background is chosen for comparing the important information sequences, characteristic. This paper analysis four different techniques using artificial neural networks for face recognition.

I. INTRODUCTION

Face recognition is a computer vision that has an ability to capture the face from the database automatically. Face recognition is one of biometric methods, to identify given face image using main features of face. This paper reviews most conventional face detection and face recognition approaches, leaving advanced issues, such as video face recognition or expression invariance, for the future work. The goal is to provide a firm statistical basis for drawing conclusions about the relative performance of different algorithms and to better explain why algorithms behave as they do. This helps further understanding of traditional methods such as Eigen faces.

II. FACE RECOGNITION SYSTEMS

In general, automatic face recognition systems are comprised of three steps namely

- Face Detection
- Extraction
- Recognition

Face Detection:

Detection may include face edge detection, segmentation and localization, namely obtaining a pre-processed intensity face image from an input scene, either simple or cluttered, locating its position and segmenting the image out of the background.

Feature extraction:

Denote the acquirement of the image features from the image such as visual features, statistical pixel features, transform coefficient features, and algebraic features, with emphasis on the algebraic features, which represent the intrinsic attributes of an image.

Face recognition:

Represent to perform the classification to the above image features in terms of a certain criterion.

Segmentation among three steps is considered to trivial, easy and simple for many applications such as mug shots, driver's licenses, personal ID card, and passport pictures.

2.1. APPROACHES

Face recognition can be seen as a way for systems to begin to understand human face and thus building a bridge between machines and human

Depending on the type of input data the approaches for interpreting a face could be done in different ways. Depending on the quality of input and algorithm's approach.

The approaches can be made in many ways as shown in the figure:

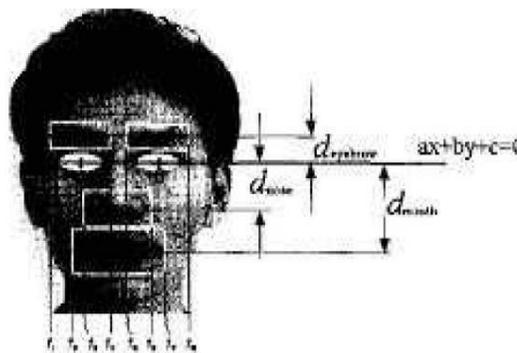


Fig1.Geometric model

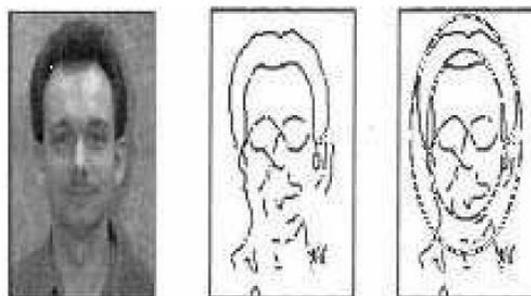
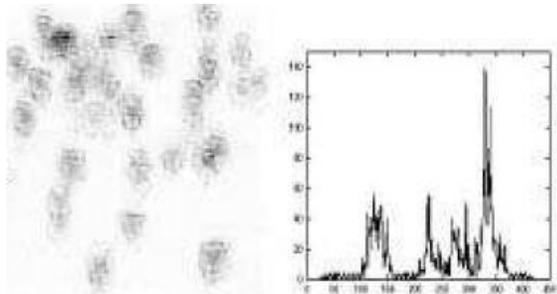


Fig1.1: Color-Based or Texture-Based Method

The approach is coarse-to-fine in both the exploration of poses and the representation of objects. Features are spatial arrangements of edge fragments, induced from training faces at a reference pose, and computation is minimized via a generalized Hough transform; there is no

on-line optimization and no segmentation apart from visual selection itself.

Color and texture are two important modalities in many images processing tasks, ranging from remote sensing to medical imaging, robot vision, face recognition, etc.



MOTION BASED MODEL



Motion analysis could extract the low-level features such as body part segmentation, joint detection and identification and recover 3D structure from 2D projections in an image sequence. This motion information, which was comprised of position and velocity of moving eyes, speaking tone and expressions, etc., incorporated with intensity value, could be employed to easily locate the face.

Other Methods:



This model is used to characterize the geometric pattern of facial components. The center and the radius of the eyeballs of a person’s eyes was detected using the face detected, the structural information extracted and the contour and region information

Some of the literature differentiates 4 different approaches in recognizing a face.

- Principle component analysis
- linear discernment analysis
- Hidden Markova method
- Eigen faces

2.3. Principle Component Analysis Approach

Principal Component Analysis (PCA) is an unsupervised method of dimensionality reduction and classification. Using Principal Component Analysis, patterns are detected in the data and on the basis of these patterns similarities and dissimilarities in the data are identified. PCA helps in detecting such type of patterns in the data which cannot be represented and analyzed graphically. If the patterns in the data are identified, then it is possible to reduce the dimensions of data without losing much information.

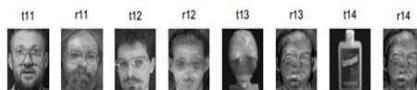


Figure 5: Unknown face and Non-face images - t11 and t12 are unknown faces. t13 and t14 are non-faces. r** means the reconstructed image

2.2 Linear Decrement Analysis Approach

Linear Discriminate is a “classical” technique in pattern recognition, where it is used to find a linear combination of features which characterize or separate two or more classes of objects or events. The resulting combination may be used as a linear classifier or, more commonly, for dimensionality reduction before it can be classified. The prime difference between LDA and PCA is that PCA does more of feature classification and LDA does data classification. In PCA, the shape and location of the original data sets changes when transformed different ATT& Indian Face Database (IFD)

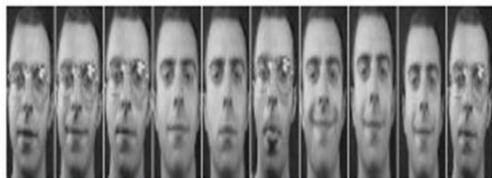


Fig. 1. One of ATT face database with ten different expressions.



Fig. 2. Images corresponding to one individual.

Limitations:

- The time taken for execution, train and test the image of LDA is more than PCA for IFD dataset.
- In terms of accuracy the LDA shows a higher recognition rate.
- This is because of the use of discrete classes to group the images and perform a covariance minimization within the same class.
- The use of this distinct class information increases then feature space used for classification.

2.4. Eigen faces

Eigen faces Approach is a principal component analysis method, in which a small set of characteristic pictures, are used to describe the variation between face images. Eigen faces Approach is superior to feature based recognizers in its simplicity, speed, invariance to noise and individual facial features. Recognition is performed by projecting a new image into the subspace spanned by the Eigen faces and then classifying the face by comparing its position in face space with the positions of known individuals. Goal is to find out the eigenvectors (Eigen faces) of the covariance matrix of the distribution, spanned by a training set of face images. Later, every face image is represented by a linear combination of these eigenvectors. Evaluation of these eigenvectors is quite difficult for typical image sizes but approximation can be done.

Limitations:

- Background (deemphasize the outside of the face)
- Lighting conditions (performance degrades with light changes)
- Scale (performance decreases quickly with changes to the head size)
- Multistage Eigen spaces
- scale input image to multiple sizes)

2.5. Hidden Markov Method

The first features used in face recognition performed with HMM were pixel intensities with a P2D-HMM and were up to 94.5% on the ORL database. The

most widely used features for HMM in face recognition are 2D-DCT coefficients. These DCT coefficients combine excellent decorrelation properties with energy compaction. Another example of features used with EHMM for face recognition is KLT features with recognition rates of up to 98% on ORL database. The main advantage of using KLT features instead of pixel intensities is their capacity to reduce redundant information in an image. The disadvantage is their dependence of the database of training images from which they are derived.

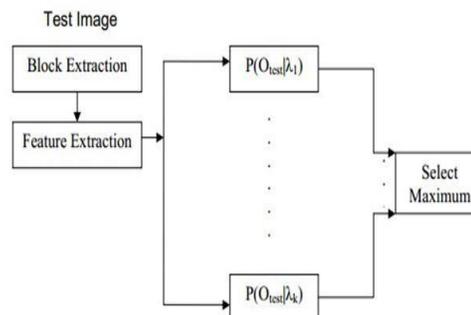


Fig2: training schema of face recognition

Advantages of HMM:

Face images with registration errors occur all of the methods except the HMM one degrade severely in performance.

The HMM algorithm is more tolerant to eye perturbation and gives much better results than the other methods when this phenomenon occurs. Face recognition using a DCT-HMM approach has an accuracy of 99.5%.

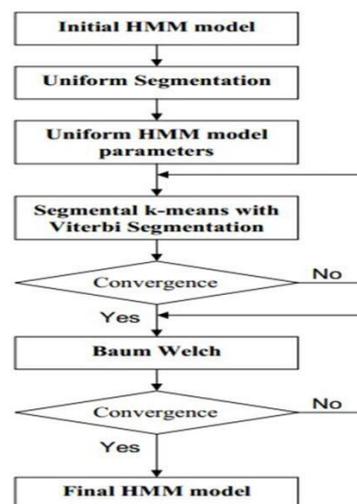


Fig: 2.1-Dimensional HMM model

III. CONCLUSION

Face recognition method is used for security purposes. Thus we have developed a system which provides high level of security in confidential areas.

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An Effective Algorithm for XML Tree Pattern Matching- A Holistic Approach

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Abstract- XML is a self-describing data representation format with a flexible structure. Since hundreds of XML-based languages have been developed, XML is widely accepted as a standard for data representation and information exchange over the internet. The major advantage of using XML is that it allows the users to create their own tags. This kind of increasing popularity of XML attracted the Business and enterprises to make queries on XML data more frequently. There is an increasing demand for efficient and effective query processing on XML data. For performing query processing operations an input XML File is required. Such an XML Files can be viewed as an XML Tree using DOM parser. XML-DOM Parser is mainly used to store, access and manipulate our XML Tree. We have proposed a new search engine named XML Search engine for pattern matching. This XML Search engine gets the input keyword query from the user and performs exact pattern matching for text, images and audio files based on an effective XML Tree Pattern Matching algorithm called TreeMatch. The downloading time of images and audio files in an XML Search engine is going to be compared with local search engine. Finally from the experimental results we are going to prove that our proposed XML Search engine performs exact pattern matching and takes less downloading time compared to local search engine.

Index Terms- XML Tree, DOM Parser, TreeMatch, TwigStack, XQuery, XPath

I. INTRODUCTION

XML is becoming a defacto standard for storing and exchanging information across various platforms. It is a hardware and platform independent tool for carrying the information. Interoperability is possible through XML. Due to the business collaborations and for the purpose of portability enterprises are storing data in XML Format. There is an increasing need for effective query processing on XML data. An input XML File is required for performing pattern matching. Such an XML Files are also validated using DTD or XML Schema. XML Parsers are available in all languages that facilitate the usage of XML programmatically. Moreover XML is tree based and it is convenient to manipulate easily using DOM (Document Object Model) API. Recently many researchers developed various methods or algorithms for processing XML tree queries. The existing system uses XML Tree Pattern

Matching algorithm called TwigStack. But the major drawback of this algorithm is that it provides support only to XML Query languages like XQuery (XML Query Language) and XPath (XML Path Language). XQuery is constructed using XPath Expressions. XPath (XML Path Language) consists of lot of notations for pattern matching. But this TwigStack algorithm supports only for two notations. For performing pattern matching for P-C (Parent-Child) relationships a notation (/) is used whereas for performing pattern matching for A-D (Ancestor-Descendant) relationships a notation (//) is used. However these kind of notations like / and //will make the query processing little bit complicated. This algorithm fails to control the size of useless intermediate results. So we have proposed an alternate solution for performing pattern matching. In our proposed system we are using keyword query and an efficient XML Tree Pattern matching algorithm called TreeMatch. This algorithm solves the sub-optimality problem faced by our existing system as it does consider useless intermediate results. This algorithm is based on the concept of Extended Dewey Labeling. According to the labeling scheme each and every node in an XML document is associated with the number or label. For an instance label 0 is assigned to the root node. The children of the root get labeling like 0.0 and continue with 0.1. The grandchildren of the first parent node starts with 0.0.0 and continue like 0.1.0. The labeling scheme makes XML Tree Pattern Matching query processing easy. Finally we are going to propose a search engine named XML Search engine which performs exact matching based on TreeMatch algorithm and takes less downloading time compared to local search engine.

II. RELATED WORK

S.Chien and C.Zhang [4] have proposed holistic algorithms for XML Query Processing. The novel holistic XML twig pattern matching method called **TwigStack** which avoids storing intermediate results unless they contribute final results. The major advantage of this method is that it avoids computation of large redundant intermediate results. But main limitation of TwigStack is that it may produce large set of “useless” intermediate results when queries contain parent child relationship. TwigStack has been proved optimal only for queries with A-D edges and it still cannot control the size of intermediate results for queries with P-D edges. TwigStack operates in two steps

1. A list of intermediate path solutions is output as intermediate results and
2. The intermediate path solutions in first step are merge-joined to produce the final solutions

Xiaoying Wu [12] have proposed **MPMGJN (Multi-Predicate Merge-Join) algorithm** and typically this algorithm consists of decomposition-matching and merging process:

- Decompose the tree pattern into linear patterns which might be binary (parent-child or ancestor –descendant) relationships between pairs of nodes or root-to-leaf paths
- Find all matching's of each linear pattern
- Merge-join them to produce results.
- MPMGJN varies from TwigStack merge join algorithm is that it requires multiple scans of input list

Li and Jaihaeng Lu [11] have proposed **Stack-Tree Algorithm** which mainly used to overcome the drawbacks of MPMGJN algorithm. The major drawback of MPMGJN algorithm is that is requires multiple scan of input list whereas Stack-Tree algorithm needs only one scan of the input lists. Stack Tree algorithm uses stacks to maintain the ancestor or parent nodes. Stack Tree Algorithm works for both P-D and A-D edges.

Jaihaeng Lu et al. [7] have proposed **OrderedTJ Algorithm** which is mainly used to overcome the drawbacks of decomposition-matching-merging algorithms. In OrderedTJ algorithm an element contributes to final results only if the order of its children accords with the order of corresponding query nodes. If we call edges between branching nodes and their children as branching edges then denote the branching edge connecting to the nth child as the nth branching edge. OrderedTJ is I/O optimal among all sequential algorithms that read entire input. In other words, the optimality of OrderedTJ allows the existence of parent-child edges in non-branching edges and the first branching edge. OrderedTJ algorithm output much less intermediate results, OrderedTJ increases linearly with the size of the database; OrderedTJ is not optimal and outputting less intermediate results.

Al-Khalifa and H.V.Jagadish [2] have proposed **TJFast algorithm** to overcome the drawbacks of containment labeling scheme. While containment labeling scheme preserves the positional information within the hierarchy of an XML Document but some limitations of containment labeling scheme are

- The information contained by a single containment label is very limited. For example, we cannot get path information from any single containment label.
- Wildcard are widely used in XPath and it cannot be supported by the containment label scheme

The containment label scheme is difficult to answer queries with wildcards in branching nodes. TJFast does not produce the individual solution for each node when there are multiple return nodes for the query. TJFast cannot work with ordered restriction and negation function.

Wen-Chiao Hsu [1] have proposed **CSI-X technique** to speed up the query evaluation in XML documents. CIS-X mainly used to overcome the drawbacks of decomposition-matching-merging algorithms to process XML Path expressions. According

to decomposition-matching-merging algorithms a query is decomposed into several sub-queries, each of which is separately executed and its intermediate results stored for further processing. However these methods still have drawbacks of producing large intermediate results and time-consuming merging processing. So in this paper CIS-X technique has been proposed which support for complex XQueries. But the drawback with the CIS-X Technique is that it takes more time for index construction.

B.Choi and M.Mahoui [6] have proposed a new algorithm called **Twig Square Stack** which mainly used to eliminate the merging costs in second phase. Twig Square Stack is a one phase algorithm which can process path matching efficiently and avoids the high cost of merging phase. The overall solutions are stored in hierarchical stacks and the final solutions can be output by applying a simple enumeration function. However the data structures are too complex and expensive to maintain.

L.V.S.Lakshmanan [9] have proposed an algorithm **TwigList** which is a refined version of Twig Square Stack, utilizing a much simpler data structure, a set of lists to store solutions. TwigList has advantages over Twig Square Stack but has same shortcomings. One drawback is that all the potential nodes related to QP (Query Processing) will be pushed into and popped from the temporary stack, even though some of them are not part of the solution. Another drawback is they have less ability to efficiently discard useless nodes.

Al-Khalifa [2] has proposed **Structural Join** methods to process twig pattern matching. In the first phase, a twig query is decomposed into several binary P-C or A-D relationships. Each binary sub-query is separately evaluated and its intermediate result is produced. The final result is formed by merging these intermediate results in the second phase. This method generates a huge number of intermediate results that may not be part of the final results. In addition, the phase of merging is expensive.

T.W.Ling and C.Chen [8] have proposed a containment labeling scheme to process twig queries. Containment labeling scheme for twig Pattern processing decomposes a twig pattern into set of binary relationships which can be either P-C or A-D. Each binary relationship is processed using structural join techniques and the final match results are obtained by merging individual binary join results together. The main problem with the above solution is that it may generate large and possibly unnecessary intermediate results because the join results of individual binary relationships may not appear in the final results. This scheme still produces useless intermediate results for queries containing P-C edges and reduces the size of useless intermediate results for queries containing A-D relationships.

III. EXISTING WORKS

Existing System uses TwigStack algorithm for performing pattern matching in an XML File. TwigStack Algorithm supports XQuery and XPath only. TwigStack Algorithm provides answers to queries containing P-C and A-D relationships. P-C edges are denoted by (/) and A-D edges are denoted by (//). The TwigStack Algorithm is a decomposition-matching and merging algorithm. According to this algorithm a query is decomposed into several sub-queries. Each sub-query is executed separately and intermediate results are stored for further processing. The final

result is obtained by merging these intermediate results. TwigStack Algorithm provides useless intermediate results for queries containing P-C relationships and it controls the size of intermediate result for queries containing A-D relationship. The TwigStack algorithm is described by the following:

```
// Phase 1
1: while notEnd (q)
2: qact = getNext (q)
3: if (isNotRoot (qact)) then
4: cleanStack (parent (qact), nextL (qact))
5: end if
6: if (isRoot (qact) or isEmpty (Sparent (qact))) then
7: cleanStack (qact, next (qact))
8: moveStreamToStack (Tqact, Sqact, pointertotop (Sparent (qact)))
9: if (is Leaf (qact)) then
10: showSolutionsWithBlocking (Sqact, 1)
11: pop (Sqact)
12: end if
13: else
14: advance (Tqact)
15: end if
16: end while
// Phase 2
17: mergeAllPathSolutions ()
```

Algorithm **TwigStack** operates in two phases. In the first phase (lines 1-16), some (but not all) solutions to individual query root-to-leaf paths are computed. In the second phase (line 17), these solutions are merge-joined to compute the answers to the query twig pattern. The major drawbacks of an existing system are described below:

- XQuery and XPath is complicated to understand by non-database users
- XQuery and XPath are not user friendly to non-expert users
- Query Answering becomes little bit complicated using XQuery and XPath
- TwigStack Algorithm fails to control the size of useless intermediate results

IV. PROPOSED WORKS

In proposed system keyword and TreeMatch algorithm is used for performing exact pattern matching. Our input XML File is represented as a Tree using DOM Parser. An XML Search engine is created which gets the input query and performs pattern matching using an effective XML Tree Pattern Matching algorithm TreeMatch. TreeMatch algorithm is based on Extended Dewey Labeling concept. The input query matches with the Extended Dewey label and completes query processing. In proposed system we are performing pattern matching for text, images, audio and video files and the downloading time of audio and video files are computed. The downloading time of audio and video files are compared with local search engine. It is shown that XML search engine takes less downloading time. The concept of the TreeMatch Algorithm is given as follows:

```
1: locateMatchLabel (Q);
2: while(endroot)) do
```

```
3: fact= getNext(topBranching Node);
4: if (fact is a return node)
5: addToOutputList (NAB(fact, cur(Tfact)));
6: advance (Tfact); //read the next element in Tfact
7: updateSet (fact); //update set-encoding
8: locateMatchLabel (Q); //locate next element with matching path
9: emptyAllSets (root);
```

Line 1 locates the first element whose paths match individual root-leaf path pattern. In each iteration, a leaf node f_{act} is selected by getNext function (line 3). The purpose of line 4, 5 is to insert the potential matching elements to outputlist. Line 6 advances the list Tfact and line 7 updates the set encoding. Line 8 locates the next matching element to the individual path. Finally, when all data have been processed, we need to empty all sets in Procedure EmptyAllSets (Line 9) to guarantee the completeness of output solutions.

The proposed system does not require complex query languages like XPath and XQuery. TreeMatch Algorithm matches with the extended Dewey Label for given query and then completes the query processing. Processing time of the TreeMatch Algorithm is less when compared to the decomposition-matching and merging algorithms. TreeMatch algorithm does not produce useless intermediate results. The major advantage of introducing the TreeMatch Algorithm is to solve sub-optimality problem and to reduce the answering time of the queries.

The Proposed system is implemented by using the following two main modules:

- Admin
- User

The various sub-modules used in Admin and user are given below as follows:

Admin:

1. Insertion and deletion of data
2. Creation of an XML File

User:

1. User Login
2. Viewing XML Tree
3. XML Tree Pattern Matching
4. Comparison Module

In Admin module we are creating an XML File. After the successful creation of an XML File user can login with their id and password. Users can view the XML Tree from the selected XML File. Then it is easy for the user to perform pattern matching for text, images, and audio files. Finally downloading time of audio and image files are compared with local search engine and it is proved that XML Search engine takes less time

V. EXPERIMENTS AND RESULTS

We have implemented all tested algorithms in J.D.K 1.6 using the file system as a simple storage. We conducted all the experiments on a computer with Intel Pentium IV 1.7GHz CPU

and 2G of RAM. The concept of TwigStack algorithm has been tested using a Tool called XPath Builder. The Tree Match algorithm has been implemented using Java Programming language. The front end is java and Back end is MySQL database.

All the proposed modules have been implemented and the analysis of our project is shown in the bar chart given below. In the Bar graph X-Axis is Query and Y-axis is time in milliseconds.

The pattern matching is going to be done for text, images and audio files. For performing pattern matching for images and audio files the downloading time will be the important factor. The downloading time of images and audio files in an XML Search engine is going to be compared with some local search engines. The experimental results show that our XML search engine takes less downloading time.

The major advantages of our proposed work are as follows:

- Reduced Downloading time
- Does not consider useless intermediate results
- Very low processing time
- User-friendly
- Efficient for non-data base users
-

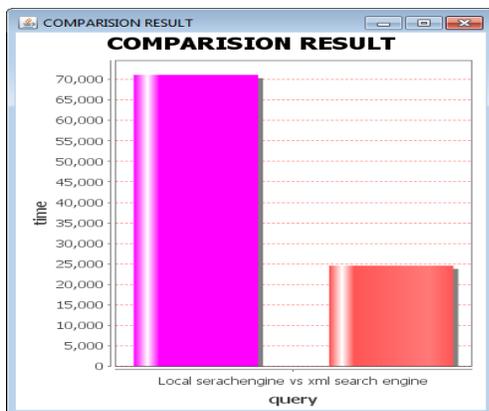


Fig 1 The downloading time of an audio file in XML Search engine is compared with Local Search engine

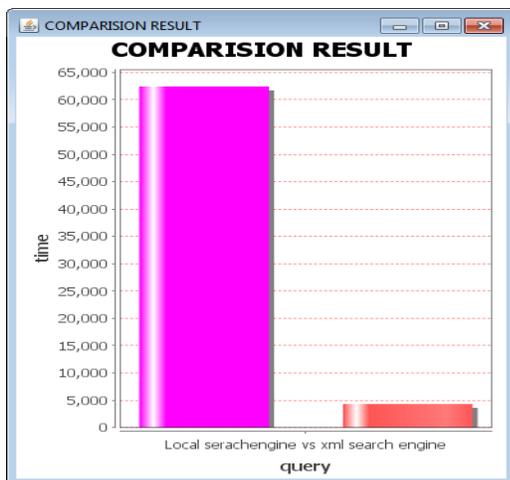


Fig 2 The downloading time of an image file in XML Search engine is compared with Local Search engine

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Designing and developing a model for converting image formats using Java API for comparative study of different image formats

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Abstract- Image is one of the most important techniques to represent data very efficiently and effectively utilized since ancient times. But to represent data in image format has number of problems. One of the major issues among all these problems is size of image. The size of image varies from equipment to equipment i.e. change in the camera and lens puts tremendous effect on the size of image. High speed growth in network and communication technology has boosted the usage of image drastically and transfer of high quality image from one point to another point is the requirement of the time, hence image compression has remained the consistent need of the domain. To cope up with the said problem, time & technology has given many image formats periodically. Researcher has identified the requirement and importance of the problem and prepared and designed conversion model to convert one image format into other image formats using java api and analyze the algorithm by taking different color as well as grey scale image. The presented paper represents conversion model and different image analysis.

Index Terms- Image conversion model, java image api, Comparative study, image size.

I. INTRODUCTION

Need and importance of image: Image is one of the most important techniques to represent data very efficiently and effectively utilized since ancient times. Image is medium for nonverbal communication which is worth a thousand words. Image conveys message fast and effectively with enough opportunity / open ends for imagination as compared to words.

Need and importance of image compression: There are many area of application of image. Quality of image required in these areas are different i.e. in health sector medical image requires high quality. Where images used for social networking does not require much quality. Quality is paid with size. One of the major issues among all problems of image domain is size of image. Equipment makes direct and intense effect to the size of image. i.e. change in the camera and lens puts tremendous effect on the size of image. High speed growth in network and communication technology has boosted the usage of image drastically and transfer of high quality image from one point to another point is the requirement of the time, hence image compression has remained the consistent need of the domain. This shows different requirement of compression in different areas of image application.

Different requirement of compression in different area of image has produced various compression algorithms or image file formats with time. These formats includes [2] ANI, ANIM, APNG, ART, BMP, BSAVE, CAL, CIN, CPC, CPT, DPX, ECW, EXR, FITS, FLIC, FPX, GIF, HDRi, HEVC, ICER, ICNS, ICO, ICS, ILBM, JBIG, JBIG2, JNG, JPEG, JPEG 2000, JPEG-LS, JPEG XR, MNG, MIFF, PAM, PCX, PGF, PICTor, PNG, PSD, PSP, QTVR, RAS, BE, JPEG-HDR, Logluv TIFF, SGI, TGA, TIFF, WBMP, WebP, XBM, XCF, XPM, XWD.

Above mentioned formats can be used to store different kind of images (i.e. grey scale, gradient, image with humans, image with full of colors etc). But each image format algorithm stores the data in their own way and hence size of the same image varies from one algorithm to another algorithm.

To study such variation in the size for the same image I have designed and developed a tool with the help of java api, which takes one image format and converts it into another format. So that, the comparison of the image size, can be performed. From various formats, I have selected only five well known image formats i.e. jpg, gif, png, bmp and tiff.

As number of formats available, it is frequent requirement to convert one format to another one. There are different tools/ ways available for conversion.

To convert the image from one format to the another format, number of tools are available. But I have studied the following two tools for the conversions.

1. Matlab: Matlab has rich library for image processing. It offers variety of operations / functions for image conversion.
2. Java api: java has java.awt.image, com.sun.media.jai and javax.media.jai packages which offer very good image library api for image conversion. Hence we have used java api for the conversion of the image.

II. CONVERSION MODEL

Fig 1 : Image conversion model

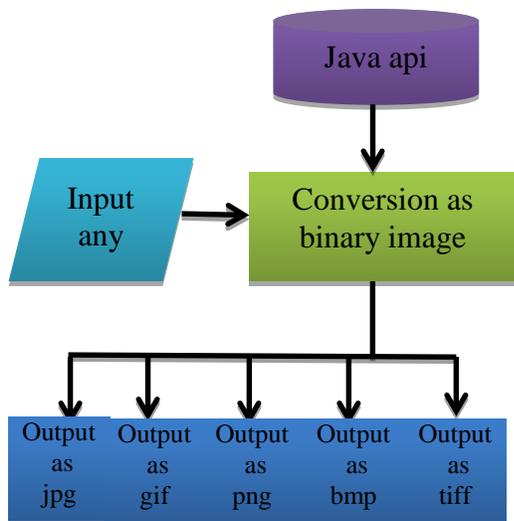


Fig1 shows images conversion model. It takes image in any format as input in the first step. In the second step it converts the imputed image file into the binary file with the help of the java api. Then in the next step the converted binary file is stored as the different image files with the help of the functions available in the java api.

III. SELECTION OF DIFFERENT IMAGES:

To study the size of selected file formats, the researcher has taken different types of images i.e. (1) grey scale image (2) natural landscape (3) human being (4) Full of colors. The reason behind selecting such type of the images is only to study, relation between types of image, size of image with reference to image format.

As the model is implemented using the Java code, the code takes any format from the selected five formats and converts it into the remaining all formats. But for the practical implementation we have taken the jpg file with the following specification:

- Width of the image : 400 pixel
- Height of the image : 300 pixels and
- Color model : 24 bits.

By implementing the model the comparative table for all the four selected files with its size and format is given in table – 1.

IV. COMPRISION OF DIFFERENT COLOR AND GREY SCALE IMAGES

In the table – 1 first column represents the type of the image second onwards all the columns represents the type of image. Each row represents the size of image for specific file format. After studying the images outcome from the table – 1 , can we assumed that the size of file has direct connection with number of colors? It means a file with more colors, is bigger in size? This question leads the researchers to performs the another experiment with only grey scale images.

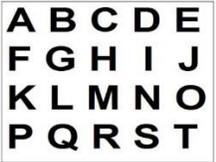
Table 1: Image size comparison table: Color & grey scale

Image	Image-format	Jpg	Gif	Png	Bmp	Tiff
	Size(KB)					
	Grey scale	11	71	75	351	352
	Natural landscape	10	26	164	351	352
	Human being	31	81	295	351	352
	Full of colors	43	88	341	351	352

V. COMPRISION OF DIFFERENT GREY IMAGES

To study the size of file formats for the grey scale images, we have taken different four grey scale images, which varies in nature (i.e text based, human, single object and multiple objects.) The experiment is performed with the same code, where the file specification is also same and the outcome is in table-2.

Table 2: Image size comparison table: Only grey scale width:400 X height:300, Color model: RGB -24bits

Image-format	Jpg	Gif	Png	Bmp	Tiff
Image Size(KB) GreyScale1 	18	23	76	351	352
GreyScale2 	16	43	88	351	352
GreyScale3 	14	37	102	351	352
GreyScale4 	38	141	148	351	352

Data analysis of table2 shows that, size of bmp and tiff has no concern with the color palettes or number of colors, which is same as analysis of table1. This data analysis also confirms assumption made in data analysis of table1. More the colors, bigger the size. Analysis shows, jpg occupies the minimum size, then gif in major cases, in turn png in major cases. In case of bw3 image, gif size is bigger than png which is exception in the trend.

VI. CONCLUSION

By analyzing the table-1 and table-2, following conclusion can be drawn.

1. Jpg occupies less space compare to remaining formats.
2. Jpg occupies less size, gif occupies size greater than jpg but less than png.

3. While BMP and TIFF does not have concern with any parameter except width, height and color model. The size of BMP and TIFF is determined by the following presented formula:

Image size = width * height * color model(bytes) + header size.

Researchers have taken width:400 pixels, height:300 pixels and color model: 24bits.

$$\begin{aligned} \text{So size of BMP images} &= 400 * 300 * 3 + 54. \\ &= 360054 \text{ bytes.} \\ &= 351 \text{ KB.} \end{aligned}$$

This outcome is exactly similar to the outcome of BMP column of table-1 and table-2, which proves the success of formula.

In the similar way TIFF file has header size of 484 bytes.

$$\begin{aligned} \text{The size of TIFF images} &= 400 * 300 * 3 + 484. \\ &= 360484 \text{ bytes.} \\ &= 352 \text{ KB.} \end{aligned}$$

This outcome is exactly similar to the outcome of TIFF column of table-1 and table-2, which proves the success of formula.

4. By viewing the table-1 and table-2, the size does not rely on colors.

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Quality Improvement of Pumping Element used in Diesel Fuel Injection Pump

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Abstract- Pumping element is an important component of a diesel fuel injection system. This project was carried out in Bosch. Ltd Adugodi, Bangalore. Using Pareto analysis, defects with highest percentage rejections are found. Barrel bore taper more and Honing Lines rejections were 2.5% and 1.8% respectively in the year 2013. Root cause analysis is done using Shainin Technique. Reason for the cause is analyzed and the solution is found. The solution is optimized by analyzing the Physics behind the problem. Optimized solution is validated for a calculated batch over particular period. After validation the solution is incorporated for daily production. The rejections were brought down by more than half.

Index Terms- FPY, Diesel Fuel Injection Pump, Pumping element, Shainin Technique

I. INTRODUCTION

Diesel engines have become the most popular power packs for heavy duty vehicles and equipments such as trucks, tractors, passenger vehicles, gensets, etc. as the diesel is one of the most efficient and energy dense fuels available today [1]. Nevertheless, the diesel engine has several great advantages, the quality production and maintenance of critical components of engine system has become yet a challenging task. Diesel Fuel Injection Pump (DFIP) System- the heart of the diesel engine is one such critical system [2].

The quality of the product has become the dominant criteria to acquire the global market. BPS is the leader in quality production by deploying advanced quality measures in its manufacturing processes and thus, satisfying the customer [3]. It has been possible through continuous improvement and proactive quality maintenance techniques like Shainin System, Failure Mode Effect Analysis (FMEA), Six Sigma, etc., in the production processes.

The quality of the product may be quantified in terms of money (INR), First Pass Yield (FPY), part per million (ppm), etc. There is a need to employ a simpler and efficient tool along with the traditional seven quality tools in order to achieve Six-sigma quality in manufacturing industries [4]. Failure of parts, products, or systems in the field can cause major damages - such as production loss, rework, warranty claims, and even image loss of the organization in the market.

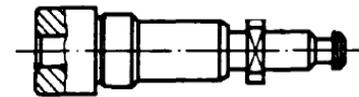


Fig.1. Pumping Element

2. METHODS

2.1 Pareto Analysis

Pareto analysis is a formal technique useful where many possible courses of action are competing for attention. In essence, the problem-solver estimates the benefit delivered by each action, then selects a number of the most effective actions that deliver a total benefit reasonably close to the maximal possible one. Pareto is commonly referred to as “80/20” rule, under the assumption that, in all situations, 20% of causes determine 80% of problems.

The important defects that occur during the production of pumping elements are barrel bore taper more, honing line in barrel, element sticky, barrel with wrong taper, ungrounded shoulder of barrel, Element rusty, dimensions out in the groove of a plunger, etc. When the percentage defects for various defects in the year 2014 were drawn, barrel bore taper more and element sticky were found to be of major concern and were contributing 80% of the defects.

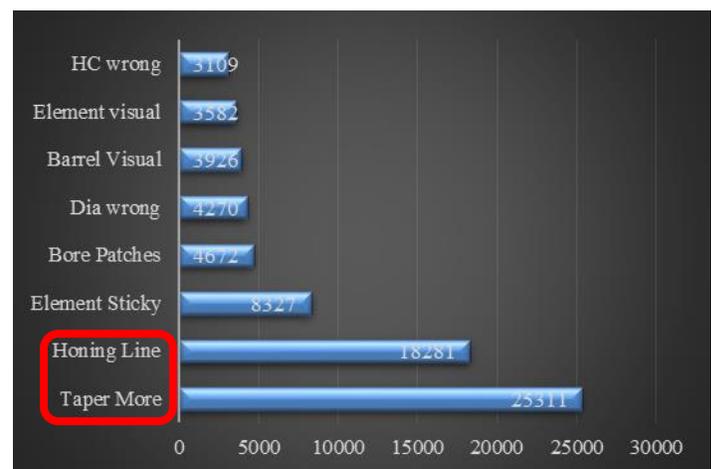


Fig.2.1 Pareto of defects in the production of Pumping element

Pareto analysis shows that honing lines and taper more defects which constitutes 20% of the type of defects is the cause for the 80% the total defectives. Pareto law suggests that these two defects should be concentrated upon. This technique saves resources like money, time, etc. If we divert our attention to trivial matter then our resources get wasted. If we concentrate on Pareto causes then the rejection can be brought down by more than half, which is actually the aim of the project then there will be a considerable decrease in the overall rejection.

2.2 Green Y: Barrel bore Taper more

Pumping element is made up of two components barrel and plunger. Barrel is analogous to the cylinder of a pump and plunger to a piston. The percentage rejection of barrel more taper defects in 2013 is 2.5%, the target of this project is to bring it to 1.8%. The barrel undergoes the following process:

1. Drilling
2. Boring
3. Reaming
4. Inscription Stamping
5. Electro chemical machining
6. Heat treatment
7. Honing
8. Profile grinding
9. Lapping
10. Durr Cleaning
11. Inspection

The defects are detected only after inspection. At inspection the barrels are inspected for their bore diameter, bore taper and various other characteristics. The specification of bore diameter depends upon the element and varies from 5mm to 10mm. The tolerance of the bore diameter is $+6\mu$ to -2μ irrespective of bore diameter. The specification of taper for bore diameter is 0 to 1.5μ when measured from collar end. If the taper is more then there will be excess gap between barrel and plunger which results in leakage of the fuel to the lubrication oil of the pump. This results in thinning of the lubrication oil which in turn results in wear and tear of the pump. The operations prior to inscription stamping are done by the supplier. The defects may be generated at the supplier or in honing or during lapping only as all other process do not machine the barrel bore.

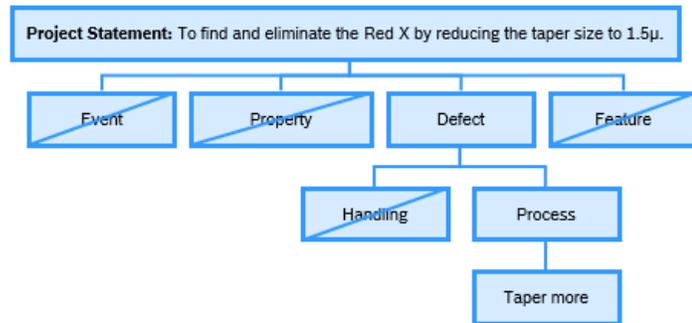


Fig.2.2 GreenY categorization as defect in process

The above figure shows that the Taper more defect comes under process. Hence the defects is generated in the production process which may be machine or measurement system.

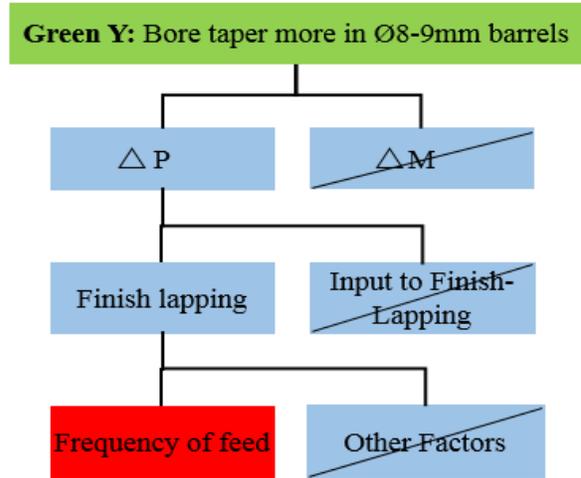


Fig.2.2.2 Solution Tree of Taper More

The above figure shows that initially the source of defects is found out in the process and not in the measurement, this is done by using a tool called Isoplot.

2.2.1 Isoplot

Ten components are taken randomly from a process, it is measured in two different measuring instrument which is taken randomly. The measurements are plotted on a graph sheet taking the measurements of one measuring instrument in one axis and the other in the other axis. The graph will look as follows below

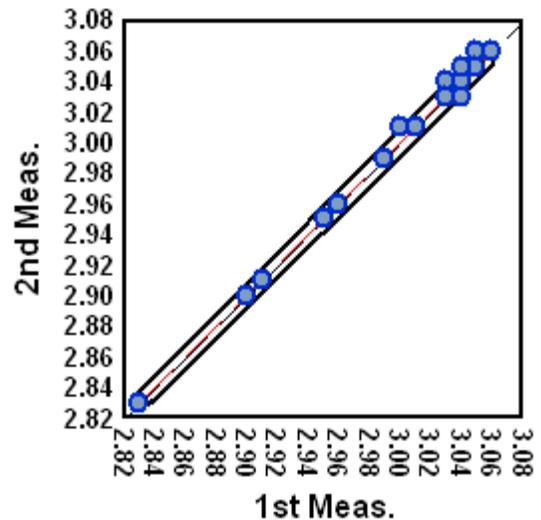


Fig.2.2.1 Graphical representation of Isoplot

A line is drawn bisecting the two axes. The second farthest point from this lines is considered and a line parallel to the middle and passing through this point is drawn. A line parallel to this extreme line and equidistance from this mid line is drawn. This two lines are joined by a semicircle at the end these semicircles include the extreme points in both the direction of the middle line.

Delta P is the value which represents the variation in process. The distance between the arcs gives delta p. Delta M represents the variation in measurement system. It is the perpendicular distance between the two extreme parallel lines. Delta P / Delta M is called as the discriminating ratio (DR). If DR is ≥ 6 then the process should be concentrated upon and if its < 6 then the measurement system is the culprit for the defects. The graph is drawn and DR is calculated and it is 9.2 which is greater than 6 hence the defects are getting generated in the process.

2.2.2 Converge - Active Multi-Vari

Active Multi-Vari is a Shainin tool used to find the process, which is generating the defects. The assumption made in the active multi-vari is that the probability that only one machine will be producing defects at a given time is high. The procedure is to take 200 barrels from a single batch of supplier. All the barrels are numbered and divided into 4 groups namely A (1-50), B (51-100), C (101-150) and D (151-200). A and B groups are mixed and given for a single honing machine for processing. C and D groups are mixed and given to another honing machine for processing simultaneously. After honing the groups are separated. A and C groups are mixed and given for lapping. B and D groups are mixed and given for lapping to another machine. All the groups are given for inspection and the percentage defects are noted for different groups separately.

If the rejection in all the groups are similar then the probability of defects being generated at the supplier is high. If the defects are only in group A and B or C and D then the probability of defects being generated in honing process is high. If the defects are only in A and D or B and C then the probability of defects being generated in lapping is high. If the pattern of defects is other than the above mentioned then that trail is discarded and new trails are carried out. If the rejections are coming in one of the above three pattern only for three times, then the process that connected with that pattern is said to be producing defects.

2.2.3 Experiment Details

The trails were carried out and results are tabulated below

Table 2.2.3: Results of Active Multi-Vari

Trail No.	A	B	C	D
1	2%	0	0	4%
2	0	0	0	0
3	0	2%	2%	0
4	0	4%	4%	0
5	4%	0	0	2%

The rejection are either in A and D or in B and C. This pattern as discussed before points the cause towards lapping process.

2.2.4 Funnelling

100 barrels are numbered and given for lapping process. The changes which are done in the lapping i.e. application of paste and the application of feed is noted down. The one to one correspondence between defects and lapping technique is noted.

Type	Sequence rejection of Taper More									
B041	1	2	3	4	5	6	7	8	9	10
	11	12	13	14	15	16	17	18	19	20
	21	22	23	24	25	26	27	28	29	30
	31	32	33	34	35	36	37	38	39	40
	41	42	43	44	45	46	47	48	49	50
	51	52	53	54	55	56	57	58	59	60
	61	62	63	64	65	66	67	68	69	70
	71	72	73	74	75	76	77	78	79	80
	81	82	83	84	85	86	87	88	89	90
	91	92	93	94	95	96	97	98	99	100

Fig.2.2.4 Defects generating sequence

When the interval of application of paste is high, Taper more defects are generated. It is found that the irregular feed is the root cause for taper more.

2.2.5 Feed

Lapping is a process used to prepare fine surface finish. Tool in the form of a sleeve which is made up of cast iron is inserted to a mandrel with a taper. The sleeve has a slit. A push up is inserted to hold the sleeve in place. Sleeve and the mandrel has a taper but in opposite direction. A cotter mechanism is used to pull the mandrel, due to pushup the sleeve will be in its place and due to taper and slit it expands which is called feed. A hand lever is used to operate the cotter mechanism. After machining of a particular number of barrels the feed is given to compensate the wear of the sleeve so that a particular diameter of barrel is obtained.

2.2.6 B vs C Test

Better vs Current test is done to check whether the root cause is correct or not and further funnelling is done. Following are the B vs C test results. Each trail is done for 100 barrels.

Table 2.2.6: Results of B vs C Test

Trail No.	Frequency of feed	Frequency of application of paste	% rejection of Taper more
1	10	8	9%
2	10	2	8%
3	4	8	1%
4	4	2	0

The above result shows that the Frequency of application of paste is the Red X. In Shainin a term called RedX is used which is analogous to root cause. Red X is that factor when controlled reduces the rejection by more than half.

2.3 Green Y: Barrel Honing Lines

As the name indicates Honing lines are the lines generated during honing operation. Honing operation generates barrels with surface finish of $Rz\ 2\mu$ hence the surface is rough which results in the wear of the element during its operation. As the rejection of honing lines is high the barrels with poor surface finish but lying within the specification that is in the border is high. This results in poor quality. The percentage rejection of barrel bore is 1.8%. The target of the project is to bring the rejection by half.

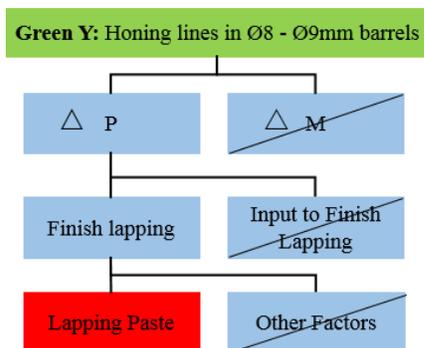


Fig.2.3 Solution tree of Honing Lines

2.3.1 Kappa Study

As the defect is an attribute Kappa study is done on measurement system. If the kappa value is ≥ 0.9 then the measurement system is capable, if it is between 0.9 and 0.7 then it is conditionally capable and if its lesser then 0.7 then it is not capable. In our case the kappa value was found out to be 0.93 which means that the measurement system is capable and the defects are being generated in the process.

2.3.2 Converge - Active Multi-Vari

Table 2.3.2: Results of Active Multi-Vari

Trail No.	A	B	C	D
1	9	0	0	7
2	0	0	0	0
3	0	5	7	0
4	0	0	0	0
5	10	0	0	10

The above result shows that the defects are generated in Lapping operation.

The defects that are rejected as honing lines are actually not honing lines but barrels with poor surface finish as a result of lapping. The reason for which the poor surface finish are many. Micro analysis of "Honing lines" specification of Rz is 0.7μ

Table 2.3.2: Rz of defective barrels

Trail No.	Collar	Middle	Shaft
Honing lines	0.9	0.17	0.25
Pseudo Honing lines	0.83	0.97	1.1

As we can see barrels which are rejected as honing lines and the other pseudo honing lines, honing lines barrels have out of specification Rz only in one region of the barrel whereas the pseudo honing lines barrels have out of specification Rz throughout the barrel. Through discussion it is found out that the reason for pseudo honing lines rejection is the contamination of lapping paste. There are two types of lapping one is pre-lapping and the other is finish-lapping. Pre-lapping is a process which mainly concentrate on material removal and it uses a paste which is Red in color as the chief content is aluminum oxide. Finish-lapping is a process where the roughness and straightness is concentrated and it uses green paste which chiefly contains chromic oxide. Chief contaminants of finish-lapping paste is the pre-lapping paste, grinding mutt or sand. All the contaminants enhance material removal rate. The contamination is done deliberately at most times as the material removal rate is high and the cycle time decreases which means the time of machining is less.

2.3.3 B vs C Test

Red and green lapping paste is mixed and a trail is done.

Table 2.3.2: Results of Active Multi-Vari

Trail No.	No of components	Paste used for Lapping	Percentage rejection of Honing Lines
1	200	Contaminated by red paste	10%
2	200	Pure	0

From the above table it is clear that the contamination of paste results in the generation of Barrel bore honing lines. Micro analysis of the above defective barrels were done and found that its characteristics were same as that of the barrels having pseudo honing lines. Hence it can be concluded that the contamination of paste is the root cause for Barrel bore honing lines.

3. Bulk Validation

A machine is assigned for 1 shift daily for 1 month. The results from this machine is noted down for that particular period. The bulk validation showed that there was a reduction in the taper more defects by 62% and honing lines rejection by 53%.

4. Conclusion

The overall defects in the production of pumping element was brought down by 36%. The quality of the pumping element in turn of the pump is increased. Satisfied customer.

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Metal mediated intramolecular interactions in the ternary complexes of beta-hydroxy ketone derivatives (O-O donors) and benzotriazole derivatives (N-N and N-O donors) with transitional metal ions

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Abstract- The metal mediated intramolecular interactions and their stabilities have been established for the ternary complexes of metal ions (copper, nickel, zinc and cobalt) with beta-hydroxy ketone (BHK) derivatives (O-O donor atoms) and benzotriazole (BTAZ) derivatives (N-N and N-O donor atoms) in 50% water + 50% dioxane medium in 0.1 M KNO_3 ionic strength at 25°C using potentiometric pH titrations. The intramolecular interactions and the stabilities of these complexes are quantified in terms of $\Delta \log K$ values, intra-molecular equilibrium constants and percentage of stacking interaction in the ternary systems. The observed positive $\Delta \log K$ values suggest that the flexible side chain in BHK ligand having butyl and phenyl ring overlaps with the fixed aromatic moiety of BTAZ ligand in the ternary complex, which results in the enhanced stabilities for the ternary complexes. Based on the experimental data we conclude that, (i) the flexible side chains of BHK ligand having butyl and phenyl ring interacts with the heterocyclic ring of BTAZ ligand in the ternary metal-ligand complex, but not with aniline ring, (ii) ternary complexes with BTAZ having N-N donor atoms form more stable complexes over the BTAZ having N-O donor atoms and (iii) ternary complexes with copper forms more stable complexes, which is followed by zinc ion complexes with the ligands, and both nickel and cobalt form complexes with similar stabilities.

Index Terms- Ternary complexes, mixed ligand complexes, stability constants, intramolecular interactions, stacking interactions.

I. INTRODUCTION

The scientific research in the identification of mixed ligand metal complexes or ternary complexes has been constantly growing for the last several decades, because of their broad arrays of applications in various scientific fields. The metal-ligand complexes have unique properties such as charge controlling agents or stabilizing agents or can act as liquid crystals etc., given the fact that the metal-ligand complexes are excellent in heat resistance and environment resistance in the medium. In view of their unique properties, the metal-ligand complexes have several applications in numerous fields from biotechnology to electronic devices. Some of the utilities include in the biological systems¹ development of luminescent materials^{2,3,4} color stabilizing or charge controlling agents for

toners in photography^{5,6,7} catalysts in chemical synthesis⁸ in the photonic and optoelectronic devices⁹ and liquid crystals¹⁰.

In the above mentioned utilities of metal-ligand complexes, the criticality is in the stabilities of metal-ligand complexes for a given medium. These stabilities are directly depending on (i) the structure of the ligand, (ii) nature of the metal ion, (iii) intramolecular interactions between the bound ligands in the metal mediated complex, and (iv) the medium for the complex formation. For example, in order to develop a metal-ligand complex for therapeutic applications with excellent properties, the first requirement is to investigation of the stabilities of metal-ligand complexes in the medium of interest. As we mentioned above, several factors influence the stability of the metal ligand complex. Therefore, understanding the factors those contribute towards the overall stabilities of metal-ligand complexes is essential in the development of a metal-ligand complex system. A mechanistic understanding of how metal complexes achieve extra stability is crucial to their utility, as well as the rational design of new complexes with improved potency.

The stability of metal ligand complexes can be estimated or predicted based on the ligand coordination atoms, the charges of coordinated atoms and metal ions, and the chelate ring size in the complex. However, in some cases, the intramolecular non-covalent interactions between ligands can contribute a significant role in the overall binding energy of the complex. These interactions include hydrogen bonding, hydrophobic interactions, and stacking interactions between the ligands of the complex. Most of the time the predicted stabilities of the metal ligand complexes, based on the pK_a values of the ligands, differ from the experimental values. This is because of the fact that the intramolecular interactions present between the coordinated ligands in the metal complex and also these interactions are depend on the orientation of the side chains of the ligands.

In order to get more information on the intramolecular interactions and their contribution towards the overall stability of metal ligand complexes, in this investigation, we designed beta-hydroxy ketone (BHK) derivatives having flexible side chains of methyl, ethyl, butyl and phenyl groups and benzotriazole (BTAZ) derivatives having to side chains, and Cu(II), Ni(II), Zn(II) and Co(II) as metal ions in the formation of metal ligand complexes. The objective of this investigation is to explore, how the side chain groups from BHK interact with fixed aromatic moieties of bound BHK ligand to the metal ion.

The BHK derivative has a methyl or ethyl or butyl or aromatic substitution in a flexible side chain and this side chain does not involve in the metal coordination. In BHK O-O atoms are the donor atoms and these atoms coordinate to the metal ion. The BTAZ derivative has a benzotriazole ring connected to ethylene amine or aniline, and nitrogen atom from benzotriazole ring and amine group from the side chain involve in the coordination to the metal ion.

The metal complexes of beta-hydroxy ketone (BHK) and benzotriazole (BTAZ) derivatives have several industrial applications. For example, metal complexes of BHK are known to use as a fluorescent probes or insecticides¹¹ whereas metal complexes of BTAZ used as catalysts in organic synthesis¹². However, there is no stability data available in the literature for these metal ligand complexes. Therefore, our report is certainly provides a valuable information in the development of metal-ligand probes using BHK and BTAZ ligands.

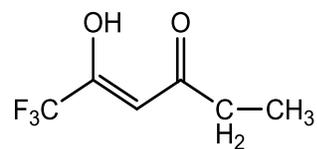
In addition to the above, the data from this report, i.e., the ternary complexes of transitional metal ions with BHK ligands (O-O donor atoms) and BTAZ ligands (N-N donor atoms) is compared with our previous communicated data for the ternary complexes of metal ions with BHK ligands (O-O donor atoms) and BTAZ ligands having N-O donor atoms (communicated to International Journal of Scientific and Research Publications Vol.4, Issue 7, July 2014) to establish the stabilities of ternary complexes with various donor atoms.

To achieve our above objectives, we chose potentiometric methodology, because it is the most convenient method and more economical to measure the stabilities of the metal-ligand complexes in solution¹³ and is being used in exploring the interactions of metal ligand(s) complexes in solution in the scientific field^{14,15,16}. In this report we adopted the potentiometric methodology to explore the stabilities of the metal-ligand complexes in solution.

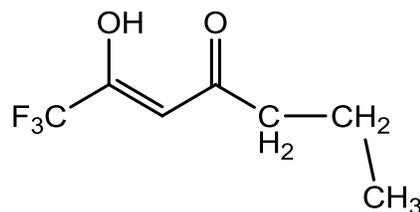
II. EXPERIMENTAL

The ligands from beta-hydroxy ketone (BHK) derivatives are shown in Figure 1 (a)-(d). The BHK ligands consisting of trifluoromethyl group in the compound. The listed ligands differ from each other at their terminal positions. The formula (a) is abbreviated as BHK-Me, the formula (b) is abbreviated as BHK-Et, the formula (c) is abbreviated as BHK-Bu, and the formula (d) is abbreviated as BHK-Ph, where BHK is $\text{CF}_3\text{-C(OH)=CH-C(=O)-CH}_2\text{-}$, Me is methyl, Et is ethyl, Bu is butyl and Ph is $\text{-CH}_2\text{-phenyl}$ group.

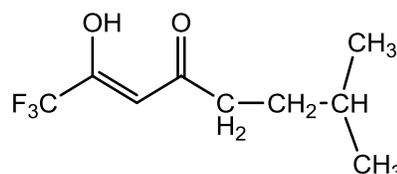
The ligands from benzotriazole (BTAZ) derivatives are shown in Figure 1 (e) and (f). The listed two ligands differed by the nature of the substituted amino side chain on the benzotriazole ring. The formula (e) is abbreviated as BTAZ-Alk-NH₂, and the formula (f) is abbreviated as BTAZ-Ph-NH₂, where Alk is $\text{-CH}_2\text{-CH}_2\text{-}$ and Ph is -phenyl group.



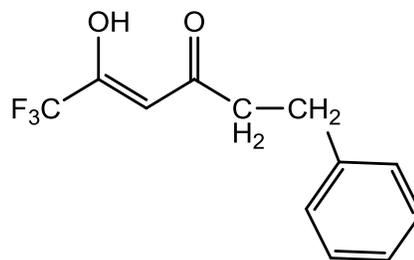
(a) BHK-Me



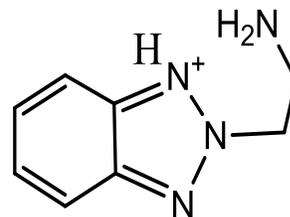
(b) BHK-Et



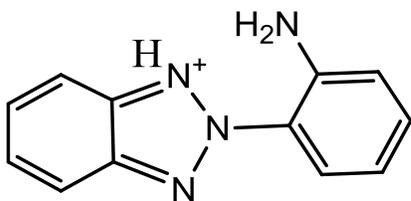
(c) BHK-Bu



(d) BHK-Ph



(e) BTAZ-Alk-NH₂



(f) BTAZ-Ph-NH₂

Figure 1. Beta-hydroxy ketone (BHK) derivatives (a)-(d) and Benzotriazole (BTAZ) derivatives (e) and (f).

The above ligands are synthesized and purified in our laboratory (unpublished data).

Metal salts of Cu(II), Ni(II), Co(II) and Zn(II) were AR grade chemicals. All the metal ions were standardized with disodium salt of EDTA¹⁷. Carbonate free sodium hydroxide was prepared and standardized by titration with potassium acid phthalate¹⁸

Stock solutions of metal ion were prepared from double distilled water. For every titration, fresh solid ligand was weighed out into the reaction cell to avoid possible hydrolysis.

The experimental method consisted of potentiometric titration of the free ligands with standard sodium hydroxide in the absence and in the presence of above mentioned metal ions being investigated. The titrations were carried out in a magnetically stirred double-walled reaction cell maintained at 25°C. The ionic strength was maintained constant by using 0.10M KNO₃ as a supporting electrolyte and relatively low concentration of the ligand and metal ion (1x10⁻³M). During the course of titration a stream of nitrogen was passed over the solution to eliminate the adverse effect of atmospheric carbon dioxide. For every titration, fresh solid ligand was weighed out into the reaction cell to avoid possible concentration effects.

A digital pH meter with a combination electrode was used to determine the hydrogen ion concentration. The electrode system was calibrated by direct titration of acetic acid, and the observed pH meter reading was compared with the actual hydrogen ion concentration. The pH regions below 3.5 and above 10.5 were calibrated by measurement in HCl and NaOH solutions, respectively.

All the titrations were conducted in dioxane-water (50:50) solvent system. The pK_w^c values were validated for 25°C and 0.1 M ionic strength using the Debye-Huckel equation for water and dioxane mixture¹⁹. The pK_w values, the dielectric constants and densities were obtained from Harned and Owen²⁰. No turbidity or precipitation was noticed at any time during the titration of metal ions with the ligands.

Calculations

The ionization constants of various ligands were calculated using the computer program PKAS¹³. Entire pH range from the titration data has been given for the calculation of pKa values using the computer program. All the formation or stability constants were subjected to refinement using the computer program BEST¹³. The refinement of the stability constants of

binary and ternary systems were done by considering all possible species present in the solution, i.e., HL⁺, HA, L⁻, A⁻, ML, ML₂, MA, MA₂ and MAL etc, where L and A are different ligands in the complex. The refined values for these complexes thus obtained are provided in the Tables. The error limits in these constants were minimized (sigma fit is 0.001).

III. RESULTS AND DISCUSSION

Dissociation constants of ligands

The potentiometric titration of BHK ligands took one mole of base per mole of ligand to complete deprotonate the ligand. The dissociation constant (pKa) for these ligands were calculated from the experimental points taken between a=0 and a=1 (a is moles of bases added per mole of ligand). The pKa values for BHK ligands were calculated by taking into consideration of species HA and A, where HA is protonated ligand and A is a deprotonated ligand. The calculated pKa value for BHK-Me is 9.88±0.04, for BHK-Et is 9.99±0.04, for BHK-Bu is 10.16±0.04 and BHK-Ph is 10.36±0.03. The single pKa value from the dissociation of H⁺ is from the -OH group on the ligand.

The potentiometric titration curve of BTAZ ligands show an inflection at a=1 followed by buffer region at high pH. The pK_a and pK_{2a} for these ligands were calculated between a=0 and a=1, and a=1 and a=2 respectively. The calculated pK_a and pK_{2a} values for BTAZ-Alk-NH₂ are 6.51±0.02 and 9.22±0.02, and for BTAZ-Ph-NH₂ are 6.72±0.03 and 9.33±0.03. The pK_a is corresponds to the release of protonated nitrogen from the heterocyclic ring, whereas the pK_{2a} is corresponds to the release of protonated amino group from the side chain in the BTAZ ligand. The protonation constants were calculated by taking into consideration of the species, H₂L, HL and L, where H₂A and HL are protonated ligand and L is deprotonated ligand.

The pKa values for BHK ligands increase in the order -CH₃ < -CH₂-CH₃ < -butyl < -CH₂-Ph. This increase can be explained based on the fact that increase in hydrophobicity of the ligand increases pK_a value. In this case hydrophobicity increases from -CH₃ to -CH₂-Ph, which increases the pK_a value of the ligand. Similar trend is noticed in the pK_a values of BTAZ ligands.

Stabilities of binary complexes

The interaction of metal ions (Cu²⁺, Ni²⁺, Zn²⁺ and Co²⁺) with BHK ligands in a 1:1 ratio at 25°C took one mole of base per mole of metal ion, i.e., m=1 (m is moles of base added per mole of metal ion) followed by buffer region till m=3, indicating simultaneous formation of 1:1 metal ligand complex between m=0 and m=1. The ligand BHK coordinates to the metal ion through its oxygen atoms (O-O donor atoms) in the formation of metal-ligand complex. The formation constants for the metal-ligand complexes were calculated in the upper buffer region taking into consideration of pK_a value of the ligand. All the stability constants for the binary complexes are listed in Table 1.

Table 1 – Stability constants[†] (log K) for the metal(II)-ligand (1:1) binary complexes, $\mu = 0.10 \text{ mol dm}^{-3}$ (KNO_3) at Temp = 25°C, Solvent 50% water + 50% dioxane

Ligand	Cu(II)	Ni(II)	Zn(II)	Co(II)
(a) BHK-Me	6.62	4.45	3.62	3.56
(b) BHK-Et	6.33	4.24	3.33	3.25
(c) BHK-Bu	6.03	3.92	3.13	2.89
(d) BHK-Ph	6.01	3.81	3.12	2.92
(e) BTAZ-Alk-NH ₂	8.92	6.91	6.47	6.03
(f) BTAZ-Ph-NH ₂	8.68	5.98	6.28	5.93

[†]standard deviation ± 0.02 to ± 0.04

The interaction of metal ions (Cu^{2+} , Ni^{2+} , Zn^{2+} and Co^{2+}) with BTAZ ligands in a 1:1 ratio at 25°C gave inflection at $m=2$ (m is moles of based added per mole of metal ion) followed by buffer region till $m=5$, indicating simultaneous formation of 1:1 metal ion complex with BTAZ ligands in between $m=0$ and $m=2$. The ligand BTAZ coordinates to the metal ion through its nitrogen atoms (N-N donor atoms) in the formation of metal-ligand complex. All the stability constants for the binary complexes are listed in the Table 1.

Table 2 – Stability constants[†] (log K) for the BHK-metal(II)-BTAZ(1:1:1) ternary complexes, $\mu = 0.10 \text{ mol dm}^{-3}$ (KNO_3) at Temp = 25°C Solvent 50% water + 50% dioxane

Ternary Complex	Metal ion			
	Cu(II)	Ni(II)	Zn(II)	Co(II)
(BHK-Me)-Metal -(BTAZ-Alk-NH ₂)	15.13	9.99	9.72	8.78
(BHK-Me)-Metal-(BTAZ-Ph-NH ₂)	15.01	9.89	9.61	8.71
(BHK-Et)-Metal -(BTAZ-Alk-NH ₂)	14.92	9.93	9.52	8.62
(BHK-Et)-Metal-(BTAZ-Ph-NH ₂)	14.79	9.82	9.42	8.52
(BHK-Bu)-Metal-(BTAZ-Alk-NH ₂)	15.29	10.22	9.82	9.04
(BHK-Bu)-Metal-(BTAZ-Ph-NH ₂)	15.04	10.02	9.62	8.93
(BHK-Ph)-Metal -(BTAZ-Alk-NH ₂)	15.74	10.26	10.14	9.24
(BHK-Ph)-Metal-(BTAZ-Ph-NH ₂)	15.51	10.04	9.92	9.12

[†]standard deviation ± 0.02 to ± 0.04

Stabilities of Ternary Complexes

The interaction of transitional metal ions (Cu^{2+} , Ni^{2+} , Zn^{2+} and Co^{2+}) with BHK and BTAZ ligands in a 1:1:1 ratio at 25°C gave inflection at $m=3$ indicating simultaneous formation of 1:1:1 mixed ligand complex between $m=0$ and $m=3$. The

stability constants for the mixed ligands and metal ion complexes were calculated in the upper buffer region taking into consideration of pK_a values of both the ligands. All the stability constants so calculated are listed in the Table 2.

Table 3 – Stabilities of BHK-metal(II)-BTAZ(1:1:1) ternary complexes in terms of $\Delta \log K$ values

Ternary Complex	Metal ion			
	Cu(II)	Ni(II)	Zn(II)	Co(II)
(BHK-Me)-Metal -(BTAZ-AlkNH ₂)	-0.41	-0.65	-0.37	-0.81
(BHK-Me)-Metal-(BTAZ-Ph-NH ₂)	-0.29	-0.54	-0.29	-0.78
(BHK-Et)-Metal -(BTAZ-Alk-NH ₂)	-0.33	-0.50	-0.28	-0.66
(BHK-Et)-Metal-(BTAZ-Ph-NH ₂)	-0.22	-0.40	-0.19	-0.66
(BHK-Bu)-Metal -(BTAZ-Alk-NH ₂)	0.34	0.11	0.22	0.12
(BHK-Bu)-Metal-(BTAZ-Ph-NH ₂)	0.33	0.12	0.21	0.11
(BHK-Ph)-Metal -(BTAZ-Alk-NH ₂)	0.81	0.26	0.55	0.29
(BHK-Ph)-Metal-(BTAZ-Ph-NH ₂)	0.82	0.25	0.52	0.27

[†]standard deviation ± 0.02 to ± 0.04

Quantification of the Stabilities of Ternary Complexes

The ligand-ligand interactions between the alkyl and aromatic groups of the bound ligands to metal ion in the ternary complex may result in an enhancement of stability of the complex, relative to the stabilities of their corresponding binary complexes. This kind of stability in the ternary complexes can be quantified in terms of $\Delta \log K$ values (the difference between the overall ternary complexes and the corresponding binary complexes), and these values are listed in Table 3.

In the analysis of stabilities of ternary complexes, specifically the role of BHK ligand, where the side chain is flexible, and is not involved with the metal ion coordination. It appears that the $\Delta \log K$ values are positive (Table 3), if the ligand BHK having the side chain of butyl and phenyl group, whereas $\Delta \log K$ values are negative for the ternary complexes, if the ligand BHK having the side chain of methyl and ethyl group. This clearly suggests that the flexible butyl and phenyl side chain from BHK ligand overlaps with the aromatic moiety of fixed BTAZ ligand in the ternary complex (Figure 2), which results in the enhanced stabilities for the (BHK-Bu)-Metal(II)-BTAZ and (BHK-Ph)-Metal(II)-BTAZ systems.

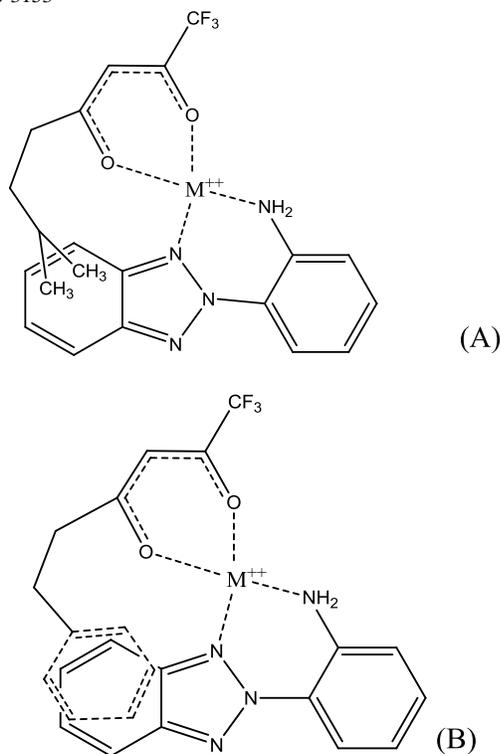


Figure 2. Tentative and simplified structure of ternary complex of (A): (BHK-Bu)-Metal(II)-(BTAZ-Ph-NH₂), and (B): (BHK-Ph)-Metal(II)-(BTAZ-Ph-NH₂), showing the intramolecular interaction between flexible side chain of BHK ligand with the heterocyclic ring of fixed BTAZ-Ph-NH₂ ligand

In the further analysis of stabilities of ternary complexes, specifically the role of BTAZ ligand, it appears that there is no effect of aniline ring on the BTAZ on the overall stability of the ternary complexes, because the $\Delta \log K$ values for both BTAZ having either -Alk-NH₂ or -Ph-NH₂ systems are about the same (Table 3). This suggests that the butyl and phenyl side chain of BHK ligand is overlapping with the heterocyclic ring, but not the aniline ring of the BTAZ ligand. The copper complexes exhibit larger positive $\Delta \log K$ or lower negative $\Delta \log K$ values, which is followed by zinc. The cobalt and nickel show about the same $\Delta \log K$ values.

The positive $\Delta \log K$ values are transformed into intra-molecular equilibrium constant and percentage of stacking interaction in the ternary system, and these values are listed in Tables 4 and 5. The intra-molecular equilibrium and percentage of stacking between the aromatic moieties of the BHK and BTAZ ligands in the ternary complex are calculated with the following equations (1) and (2):

$$K_1 = (10^{\Delta \log K}) - 1 \quad (1)$$

$$\% \text{ of (TernaryComplex)}_{\text{stacking}} = (K_1 / (1 + K_1)) * 100 \quad (2)$$

where K_1 is intra-molecular equilibrium constant, which is a dimensionless constant.

According to the data from Tables 4 and 5, the intra-molecular equilibrium constant is high for copper complexes compared to other metal ternary complexes. The percentage of stacking is also high for copper complexes, followed by zinc complexes and about the same for nickel and cobalt complexes.

Table 4 – Quantification of ligand-ligand interactions in (BHK-Bu)-metal(II)-BTAZ (1:1:1) ternary complexes in terms of $\Delta \log K$, Intra-molecular equilibrium constant (K_1) and Percentage of Stacking[‡]

Metal(II)	(BHK-Bu)-Metal-(BTAZ-Alk-NH ₂)			(BHK-Bu)-Metal-(BTAZ-Ph-NH ₂)		
	$\Delta \log K$	K_1	% of Stacking	$\Delta \log K$	K_1	% of Stacking
Cu(II)	0.34	1.19	54.29	0.33	1.14	53.23
Ni(II)	0.11	0.29	22.38	0.12	0.32	24.14
Zn(II)	0.22	0.66	39.74	0.21	0.62	38.34
Co(II)	0.12	0.32	24.14	0.11	0.28	22.38

[‡]overlap between the butyl side chain of BHK over the heterocyclic ring of benzotriazole.

Table 5 – Quantification of stacking interactions in (BHK-Ph)-metal(II)-BTAZ (1:1:1) ternary complexes in terms of $\Delta \log K$, Intra-molecular equilibrium constant (K_1) and Percentage of Stacking[‡]

Metal(II)	(BHK-Ph)-Metal-(BTAZ-Alk-NH ₂)			(BHK-Ph)-Metal-(BTAZ-Ph-NH ₂)		
	$\Delta \log K$	K_1	% of Stacking	$\Delta \log K$	K_1	% of Stacking
Cu(II)	0.81	5.45	84.51	0.82	5.61	84.86
Ni(II)	0.26	0.82	45.04	0.25	0.78	43.77
Zn(II)	0.55	2.55	71.81	0.52	2.31	69.81
Co(II)	0.29	0.95	48.71	0.27	0.86	46.29

[‡]overlap between the phenyl side chain of BHK over the heterocyclic ring of benzotriazole

In the above mentioned ternary systems, where BHK having O-O donor atoms and BTAZ having N-N donor atoms

are involved in the coordination of metal ions. It is important to compare the above data with their corresponding ternary complexes where BTAZ having N-O donor atoms (communicated to International Journal of Scientific and Research Publications Vol.4, Issue 7, July 2014). This comparison data is listed in Table 6 and 7. In this report we compared, in Table 6 and 7, the ternary systems with only BHK having side chains butyl and phenyl group with BTAZ (N-O donor atoms) *versus* BTAZ (N-N donor atoms) to evaluate the effect of overall charge on the complex formation and its role on the stability of the ternary complexes in addition to the existing ligand-ligand interactions.

The data from the Table 6 and 7 reveals that the ternary complexes with BTAZ having N-N donor atoms forming more stable complexes (higher $\Delta \log K$ and higher % of stacking values) compared to that of complexes with BTAZ having N-O donor atoms. This is because of the absence of electrostatic repulsion between the donor atoms of the two ligands, ternary complexes involving N-N donor ligands from BTAZ ligands are destabilized to a lesser extent than the corresponding complexes containing dinegative oxygen donor ligands from BHK ligands. The decreased stability is attributable to the electrostatic repulsion arising from the negatively charged oxygen atoms.

IV. CONCLUSION

We quantified the metal mediated intramolecular interactions and their stabilities for the ternary complexes of the ternary complexes of metal ions (copper, nickel, zinc and cobalt)

with beta-hydroxy ketone (BHK) derivatives (O-O donor atoms) and benzotriazole (BTAZ) derivatives (N-N and N-O donor atoms) in terms of $\Delta \log K$, intra-molecular equilibrium constant and % of stacking (for both alkyl and aromatic groups). Our experimental data suggest that, (i) the flexible side chains of BHK ligand having butyl and phenyl ring interacts with the heterocyclic ring of BTAZ ligand in the ternary metal-ligand complex, but not with aniline ring, (ii) ternary complexes with BTAZ having N-N donor atoms form more stable complexes over the BTAZ having N-O donor atoms and (iii) ternary complexes with copper forms more stable complexes, which is followed by zinc ion complexes with the ligands, and both nickel and cobalt form complexes with similar stabilities.

In view of the importance of metal complexes of beta-hydroxy ketone and benzotriazole derivatives in the chemical and biochemical fields, the established unexpected stabilities for the reported ternary complexes may be good model complexes in the design and development of chemical probes. The chemical probe can be a luminescent material or charge controlling agent or an ionic liquid crystal or a catalyst. The stability and the extra stability contributions from the ligand-ligand interactions in the metal-ligand complexes are directly related to the overall stability of the chemical probe. Our data also suggest that copper and zinc complexes may be superior to the nickel and cobalt complexes.

Table 6- Comparison of intramolecular interactions in between BHK-Bu (O-O donor atoms) and BTAZ (N-O and N-N donor atoms) in metal mediated ternary complexes

BTAZ with N,O donor atoms [§]					BTAZ with N,N donor atoms			
(BHK-Bu)-Metal-(BTAZ-Alk-OH)			(BHK-Bu)-Metal-(BTAZ-Ph-OH)		(BHK-Bu)-Metal-(BTAZ-Alk-NH ₂)		(BHK-Bu)-Metal-(BTAZ-Ph-NH ₂)	
	$\Delta \log K$	% of Stacking	$\Delta \log K$	% of Stacking	$\Delta \log K$	% of Stacking	$\Delta \log K$	% of Stacking
Cu(II)	0.17	32.39	0.15	29.21	0.34	54.29	0.33	53.23
Ni(II)	0.02	4.51	0.04	8.79	0.11	22.38	0.12	24.14
Zn(II)	0.11	22.38	0.14	27.56	0.22	39.74	0.21	38.34
Co(II)	0.03	6.67	0.03	6.67	0.12	24.14	0.11	22.38

[§]Data is from sridarala et al (submitted to International Journal of Scientific and Research Publications)

Table 7- Comparison of intramolecular interactions in between BHK-Ph (O-O donor atoms) and BTAZ (N-O and N-N donor atoms) in metal mediated ternary complexes

BTAZ with N,O donor atoms [§]					BTAZ with N,N donor atoms			
(BHK-Ph)-Metal-(BTAZ-Alk-OH)			(BHK-Ph)-Metal-(BTAZ-Ph-OH)		(BHK-Ph)-Metal-(BTAZ-Alk-NH ₂)		(BHK-Ph)-Metal-(BTAZ-Ph-NH ₂)	
	$\Delta \log K$	% of Stacking	$\Delta \log K$	% of Stacking	$\Delta \log K$	% of Stacking	$\Delta \log K$	% of Stacking
Cu(II)	0.67	78.62	0.68	79.11	0.81	84.51	0.82	84.86
Ni(II)	0.13	25.86	0.16	30.81	0.26	45.04	0.25	43.76
Zn(II)	0.39	59.26	0.41	61.09	0.55	71.81	0.52	69.81
Co(II)	0.13	25.86	0.16	30.81	0.29	48.71	0.27	46.29

[§] Data is from Sridarala et al (submitted to International Journal of Scientific and Research Publications)

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Analysis of Curved Plate Elements using Open Source Software

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Abstract- Analysis of curved plate elements requires a high computational effort to obtain a reliable solution for a buckling load for design purposes. Available programs are expensive to acquire and they need thorough knowledge for effective use. There is therefore need to code cheaper and accessible programs in line with using sustainable methods to better the livelihood of mankind. To address this issue a theory is formulated based on the Euler-Bernoulli beam model. This model is applicable to thin elements which include plate and membrane elements.

This paper illustrates a finite element theory to calculate the master stiffness of a curved plate. The master stiffness takes into account the stiffness, the geometry and the loading of the element. The determinant of this matrix is established from which the buckling load which is unknown in the matrix is evaluated by the principal of bifurcation.

The curved element is divided into 2,3,6,9 and 12 elements; this demonstrates the computational effort to a reliable solution. As expected, that as you divide the curve into smaller constituent elements, the solution of the buckling load is tedious as more mathematical operations are involved hence the need to program the operations.

Numerical analysis is carried out by abstracting the procedural development of the theory and programming it to run in a visual basic platform. The results obtained are giving a good agreement with results obtained with classical plate equations. This program is proposed to increase computational efficiency in the analysis of curved plates at a sustainable cost. It can also be used to establish the relationship between buckling load and curvature of plates.

Index Terms- finite element method, analysis, curved plates, program

I. INTRODUCTION

A plate is a planar body whose thickness is small compared with its other dimensions. Curved plate structures are frequently used in; aerospace vehicles, domes, roof structures and pressure vessels. A plate structure may be as simple as the web of a stiffener or as complex as an integrally stiffened plate supported by heavy frames and rings.

Thin plates are characterized by a structure that is bounded by upper and lower surface planes separated by a distance h (figure 1). The x-y coordinate axes are located on the neutral plane of the plate and the z-axis is normal to the x-y plane.

For this paper it was assumed that h is a constant and those material properties are homogeneous through the thickness.

Consequently, the location of the x-y axes (figure 2) lie at the mid-surface plane ($z=0$) with the upper and lower surfaces corresponding to $z=h/2$ and $z=-h/2$, respectively.

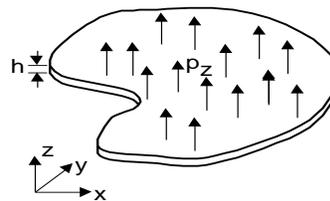


Figure 1 Structure of thin plate

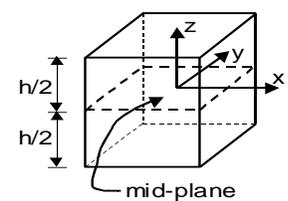


Figure 2 Location of thin plate axes

In the behavior of plate structures under in plane compression, a critical point exists where an infinitesimal increase in load can cause the plate surface to buckle; the load at this critical point defines the buckling strength of the plate.

Any further increase in load beyond the load at the initiation of buckling increases the buckling deformations until collapse occurs. Thus, the load at collapse defines the post buckling or crippling strength of the plate. The behavior of plate structures in this regard differs markedly from the behavior of columns and many other thin curved shell structures for which the buckling load corresponds closely to the collapse load.

Buckling of a plate structure can cause an unacceptable degradation. It can trigger general buckling of larger structures because of a redistribution of stresses; it can also affect the response by the structure to excessive displacement or fatigue which may be a cause of failure.

A lot of research has been done in this area of research which has been referenced. Available programs give criteria to do analysis of curved elements, but they are expensive to acquire and use. So, there is need to have an accessible criterion at an affordable cost.

1.1 Objectives

- 1) To develop an analytical program of curved plates.
- 2) To develop a numerical method for analysis of curved plates
- 3) To write a finite element analysis program to analyze curved plate elements using the method developed.

1.2 Scope for the work

An analytical formulation of the curved-plate non-linear equilibrium equations will be made. The analytical formulation will be implemented into a computer based program.

A convergence study using a segmented-plate approach will be performed for a simple example problem to obtain baseline results for use in future comparisons. Results will be compared with results from classical plate equations.

1.3 Methods of analysis

Finite element methods are now widely used to solve structural, fluid, and multi-physics problems numerically^[1]. The Euler –Bernoulli beam model applies since only thin elements are considered (shear deformations are neglected)^[2].

Two methods of analysis of curved elements exist: the Eigenvalue Buckling Analysis and Nonlinear buckling Analysis.

1.3.1 The Eigenvalue Buckling Analysis

The Eigenvalue analysis predicts the theoretical buckling strength of an ideal linear elastic structure. This is analogous to the classical plate equation approach to elastic buckling analysis^[3]. However, imperfections and nonlinearities prevent most real-world structures from achieving their theoretical elastic buckling strength.

1.3.2 Nonlinear Buckling Analysis

This method takes account of imperfections and nonlinearities of real-world structures. In this method the load is increased until the solution fails to converge, indicating that the structure cannot support the applied load (or that numerical difficulties prevent solution)^[4]. If the structure does not lose its ability to support additional load when it buckles, a nonlinear analysis can be used to track post-buckling behavior.

II. BASIC ELEMENT SHAPES

For the discretization of problems involving curved geometries, finite elements with curved sides are useful. The ability to model curved boundaries has been made possible by the addition of midsized nodes. Finite elements with straight sides are known as linear elements, whereas those with curved sides are called higher order elements^[5].

2.1 Size of Elements

The size of elements influences the convergence of the solution directly. If the size of the elements is small, the final solution is expected to be more accurate.

2.2 Number of Elements

The number of elements is related to the accuracy required and the number of degrees of freedom involved^[5]. Although an increase in the number of elements generally means more accurate results, for any given problem, there will be a certain number of elements beyond which the accuracy cannot be improved by any significant amount shown graphically in figure 3^[5].

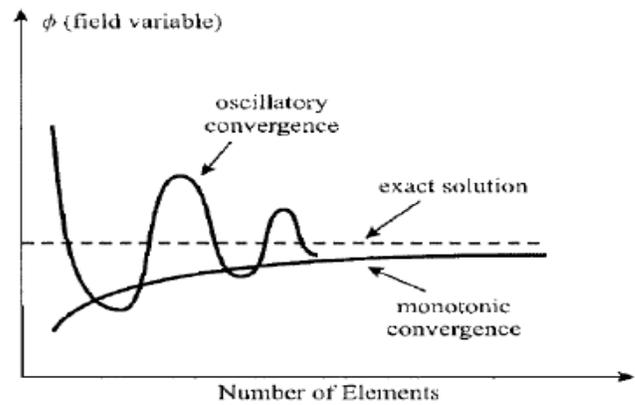


Fig 3 Relationship between the number of elements and accuracy^[5]

III. PROGRAM DEVELOPMENT

Computer programming languages are built around two approaches;

- (1) Procedural programming and
- (2) Object oriented programming.

In procedural programming, the program is prepared by a series of steps or routines that follow the data provided. The main drawback of the procedural programming languages is that they are not structured and the flow of the program largely depends on conditional statements that induce more chances of errors. These languages are good for small programs and are difficult to maintain when they become larger.

The object oriented programming languages are built on the concept of abstraction. Large complex procedures are subdivided into small procedures by abstraction, encapsulation and inheritance. Each of these sub procedures represents different objects with their own separate identity^[6,7]. The program developed is object oriented and follows the following steps used in the formulation of the theory;

1. Identify the principal theory
 $\{Q^1\} = [[K] + [G] + [L]] \{q^1\} = \{0\}$ ^[8]

2. Divide the curved plate into appropriate elements and calculate the arc length (L) and the internal angle (ψ) and angle (α) of each element relative to the x axis.

It is noted that the unknown vector does not involve the rotation angle; the essential boundary condition can be imposed with the penalty function method^[9,10].

3. Enter the following specific member properties (variables).
 - a) Area in m^2
 - b) Moment of inertia I in m^4
 - c) Length L in m
 - d) Young's modulus E in N/m^2
 - e) (ψ) and (α) in degrees for each element

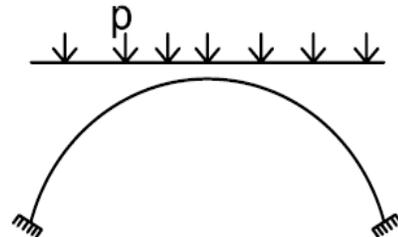
4. For each element calculate:

a) The stiffness matrix K from the matrix below

$$[K] = \begin{bmatrix} \frac{AE}{L} & -\frac{AE}{L} & 0 & 0 & 0 & 0 \\ -\frac{AE}{L} & \frac{AE}{L} & 0 & 0 & 0 & 0 \\ 0 & 0 & \frac{12EI}{L^3} & -\frac{12EI}{L^3} & -\frac{6EI}{L^2} & \frac{6EI}{L^2} \\ 0 & 0 & -\frac{12EI}{L^3} & \frac{12EI}{L^3} & \frac{6EI}{L^2} & -\frac{6EI}{L^2} \\ 0 & 0 & -\frac{6EI}{L^2} & \frac{6EI}{L^2} & \frac{4EI}{L} & \frac{2EI}{L} \\ 0 & 0 & \frac{6EI}{L^2} & -\frac{6EI}{L^2} & \frac{2EI}{L} & \frac{4EI}{L} \end{bmatrix} \begin{matrix} F_{X^1} \\ F_{X^2} \\ F_{Z^1} \\ F_{Z^2} \\ M_1 \\ M_2 \end{matrix}$$

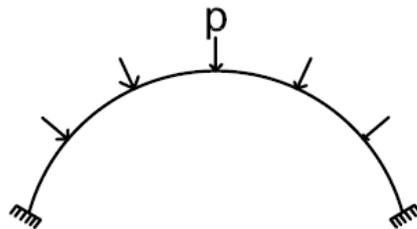
$$[L_F] = P \begin{pmatrix} 0 & 0 & 0 & 0 & -F_{Z1} & 0 \\ 0 & 0 & 0 & 0 & 0 & -F_{Z2} \\ 0 & 0 & 0 & 0 & -F_{X1} & 0 \\ 0 & 0 & 0 & 0 & 0 & -F_{X2} \\ 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 \end{pmatrix}$$

Load case ii-Loads remain parallel to the original direction



$$L_P = L_F = [0]$$

Load case iii-Loads remain directed towards a fixed point



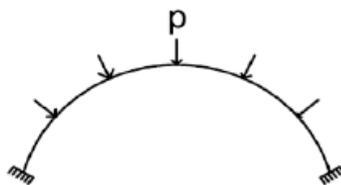
a) The geometric matrix from the matrix below

$$[G] = \begin{pmatrix} u_1^i & u_2^i & w_1^i & w_2^i & \theta_1^i & \theta_2^i \\ 3EA[u^0] \begin{bmatrix} \gamma_k \gamma_j \gamma_1 \end{bmatrix} & EA[w^0] \begin{bmatrix} \phi_k \phi_j \gamma_1 \end{bmatrix} \\ 3EA[u^0] \begin{bmatrix} \gamma_k \gamma_j \gamma_2 \end{bmatrix} & EA[w^0] \begin{bmatrix} \phi_k \phi_j \gamma_2 \end{bmatrix} \\ EA[w^0] \begin{bmatrix} \phi_1 \phi_k \gamma_j \end{bmatrix} & EA[u^0] \begin{bmatrix} \phi_1 \phi_j \gamma_k \end{bmatrix} \\ EA[w^0] \begin{bmatrix} \phi_2 \phi_k \gamma_j \end{bmatrix} & EA[u^0] \begin{bmatrix} \phi_2 \phi_j \gamma_k \end{bmatrix} \\ EA[w^0] \begin{bmatrix} \phi_3 \phi_k \gamma_j \end{bmatrix} & EA[u^0] \begin{bmatrix} \phi_3 \phi_j \gamma_k \end{bmatrix} \\ EA[w^0] \begin{bmatrix} \phi_3 \phi_k \gamma_j \end{bmatrix} & EA[u^0] \begin{bmatrix} \phi_2 \phi_j \gamma_k \end{bmatrix} \end{pmatrix}$$

b) Calculate the load matrix L selecting a specific load case

$$[L] = [L_P] + [L_F]$$

Load case i-Loads remain normal to the element



$$[L_P] = P \begin{pmatrix} 0 & 0 & \frac{1}{2} & \frac{1}{2} & -\frac{L}{12} & \frac{L}{12} \\ 0 & 0 & \frac{1}{2} & \frac{1}{2} & \frac{L}{12} & -\frac{L}{12} \\ 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 \end{pmatrix}$$

$$[L_F] = P \begin{pmatrix} -\frac{L}{3R} & -\frac{L}{6R} & 0 & 0 & 0 & 0 \\ -\frac{L}{6R} & -\frac{L}{3R} & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 \end{pmatrix}$$

a) Rearrange all the matrices in the following order

Table 1 Relationship of number of elements and resistance to buckling pressure

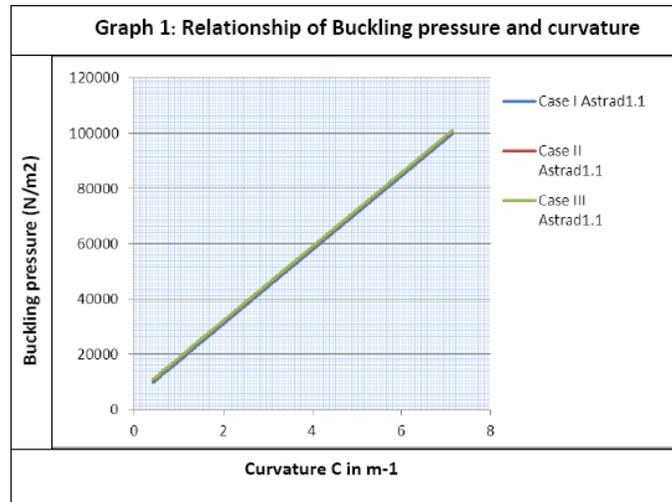
Number of elements	Buckling pressure (N/m ²)		
	Case I	Case II	Case III
	Astrad1.1	Astrad1.1	Astrad1.1
2	16580.425	16580.84	16580.85
3	9952.05	11299.77	11859.48
6	10012.20	10806.076	11964.198
9	9962.183	10760.107	11300.183
12	9962.706	10801.956	11089.702
Exact solution			
	9959.463	10673.981	11113.549

ii) Effect of varying plate properties

a) Curvature

b) Relationship of Buckling pressure and Curvature

Curvature C in m ⁻¹	Buckling pressure (N/m ²)		
	Case I	Case II	Case III
	Astrad1.1	Astrad1.1	Astrad1.1
0.4082	9962.706	10801.96	11089.7
0.4274	10108.31	10941.42	11233.42
0.5155	11284.06	12117.15	12409.16
0.6494	13070.34	13903.44	14195.44
0.7463	14362.83	15195.93	15487.93
1.0638	18600.95	19434.05	19726.05
1.3514	22436.5	23269.6	23561.7
1.8519	29114.52	29947.62	30239.62
2.9412	43649.38	44482.48	44774.48
7.1429	99716.68	100549.8	100841.8



c) Cross sectional Area

i) **Table 3 : Area = $3.05 \times 10^{-4} \text{m}^2$**

Number of elements	Buckling pressure (N/m ²)		
	Case I	Case II	Case III
	Astrad1.1	Astrad1.1	Astrad1.1
2	15035.443	15035.886	15035.886
3	8348.574	9695.646	10255.803
6	8408.561	9202.913	10360.651
9	8358.275	9157.455	9696.275
12	8362.302	9195.403	9487.40

ii) **Table 4: Area = $2.05 \times 10^{-4} \text{m}^2$**

Number of elements	Buckling pressure (N/m ²)		
	Case I	Case II	Case III
	Astrad1.1	Astrad1.1	Astrad1.1
2	13738.393	13738.836	13738.836
3	7051.524	8398.596	8958.953
6	7111.511	7905.596	9063.511
9	7061.225	7860.405	8399.225
12	7065.252	7898.353	8190.353

4.2 DISCUSSION OF THE RESULTS

i) Nature of results

As the number of elements increases, the results have an oscillatory convergence to the exact solution. More divisions results into output of higher accuracy but requires more computational effort as there are more calculations. The program will increase the efficiency of the final result as the computations have been programmed.

ii) Loading cases

The results show that a curved plate resists a higher load when it is directed towards the center of the arc. The loading cases vary as to the use of the plate element e.g. as a water structure or roof element. The program can be useful in a quick analysis considering the particular load case, given the load cases programmed are those frequently encountered.

ii) Relationship between load and curvature.

From the results, load resistance of a curved plate is directly proportional to curvature.

4.3 CONCLUSION AND RECOMMENDATIONS

The research had 3 specific objectives which have been achieved

a) Analytical program

An analysis criterion based on Euler Bernoulli theory was developed. This is applicable only to thin elements which includes thin plates and membranes.

b) Numerical method

The six step procedure of analysis to arrive at a buckling load forms a summary of the numerical method.

c) Finite element program

The six steps above were programmed to run on a visual basic platform. This program is referred as Astrad 1.1. This code was named with a future intention of redeveloping it to include analysis of thicker elements. The program is less costly and requires less effort to use.

In order to access the efficiency and accuracy of the program, an example is analyzed whose results is tabulated in tables 1,2,3 and 4. The analysis shows a good agreement with classical plate equations. The program

It can be seen that a curved element resists more loads directed towards its center than other loading cases. Curvature and plate thickness proportionately influence plate resistance to load. Use of the program is useful for the study of curved plate elements because it manipulates the given plate and loading parameters to give output.

The program should be developed further to cater for more attributes like modification of thin plates into a composite element and with stiffeners.

Further research into the inclusion of the Timoshenko theory into the program to cater for thicker elements should also be done.

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Assessment of Workshop Facilities Management Practices in Technical Colleges of Niger State

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Abstract- This study was designed to assess the workshop facilities management practices in Technical Colleges of Niger State. Four research questions were formulated to guide the conduct of the study. A descriptive survey research design was employed for the study. The study was carried out in all the Technical Colleges in Niger State. A total of 488 respondents comprising 443 technical teachers and 45 administrators were used as population for the study. A structured questionnaire developed by the researcher was used for the data collected for study. The instrument was face and content validated by three lecturers. Mean and standard deviation were the statistical instruments used to analyze the data for answering research questions. The findings of the study revealed among others that technical teachers were not allowed to participate in the planning of the workshop facilities, workshop facilities were not stored according to their characteristics and preventive maintenance are not regularly observed. Based on the findings it was recommended that technical teachers should be involved in the planning of workshop facilities, workshop facilities should be stored according to their characteristics and preventive maintenance should be observed regularly in the workshop.

Index Terms- Assessment, Workshop Facilities, Management Practices and Motor Vehicle Mechanics

I. INTRODUCTION

Technical colleges are regarded as the principal vocational institutions in Nigeria. They give full vocational training intended to prepare students for entry into the various occupations (Okoro, 1993). According to Abdulkadir (2011) the responsibilities of technical college education in Nigeria include: provision of full time or part-time courses of instruction and training in technology, applied science and commerce, in such other field of applied learning, relevant to the needs of the development of Nigeria in the areas of industrial, commercial and vocational agriculture, professional studies in engineering and other technologies and perform such other functions as in the opinion of the society as may serve to promote the objectives of the technical colleges.

National Policy on Education (2004) made the production of craftsmen, artisans and other sub-professional skilled personnel the responsibility of technical college education and maintained that trainees completing technical college programmes shall have three options: Secured employment either at the end of the whole course or after completing one or more modules of employable skill, Set up their own business and become self-employed and be able to employ others and Pursue further education in advance

– craft/technical programme and in post-secondary (tertiary) technical institutions such as science and technical colleges, polytechnics or colleges of education (technical) and universities. However, the attainment of these goals is largely dependent on the effective workshop facilities management practices.

Workshop facilities management practices refer to various strategies or techniques of managing a workshop.

The major concern of good workshop management is the identification and judicious utilization of available resources to achieve the objective of helping the learners to learn and to encourage them to want to learn (Ogwo & Oranu, 2006). In essence, workshop management has to do with the process of bringing out the best from the workshop personnel so as to achieve the set goals and objectives of practical lesson. Effective workshop management in teaching-learning situation refers to the ability to maintain harmony and order in the workshop (Lofafa & Polongana, 2001). They further explained that it shows how teacher can prevent misbehaviour by carefully organizing the tools, machines, engines, consumable items, establishing clear rules and regulation that are needed for effective acquisition of practical skills in the workshop. Considering the importance of workshop facilities in the provision of effective instruction there is need to assess the management of the available workshop facilities in technical colleges with a view to ascertain whether the workshop management practices adopted in the planning, storing and maintenance of workshop facilities affect the students performances in the technical colleges of Niger State. Hence assessment according to UNESCO (2002) is the systematic process of generating data about traits, performances, projects, activities e.t.c. for the purpose of making evaluative judgments. Therefore, assessment in the context of this study is a systematic process of generating data about effective management of workshop facilities for the purpose of making evaluative judgments.

Technical colleges are mainly established for the training of students to acquired practical skills, knowledge and attitude. However, the major goals of technical college education is to produced efficient and relevant craftsmen and women that will promote and industrial development in the area of maintenance, goods production and general services (Abdulkadir, 2011). Boyi (2008) also opined that the goal of technical college education is develop saleable skills in youths in order to make them useful to themselves, society and also become labour assets in the industries.

Incidentally, these technical colleges appear not fulfilling these objectives as noted by Enemali (1994) who lamented technical colleges are haphazardly managed, they lack the ability

to equip students with the requisite skills, knowledge and attitude needed for gainful employment. Also commenting on the performance of technical colleges in the area of skill development and workshop facilities, Gana (1989) stressed that some of the available facilities have been grounded and overstretched. It is probable that workshop facilities management practices adopted by the teachers may be responsible for these. Therefore, the problem of this study is to assess the current workshop management practices in the technical colleges of Niger State.

II. PURPOSE OF THE STUDY

The purpose of this study is to assess workshop facilities management practices in technical colleges of Niger State, Specifically the study sought to determine:

1. Workshop management practices adopted in the planning of training facilities in technical colleges.
2. Workshop management practices adopted in the storage of available training facilities in technical colleges.
3. Workshop management practices adopted in the maintenance of training facilities in technical colleges.
4. The mechanisms adopted in the management of workshop facilities in technical colleges.

III. RESEARCH QUESTIONS

The following research questions were formulated to guide the study.

1. What are the workshop management practices adopted in the planning of training facilities in technical colleges?
2. What are the workshop management practices adopted in the storage of available training facilities in technical colleges?
3. What are the workshop management practices adopted in the maintenance of training facilities in technical colleges?

4. What are the mechanisms that should be adopted in the management of workshop facilities in technical colleges?
- 5.

IV. METHODOLOGY

A descriptive survey research was adopted for this study. A total of 488 respondents comprising 443 technical teachers and 45 administrators from all technical colleges in Niger State formed the population for this study and the entire population was studied, this is owing to the less number of the subjects involved in the study; hence there was no need for the adoption of any sampling technique. A structured questionnaire developed by the researchers, named Workshop Facilities Management Practices Assessment Questionnaire (WFMPAQ) validated by three experts from Industrial and Technology Education Department was used for data collected for the study. The questionnaire was assigned four points rating scale of strongly agree (4), agree (3), disagree (2) and strongly disagree (1). 438 copies of questionnaire were distributed to teachers and students by the researchers and the research assistants appointed each from each of the technical College in the State. Thus, 387 copies of the questionnaire dully filled by the respondents were returned to the researchers and the returned rate is 88.4%. Mean and Standard Deviation were the statistical tools used to analyzed the data for answering research questions; While t-test statistics was use to test the hypotheses at 0.05 level of significant. A mean score of 2.50 was used as a bench mark for accepting or rejecting items. Therefore, items with a mean score of 2.50 and above were considered agreed; while items with mean score of 2.49 and below were considered disagreed.

Results

Research Question 1

What are the workshop management practices adopted in the planning of training facilities in technical colleges?

Table 1

Mean responses of technical teachers and administrators on the workshop management practices adopted in the planning of training facilities in technical colleges.

$N_1 = 443$ $N_2 = 45$

S/No	Items	\bar{X}_1	\bar{X}_2	\bar{X}_t	Decision
1	Technical teachers participate in the planning of workshop facilities	3.56	2.66	3.11	Agree
2	Improper planning of training facilities leads to failure	4.57	4.71	4.64	Agree
3	Curriculum contents for the technical programmes determines the planning of available training facilities	2.70	2.55	2.63	Agree
4	Student enrolments are taken into consideration when planning the workshop facilities	3.88	3.79	3.84	Agree
5	Learning objectives influences the planning of workshop facilities	2.97	2.88	2.93	Agree
6	Attention is given to topic area when planning the				

	training facilities	3.02	3.01	3.02	Agree
7	Planning of workshop facilities assist in achieving the objectives of the school annually	2.71	2.56	2.64	Agree
8	Provision of the spare parts are taken into consideration when planning the available equipment	2.88	2.79	2.84	Agree

N_1 and N_2 = No of Technical Teachers and Administrators \bar{X}_1 = Mean responses of Technical Teachers; \bar{X}_2 = Mean responses of Administrators \bar{X}_t = Mean responses of all respondents.

Analysis in Table 1 revealed that the respondents jointly agree with all the items as workshop management practices adopted in the planning of training facilities in technical colleges.

Research Question 2

What are the workshop management practices adopted in the storage of available training facilities in technical colleges?

Table 2

Mean responses of technical teachers and administrators on the storage of available training facilities in technical colleges?

$N_1 = 443$ $N_2 = 45$

S/No	Items	\bar{X}_1	\bar{X}_2	\bar{X}_t	Decision
1	Hand tools are kept in the tool room	2.31	2.05	2.18	Disagree
2	Hand tools are kept in the tool cabinet	2.10	2.45	2.28	Disagree
3	Effective tool inventory system is adopted	2.09	2.44	2.27	Disagree
4	Bench tools are properly stored	1.80	2.00	1.90	Disagree
5	Workshop facilities are stored according to their traits	1.70	2.45	2.08	Disagree
6	Tools are stored in rack and boxes	1.61	2.03	1.82	Disagree
7	Adequate storage space for the available facilities	1.34	2.43	1.89	Disagree
8	Proper record of facilities are kept properly	1.90	1.77	1.84	Disagree
9	Training facilities are kept under the care of technical teachers	2.40	2.06	2.23	Disagree
10	School administrators are actively involved on the storage of training facilities	2.34	2.11	2.23	Disagree
11	Training facilities are kept under the care of store keeper	2.09	2.11	2.10	Disagree
12	Training facilities are always audited regularly	1.80	2.00	1.90	Disagree

N_1 and N_2 = No of Technical Teachers and Administrators \bar{X}_1 = Mean responses of Technical Teachers; \bar{X}_2 = Mean responses of Administrators \bar{X}_t = Mean responses of all respondents.

Analysis in Table 2 revealed that the respondents jointly disagree with all the items as workshop management practices adopted for the storage of available training facilities in technical colleges.

Research Question 3

What are the workshop management practices adopted in the maintenance of training facilities in technical colleges?

Table 3

Mean responses of technical teachers and administrators in the maintenance training facilities in technical colleges

$N_1 = 443$ $N_2 = 45$

S/No	Items	\bar{X}_1	\bar{X}_2	\bar{X}_t	Decision
1	Tools and equipment are usually refurbished after they have completely broke down	2.50	1.00	1.75	Disagree

2	Damage tools and equipment are abandoned without effort to made to repair them	2.07	2.00	2.04	Disagree
3	Students are usually encourage to clean their tools after use	3.45	3.09	3.27	Agree
4	Maintenance of tools is a regular practice in the workshop	3.88	2.95	3.42	Agree
5	Student are made to replace any damage tool	1.09	2.02	1.56	Disagree
6	Oiling of machines are done on regular basis	3.80	3.01	3.41	Agree
7	Lubricants such as oil and grease are usually available in the workshop	2.55	3.56	3.06	Agree
8	Technical teachers adopt appropriate principles for equipment maintenance	1.22	2.09	1.66	Disagree
9	There is planned maintenance policy in the workshop for equipment maintenance	2.01	1.77	1.89	Disagree
10	Operating manuals are available	2.05	1.75	1.90	Disagree
11	Preventive maintenance is observed regularly	2.03	2.11	2.07	Disagree
12	Training facilities are serviced regularly	1.32	2.07	2.07	Disagree
13	Adequate fund are provided for maintenance activities	2.06	1.65	1.86	Disagree
14	Outside maintenance personnel are involved in maintenance	2.23	1.08	1.66	Disagree

N_1 and N_2 = No of Technical Teachers and Administrators \bar{X}_1 = Mean responses of Technical Teachers; \bar{X}_2 = Mean responses of Administrators \bar{X}_t = Mean responses of all respondents.

Analysis in Table 3 revealed the views of the respondents on workshop management practices adopted in the maintenance of training facilities in technical colleges.

Research Question 4

What are the mechanisms that should be adopted in the management of workshop facilities in technical colleges?

Table 4

Mean responses of technical teachers and administrators on the mechanisms adopted in the management of workshop facilities in technical colleges

$N_1 = 443$ $N_2 = 45$

S/No	Items	\bar{X}_1	\bar{X}_2	\bar{X}_t	Decision
1	Disciplinary action should taken against any theft case	3.44	3.24	3.34	Agree
2	Security should be provided for training facilities	3.10	3.00	3.05	Agree
3	Technical teachers should be engaged in the in the management of training facilities	3.33	2.06	2.66	Agree
4	There should be regular training for workshop technical teachers	3.46	2.58	3.02	Agree
5	Conferences/seminars should be organize regularly for technical teachers	2.67	3.10	2.89	Agree
6	Adequate possible supervision should be given to oiling of machinery	2.50	3.65	3.08	Agree
7	Organizing tools on the shelves and tool boxes based on the function they perform	2.65	3.00	2.83	Agree
8	Workshop personnel with good character should employed	2.90	3.09	2.96	Agree
9	Proper layout of workshop to show clearly carriage ways and location of machine tools	3.34	3.21	3.23	Agree

N_1 and N_2 = No of Technical Teachers and Administrators
 \overline{X}_1 = Mean responses of Technical Teachers; \overline{X}_2 = Mean responses of Administrators
 \overline{X}_t = Mean responses of all respondents.

Analysis in Table 4 revealed that the respondents agree with all items as the mechanisms that should be adopted in the management of workshop facilities in technical colleges

V. FINDING AND DISCUSSION

The findings as contained in table 1 revealed that respondents disagree with all the items as workshop management practices adopted in the planning of training facilities in technical colleges. This in consonance with the views of Jojoh (2006) who explained that improper planning lead to failure in any organisation. He further stressed that improper planning of the workshop facilities results in wastages as well as poor management of human and resources. The researcher is of the opinion that planning of the workshop facilities should depends very much on what a workshop is design for and should further be determined by the type of tools, equipment and number of students required there at a time. Effective planning of workshop facilities determines the achievement of learning objectives (Aromolaran, 2000).

In Table 2 findings revealed that the respondents disagree with all the items as workshop management practices adopted for the storage of available training facilities in technical colleges. This is in-line with the findings of Ekah (1998) who asserted that most technical colleges lack storage room in the workshop where consumable items and working tools can be safely stored. Hakha (2008) in support of this finding also noted that racks and boxes for tools storage are not available in most technical colleges there by rendering the available tools in effective for practical purposes. The researcher is of the view that good housekeeping such as effective tool inventory system and involvement of technical teachers which will in turn lead to proper storage and management of materials and tools for easy reach of students are generally absent in most technical colleges.

Findings in Table 3 revealed the views of respondents on the items as workshop management practices adopted in the maintenance of training facilities in technical colleges. The findings revealed that lubricants such as oil and grease are usually available in the workshop this corroborate with the views of Dabban and Abbas (2000) who opined that periodic oiling of machines reduces the wear of moving parts and prolong the life span of the equipment. The findings further revealed that there is no planned maintenance policy in the workshop for equipment maintenance this is in line with the views of Doyin (2004) who opined that lack of planned maintenance policy affect the facilities in the workshop which according to him in turn affect the teaching and learning of technical courses. However, the researcher is of the view that there is need to provide well organize and complete maintenance instructions with periodic inspections that will assist in determining the type of maintenance to be adopted in the workshop.

Analysis in Table 4 revealed that the respondents agree with all items as the mechanisms that should be adopted in the management of workshop facilities in technical colleges. This in consonance with Umar (2008) who stressed on measures for maitaning discipline in the industry outlined some methods

which includes drawing a code of conduct, provision for better condition of service and more broad minded policy. However, Okorie (2000) emphasizing on the security of equipment in work endowment stressed that machines should be fixed on the floor in order to be firm and also serve as a security mechanism. Abdullahi (1994) also maintained that workshop and conferences should be organized for teachers and workshop personnel in order to update their skills in their respective discipline. Well the researcher as this point is of the opinion that these mechanisms is well implemented would improve the effective management of technical colleges workshop as well as the facilities which will in turn lead to improved skills acquisition in technical colleges.

VI. CONCLUSION

This study has identified some evident and thus formed the following conclusion: the objectives of vocational and technical education programme are not completely achieved as a results of improper planning of teaching facilities, lack of proper storage for available training facilities, lack of effective maintenance for training facilities as well as in effective mechanisms for proper management of workshop facilities in technical colleges. . Accordingly, if the findings of this study are effectively utilized a batch of highly and skilled technical colleges graduate will be produced.

VII. RECOMMENDATIONS

Based on the findings, the following recommendations were made:

1. Technical teachers should be allowed to participate in the planning of the workshop facilities.
2. Workshop facilities should be stored according to their characteristics.
3. Preventive maintenance should be observed regularly.
4. Adequate security should be provided for the workshop facilities.
5. Workshop personnel with good and training habit should be employed.

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Quality Assessment of the Main Water Source of Barangay Ambassador, Tublay, Benguet, Philippines using the *Allium cepa* Test

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Abstract- In view of the ecological hazards of chemicals, in vitro experiments were conducted to determine the probable toxicity of the different water samples from the main water source of Barangay Ambassador, Tublay, Benguet employing the classical *Allium cepa* test prior to the establishment of communal water catch basins/tanks. In this study, experimental *Allium cepa* were grown in the different water samples from Lower and Upper Coroz, Baliti, and Salaksak. The different parameters that were utilized in the study (i.e. macroscopic and microscopic) served as indicators of the genotoxicity of the water samples to the test organisms. This laboratory experiment of the genotoxic effect of the water samples revealed insignificant differences among the different water samples and the control group for all the following observations: macroscopic level in terms of root length and frequencies of root forms and the mitotic index values scored at microscopic level. This interaction implies that the different water samples inhibited the growth of the onions, may have caused some morphological abnormalities and possible genotoxic effect on the onions in all the treatment groups. However, the level of toxicity did not vary significantly among the treatment groups and the control group. Taken together, results of the study showed that the selected water samples from the main

water source of Barangay Ambassador may be tapped as possible sources of potable water.

Index Terms- water quality, *Allium cepa* test, genotoxicity,

I. INTRODUCTION

Water is an essential commodity for every community. In the Philippines, Ambassador, Tublay, Benguet, is only one of the community that needs a good source of water. The local government wanted to find out the potability of the main water sources. This research tested the quality of the identified water sources. Specifically, this study aimed to:(1).compare the effect of the different water samples on the roots produced, root lengths and frequencies of root forms of *Allium cepa* var. *aggregatum* to the control sample;(2) find out if the water in the main source of Barangay Ambassador has genotoxic effect on *Allium cepa* var. *aggregatum*; (3) determine if the sites where water samples were collected can be possible sources of potable water for the barangay; (4) create public awareness about the toxic effects of the river pollution to biological systems.

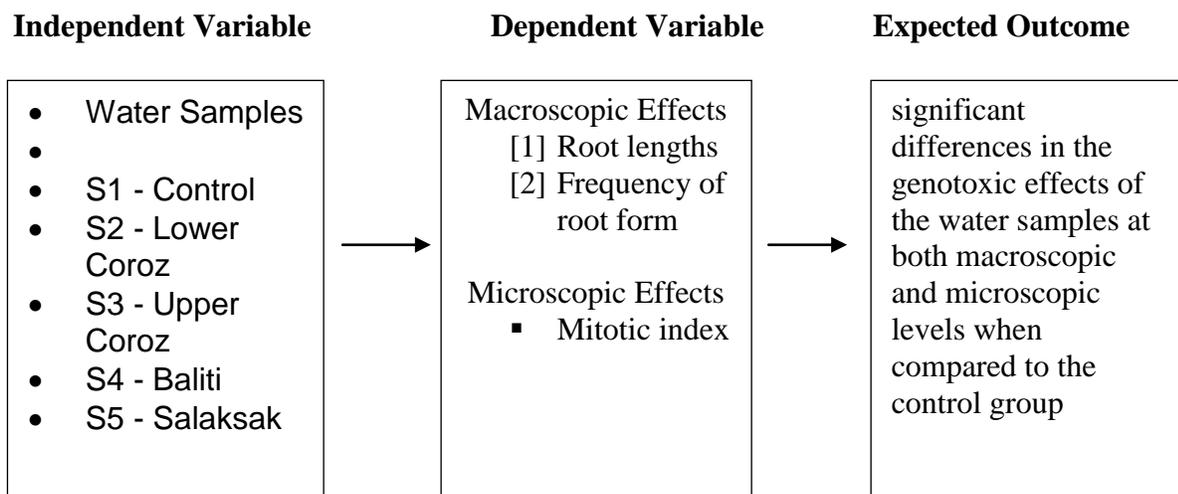


Figure 1. Paradigm of the Study

II. STATEMENT OF THE PROBLEM

This study was conducted to investigate the macroscopic and microscopic effects of the main water source of Ambassador, Tublay, Benguet on *Allium cepa*. Furthermore, this study sought to answer the following questions:

(1) What are the effects of the different water samples on the *Allium cepa* in terms of:

a) Macroscopic indicators such as (i) root lengths (longest and shortest roots) (ii). frequencies of root forms (bulbous and curved) b. Microscopic indicators (mitotic index)?

(2) Are there significant differences in the effect of the water samples on *Allium cepa* as to the macroscopic and microscopic indicators among the water samples and the control?

III. SCOPE AND DELIMITATION

This study was concerned in the determination of the possible genotoxicity of the different water samples from the main water source of Barangay Ambassador, Tublay, Benguet on the roots of *Allium cepa* var. *aggregatum*. The classical *Allium cepa* test was used to gather and quantify data on the macroscopic and microscopic parameters. The influences of water samples on macroscopic (root length, form and color) and microscopic (root tip mitotic index) parameters were examined. The water samples were gathered from Ambassador, Tublay, Benguet on July 2009.

For the macroscopic effects, parameters were limited to the following: Root lengths (shortest and longest). Frequencies of root forms (curved and bulbous) The microscopic parameter was also limited to measuring the mitotic index values of the root tips of the onions. *Allium cepa* var. *aggregatum* was the test organism used in this experiment since this kind of onion possesses a very advantageous characteristics, i.e. highly sensitive to toxicants, and is readily available in the market. Moreover, *Allium cepa* test offers possibility to investigate samples not requiring any previous extraction, concentration or isolation procedure. Owing to qualities such as low cost, easy application, and good correlation with mammalian genotoxicity test systems (Fiskesjo 1985, Plavica et al. 1991). As to the effects of the water samples on microscopic level, determining the frequency of chromosome aberrations should also be of importance as to further investigate the potentiality of the water samples tested of their genotoxicity. Furthermore, since this only a preliminary study on the assessment of the water quality of the said barangay, microbiological and chemical analyses will be conducted after in collaboration with the Baguio Water District.

IV. SIGNIFICANCE OF THE STUDY

Through the *Allium cepa* test to be conducted on the water samples from the main source of the stream tributaries, UC Project HELEN through its area on environment will be able to offer the appropriate recommendations as to the following: Steps to be undertaken to ensure potable water, such as reiteration of importance of proper waste management, among others;

identification of clusters of *sitios* that would share a communal water basin/tank; design of the communal water basin/tank and the appropriate system of distribution to the different household; Construction of the communal water basin/tank via the *bayanihan* system among the barangay officials, kagawads and community members of the clustered *sitios*.

V. MATERIALS AND METHODS

Research Design and Methodology

The study made used of the experimental method of research because of the need to observe and examine the genotoxic effects of the different water samples on the root growth of *Allium cepa* var. *aggregatum*. Descriptive analysis was employed for the interpretation and discussion of the obtained results. The experimental design utilized in this study was Complete Randomized Design where the macroscopic and microscopic effects of the water samples to the onion roots were observed with the applied subsequent treatments to determine the effect. The experimental set-up employed replication, control, and treatments.

Strategic sampling stations were along the main water source of Barangay Ambassador. Surface water was collected from all the sources and distilled water was used as the control.

Data on both the macroscopic and microscopic indicators were analyzed by analysis of variance (ANOVA), with the calculations of the F-statistic and respective P values. The P values were compared with the calculation of the minimum significant difference for $P=0.05\%$. Mean was used as a measure of central tendency. Analysis of variance (ANOVA) of the data was performed with the SPSS Statistical Package.

VI. RESULTS AND DISCUSSIONS

This portion of the study presents the data gathered from the experiment that were tabulated, analyzed and interpreted. The data that were analyzed were focused on the effects of the water samples on the root growth of *Allium cepa* var. *aggregatum* in terms of the macroscopic parameter (as manifested by the presence of bulbous or curved roots, shortest and the longest roots) and the microscopic parameter in terms of the mitotic index values.

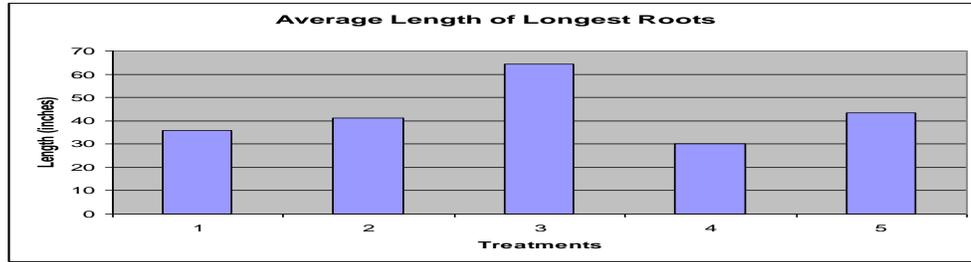
Effects on the macroscopic parameters

A. Root Length

1. Longest Roots

Table 1 presents the ANOVA of the mean number of longest roots. The computed F value of .147 is not significant at .05 level of significance. This means that the water samples do not have significant effect on the onion roots in terms of longest roots.

Figure1. Mean Length of the Longest Roots



Legend : T1 - Control T2 – Lower Coroz T3 – Upper Coroz T4 – Baliti T5 – Salaksak

Table1. Analysis of Variance (ANOVA) in CRD and LSD of the macroscopic effect of the water samples in terms of the presence longest roots.

	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	2042.267	4	510.567	2.163	.147 ^{ns}
Within Groups	2360.667	10	236.067		
Total	4402.933	14			

^{ns} - The mean difference is not significant (p>0.05)

Shortest Roots

Figure 2. Mean Length of the Shortest roots.



Legend : T1 - Control T2 – Lower Coroz T3 – Upper Coroz T4 – Baliti T5 - Salaksak

Table 2 shows that there is significant difference in the effect in terms of shortest roots. This means that the water samples have differed in effect in terms of the shortest roots. Upper Coros, Baliti and Salaksak differed with lower Coroz and the control.

Table 2. Analysis of Variance (ANOVA) in CRD and LSD of the macroscopic effect of the water samples in terms of the presence of shortest roots.

	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	35.067	4	8.767	8.219	.003
Within Groups	10.667	10	1.067		
Total	45.733	14			

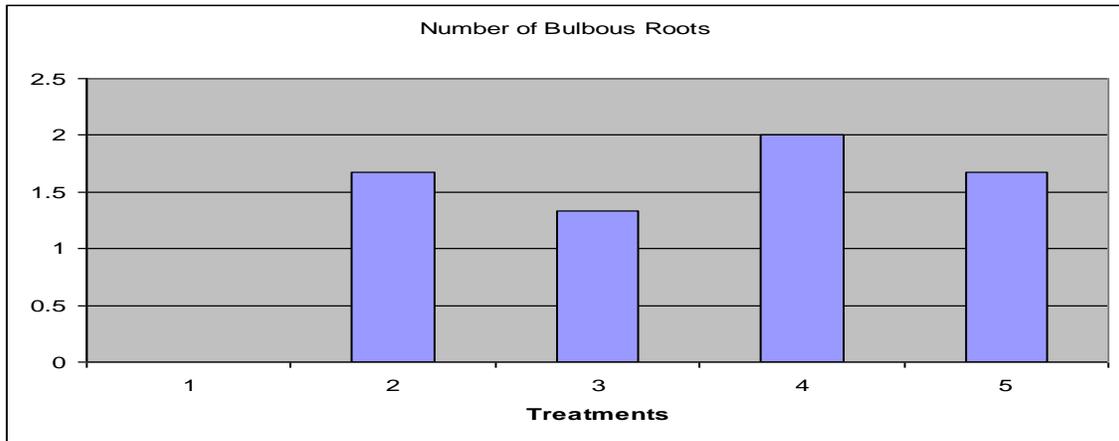
^{ns} - The mean difference is not significant (p>0.05)

B. Frequencies of Root Forms is

1. Bulbous Curved Roots

Table 3 showed that ANOVA of the bulbous or curved roots. The value of .267 means that there is no significant difference in the effect of the water samples and the control in terms of curved or bulbous roots.

Figure 3 .Mean of Bulbous or Curved Roots.



Legend : T1 - Control T2 – Lower Coroz T3 – Upper Coroz T4 – Baliti T5 – Salaksak

Table 3. Analysis of Variance (ANOVA) in CRD and LSD of the macroscopic effect of the water samples in terms of the presence of bulbous roots.

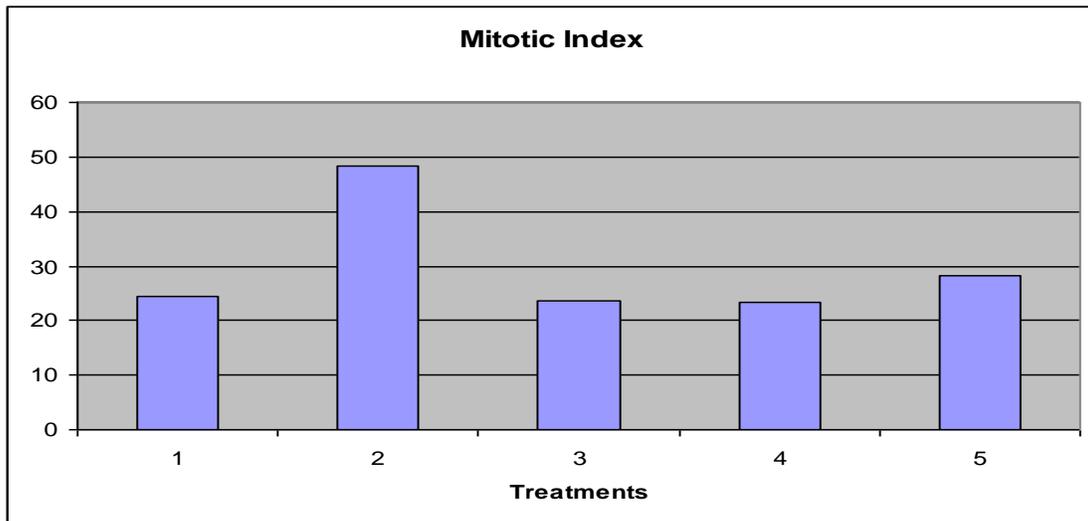
	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	7.333	4	1.833	1.528	.267 ^{ns}
Within Groups	12.000	10	1.200		
Total	19.333	14			

^{ns} - The mean difference is not significant (p>0.05)

C. Effect on the microscopic parameter in terms of the mitotic index (MI)

In terms of terms of mitotic index ANOVA, this shows no significant difference in the effect of the water samples on the onion roots. This means that the water samples and pure water are not different in effect in terms of mitotic index.

Figure 4. Mean of the Mitotic Index Values



Legend : T1 – Control ; T2 – Lower Coroz ; T3 – Upper Coroz ; T4 – Baliti ; T5 – Salaksak

Table 4. Analysis of Variance (ANOVA) in CRD and LSD of the microscopic effect of the water samples in terms of the mitotic index (MI).

	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	7.333	4	1.833	1.528	.267 ^{ns}
Within Groups	12.000	10	1.200		
Total	19.333	14			

^{ns} - The mean difference is not significant (p>0.05)

VII. CONCLUSIONS

Based on the aforementioned discussions and the initial findings obtained from this scientific study, some conclusions may be drawn. Even though water samples obtained from the main water source of Barangay Ambassador showed growth inhibition of the onion roots and other morphological effects such as bulbous and curved roots, all of which yielded insignificant difference as compared with the control. Furthermore, based on the results that were obtained from the microscopic indicator, the samples were found to produce insignificant genotoxic effect. Therefore, the different sources of water from the main water source of Ambassador could be tapped as sources of potable water.

VIII. RECOMMENDATIONS

This project also recommends that there should be an overall assessment of the water quality prior to the establishment of a water source that will provide the community with potable water. Over all assessment of water quality such as bacteriological tests and other available water potability test should be done by the local government. The local government should find ways to implement the elimination of discharge pollutants into the rivers of Barangay Ambassador. Significantly, it must also set guidelines in prohibiting the discharge of wastes that might adversely affect the rivers of the barangay. In addition, implementation of programs which highlight the importance of protecting the river in the locality and proper waste management must be set. This study can also lead towards an investigation of the effects of water pollution on human health and the different sources of pollution of water of Barangay Ambassador. This project also is meant to create an environmental awareness among the community residents about the possible effect on their health and provide them with an opportunity, as the concerned individuals, to become aware and actively participate in the protection, preservation and conservation of the water resource that they have at present.

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Coronary Artery Disease in Young: A Study of Risk Factors and Angiographic Characterization in the Valley of Kashmir

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Abstract- Ischemic heart disease is uncommon in young adults and may have some characteristics that are different from those in older patients. This study examined the risk factors for coronary artery disease and angiographic characterization in young adults. In current study 45 patients (90%) were men and only 5(10%) women. 10% of this population were obese and 78% were overweight. Risk factor analysis revealed smoking to be present in 78% of population. Family history was present in 52% of population. As compared to Diabetes Mellitus 12%, hypertension was present in 40% of patients and hyperlipidemia was seen in 48% of patients. Angiographically the percentage of coronaries involved was 84% (n=42). Nevertheless single vessel disease was the most common angiographic finding in the study group, 67% of patients had single vessel disease and 28% had double vessel while as about 5% patients had triple vessel disease. The left anterior descending artery was the most common artery involved followed by right coronary artery and circumflex artery. From these results we conclude that Myocardial infarction before age 45 is a disease of men. A sizeable proportion of patients will have normal coronary arteries. Coronary arteriography should be considered for patients who sustain a myocardial infarction before age 45 for purposes of diagnosis, management and prognosis.

Index Terms- ischemic heart disease, risk factors, angiography.

I. INTRODUCTION

Ischemic heart disease although relatively uncommon in young adults constitutes an important problem for such patients because of its devastating effect on their more active lifestyle. When the afflicted individual is under the age of 40, the tragic consequences for family, friends, and occupation are particularly catastrophic and unexpected. In addition these patients may have different risk factor and angiographic profiles, clinical presentations and prognosis compared to older patients¹. There are several risk factors for IHD in young adults, most of whom have coronary atherosclerosis. As the number of atherosclerosis risk factors increases so does the severity of coronary atherosclerosis in young adults. However IHD in the absence of atherosclerosis, although uncommon in older patients accounts for approximately 20% of cases in patients under age 45²⁻⁴. Young patients with IHD have a greater prevalence of anatomically normal epicardial coronary arteries than do older

patients with IHD. However approximately half have single vessel atherosclerotic disease. The remainder have multi-vessel disease. The prevalence of left main coronary artery stenosis is approximately 5%. Multi-vessel disease is more likely in patients with multiple risk factors and diabetes. All young patients presenting with symptoms suggestive of IHD should be questioned of cocaine use⁵. Younger patients with IHD who undergo diagnostic catheterization are much more likely to have a major change in management than are older patients. Cigarette smoking appears to be the most common risk factor in young patients. The extent of smoking appears to be inversely related to the age at which IHD occurs⁶. The other significant risk factors in this age group include deranged lipid profile, positive family history, obesity, hypercoagulable states, coronary anomalies, diabetes mellitus, and oral contraceptive use in young woman. Other unusual causes include hypertension, vasulitic disorders, coronary aneurysms, mediastinal irradiations, valvular abnormalities, infective endocarditis⁷⁻⁹. A particular challenge remains for the clinician in the management of the young patients with coronary disease who might anticipate a life expectancy measured in decades rather than years. It must be noted, however, that those patients who come to medical attention owing to symptomatic disease may well represent the "tip of the iceberg" when considering manifest and subclinical disease together.

India topped the world with 1531534 cardiovascular disease-related deaths in 2002. Median age of first heart attack in Indians is 53 years. Incidence of CAD in young Indians is about 12%–16%, which is higher than any other ethnic group. About 5%–10% of heart attacks occur in Indian men and women younger than 40 years¹⁰.

II. MATERIAL AND METHODS

The study was conducted in Department Of Cardiology at Sheri-Kashmir Institute of Medical Sciences (SKIMS) tertiary care hospital rendering services of type of primary PCI to a large population in Srinagar, India. The patients in this study were recorded over a period of two years after a proper consent was taken from them. In this study angiographic profile was studied in young patients who presented mainly as one of the variants of IHD which includes stable angina, unstable angina, and acute MI (both ST elevation and non ST elevation.) The study included patients under age 45 years which has been internationally

accepted as age bar for young adults. The study includes risk factor screening with parameters like BMI, history of smoking, diabetic history, and include some invasive and non invasive investigations like cardiac enzymes, lipid profile, electrocardiography, echocardiography and stress ECG.

An important objective was to study the Angiographic profile in patients younger than 45 years of age. As we have found that incidence of patients with IHD is increasing, so the study laid more importance on the pattern of involvement of coronary arteries, No. of coronary arteries involved, type of lesions, whether coronaries are involved or they are normal and whether there was an association of vasospastic angina.

III. STATISTICAL ANALYSIS

Data was described as mean \pm SD and percentage. Chi square analysis was used for inter group comparison and variance was checked at 95% confidence interval. SPSS software was used for data analysis.

IV. RESULTS

The study population consisted of 50 patients less than 45 years of age (mean age, 39.7 ± 5.0). There were 11 patients below 35 years of age, 14 patients between 36 to 40, and 25 patients between 41 and 45. The mean age of presentation among men was 39.4 years and it was 42.8 years among female population (Table 1). 45 patients (90%) belonged to male sex and only 5(10%) were female. 70% were from rural population. Risk factor analysis revealed smoking to be present in seventy eight percent of population. Family history was present in fifty two percent of population. As compared to diabetes mellitus (12%), hypertension was present in 40% of patients. Among five female participants only one had history of contraceptive use. In the non invasive investigations, hyperlipidemia was seen in twenty four patients (48%) patients. In thirty six percent patients's chest x ray showed cardiothoracic ratio of more than 0.5. Thirty-four percent patients had anterior wall involvement while as thirty six had inferior wall and sixteen had lateral wall involvement. Fourteen percent had normal electrocardiogram. Eighty-two percent patients had echo documented regional wall motion abnormality. Eighty-two percent patients had elevated cardiac troponin levels. Majority of patients had presented as myocardial infarction (82%), while as 7% percent had unstable angina and only 4% had stable angina (Table 2). Angiographically, the percentage of coronaries involved was eighty-four percent. (n=42). Nevertheless single vessel disease was the most common angiographic finding in the study group. Sixty-seven percent patients had single vessel disease & twenty eight percent had double vessel while as about five percent patients had triple vessel disease. The left anterior descending artery was the most common artery involved followed by right coronary artery and circumflex. No patient had involvement of left main coronary. The proximal and mid segments were most commonly involved. Type A lesion was the most common type of lesion. Among Myocardial infarction patients sixty-eight percent had LAD involvement and unstable angina patients had anatomically

normal arteries. Both stable angina patients had coronary involvement. One had SVD and other had DVD (Table 3).

Regarding relationship of risk factors and pattern of coronary involvement-it was seen that among 39 smokers only 6 had normal coronaries and 25 had predominantly SVD while as among 20 hypertensive's, only 2 had normal coronaries while as 10 had SVD.

Among DM patients out of six patients 3 had DVD & none had normal coronaries. Among hyperlipidemics, out of 24 patients 12 had SVD and 8 had DVD while as 2 had TVD and two patients had normal coronary anatomy (Table 4).

V. DISCUSSION

This study was conducted in a group of patients under age of 45 who were diagnosed as a case of ischemic heart disease viz stable angina pectoris, unstable angina or myocardial infarction. This study was conducted in dept. of cardiology at Sheri-Kashmir Institute Of Medical Sciences for a period of 2 years from Nov 2009.

A close association exists between traditional risk factors and risk of cardiovascular disease in young adults.

In our study 90% of patients belonged to male sex which is consistent with international studies conducted world over^{1,11}. More young patients were currently smoking cigarettes (78%) which is comparable to that seen by Zimmerman et al.in 1995 and other studies^{5,15-18}.

In our population 10 percent patients were obese (BMI > 30kg / m²) and 78 percent were overweight (BMI 25-29.9 kg/m²) suggesting that it again is a major risk factor. A positive family history, defined as premature incidence of overt CAD in a first degree relative has been widely reported. In our study, family history was present in fifty two percent of population. It has been determined that younger the patient is when the first MI occurs, the more common was CAD in relatives¹⁵⁻¹⁸. Although systemic hypertension and diabetes mellitus are also well established risk factors for atherosclerosis, they may not be as prevalent in younger age groups as in older ones. In our study it was found that 40 percent of patients were in hypertensive range and only 12 percent had diabetes^{5,15-18}. It is probable that not only the pressure levels but also the duration of the hypertensive disease are of importance in increasing the risk of acute MI. Hyperlipidemia was documented in 46 percent of study population. Other studies of young MI patients have reported the prevalence of hyperlipidemia in the range of 41 to 80%. The low incidence of MI in women (10%) limited our ability to investigate this entity adequately. Conventional risk factors associated with MI in men had similar implications in women, with oral contraceptives being an additional consideration.

The present study focuses on the angiographic extent of the coronary lesions in young adults having IHD. Angiographically, the percentage of coronaries involved was eighty-four percent. Nevertheless single vessel disease was the most common angiographic finding in the study group. Sixty-seven percent patients had single vessel disease & twenty eight percent had double vessel disease while as about five percent patients had triple vessel disease¹⁵⁻¹⁸.

The left anterior descending artery was the most common artery involved followed by right coronary artery and circumflex artery. No patient had involvement of left main coronary.

The proximal and mid segments were most commonly involved. Type A lesion was the most common type of lesion. As described in the literature, young adults are characterized by a less extensive coronary disease, mainly as one vessel form.

Despite the involvement of only one vessel, the extent of left ventricular dysfunction (ECHO documented regional wall motion abnormality) appeared to be as great as in those patients with more extensive CAD.

This suggests that MI in the young occurs secondary to rapid occlusion of the coronary artery, without time for establishment of collateral pathways.

VI. CONCLUSION

- Myocardial infarction before age 45 is a disease of men.

- Most important risk factor is smoking and often patients have a family history of premature coronary artery disease.
- Most common pattern of involvement is SVD.
- A sizeable proportion of patients will have normal coronary arteries.
- Coronary arteriography should be considered for patients who sustain a myocardial infarction before age 45 for purposes of diagnosis, management and prognosis.

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TABLE 1: DEMOGRAPHIC CHARACTERISTICS OF THE STUDIED SUBJECTS.

		N	%
AGE (YR)	≤ 30	4	8.0
	31 TO 35	7	14.0
	36 TO 40	14	28.0
	41 TO 45	25	50.0
	MEAN ± SD	39.7 ± 5.0 (21, 45)	
GENDER	MALE	45	90.0
	FEMALE	5	10.0
DWELLING	RURAL	35	70.0
	URBAN	15	30.0
BODY MASS INDEX (KG/M ²)	NORMAL	6	12.0
	OVER WEIGHT	39	78.0
	OBESE	5	10.0
	MEAN ± SD	27.5 ± 2.0 (23.9, 33.2)	

TABLE 2: NON INVASIVE INVESTIGATIONS OF THE STUDIED SUBJECTS.

		N	%
INCREASE IN LIPIDS	CHOLESTEROL	23	46
	TRIGLYCERIDES	6	12
	LDL	8	16
INCREASED CXR (CARDIOMEGALY)	CT R > 0.5	18	36
ECG	ANTERIOR	17	34
	INFERIOR	18	36
	LATERAL	2	4
	ANTERO-LATERAL	6	12
	NORMAL	7	14
REGIONAL WALL MOTION ABNORMALITY ON ECHO		41	82
ELEVATED TROPONIN T LEVELS		41	82
CLINICAL DIAGNOSIS	STABLE ANGINA PECTORIS	2	4
	UNSTABLE ANGINA	7	14
	MYOCARDIAL INFARCTION	41	82

TABLE 3: DIAGNOSIS ACROSS CORONARIES INVOLVED.

		STABLE ANGINA PECTORIS		UNSTABLE ANGINA		MYOCARDIAL INFARCTION	
		N	%	N	%	N	%
		CORONARIES INVOLVED	YES	2	100.0	0	0.0	40	97.6
NO	0		0.0	7	100.0	1	2.4
PATTERN OF INVOLVEMENT	SVD	1	50.0	0	0.0	27	67.5
	DVD	1	50.0	0	0.0	11	27.5
	TVD	0	0.0	0	0.0	2	5.0
LAD VESSEL	NO	0	0.0	7	100.0	13	31.7
	YES	2	100.0	0	0.0	28	68.3
LCX VESSEL	NO	2	100.0	7	100.0	29	70.7
	YES	0	0.0	0	0.0	12	29.3
RCA VESSEL	NO	1	50.0	7	100.0	25	61.0
	YES	1	50.0	0	0.0	16	39.0

TABLE 4: RELATIONSHIP B/W RISK FACTOR AND PATTERN OF INVOLVEMENT

	N	NORMAL	SVD	DVD	TVD		
SMOKING	39	6	25	7	1		
HYPERTENSION	20	2	10	6	2		
DIABETES MELLITUS	6	0	2	3	1		
HYPERLIPIDEMIA	24	2	12	8	2		

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Information Imbalance: A Case Study of Print Media in India

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Abstract- The fundamental concerns of imbalances in information and communication had been discussed for a longtime globally. The American media scholar Wilbur Schramm (1964) stated that the flow of news among nations is thin, that much attention is given to developed countries and little to less-developed ones, that important events are ignored and reality is distorted. After a long discussion and debate over media representations of the developing world in UNESCO in the late 1970s and early 1980s, a new term was coined as 'the New World Information and Communication Order (NWICO or NWIO).' The term was widely used by the MacBride Commission, which was charged with creation of a set of recommendations to make global media representation more equitable.

But after three decades from the publication of the MacBride Commission's report *Many Voices, One World* (1984), the situation has not changed in the information flow from developed to developing nations. This research paper has only one objective to explore the predominance of Foreign News Agencies in Indian Print Media at various levels. This study is basically a content analysis of nine Indian newspapers and periodicals, which were selected on the regional and national basis only for three days.

Index Terms- International news flow, news agency, Indian media, free flow of communication, New World Information and Communication Order

I. INTRODUCTION

In equilibrium in the flow of information is the delicate concern for the world information scenario. What we know and how we know are the key factors. Adverse selection, moral hazard and information monopoly create the information imbalance. After World War-II, the democratic dicta – 'free flow of information' was badly challenged. It proved the western dominance in the information dissemination process throughout the world. The end of colonization still could not end the hierarchical structure of one way news flow from developed to developing countries. Traditional dependency on the west based news agencies strangleholds the reasons of imbalanced communication procedure like scarcity of infrastructure, economy, manpower, training, and scope of knowledge sharing.

It results inconceivable competition for third world countries with that of developed countries.

The media is the mirror of the power structure of society. News reporting on the developing world that reflects the priorities of news agencies in London, Paris and New York. Reporting of natural disasters and military coups are preferred rather than the fundamental realities. At the time four major news agencies controlled over 80% of global news flow (New World Information and Communication Order, nd). A few news-networks emphasize capitalism, on the other hand a few use to try to convince the world to see according to their views which manifests the complete, unconditional dependency in news flow. Those imperialist transnational communication dissemination organizations not only deform the fact that to be communicated, but also mostly ignore the common interest of the developing countries. To get rid of the situation and struggle against the imbalance of information, Mac Bride commission suggested a few neutral paths to be adopted by the various media throughout the world. The commission aimed to analyze communication problems in modern societies, particularly relating to mass media and news, consider the emergence of new technologies. The commission called for democratization of communication and strengthening of national media to avoid dependence on external sources, among others. New World Information and Communication Order was formed to diminish these problems to further peace and human development (MacBride report, 1984). NWICO grew out of the New International Economic Order of 1974.

II. OBJECTIVE RESEARCH METHODOLOGY

Objective:

This research paper has only one objective, which is to investigate the predominance of Foreign News Agencies (at the time of propagating international news) in Indian Print Media at various level (regional, national) after 40 years of Mac Bride Commission.

Research Methodology:

The researchers adopted only content analysis. Three regional newspapers were selected based on circulation in the Hindi speaking belt, Bengali speaking region and multilingual north eastern region of the country. Ananda Bazar Patrika- the highest circulated Bengali newspaper, Dainik Jagaran- the leading Hindi newspaper and the leading English newspaper of the north eastern part of the country- The Assam Tribune were

chosen for the date of March 06, 2014. As the researchers cannot read any language from South or any other part of the country, therefore the selection of the regional newspapers were done accordingly. Three national English newspapers were selected based on the circulation for the date of March 07, 2014- Times of India, Hindustan Times and The Hindu. Apart from these newspapers, three leading magazines namely India Today, The Week, Outlook were selected for the date of March 08, 2014.

III. ANALYSES AND FINDINGS

The study is basically on nine Indian newspapers and periodicals, which were selected on the regional and national basis for only three days. The analysis is based on the quantitative content analysis.

A. News Agencies in Asia

Before going to discuss on the content analysis, it is necessary to have a look on the various news agencies working in Asia and more particularly in India. Organization of Asia-Pacific News Agencies (OANA) is an association of news agencies from UNESCO (United Nations Educational, Scientific and Cultural Organization). It provides a news wire service containing articles donated by its members. There are several news agencies working in this region. Among them the prominent are- Bakhtar News Agency (Afghanistan), Azerbaijan State Telegraph Agency (Azerbaijan), Trend News Agency (Azerbaijan), Bahrain News Agency (Bahrain), Bangladesh Sangbad Sangstha (Bangladesh), United News of Bangladesh (Bangladesh), Agence Khmer de Presse (Cambodia), Xinhua News Agency (China), Korean Central News Agency (North Korea), Emirates News Agency (Emirates), Press Trust of India (India), Asian News International (India), United News of India (India), Indo-Asian News Service (India), Antara (Indonesia), Islamic Republic News Agency (Iran), Mehr News Agency (Iran), Fars News Agency (Iran), National Iraqi News Agency (Iraq), Jiji Press (Japan), Kyodo News (Japan), Kazinform (Kazakhstan), Khabar Agency (Kazakhstan), Kuwait News Agency (Kuwait), Kabar (Kyrgyzstan), Lao News Agency (Laos), Bernama (Malaysia), Montsame News Agency (Mongolia), Rastriya Samachar Samati (Nepal), Oman News Agency (Oman), Pakistan Press International (Pakistan), Associated Press of Pakistan (Pakistan), Philippines News Agency (Philippines), Qatar News Agency (Qatar), Yonhap News Agency (South Korea), ITAR-TASS News Agency (Russia), Russian Information Agency (Russia), Saudi Press Agency (Saudi Arabia), Lankapuvath (Sri Lanka), Syrian Arab News Agency (Syria), Thai News Agency (Thailand), Anadolu News Agency (Turkey), Vietnam News Agency (Vietnam), Yemen News Agency (Yemen).

But the content analysis shows less involvement of Asia based news agencies especially in the Indian print media in covering international news.

B. Content Analysis

March 06, 2014 was the date selected to analyse the content in the regional newspapers. It is already mentioned that Ananda Bazar Patrika was chosen from East. It is a Bengali

newspaper having about 5.5 million circulations. On the specific date, six international news were covered by the newspaper. But interestingly every news was taken from the news agencies based in Peiyongyoung, Kiev, Ukraine and Vatican. But there is no mention of the name of the news agency as well as from where it is reported. Only 'Sambad Sanstha' (News Agency) is mentioned at the credit line portion.

The same can be seen in Dainik Jagaran. The names of news agencies are not mentioned in the newspaper, but the place from where it is being reported is mentioned in the portion of international news. Most of the stories are reported from London, Beijing, Ukraine, Bangkok, Huston, Los Angeles, New York, Bagdad and Washington. Dainik Jagaran is a Hindi Language Daily having 15.5 million circulations.

On the other hand, The Assam Tribune contains good number of international news than that of others. Most of the news are accompanied by the name of the news agency as well as the place from where the news was reported. The information provided by PTI and AFP gets preference. The news have been reported from the places like London, Melbourne, Jakarta, Hong Kong etc.

The analysis depicts the fact that though the news from other developing countries are very significant and delicate in nature but the news from the developed countries get more preference than that of others. It seems that though we get international news from developing countries, but we can see the angels of those news as the news providers want depending on the political point of view and international relations.

C. News Flow in the Selected National Newspapers

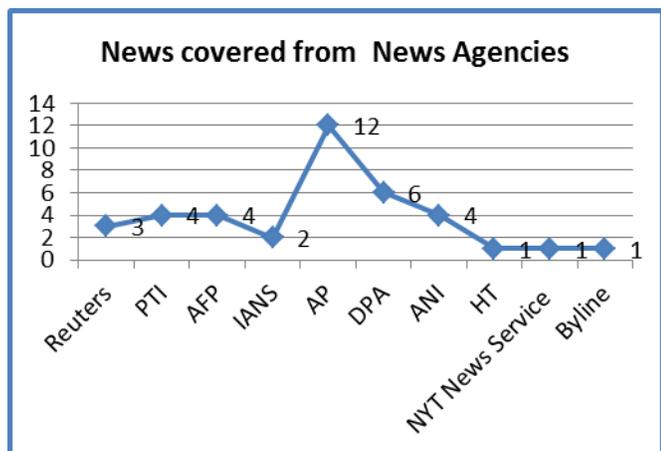
The Times of India owned by Bennett, Coleman and Co. Ltd is an English newspaper with 7.2 million circulations. On March 07, 2014, the news stories were provided by Reuters, PTI, AFP, IANS, Edward Wong, NYT News Service from various places like Washington, Kiev, Los Angeles etc. All the international news were published with by line.

Whereas the Hindustan Times published various news stories provided by Reuters, Associated Press, AFP, PTI, Asian News International from various places like Simferopol, Washington, Tripoli, Paris, Boston, London, Vatican City etc. On that day two letters –one from Yashwant Raj and one from Noopur Tiwari can be found carrying international news content. The Hindustan Times is owned by HT Media Ltd. It is an English newspaper having 4.3 million circulations.

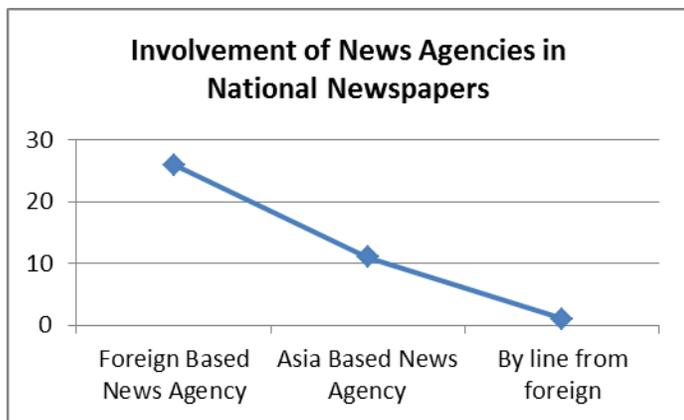
The Hindu owned by Kasturi & Sons Ltd. is having 1.47 million circulations. On the particular date, this English daily was provided various international news stories from AP, DPA, PTI from Riyadh, Saudi Arabia, Damascus, Syria, Brisbane, Australia, Ankara, Turkey, Ramallah, West Bank, Beirut, The Hague, Kuala Lumpur, Eijing, Tokyo, Caracas, Auckland, Los Angeles, Washington and Brussels.

**D. Involvement of News Contents in National Newspapers
(For International News)**

The analysis shows that in three national newspapers, there three news covered from Reuters, whereas four news were taken from PTI, four from Agence France-Presse, two from Indo-Asian News Service, twelve from Associated Press, six from Deutsche Presse-Agentur, four from Asian News International, one from own source (HT), one from Edward Wong, NYT News Service, and one By line.



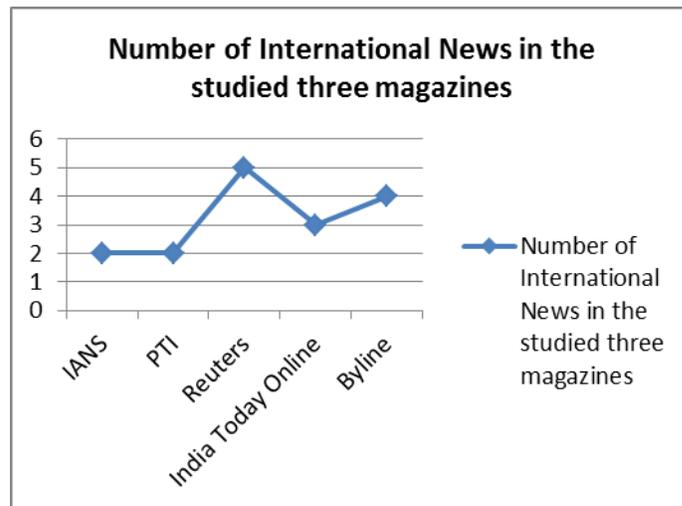
The analysis shows that 26 news covered in these three national newspapers on the particular day from the News agencies based in western and developed countries. Less than one third news (11) were covered from the Asian news agencies and only one from the foreign correspondent. The data gives a vivid picture of the foreign interruption in the international flow of information in the developing countries like India.



E. Magazine:

Most Indian publications are publicly secretive about their circulation numbers. But four news magazines are popular in the national level as 'Big-4' including the Week, Outlook, Frontline and India Today. All these are English news magazines (Magazine, nd).

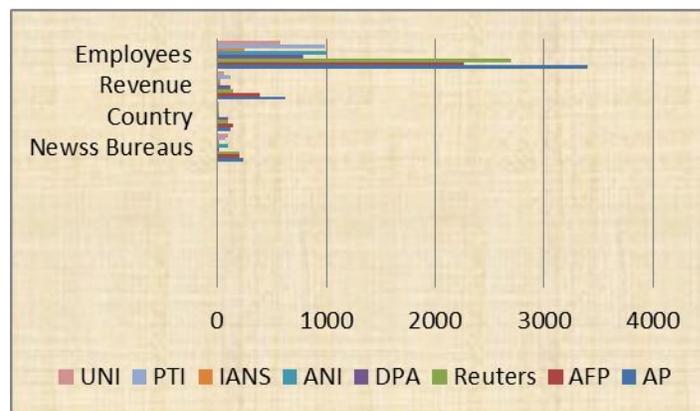
The research shows that in case of major magazines in India, the information on international issues is taken from the news agencies based in developed countries. Here it can be seen that in total three magazines two news came from IANS, two from PTI, five from Reuters, three from own sources and four bylines from abroad. It is clearly seen the dominance of the western news agencies.



F. Reasons

In this small analysis, the fact says that Asia based news agencies are less preferred in Indian print media. We have to take into the consideration of various factors for the less preference of these news agencies like maintaining balance between revenue generation and cost of subscription of the news agencies, number of countries (as subscribers), number of news bureaus and of course the correspondents' employment structure.

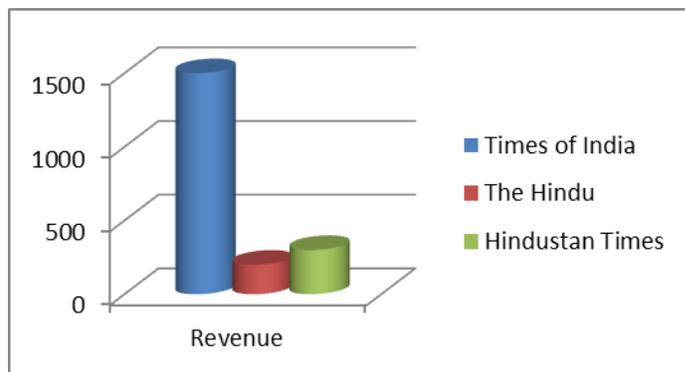
Basic structure of the news agencies



The chart is depicting the data that in competition of Asia based news agencies cannot stand anyway. Associated Press not only has the highest employee structure but also in terms of revenue, number of news bureaus. On the other hand AFP is the

highest in rank in number of countries covered. In India, UNI is in the lowest rank in every sector. But the condition and status of PTI is quite satisfactory.

Now the question comes that- why the media of India are dependent upon the western news agencies for international news? One of the answers could be like this- lack of infrastructure and constrain in affordability. For regional level print media, to some extent is quite valid consideration and in ignorable cause to sustain and give coverage of international news to the local people. But in case of national newspapers these reasons cannot be applicable. The graph below is depicting the fact.

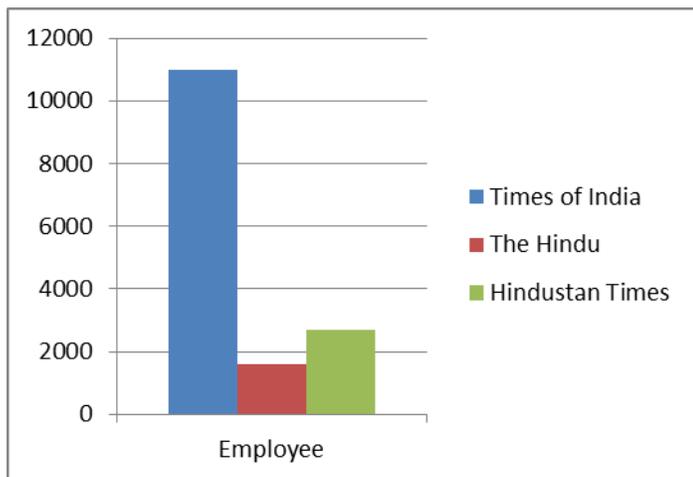
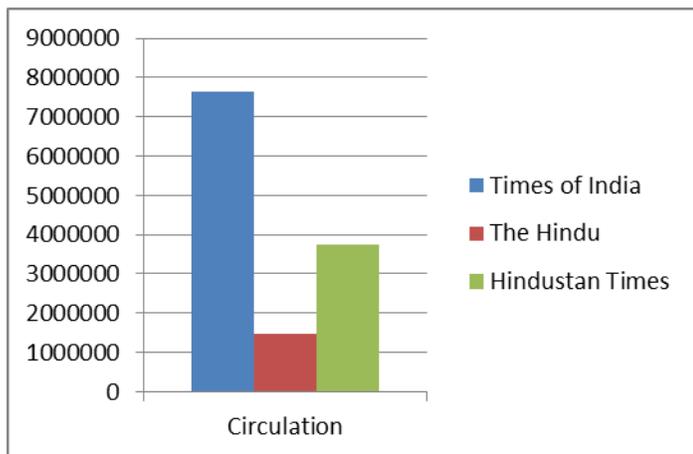


IV. CONCLUSION

As we know after the cold war, colonization of news flow was clearly emerged. That time it was felt that the information dissemination process has become one sided and purely one way of communication. But after 1970's this trend was not accepted by various countries and Non Alignment Movement came into existence. In parallel way, Mac Bride Commission, NWICO were also formed to control over the dominance of a few powerful countries in free flow of information throughout the world. Over the time especially in India, the media scenario has changed its phenomenon. In the 90's, not only the number of newspapers increased but also various private satellite channels have started to capture the media market in a wide range since 2000.

But unfortunately the dependency on foreign source and news network was not at all abolished. The common mass is unknowingly digesting all the international information as they (the dominant providers) want. People are compelled to think about Ukraine as America or Europe aspires. We see Pakistan as they make the common people seen. On the contrary except a few big stories, the developing countries are hardly represented as international issues. The foreign based news agencies like Reuters, AFP, DPA, AP have huge worldwide network, and of course for which the revenue becomes so huge that they can afford the staff or stringers in every required place, whereas Asia based news agencies have less number of subscribers and that is the reason that they are unable to put the representation in every required field. On the other hand the big media organizations (though they can afford) are less concerned about the view and intention of news rather they are more intend to concentrate the international issues and the increasing number of news.

The Press Trust of India has a place of satisfactory coverage, The media organizations should try to strengthen the activities of news network of Asia. More subscribers more revenue more representation of the required field are needed. Not only Organization of Asia-Pacific News Agencies (OANA) will work properly but also Association of News agencies of Asia should be formed to checklist of the foreign interference especially in case of international issues. On the other hand the Government should have regulation on the using of international information in national or regional media. There should be a strong policy to gate keep the one way of communication. It should instigate the



According to 2011 data, Times of India has an yearly turnover of US \$ 1.5 billion, whereas in 2010 the yearly income of The Hindu was \$200 million, and the Hindustan Times had US\$300 million (according to 2011 report) yearly turn over. In terms of employee structure and circulation of three of them have satisfactory output.

free flow of information. Otherwise, not only the confusion among third world countries but also between developed and developing countries will be increased without having any solution.

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Ky Fan's Best Approximation Theorem in Hilbert space

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Abstract- The aim of this paper is to prove a fixed point theorem using semicontractive mapping a well-known result of Ky Fan in Hilbert space.

Keywords - Fixed point theorem, Ky Fan's best approximation theorem, Semicontractive mapping.

AMS (2010) Subject Classification - 47H10, 54H25.

I. INTRODUCTION

Fixed point theory has always been existing itself and its applications in new areas. The theory of approximation also played an important role. Ky Fan one of the great mathematician establish an existing theorem in 1969, which was known as Ky Fan's best approximation theorem which has been of great importance in nonlinear analysis, minimax theory and approximation theory. Several interesting fixed point theorems have been proved by using Ky Fan's best approximation theorem. This approach helps to find fixed point theorems under different boundary conditions. Most of the fixed point theorems are given for self maps that are for a function with domain and range are the same. In case a function does not have the same domain and range then we need a boundary condition to guarantee the existence of fixed point.

Let X be a normed linear space and K be a nonempty subset of X . Let $T : K \rightarrow X$ be a function. We look for an x in K that satisfies the following equation

$$\|x - T(x)\| = d(T(x), K) = \inf\{\|y - T(x) : y \in K\| \} \text{----- (A)}$$

If a solution x in K exists, it is called a best approximation for $T(x)$. We note that $x \in K$ is a solution of (A) if and only if x is a fixed point of $Q_K \circ T$ where Q_K is the metric projection on K . We refer to Carbone [2], Caristi [3], Cheney [4], Furi Et al. [6], Kuratowski [8], Nussbaum [10], Park [11], Schoneberg [14], Singh and Watson [15]. In this paper fixed point theorem has been established using the concept of semicontractive mapping which generalized the result of some standard result.

II. PRELIMINARIES

Lemma 2.1 [1] Suppose that H be a Hilbert space and K be a nonempty closed convex subset of X . A function $T : K \rightarrow H$ is called semicontractive if there exists a mapping D of $H \times H \rightarrow K$ such that:

- (i) for each fixed x in K $T(x) = D(x, x)$,
- (ii) for each fixed x in K , $D(x, \cdot)$ is compact,
- (iii) for each fixed x in K , $D(\cdot, x)$ is nonexpansive.

Corollary 2.2[13] Suppose that K be a closed bounded and convex subset of H and suppose $T : K \rightarrow H$ be a semicontractive. Then there exists a $y \in K$ such that $\|y - T(y)\| = d(Ty, K)$.

Definition 2.3[7] Suppose that K be a subset of a Hilbert space H for each $x \in K$. Let the inward set of K at x , $I_K(x)$ be defined by $I_K(x) = \{x + r(t - x) : t \in K, r > 0\}$.

A mapping $T : K \rightarrow H$ is said to be inward if for each $x \in K$, $T(x)$ lies in $I_K(x)$ and it is weakly inward if $T(x)$ lies in $\overline{I_K(x)}$.

Theorem 2.4 [9] Suppose that H be a Hilbert space and K be a nonempty closed convex subset of H , T a continuous semicontractive map of K into H . Let either $(I - Q_K \circ T)(K)$ is closed in H or $(I - Q_K \circ T)(\text{clco}(Q_K \circ T(K)))$, where Q_K , is the proximity map of H into K . If $T(K)$ is bounded then there exists a point v in K such that $\|v - T(v)\| = d(T(v), K)$.

III. MAIN RESULTS

Theorem 3.1 Suppose that H be a Hilbert space and K be a nonempty closed convex subset of H and T be a continuous semicontractive map of K into H . Let either $(I - Q_K \circ T)(\text{clco}(Q_K \circ T(K)))$ or $(I - Q_K \circ T)(K)$ is closed in H where Q_K is the proximity map of H into K . Suppose $T(K)$ is bounded and T has a fixed point in K if and only if it satisfies one of the conditions below:

[1] $\exists y$ in $I_K(x) = \{x + t(z - x) : \text{for some } z \in K, \text{ some } t > 0\}$ such that $\|y - T(x)\| < \|x - T(x)\|$, for $x \in K$ with $x \neq T(x)$.

Proof: Consider that T satisfies condition. By using theorem 2.4 \exists a point v in K such that $\|v - T(v)\| = d(T(v), K)$. If $v \neq T(v)$, then \exists a y in $I_K(v)$ such that $\|y - T(v)\| < \|v - T(v)\|$. If $y \in K$, which is a contradiction for supposition of v . Hence $y \notin K$, and \exists a $z \in K$, such that $y = v + t(z - v)$ for some $t > 1$.

$$\text{i.e. } z = \frac{1}{t}y + (1 - \frac{1}{t})v = (1 - \lambda)y + \lambda v \text{ where } \lambda = 1 - \frac{1}{t}, 0 < \lambda < 1.$$

Hence

$$\begin{aligned} \|z - T(v)\| &= \|(1 - \lambda)y + \lambda v - T(v)\| \leq (1 - \lambda)\|y - T(y)\| + \lambda\|v - T(v)\| \\ &< (1 - \lambda)\|v - T(v)\| + \lambda\|v - T(v)\| = \|v - T(v)\| \end{aligned}$$

Which contradicts the supposition of v .

Hence $v = T(v)$

[2] There is a number α real or complex depending on the vector space X respectively. For each $x \in K$, such that $|\alpha| < 1$ and $\alpha x + (1 - \alpha)T(x) \in K$.

Proof: Consider that T satisfies condition. Using theorem 2.4 \exists point v in K such that $\|v - T(v)\| = d(T(v), K)$. Let T has no fixed point in K , then $0 < \|v - T(v)\|$. For point v , there is a number α such that $|\alpha| < 1$ and $\alpha v + (1 - \alpha)T(v) = x \in K$.

$$\text{Therefore } 0 < \|v - T(v)\| = d(T(v), K) \leq \|x - T(v)\| = |\alpha|\|v - T(v)\| < \|v - T(v)\|$$

Which our supposition. Hence T has a fixed point in K .

[3] If $v = Q_K \circ T(v)$, where v be any point on the boundary of K , then v is a fixed point of T .

Proof: Consider that T satisfies condition. Using theorem 2.4 \exists a point v in K such that $\|v - T(v)\| = d(T(v), K)$. If $T(v) \in K$, then $d(T(v), K) = 0$ and v is a fixed point of T . If $T(v) \notin K$ then from $\|T(v) - Q_K \circ T(v)\| = d(T(v), K) = \|T(v) - v\|$, and the uniqueness of the nearest point, $Q_K \circ T(v) = v$. Implies that v lies on the boundary of K , which contradicts our supposition. Hence v is a fixed point of T .

[4] $\forall x \in K, T(x) \in \text{cl}I_K(x)$, i.e. T is weakly inward.

Proof: Consider that T satisfies condition. $\forall x \in K, T(x) \in cl_K(x)$. If $x \neq T(x)$ then there exists a point y in $I_K(x)$ such that $y \in B(T(x), \frac{\|x-T(x)\|}{2})$, where $B\{T(x), \frac{\|x-T(x)\|}{2}\}$, is an open ball with centre $T(x)$ and radius $\frac{\|x-T(x)\|}{2}$, Therefore $\|y-T(x)\| < \|x-T(x)\|$.

Hence T has a fixed point in K .

[5] $\forall x$ On the boundary of K , $\|T(x) - y\| \leq \|x - y\|$ for some y in K .

Proof: Proof of this condition is similar to the proof of condition (1).

Corollary 3.2 Suppose that H be a Hilbert space and K be a nonempty closed convex subset of a Hilbert space H and T be a continuous 1-setcontraction map of K into H . If $T(K)$ is bounded and T satisfies any one of the five conditions of Theorem 3.1. Then T has a fixed point in K .

Corollary 3.3 Suppose that H be a Hilbert space and K be a closed convex subset of Hilbert space H . Suppose that $T : K \rightarrow H$ be semicontractive mapping with bounded range such that for each $x \in \partial K$, $\|Tx - y\| \leq \|x - y\|$, for some $y \in K$. Then T has a fixed point.

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Design and Simulation Application of Heart Attack Prediction Using Fused Clinical and ECG Data

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Abstract- Heart is a most important and vital organ in the whole body which performs different functions throughout the day. The term heart attack has become the most familiar disease for doctors in the medical field today. The need to predict the attacks accurately is of major importance as the patients having heart attack are increasing day by day because of many reasons like stress, lack of physical exercise, bad habits like smoking, alcohol etc. This paper describes the efficient method of predicting the heart attack using the fusion of both clinical data as well as ECG parameters to increase the accuracy. Probabilistic Neural Network is adopted for training and testing the data. The comparison of results is done for all the three methods and the fusion method is found more efficient.

Index Terms- ECG, Clinical Data, PNN, heart rate, Variability, Acceleration, Deceleration.

I. INTRODUCTION

P MATERIALS AND METHODS ADAPTED

Prediction of heart attack is made either based on clinical data or using ECG parameters. When we are predicting the heart attack through the clinical method mainly the following 13 parameters with reference to [3] are used:

1. Person age: age in years
2. Gender: sex (1 = male; 0 = female)
3. chest pain type (cp)
 - Value 1: typical angina
 - Value 2: atypical angina
 - Value 3: non-anginal pain
 - Value 4: asymptomatic
4. restbps: resting blood pressure (in mm Hg on Admission to the hospital)
5. chol: serum cholesterol in mg/dl #10 (restbps)
6. fbs: (fasting blood sugar > 120 mg/dl) (1 = true; 0 = false)
7. restecg: resting electrocardiographic results
 - Value 0: normal
 - Value 1: having ST-T wave abnormality (T wave inversions and/or ST elevation or depression of > 0.05 mV)
 - Value 2: showing probable or definite left ventricular hypertrophy by Estes' criteria
8. thalach: maximum heart rate achieved
9. exang: exercise induced angina (1 = yes; 0 = no)
10. oldpeak = ST depression induced by exercise relative to rest
- 11 slope: the slope of the peak exercise ST segment
 - Value 1: upsloping

- Value 2: flat
- Value 3: downsloping
- 12. ca: number of major vessels (0-3) colored by flourosopy)
- 13. thal: 3 = normal; 6 = fixed defect; 7 = reversable defect
- 14. num: diagnosis of heart disease (angiographic disease status)
 - Value 1: Absence
 - Value 2: Presence

II. DATA PREPROCESSING

The available data need to be arrange in format so that further processing becomes easy, for these unnecessary data can be filtered, duplicated records can be removed, normalize the dataset, make data encoding if required. Arrange data cleanly, if require combine the dataset.

From ECG signal fetch the required parameters and make the dataset, if require make data preprocessing as above.

Finally fuse the clinical and ECG data in signal knowledgebase.

The parameters considered in ECG method to predict heart attack are:

1. Heart rate
2. Variability
3. Accelerations
4. Decelerations

How to calculate heart rate from an ECG signal? Standard ECG related textbooks of physiology and medicine Science [7] provide the theory that heart rate (HR) is readily calculated from the ECG as follows:

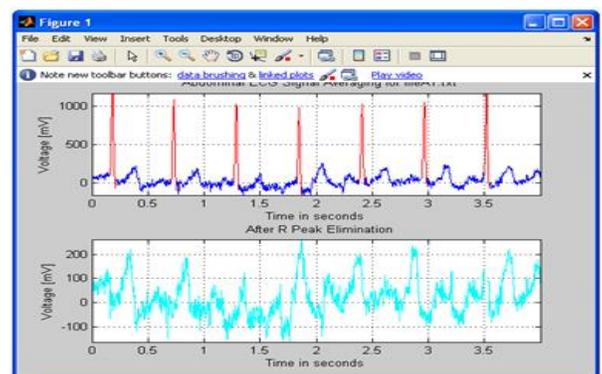


Figure 1: ECG Sample

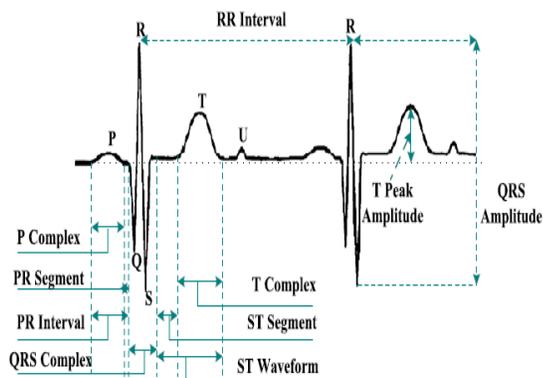


Figure 2:ECG waveform

Depending on availability of parameters ie R-R distance in mm , or in seconds or in number of squares the HR can be formulates as :

- HR = 1500 / RR in mm
- HR = 60 / RR interval in seconds.
- HR = 300 / number of large squares between successive R waves

In each of the above formula, the authors are actually referring to instantaneous heart rates, which is the number of times the heart would beat if successive RR intervals were constant.

If the rhythm is regular as in ECG1, i.e. successive RR intervals are fairly constant, then 1500 / RR in mm may give a reasonably accurate value of HR. However, if RR intervals vary, it is best to determine the number of RR intervals that are contained in a 10 second strip and multiply this by six.

If the rhythm is regular is irregular then the difference of RR-peak with respect to next is considered as variability.

III. KEY POINTS

1. To determine HR from an ECG, RR variability must be assessed. If successive RR intervals appear relatively constant, then average HR is approximately 1500 / RR in mm.

Flowchart to determine heart rate:

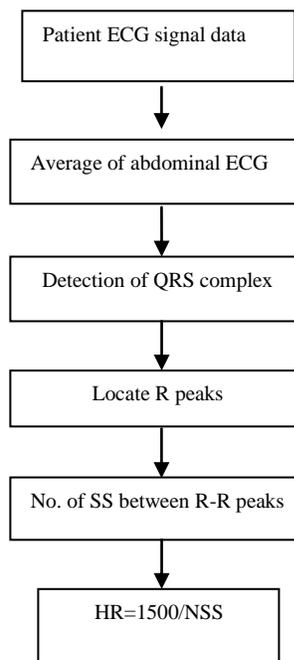


Figure 3:Flowchart for HR calculation

2. If RR intervals vary, average HR (ventricular rate) should be estimated by determining the number of RR intervals in a 10 second strip and multiplying this by 6.

3. If cardiac cycle duration changes significantly and abruptly, then HR should be calculated over shorter periods of time (it may be as short as one cardiac cycle) to correctly interpret underlying physiology.

In our work we are fusing both the methods described above to increase the accuracy of prediction. Then the fused data undergoes training we have used PNN for training because of its advantages like parallelism, fast training process and training samples can be added or removed without extensive retraining. Then the data is stored in the knowledge base and with reference to knowledge base testing is applied and after that heart attack prediction is done.

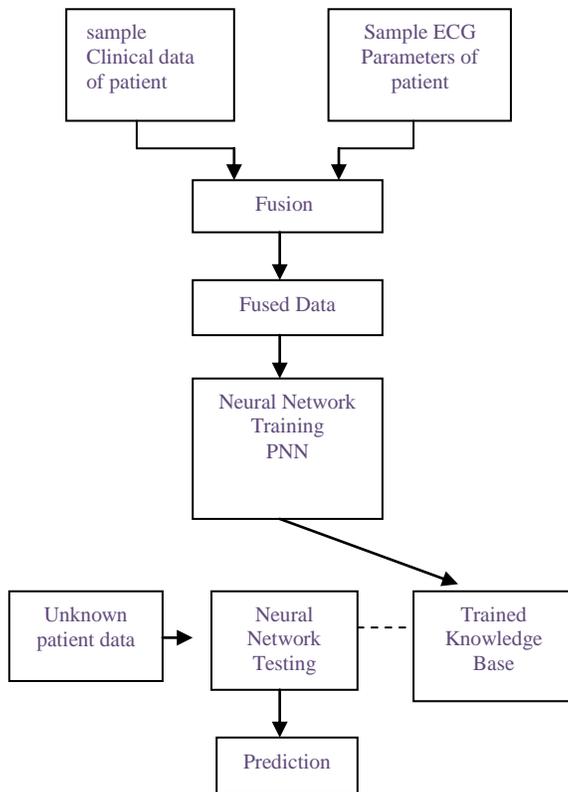


Figure 4: Heart Disease Prediction using fusion of clinical and ECG data

Dataset

In our study abdominal signals were used, which were obtained from the ECG database of the PhysioNet bank. This database contains a series of multichannel abdominal electrocardiogram (ECG) recordings, taken from a many subjects. The records have variable durations, and were taken 10 subject recordings for our analysis. These records may be very useful for testing signal separation algorithms.

IV. RESULTS AND DISCUSSION

The fusion method is tested taking total of 17 parameters 13 from clinical method and 4 from ECG method. The same patients data set was taken for all the three methods. The results are compared using ROC curve in which fusion methodology has found the more accurate and efficient one .

Table 1 shows the comparison results of the three methods in which same patient data set was considered.

Table 1: Result analysis

Method	Accuracy
Clinical	89%
ECG	83%
Fusion	93%

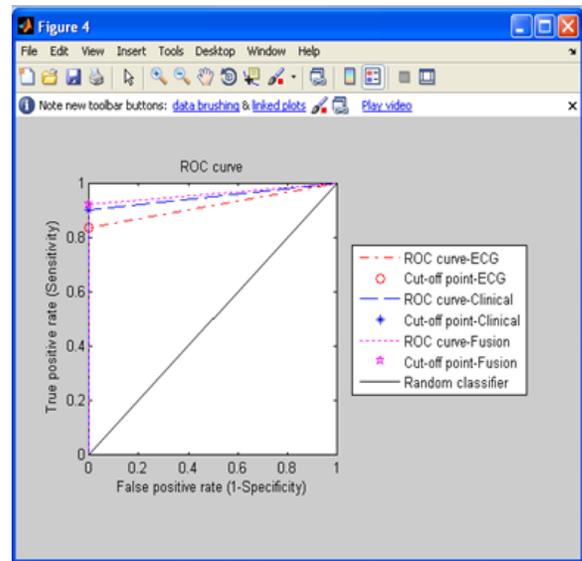


Figure4 : ROC curve comparison

V. CONCLUSION

In this developed paper it has been proved that the fusion of clinical and ECG parameters gives better accuracy when compared to clinical and ECG methods individually. Predicting the probability of getting heart attack by having a history of previous attacks using fusion method can be considered for future work.

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Enhance Sensor Data Fusion Based on Time Slot Voting Mechanism

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Abstract- A Virtual Sensor estimates product objective or process conditions using mathematical models rather than and sometimes in conjunction with physical sensors. These mathematical models use other physical sensor readings to calculate the estimated property or condition. Virtual sensor may provide flexibility, cost effective solutions, promote diversity, ensure security and increase manageability. In this work, data fusion is performed and privacy gets increase in virtual sensor. Data fusion is often performed in order to reduce the overall message transmission from the sensors toward the base station. Time slotted voting mechanism is used for data fusion. This work investigates the problem of data fusion assurance in multi-level data fusion or transmission in this paper. Different to a recent approach of direct voting where the base station polls other nodes directly regarding to the received fusion result, this work propose a scheme that uses the time-slotted voting technique. In this scheme, each fusion node broadcasts its fusion data or vote during its randomly assigned time slot. Only the fusion result with enough number of votes will be accepted. Thus, our scheme eliminates the polling process and eases the energy consumption burden on the base station or the fusion data receiver, which could well be the intermediate nodes. In this work, for security plumstead's algorithm is used to overcome against threat and attack

Index Terms- *Virtual sensor, Data fusion, Privacy.*

I. INTRODUCTION

Virtual sensor networks (VSNs) is an emerging form of collaborative wireless sensor networks. In contrast to early wireless sensor networks that were dedicated to a specific application (e.g., target tracking), VSNs enable multi-purpose, collaborative, and resource efficient WSNs. The key idea difference of VSNs is the collaboration and resource sharing. By doing so nodes achieve application objectives in a more resource efficient way. These networks may further involve dynamically varying subset of sensor nodes.

A VSN can be formed by providing logical connectivity among collaborative sensors. Nodes can be grouped into different VSNs based on the phenomenon they track or the task they perform. VSNs are expected to provide the protocol support for formation, usage, adaptation, and maintenance of subset of sensors collaborating on a specific task(s). Even the nodes that do not sense the particular event/phenomenon could be part of a

VSN as far as they are willing to allow sensing nodes to communicate through them. Thus, VSNs make use of intermediate nodes, networks, or other VSNs to efficiently deliver messages across members of a VSN.

It is necessary to incorporate appropriate secure mechanisms into virtual sensor networks. However, given the stringent constraints on processing power, memory, bandwidth, and energy consumption, it is very difficult to design suitable secure mechanisms for virtual sensor networks. This leave very limited resources for the necessary security components in VSNs. The constraints posed by the sensor hardware make it impossible to deploy most of the traditional security primitives and protocols. For example, it is too expensive to apply asymmetric cryptography to virtual sensor networks, such as the RSA and Diffie-Hellman algorithm, because they require expensive computations and long messages that could easily exhaust the sensor's resources.

II. RELATED WORK

Projects targeted directly for sensor networks have often explored representing the sensor network as a database. Two demonstrative examples are TinyDB [17] and Cougar [18]. Generally these approaches enable applications with data requests that flow out from a central point (i.e., a base station) and create routing trees to funnel replies back to this root. These approaches focus on performing intelligent in-network aggregation and routing to reduce the overall energy cost while still keeping the semantic value of data high. In both approaches, data aggregation is specified using an SQL-like language. Queries cannot be used to merge different data types, i.e. only homogeneous data aggregation is possible. In contrast, the virtual sensors approach offers simple programming interface, supports multiple access points and offers raw and heterogeneous in-network data processing. A more lightweight implementation designed specifically for wireless sensor networks is TinyML [3]. It follows some of the SensorML ideas that are built on XML and has the important concept of virtualizing physical components.

VSN for distributed detection with N sensors for collecting environment variation data. The collected data are transmitted to a fusion node from all of the sensors. The fusion node yields a final result according to the data, and sends the final result to a base station directly. Two problems must be addressed to ensure that the base station obtains the correct result. First, the fusion

node must correctly fusion all of the collected data. The second problem concerns assurance of the fusion result (transmission between the fusion node and the base station is assumed herein to be error free). Since the fusion node may be compromised, forged data may be transmitted to the base station, which has no way to detect such forged results. This is the so-called stealthy attacks, where an attacker tries to trick the base station to accept a forged result [1]. This work only focuses on the stealthy attack but not others. The main idea of the proposed scheme is to avoid using integrity mechanism such as Message Authentication Codes (MACs) which introduce extra transmission overhead. Since only stealthy attack is considered, for which assurance of receiving correct fusion data is the main issue, a simple voting scheme is proposed. The fusion result is broadcast such that compromised node can only jam the signal but cannot modify it. However, we do not consider the denial of service attack in this work. The only overhead that is taken into account is the extra effort for preventing the network from the stealthy attack.

III. PROPOSED ARCHITECTURE

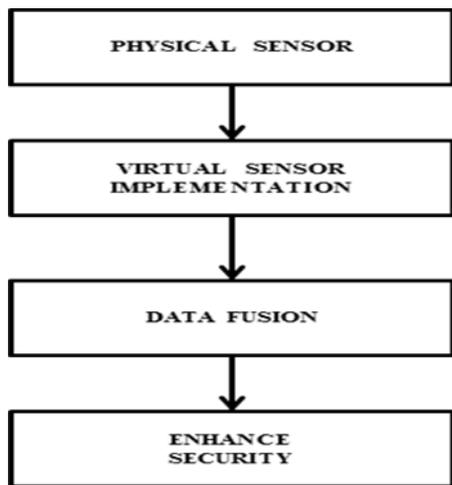


Fig. 2 Proposed Architecture

In this work, first the physical sensor is converted into virtual sensor. Later the data collected by sensor are fused based on data fusion technique. There is for possibility of intruders to attack or change the data sent by sensor. Security is increased in order to overcome threat and attack.

IV. VIRTUAL SENSOR

Virtualization provides the ability to do several things. First, when associated with a platform, a virtual sensor or actuator can be created from physical devices. For example, if a platform has a thermistor that provides voltage readings as an output, a virtual sensor could be defined that would use the platform's processor to take thermistor output and, using calibration information, transform it to Celsius or Fahrenheit responses. Virtual devices can also be a collection of sensor outputs or actuator actions. There are two major types of virtual sensors/actuators: those

focused on platforms and those focused on sensor fields. Platform virtual sensors/actuators are associated only with basic sensors and/or actuators on a physical platform. For example, sensor field can have a virtual sensor or actuator associated with it. A field virtual sensor is an aggregate virtual sensor that can take readings from all the same sensors in the field and use a function such as Average, Maximum, or Minimum as possible virtual sensor output. Virtual sensors can also be associated with groups of sensors in the sensor field. This creates subgroups of platforms that use a function to develop a composite value. For instance, consider a sensor field throughout a building. A field virtual sensor could be the temperature sensors in a room providing a single temperature reading for the room.

Consider a sensor network made up of platforms that have two sensors on them – represented in the diagrams as a triangle and a circle. Figure 3a. Shows a single platform with two sensors. Figure 3b shows a platform where a Virtual sensor is made by combining the output of two sensors. This would be a virtual sensor. The platform virtual sensor would have a function and a list of members in this case the types of sensors that make up the virtual sensor



Fig 3a. Two Physical Sensors

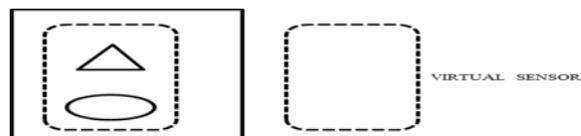


Fig 3b. Two Physical Sensors made into Virtual sensor

V. TIME SLOTTED VOTING SCHEME

The network structure for data fusion assurance in such VSNs with N sensors and M_1 fusion nodes is illustrated in fig 4. H hops are required to transmit the fusion result to the base station from the fusion node. At the h_{th} hop, $h = 1, 2, \dots, H - 1, M_{h+1}$ fusion nodes are grouped at the $h + 1$ layer to receive and forward the fusion result. Note that the relation between M_{h+1} and M_h is arbitrary. Local time synchronization is assumed at each layer 2. The base station obtains the fusion result at the H_{th} hop (the final hop). This network structure can be found in clustered WSNs [15]. Several real multi hop sensor networks can be found in [16]. In the direct-voting scheme, the base station consumes most power in the polling process. In this work, we propose a time-slotted voting approach, in which every fusion node at one layer of the multi-hop VSN transmits its vote or fusion result to the fusion node at the next layer in a pre-assigned and fixed time slot. With such pre-assigned time-slotted transmissions, no polling is necessary. We use the fusion process

of the h_{th} layer fusion nodes as an example for discussion. Fusion nodes of other layers follow the same procedure. Assume there are M_h fusion nodes at the h_{th} layer. In general, each of the M_h fusion nodes gets a chance to submit its data or vote, unless it is unnecessary. The transmission schedule for these M_h fusion nodes can be rotated to balance their power consumption. All fusion nodes will listen while other fusion nodes at the same layer transmit. A threshold T_h is used in order to decide whether a certain result has obtained enough votes. Without loss of generality, we name the M_h fusion nodes at the h_{th} layer as node 1, 2, ..., i, ..., M_h according to the sequence of their transmission schedule. Therefore, node 1 sends first and node 2 sends next, and so on. When it is node i's turn to transmit, it will choose the first clause that agrees with its observation thus far:

- C1. If more than T_h votes have been submitted to support a certain fusion result, node i remains silent.
- C2. If no fusion result has received at least $T_h - (M_h - i)$ votes, node i remains silent.
- C3. If there has been a fusion result transmitted earlier on (by one fusion node whose transmission schedule is ahead that of node i), node i will send an agreement vote to support this result.
- C4. Otherwise, it will send its fusion result.

At the end of the transmission time slots of all fusion nodes at this layer, if there exists a data fusion result with at least T_h supporting votes, this result will be accepted.

We explain the intuitive reasons to follow the different clauses in our algorithm as below. Our algorithm ensures that a data fusion node sends its data only when it is necessary to do so. The objective of each hop is to ensure an agreement on a correct data fusion result. If there has been such a result with more than T_h supporting votes (including the original sender), other nodes do not need to vote (hence clause C1). In some scenarios, the nodes close to the end of the transmission sequence may see that, even if all the rest of fusion nodes agree with the currently most-popular result, there is no way to come up with a result with at least T_h supporting votes.

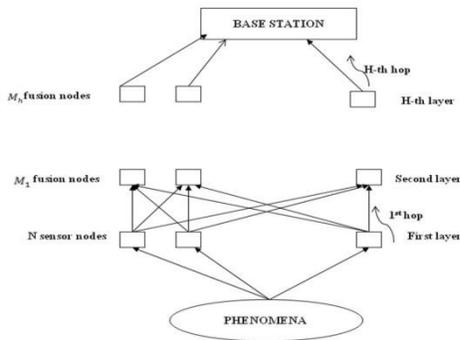


Fig 4. Structure of multi hop sensor

Therefore, it is useless to send in more votes or even new data (hence clause C2). Clause C3 simply states that a fusion node will send an agreement vote to support a result that has

been submitted before. Clause C4 makes sure that someone will submit new results when there is a chance to obtain enough votes.

VI. ENHANCING SECURITY

In our work, we first use the LCG to generate a random number X_1 (Step 1) and embed the pseudo-random number X_1 into the plaintext message (Step 2). We then apply the permutation function (Step 3). X_1 will also serve as the source of the permutation function. The final cipher text is obtained after Step 4.

a. Step 1 – Random Number Generation: We use the LCG to generate the random number. Given a 16 byte block cipher, one 16 byte random number, X_1 , is needed.

b. Step 2 – Stage I: Suppose P_1 and P_2 are the plaintext message to be encrypted using this block cipher. Each P_i is 8 bytes. We embed the pseudo-random number X_1 into the plaintext message in the following way. For example, let Wireless sensor (16 bytes) be the message to be encrypted. So $P_1 = \text{Wireless}$, and $P_2 = \text{sensor}$. The first three characters of P_1 are $W = 87, i = 105$, and $r = 114$. The embedding operations are simply the addition modulo 256. If

$$X_1 = 10\ 5A\ FB\ 11\ FC\ BB\ 00\ 11\ 22\ 33\ 44\ 55\ 66\ 77\ 88\ 99_{16}$$

The values of the first three bytes are $10_{16} = 16$, $5A_{16} = 90$, and $FB_{16} = 251$. Therefore, the values of the first three ciphertext characters encrypted are:

$$\begin{aligned} 87 + 16 \bmod 256 &= 103 \\ 105 + 90 \bmod 256 &= 195 \\ 114 + 251 \bmod 256 &= 109 \end{aligned}$$

C_1 , and C_2 are the scrambled text after X_1 is embedded. Each C_i is also 8 bytes.

- a. Step 3 – Permutation: X_1 is broken into 16 1 byte random numbers, denoted as B_0, B_1, \dots, B_{15} , respectively. We introduce a permutation function P over $Z_{16} = \{0, 1, 2, \dots, 15\}$.
- b. Let values $\pi = \pi_0 \pi_1 \pi_2 \dots \pi_{15}$ be constructed as follows

$$I. \pi_0 = B_0 \bmod 16;$$

II. $\pi_i = (n \bmod 16)$, for $i = 1 \dots 15$ with n is the smallest integer such that $n \geq B_i$ and $\pi_i \notin \{\pi_0, \pi_1, \dots, \pi_{i-1}\}$

- c. Step 4 – Stage II: After we obtain Π , we apply Π to $C1C2$ obtained in Step 2 in a standard manner, i.e., the i^{th} byte of $\Pi(C1C2)$ is the Π i^{th} byte of $C1C2$. Presented by 8 byte segments, let $\Pi(C1C2) = C11C12$, which are our final encrypted message.

Decryption is straightforward. The receiver node could generate the same X_1 that the sender generates. Using X_1 , the

receiver can obtain P_1 and P_2 . Based on an LCG based block cipher, sensor nodes, such as nodes A, B, C, and D have monitored some events and transferred the readings to their immediate aggregator, node H. Each sensor node appends a MAC to the plaintext message P and uses their shared secret keys with H to encrypt the whole message. After H receives the readings, H uses the corresponding secret to decrypt and to authenticate the received messages. This time, node H appends a new MAC to the aggregated result and uses its shared secrets with its immediate aggregator, node J, to encrypt the whole message. The process continues until the result reaches the base station

```

1 package javaapplication2;
2 import java.io.File;
3 import javax.xml.parsers.DocumentBuilder;
4 import javax.xml.parsers.DocumentBuilderFactory;
5 import org.w3c.dom.Document;
6 import org.w3c.dom.Element;
7 import org.w3c.dom.Node;
8 import org.w3c.dom.NodeList;
9 import org.xml.sax.SAXException;
10 import org.xml.sax.SAXParseException;
11
12 public class sensor {
13
14     public static void main (String argv []) {
15         try {
16             DocumentBuilderFactory docBuilderFactory = DocumentBuilderFactory.newInstance();
17
18             // ... (rest of the code is partially visible)
19         }
20     }
21 }
    
```

Output - JavaApplication2 (run) x Tasks

```

Done element of the doc is sensor
Total no of sensors : 2
X coordinate : 7
Y coordinate : 5
Month : March
Day: Friday
FPM: 86.2
DMT: 65.2
DC: 94.3
Temperature: 8.2
Wind: 8.2
Rain: 0
Acra: 0
X coordinate : 8
Y coordinate : 6
Month : March
Day: Friday
FPM: 91.7
DMT: 53.3
DC: 77.5
Temperature: 8.3
    
```

Fig 5. Result

The result for virtual sensor is shown in fig 5. The physical sensor is made into virtual sensor and data fusion process is performed. Overall security of data sending from sensor is increased.

VII. CONCLUSION AND FUTURE WORK

This paper presented data fusion and security techniques in virtual sensor network. We investigate the information assurance issue of the data fusion process, in which the compromised

Sensor nodes may launch stealthy attacks to trick data fusion nodes and eventually the base station to accept false results. The proposed scheme provides good security against sensor node compromise. Moreover, the traffic to be transmitted at h_{th} hop is $O(T_h)$. In Future work It is worthwhile to find other applications such as encryption on some virtual sensor network, where the communications between sensors are short and frequent, and the computational resource on each sensor is limited.

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Quantitative Changes in Primary Metabolites in Barley (*Hordeum Vulgare L.*) Due to Stripe Disease, Causal Agent *Drechslera Graminea*

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Abstract- Quantitative studies of primary metabolites were conducted on healthy (control) and naturally infected (weakly, moderately and heavily) with *Drechslera graminea*, seeds and seedlings of Barley at different stages after sowing. Observations revealed that content of total sugars were highest in healthy (control) seeds and lowest in heavily infected seeds and were continuously increased in healthy (control), weakly and in moderately infected seedlings and decreased in heavily infected seedlings from 10 to 30 days after sowing. Total starch contents were also highest in healthy (control) and lowest in heavily infected seeds. Starch contents were slightly increased up to the 20 days and followed by decreased to the 30 days after sowing in all categories of naturally infected. Phenols and proteins decreased as the severity of infection increased and were highest in weakly infected and lowest in heavily infected seeds among naturally infected seeds. Total phenol contents were increased throughout from 10 to 30 days after germination. Proteins showed same response as phenols.

Index Terms- Quantitative changes, Primary Metabolites, Barley, Stripe disease and *Drechslera graminea*

I. INTRODUCTION

Barley (*Hordeum vulgare L.*), a member of the grass family, is a major cereal grain. *H. vulgare*, the fourth important world crop, used for animal feed, beer, and human food was domesticated polyphyletically by humans 10,000 years ago in the Neolithic revolution in at least three centers¹. Stripe disease is a major disease in our country causing losses as high as 70 to 72 per cent under epiphytotic conditions². *Drechslera graminea* (Rabenh. ex Schlecht.) Shoemaker (sexual *Pyrenophora graminea*) is the causal agent of barley stripe. Barley stripe is disease of barley that once caused significant crop yield losses in many areas of the world. The fungus is present in the seed coat and on the seed surface. As seedlings start to grow, the fungus invades the coleoptile, penetrating to the first leaf. During infection the host plant defend itself against potential pathogens by means of number of physical and chemical factors which may already present in the host, or may be produced in response to the infection³

II. MATERIAL AND METHOD

Seeds and seedlings of healthy (control) and naturally infected (three categories weakly, moderately and heavily) with *Drechslera graminea* after 10, 20 and 30 days of sowing were taken for conducting studies. The seeds were grown in petriplates on blotter and earthen pots (height 30 cm, diameter 20 cm) filled with sterile coarse sand (pH 8.3). The emerging healthy and naturally infected seedlings were excised for the estimation of primary metabolites at 10, 20 and 30 days after sowing.

Estimation of primary metabolites: Total sugars and starch were estimated by the method of Dubois *et al*⁴. Total phenols were determined by Swain and Hills's method⁵ and total proteins were measured according Lowry *et al*⁶.

III. STATISTICAL DATA ANALYSIS

All experiments were performed in 3 different sets with each set in triplicates. The data are expressed as mean, \pm SEM (standard error of the mean). Statistical analysis of data was done by using BioStat 2009 professional 5.8.4 software in a completely randomized design. All data obtained by subjected to one way analysis of variance (ANOVA). Values of p which were ≤ 0.05 were considered as significant. Graphs were drawn by using Microsoft Excel software

IV. RESULT

Total sugar contents were highest in healthy (control) and lowest in heavily infected among all three categories of naturally infected seeds. Sugars were continuously increased in healthy, weakly and in moderately infected seedlings and decreased in heavily infected seedlings from 10 to 30 days after sowing.

Total starch contents were also highest in healthy (control) and lowest in heavily infected seeds. In all three categories of naturally infected (weakly, moderately and heavily) starch contents were slightly increased up to the 20 days and followed by decreased to the 30 days stage after sowing.

Proteins were decreased as the severity of infection increased in seeds. In seedlings, protein contents were continuously increased in healthy, weakly and heavily infected seedlings throughout from 10 to 30 days after sowing except in moderately infected seedlings.

Phenols showed same response to infection as protein and decreased as the severity of infection increased. Phenols were

highest in weakly infected and lowest in heavily infected seeds. Total phenol contents were increased in weakly, moderately and heavily infected seedlings from 10 to 30 days after sowing. All experiments were performed in triplicates. One way analysis of variance (ANOVA) was used to show significance of

difference with respect to control. In all experiments p value was found to be lower than 0.05 ($p < .05$) which indicate that differences in seedlings of different categories and of different time intervals was statically significant.

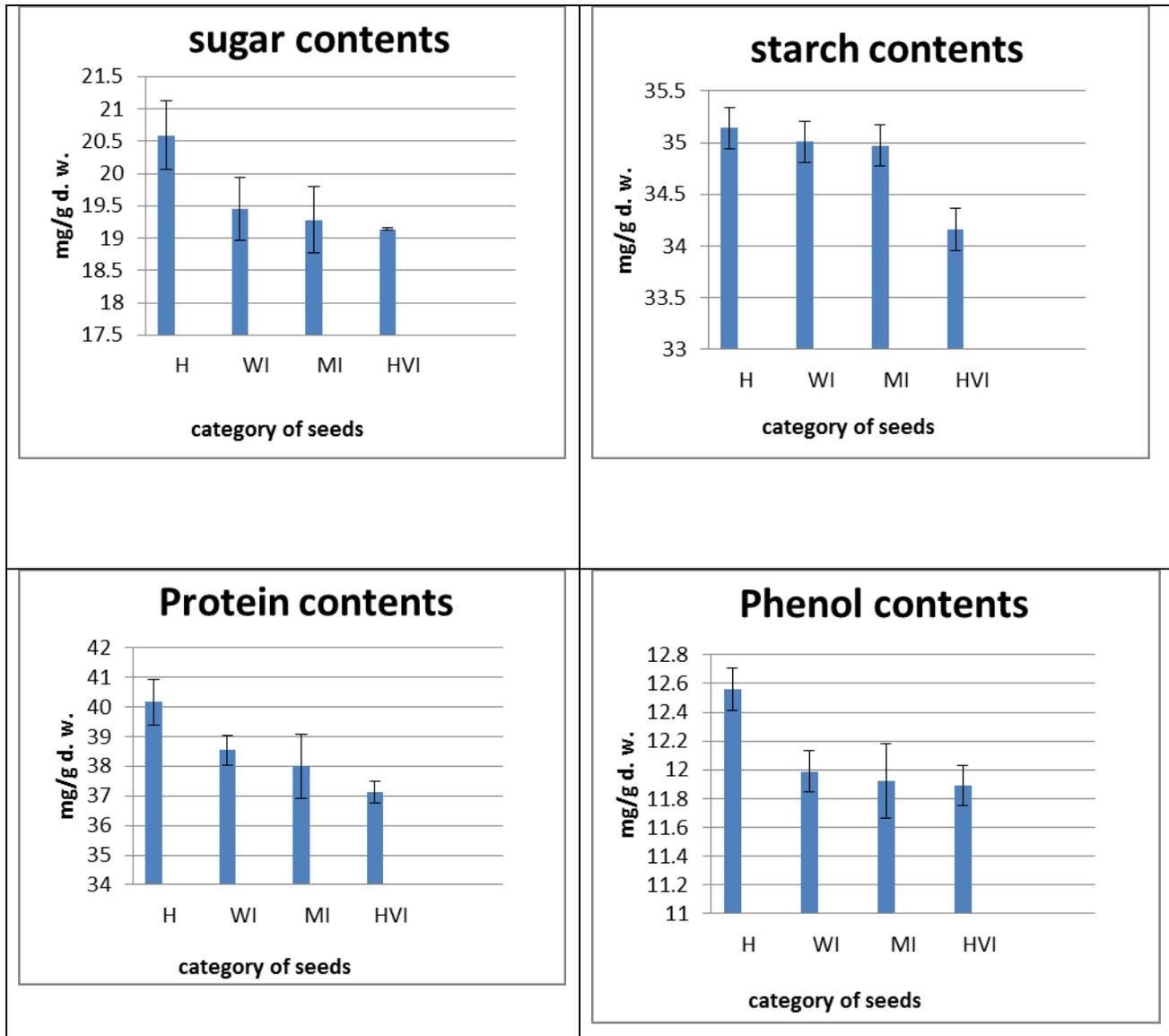


Figure: 1 Amount of sugars, starch, phenols and protein in seeds of healthy (control) (H) and naturally infected (weakly (WI), moderately (MI) and heavily (HVI)).

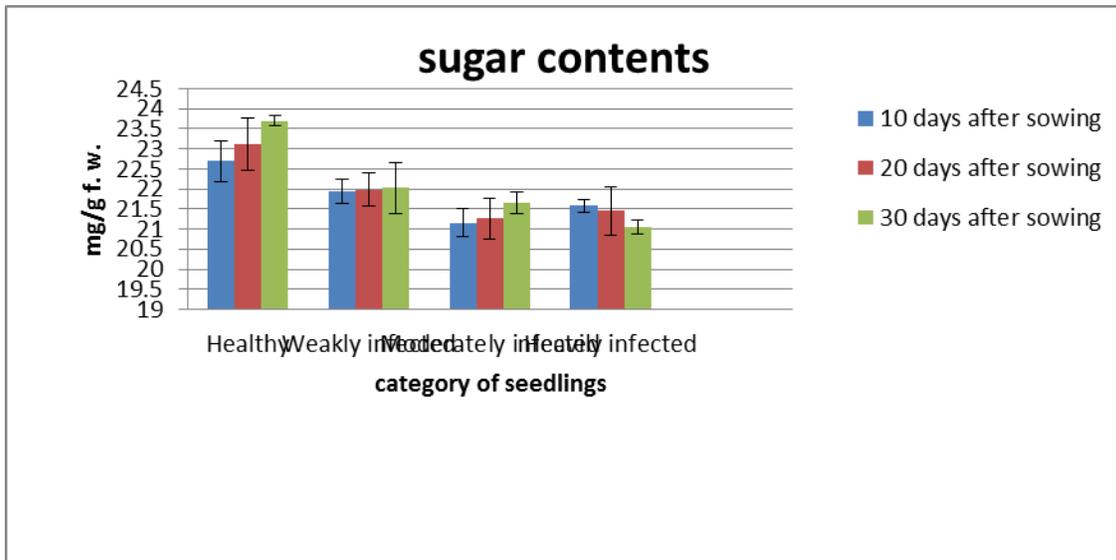


Figure: 2 Amount of sugars in seedling of healthy (control) and naturally infected (weakly, moderately and heavily) on 10th, 20th and 30th day of sowing.

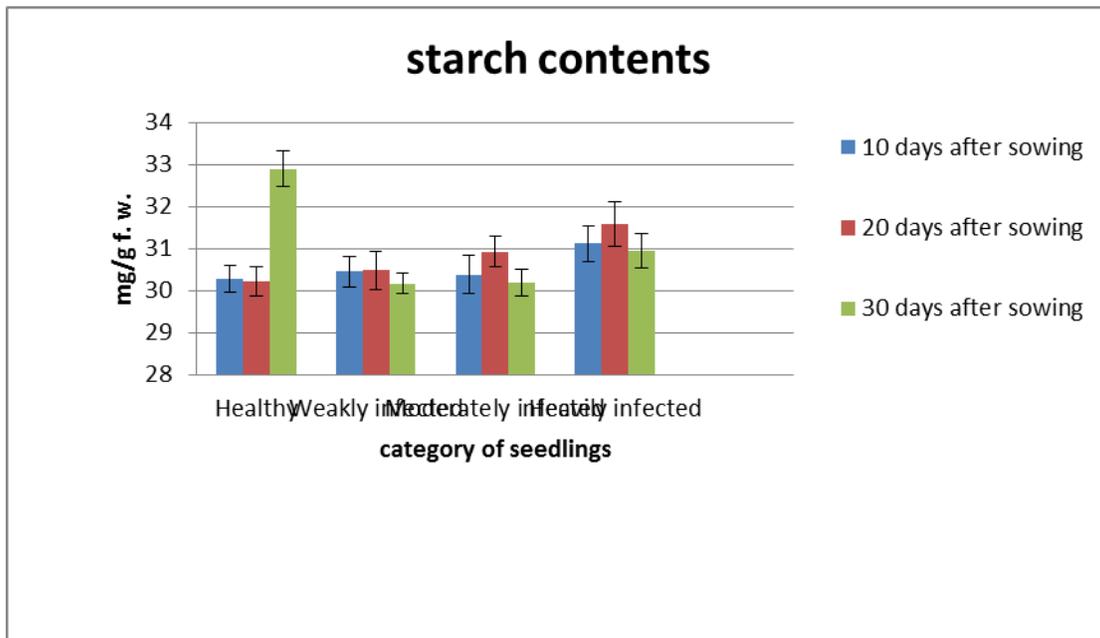


Figure: 3 Amount of starch in seedling of healthy (control) and naturally infected (weakly, moderately and heavily) on 10th, 20th and 30th day of sowing.

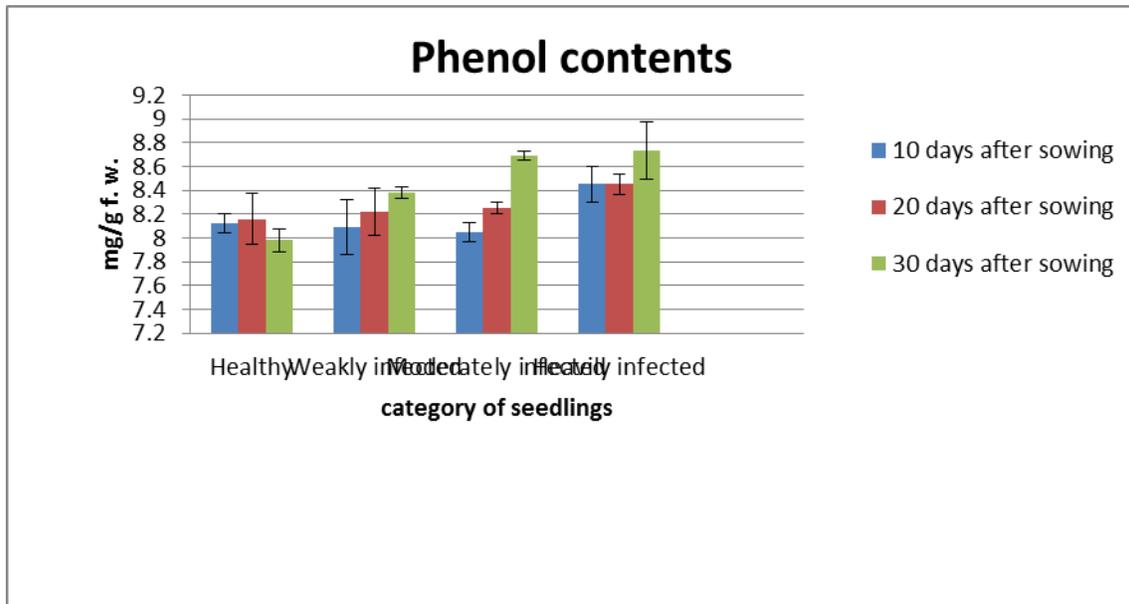


Figure: 4 Amount of phenols in seedling of healthy (control) and naturally infected (weakly, moderately and heavily) on 10th, 20th and 30th day of sowing

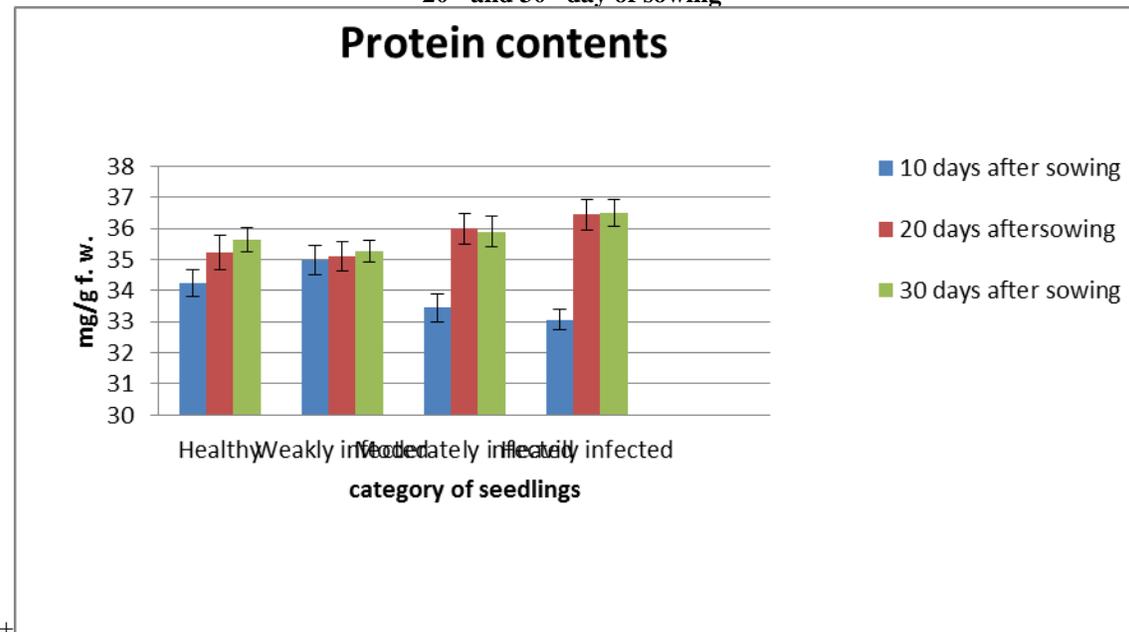


Figure: 5 Amount of proteins in seedling of healthy (control) and naturally infected (weakly, moderately and heavily) on 10th, 20th and 30th day of sowing

V. DISCUSSION

Sugar decreased after infection because it is a good source of food and carbon and is easily digested by the fungus. Fungi acquire sugars to fuel additional fungal growth. Ushamalini, C (1998) reported the effect of seed borne fungi *Fusarium oxysporum* on cowpea. Fungus caused maximum reduction in sugars compared to other fungi in cowpea⁷. Sondeep Singh *et al* (2009) reported a gradual increase in the levels of total free sugars till 15 DAI in both genotypes PL 426 BL4 infected with leaf blight and thereafter sugar level declined which may be

correlated to the utilization of sugars from leaves⁸. Angra Sharma *et al.* (1993) showed involvement of carbohydrates during pathogenicity, serving as constant energy sources for the growing pathogen has been indicated in *Helminthosporium maydis*, *H. carborum* and *H. teres*⁹.

The decline in starch contents in the infected seedlings may be due to the infection proceedings. Singh, Archana also supported high levels of proteins, total sugars, total starch, phenolics and peroxidase activity in the infected seedlings as compared to healthy¹⁰.

The presence of higher levels of proteins and phenols in infected tissues may be implicated in resistance of the host to infection. Fungi synthesize several enzyme proteins and sometimes cause rearrangement of nutritional composition of substrate due to formation of several degradation products thereby increase its protein contents. Proteins and phenols may be responsible for the delay and decline in number of germinations appressoria, penetrations and colonisations at the onset of infection¹¹. R. Angra Sharma and D K Sharma (1994) reported high levels of protein and phenolic compounds in the resistant variety compared with the susceptible host. The levels of lipids were, however, lower in the resistant host and decreased with the time of incubation of the host pathogen complex. Higher levels of proteins, lignins, phenolics and callose synthesized in the resistant variety may play a role in inhibiting the infection¹².

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Effective Classification after Dimension Reduction: A Comparative Study

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Abstract- Classification is undoubtedly gaining major importance in the fields of machine learning, pattern recognition genetic engineering and bio medical sciences where it can be used for automated decision making. Mostly these areas contain datasets having large number of dimensions which require some preprocessing. Thus dimension reduction is a preprocessing step carried out prior to classification so that the classifiers can be designed in an easy to compute way. However while doing so, it must also retain the accuracy and must not lead to loss of information. Thus effective classification must be carried out by employing proper dimension reduction techniques. The paper discusses in brief about the dimension reduction techniques. It also describes the system developed for dimension reduction and use of the tool WEKA for dimension reduction and preprocessing. Finally a comparative study of the results obtained by the system and WEKA is done.

Index Terms- Classification, Dimension Reduction, Preprocessing, WEKA

I. INTRODUCTION

Reduction of dimensions(attributes) of large datasets has always been an area of research, specially for the datasets involved in the field of medical science, genetics and bio engineering. These datasets have dimensions of the order of thousands and not all of them may be relevant for classification purpose. From the point of view of classification applications, it is important to retain only those attributes which help to increase the effectiveness. This also helps in designing simple and easy to compute algorithms. Dimension reduction covers not only the attribute reduction but also the instance reduction. But the major focus has always been on attribute reduction. Thus when preprocessing of the data is done for dimension reduction, it must focus on describing the dataset using minimum number of attributes but it must give the performance comparable to that of original dataset containing all the attributes. Basically two categories of solutions have been described in the literature [1][2] for attribute reduction. The first one is attribute selection[1] which chooses the attributes to be retained in the reduced dataset and removal of the remaining. Second approach to reduce the dimensions is by attribute extractions[1] where the data contained in the original attributes can be completely used up and new dimensions can be generated which are richer in content as compared to original. Each of these methods has their own pros and cons. A midway between the two is combining the merits of both where a system can either perform selection or extraction depending upon the problem to be solved. A brief

summary of this has been given in our earlier work [3]. Also there are different criteria and factors which need to be considered while choosing the dimensions for retention like relevance, significance, dependency etc. And these criteria are based on theories like rough sets, fuzzy sets, and fuzzy rough sets [4]. Once the dataset is reduced it needs to be combined with a classifier to check for accuracy and the best combination needs to be determined. Different classifiers like nearest neighbor and decision trees are already in the field for better classification. Besides them, neural network classifiers have been an emerging classifier these days which is hoped to have a better performance. Thus if a system can be designed which can reduce the dimensions and perform classification with neural network classifiers, it could provide an effective solution for many applications in the field of medical science. This has been described in the paper. Also WEKA [5] has been a very powerful tool designed for machine learning and data mining. It contains tools for data pre-processing, classification, regression, clustering, association rules, and visualization. It provides various algorithms for data preprocessing which includes the ones for attribute selection and extraction. The paper gives a description about the background of dimension reduction; system designed; the inbuilt algorithms used by WEKA for dimension reduction and finally tabulates the comparison of the results.

II. TECHNIQUES FOR DIMENSION REDUCTION

This section describes some of the techniques available in literature for dimension reduction.

- In [6], Ron.Kohavi et.al has described various wrapper techniques for selecting the features. It mentions about the FOCUS algorithm which makes use of exhaustive technique to try out all the subset of features and selects the minimum subset which can be sufficient to determine the class value for all the objects of training set. It also describes RELIEF algorithm which makes use of the relevance criteria to determine the importance of the features. The relevance values are computed by finding the difference values between the selected instance and two nearest instances of same and opposite class. Thus it attempts to find all the relevant features.
- In [7], Isabelle Guyon et.al have described about the SVM-RFE(Support Vector machine- Recursive Feature Elimination) algorithm which makes use of the weight criteria for ranking the features. It first selects training examples having good feature indices and then trains the SVM classifier. Then it computes the weight vector

and finds the ranking criteria. Feature that has the smallest ranking criterion is removed from the list and further iterations are carried out.

- In [8], Yijun Sun et.al have proposed an algorithm for feature selection in microarray datasets. It first finds out the margin for each sample. For this it makes use of the neighbors of the sample, one from same class and other from different class. From them, the margin is computed by using Manhattan/ Euclidian distance. This computation gives an idea about how many features of the object may be corrupted by noise and helps to minimize the induced feature space. Thus the algorithm transforms arbitrary non linear problem into set of locally linear ones. This is then used to estimate the feature weights. A probabilistic model has been employed for computation.
- In[9], Hua-Liang Wei et.al have described the FOS(Forward Orthogonal Search) algorithm. It makes use of the squared correlation function as the criteria for measuring the dependency between the features and keeps on selecting the features in a stepwise way. In every iteration, such feature is selected by which the resultant candidate subset can represent the original dataset containing all the features.
- In [4], R.Jensen et.al have discussed about the Quick Reduct and Fuzzy Rough Quick Reduct algorithms. The algorithms work on the same principle, they keep on adding one by one the attribute which increases the dependency with respect to the decision label and stop when the dependency no longer increases i.e when the dependency of the reduced set equals the dependency of original attribute set. The only difference is in the criteria used for finding the dependency, the Quick Reduct algorithm makes use of the measures based on rough set theory while that of Fuzzy Quick Reduct makes use of measures based on the fuzzy rough theory.

III. DIMENSION REDUCTION IN WEKA

WEKA is a software workbench developed for supporting machine learning and supports a number of activities including the preprocessing activities, classification, clustering and visualization [5]. As a part of the preprocessing step, the dimensions of large datasets can be reduced in WEKA by following ways

A. Supervised Filter Approach

WEKA provides a supervised attribute filter that can be flexible and allows various search and evaluation methods to be combined. It makes use of two things that are evaluator and search. Evaluator determines the criteria used for selecting the attribute.

Different evaluators [10] that can be used are:

- CfsSubsetEval: It considers the predictive ability of each feature and finds out the relevance. It also checks for redundancy between the selected features. Finally the subset of attributes which are highly co-related with the class and are less redundant is chosen.

- CorrelationAttributeEval: It evaluates the worth of an attribute by measuring the correlation (Pearson's) between it and the class. Nominal attributes are considered on a value by value basis by treating each value as an indicator. An overall correlation for a nominal attribute is arrived at via a weighted average.
- GainRatioAttributeEval: The gain ratio with respect to class label is computed and this determines the worth of attribute for selection.
- OneRAttributeEval: Evaluates the worth of an attribute by using the OneR classifier.
- ReliefAttributeEval: It is based on the RELIEF algorithm which evaluates the relevance of attribute by considering the difference between the instance and the two nearest instances from same and opposite class. It can operate on both discrete and continuous class data.
- SymmetricalUncertAttributeEval: Evaluates the worth of an attribute by measuring the symmetrical uncertainty with respect to the class.
- WrapperSubsetEval: Evaluates attribute sets by using a learning scheme. Cross validation is used to estimate the accuracy of the learning scheme for a set of attributes.

The search option is provided for determining the way of searching the attribute. Different methods provided[10] are

- BestFirst: It searches for the attribute subset by greedy hill climbing method in combination with backtracking. The backtracking is based on the concept that if some number of consecutive nodes is found such that they do not improve the performance then backtracking is done. It may apply forward approach where it starts from empty set of attributes and goes on adding the next. It may also go for backward approach where it starts from a set of all attributes and removes one by one. It may also adopt a midway between both approaches where search is done in both directions (by considering all possible single attribute additions and deletions at a given point) which is also called as hybrid approach.
- GreedyStepwise: Performs a greedy forward or backward search through the space of attribute subsets. May start with no/all attributes or from an arbitrary point in the space. Stops when the addition/deletion of any remaining attributes results in a decrease in evaluation. Can also produce a ranked list of attributes by traversing the space from one side to the other and recording the order that attributes are selected.
- Ranker: Individual evaluations of the attributes are done and they are ranked accordingly. It is normally used in conjunction with attribute evaluators (Relief, GainRatio, Entropy etc).

B. Unsupervised Filter Approach

WEKA provides an unsupervised attribute filter approach namely PCA[10] which is used for extracting the features and reducing the dimensions.

- PrincipalComponents (attribute transformer): Performs a principal components analysis and transformation of the data. Used in conjunction with a Ranker search.

Dimensionality reduction is accomplished by choosing enough eigenvectors to account for some percentage of the variance in the original data---default 0.95 (95%). Attribute noise can be filtered by transforming to the PC space, eliminating some of the worst eigenvectors, and then transforming back to the original space.

IV. PROPOSED SYSTEM

This section briefs about the proposed system.

The steps of working are as:

1. Select the desired dataset
2. Set the number of instances and attributes
3. Check for memory requirement and perform instance selection accordingly.
4. Compute the relevance value for each attribute.
5. Select the attribute having highest relevance
6. Using the selected attribute partition the attributes into subsets containing significant, insignificant and intermediate attributes
7. From the intermediate set select or extract new attribute depending upon the problem at hand
8. Remove the used attributes from the intermediate set and the insignificant attributes
9. If the set of attributes is empty or desired attributes are fetched goto step 11
10. Select next attribute as the one which is relevant and significant and goto step 6
11. Store the resultant dataset containing some selected features / extracted features in WEKA compatible format(.arff)
12. Give the reduced dataset as input to WEKA and test for classification accuracy using training testing method with classifiers like J48(decision trees),KNN(K-Nearest Neighbor) and ANN(Artificial Neural Networks)

The relevance and significance of the attributes is computed using fuzzy rough theory [4][11][12]

V. RESULTS AND DISCUSSIONS

This section describes the results obtained and the comparisons made.

The system was implemented and tested with six datasets namely colon tumor, lung cancer, leukemia, breast cancer, lymphoma and central nervous. The datasets were also given to WEKA and preprocessed using the attribute selection preprocessing filter. The outputs generated by both were to given to classifiers like decision trees (J48),KNN(K nearest neighbor with k=3) and ANN(Artificial Neural Networks) and the accuracies were measured.

The summarized results are tabulated in Table 1. It can be seen that on an average the proposed system gives better accuracy as compared to that of inbuilt filters provided by WEKA. Also for the breast cancer dataset , WEKA could not process the dataset and provided error as insufficient memory heap.

Table 3:Results and Comparison

Data set	No. of Attributes	No. of Records	No. of attributes after reduction	Accuracy after Dimension Reduction in Weka					
				Using Inbuilt Weka Filters			Using Fuzzy Rough Approach		
				J48	ANN	KNN	J48	ANN	KNN
Colon	2001	62	27	87.09	82.25	83.87	72.58	83.87	85.48
Leukemia	7130	34	23	91.11	100	100	97.05	94.11	97.05
Lung	12533	32	41	75	100	100	96.87	100	100
Lymphoma	4027	45	75	82.22	100	100	95.56	97.78	93.33
Central Nervous	7129	60	40	65	80	78.33	100	100	100
Breast Cancer	24482	48	Err	-	-	-	85.41	93.75	93.71
Average				80.08	92.45	92.44	92.39	95.15	95.17

VI. CONCLUSION

We have presented a comparative study on dimension reduction. Firstly we discussed the concept of dimension reduction, its need and areas of application. Then we focused upon some of the techniques used for reducing dimensions. A brief discussion on the inbuilt filters of WEKA for dimension reduction was given. The system was then described and finally we discussed about the results which show that the proposed system can be used as a future direction of computing specially for medical and bio engineering field which has large dimensional datasets. And this is possible because of the fuzzy rough theory which helps to increase the accuracy and also the use of neural network classifiers which provide a good performance. In future, we plan to merge genetic algorithm based dimension reduction with the combination of neural network classifier which may provide comparable or better results in the domain.

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Climate Predictions of the Twenty First Century Based on Skill Selected Global Climate Models

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Abstract- A subset of global climate models from the Coupled Model Inter-comparison Project 5 was used to explore the changes in temperature and rainfall under moderate and high climate change scenarios. We used downscaled model projections of daily minimum and maximum temperature and rainfall for the period 2040-2070 relative to the 1980-2010 reference period. Analysis of variance (ANOVA) was used to test (at 5 % level of significance) for differences among the three selected models in predicting the three variables under both climate change scenarios. Where significant differences were observed, we carried out multiple pair-wise comparison of the models using Dunnett's test. Overall, two of the three models showed insignificant differences ($p < 0.05$) in predicting minimum and maximum temperature while the other model deviated from the two. However, we identified a consistent warming trend across all the three models. The strength of global climate models in rainfall prediction was found to lie in their ability to simulate extremes, making the models relevant to sectors of the economy that are vulnerable to extreme rainfall such as drought and floods.

Index Terms- downscaled model projections, multiple pair-wise comparison, extreme rainfall.

I. INTRODUCTION

A variety of processes characterise the climate system. Some of them include; boundary layer processes, radiative processes and cloud processes. These processes interact with each other both spatially and temporarily. Global climate models (GCMs) have been shown to be useful tools for studying the climate system (Pitman and Perkins, 2008; Houghton *et al.*, 2001; Randall *et al.*, 2007), however because they have limited resolutions at smaller scales, many climate processes are not resolved adequately by climate models. Climate projections of the future remain a challenge to many climate modeling communities. Chiew *et al.* (2009) point out that climate change impact assessment is likely to be more reliable if it is based on future climate projections from the better GCMs. However, it is difficult to objectively determine which GCMs are more likely to give reliable future climate projections. Pitman and Perkins (Pitman and Perkins, 2008) carried out climate projections for Australia using GCMs. The authors based their study on the assumption that a model that is able to simulate the probability density function (PDF) of a climate variable well for the twentieth century is likely to be able to simulate well the future PDF of the same variable. Pitman and Perkins (2008) reported a considerable overlap between the PDFs of the twentieth century

and those of the twenty first century. In this paper, we attempt to provide climate projections of the twenty first century in Zimbabwe, based on skill selected global climate models from the Coupled Model Inter-comparison Project 5 (CMIP5). The GCMs are based on the recently developed Representative Concentration Pathway (RCP) emission scenarios. Measures of model skill have been presented using a variety of metrics (e.g. Johnson and Sharma, 2009; Carmen Sánchez de Cos, 2012; Boberg *et al.*, 2009; Perkins *et al.*, 2007; Masanganise *et al.*, 2013). We follow the methodology of Masanganise *et al.* (2014a) to select models that are highly skilful at simulating daily probability density functions of maximum temperature (T_{max}), minimum temperature (T_{min}) and rainfall (R). Masanganise *et al.* (2014a) used probability density functions to compare daily model simulations with daily observed climatology over the same period. To rank the models, the authors used a match metric method based on the common overlap of the model and observed PDFs with a skill score value ranging from zero for no overlap to a skill score of one for a perfect overlap. Using this method, we select three models that best match observations for each variable out of ten models and apply them to make climate projections of the mid-century (2040-2070) period relative to the 1980-2010 baseline period. The projections are based on the moderate (RCP4.5) emission scenario and the highest (RCP8.5) emission scenario. The methodology is provided in section 2, results and discussion in section 3 and lastly, conclusions in section 4.

II. DATA AND METHODOLOGY

The study was carried out in Zimbabwe in a district called Mutoko. The climatic variables used were maximum air temperature T_{max} , minimum air temperature T_{min} and rainfall R . The choice of these three variables was partly based on data availability. Details of data acquisition and processing are presented in Masanganise *et al.* (2014a). The GCMs used are listed in Table 1.

Table 1 A list of the 10 coupled global climate models from which 3 models were selected.

Model name	Modeling centre(or group)	Resolution (degrees) latitude x longitude
Beijing Normal University Earth System model (BNU-ESM)	College of Global Change and Earth System Science, Beijing Normal University, China	2.810 x 2.810
Canadian Earth System Model version 2 (CanESM2)	Canadian Centre for Climate Modelling and Analysis, Canada	2.810 x 2.810
Centre National de Recherche Météorologiques Climate Model version 5 (CNRM-CM5)	CNRM/Centre Europeen de Recherche et Formation Avancees en Calcul Scientifique, France Calcul Scientifique, France	1.410 x 1.410
Flexible Global Ocean-Atmosphere-Land System Modelspectral version 2 (FGOALS-s2)	State Key Laboratory of Numerical Modeling for Atmospheric Sciences and Geophysical Fluid Dynamics, Institute of Atmospheric Physics, Chinese Academy of Sciences, China	1.670 x 2.810
Geophysical Fluid Dynamics Laboratory Earth System Model (GFDL-ESM2G)	NOAA Geophysical Fluid Dynamics Laboratory	2.000 x 2.500
Geophysical Fluid Dynamics Laboratory Earth System Model (GFDL-ESM2M)	NOAA Geophysical Fluid Dynamics Laboratory	2.000 x 2.500
Model for Interdisciplinary Research on Climate-Earth System, version 5 (MIROC5)	The University of Tokyo, National Institute for Environmental Studies and Japan Agency for Marine-Earth Science and Technology	1.417 x 1.406
Atmospheric Chemistry Coupled Version of Model for Interdisciplinary Research on Climate-Earth System (MIROC-ESM-CHEM)	Japan Agency for Marine-Earth Science and Technology, The University of Tokyo and National Institute for Environmental Studies	2.857 x 2.813
Model for Interdisciplinary Research on Climate-Earth System (MIROC-ESM)	Japan Agency for Marine-Earth Science and Technology, The University of Tokyo and National Institute for Environmental Studies	2.857 x 2.813
Meteorological Research Institute Coupled General Circulation Model version 3 (MRI-CGCM3)	Meteorological Research Institute, Japan	1.132 x 1.125

Three models were selected from Table 1 using the match metric method described in Masanganise *et al.* (2014a). For temperature, these were models that were able to capture at least 97 % of the observed probability density function in their simulations. In the case of rainfall, the skill scores were low and we selected only those models that were able to capture at least 31 % of the observed probability density function. We then analysed climate projections for the period 2040-2070 relative to the 1980-2010 baseline based on the three global climate models selected from Table 1.

i. Temperature and rainfall projections

Using downscaled historical (1980-2010) daily data, we calculated monthly mean values for T_{max} , T_{min} and R for each climate change scenario. We also calculated monthly mean values for the same variables and scenarios using projections for the period 2040-2070. Anomalies were then calculated as the absolute difference (2040-2070) minus (1980-2010) for each model and variable to depict the magnitude of change.

ii. Model convergence

Model convergence was assessed using probability density functions (PDFs) to establish the consistency in predictions from the 3 models. We calculated PDFs for each of the variables T_{max} , T_{min} and R using downscaled GCM projections for the period 2040-2070 under RCP4.5 and RCP8.5. The PDFs were constructed using the method described in Masanganise *et al.* (2014a). Analysis of variance (ANOVA) was used to test (at 5 % level of significance) for differences among the three selected models in predicting T_{max} , T_{min} and R under both climate change scenarios. If the differences were observed to be significant under ANOVA, we proceeded to carry out multiple pairwise comparison of the models using Dunnett's test.

III. RESULTS AND DISCUSSION

i. Projections of temperature

Monthly time series plots of temperature anomalies are shown in Figure 3.1 to Figure 3.4

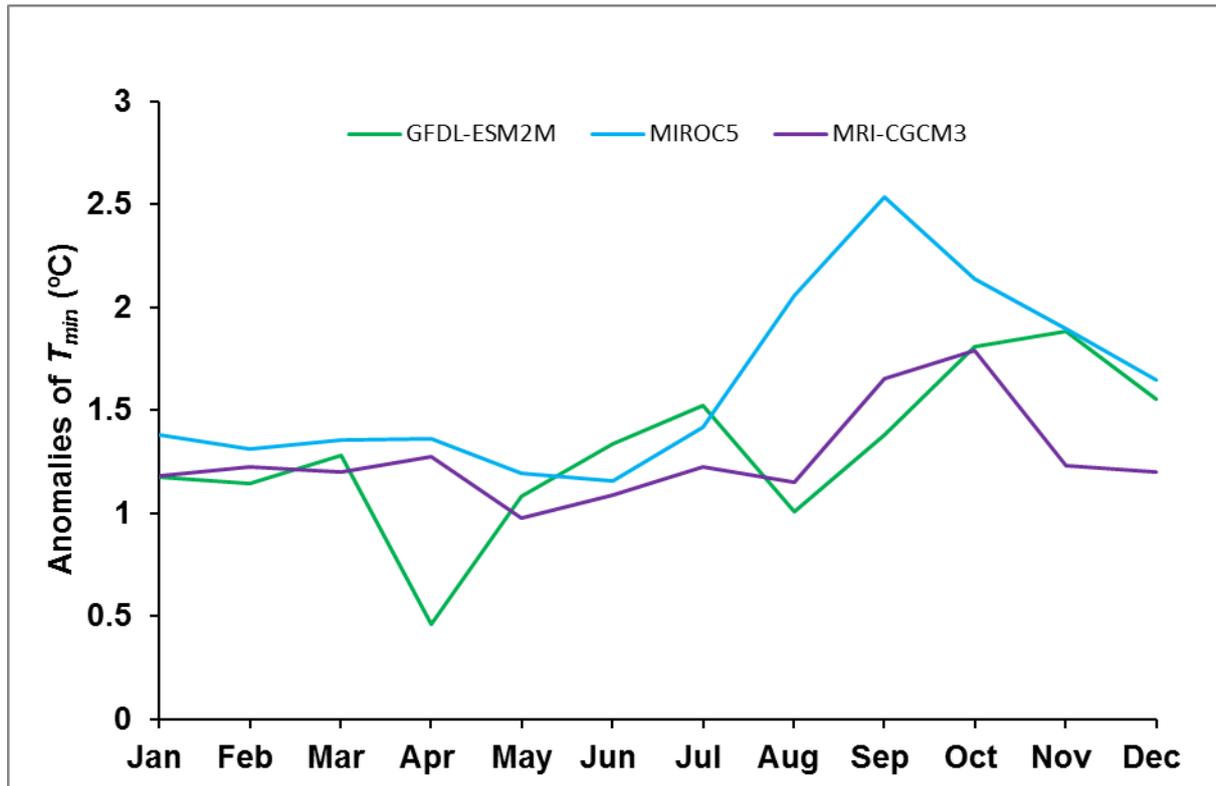


Figure 3.1 Projections of mean monthly anomalies for T_{min} for the period 2040-2070 under RCP4.5

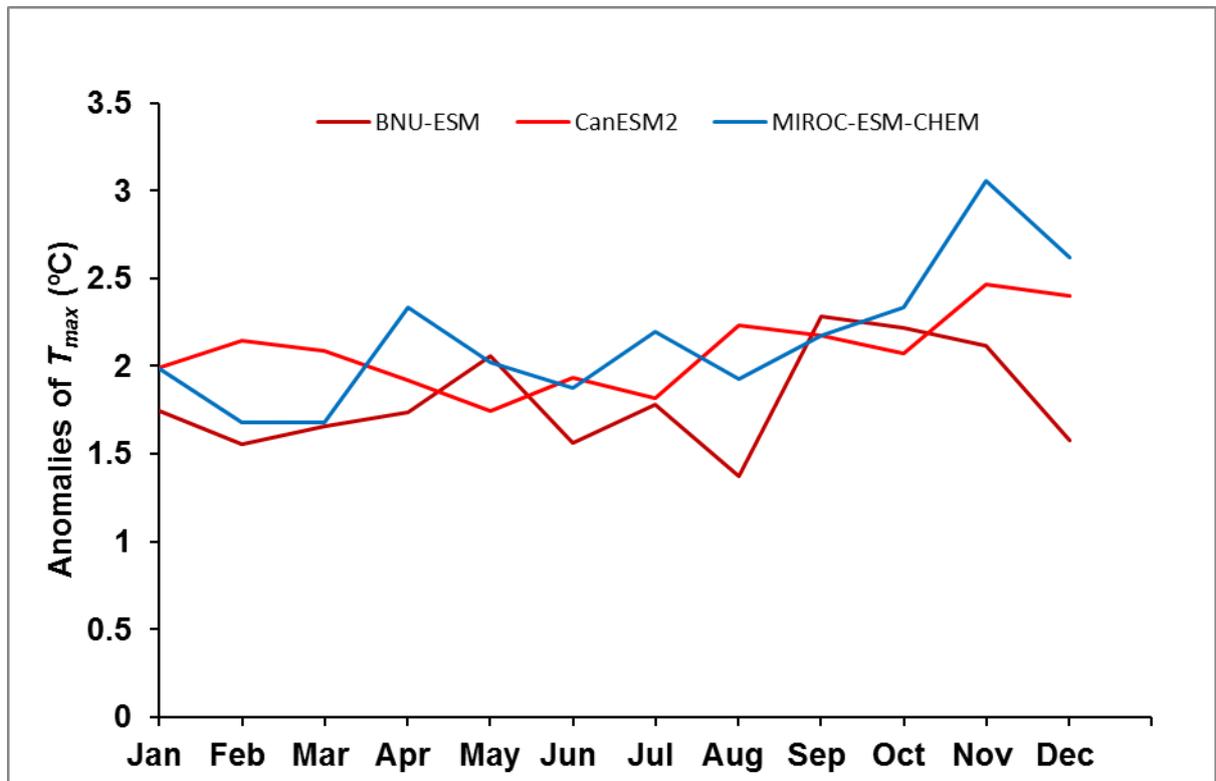


Figure 3.2 Projections of mean monthly anomalies for T_{max} for the period 2040-2070 under RCP4.5

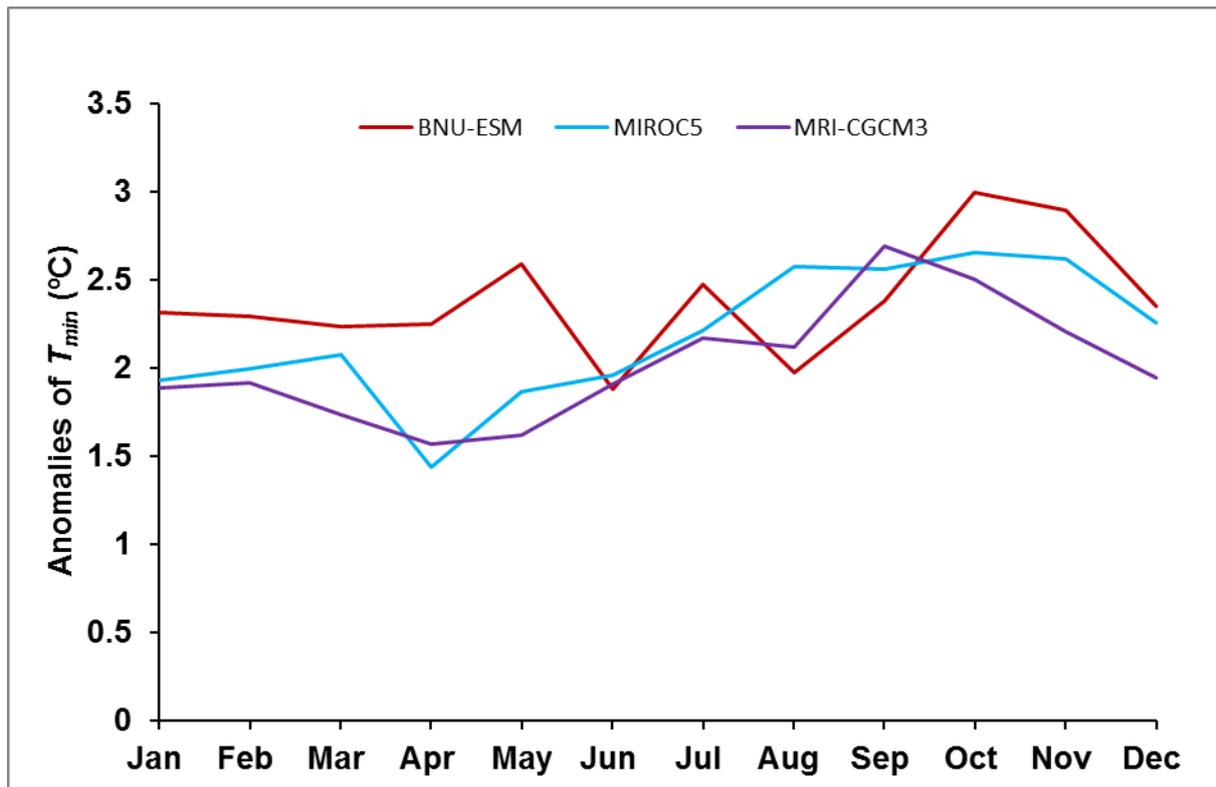


Figure 3.3 Projections of mean monthly anomalies for T_{min} for the period 2040-2070 under RCP8.5

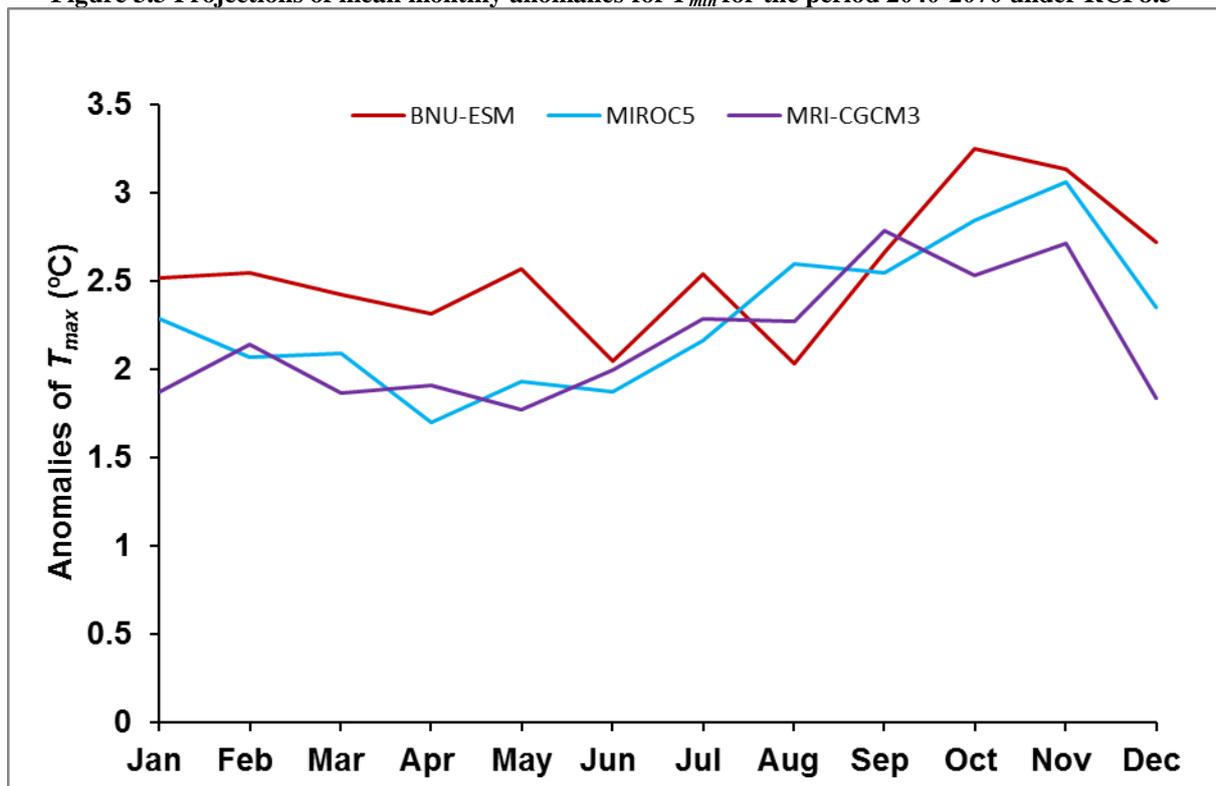


Figure 3.4 Projections of mean monthly anomalies for T_{max} for the period 2040-2070 under RCP8.5

The best three models selected for simulating T_{min} under RCP4.5 were MRI-CGCM3, MIROC5 and GFDL-ESM2M. Figure 3.1 shows the mean monthly temperature changes projected by each model. The three models projected an increase in temperature in the period 2040-2070 above the

1980-2010 baseline. The models were consistent in their projections although the GFDL-ESM2M model deviated from the other two in the month of April while the MIROC5 model showed large deviations in the months of July to October. The best three models selected for simulating T_{max} under

RCP4.5 were CanESM2, BNU-ESM and MIROC-ESM-CHEM. Temperature projections by these models are less than about 1 °C in most of the months as shown in Figure 3.2. Under RCP8.5, the models selected for simulating T_{min} were MRI-CGCM3, MIROC5 and BNU-ESM. The same models were also selected for simulating T_{max} . These models projected a consistent warming trend of about 1 °C or less as shown in Figure 3.3 and Figure 3.4. Time series plots of Figure 3.3 and

Figure 3.4 indicate very similar trends predicted by the MRI-CGCM3 and MIROC5 models. By using fewer models, we found a reduction in the amplitude of warming compared to that reported in Masanganise *et al.* (2014b) who applied all the 10 climate models to make climate projections over the same period.

ii. Projections of rainfall

Monthly time series plots of rainfall anomalies are shown in Figure 3.5 and Figure 3.6

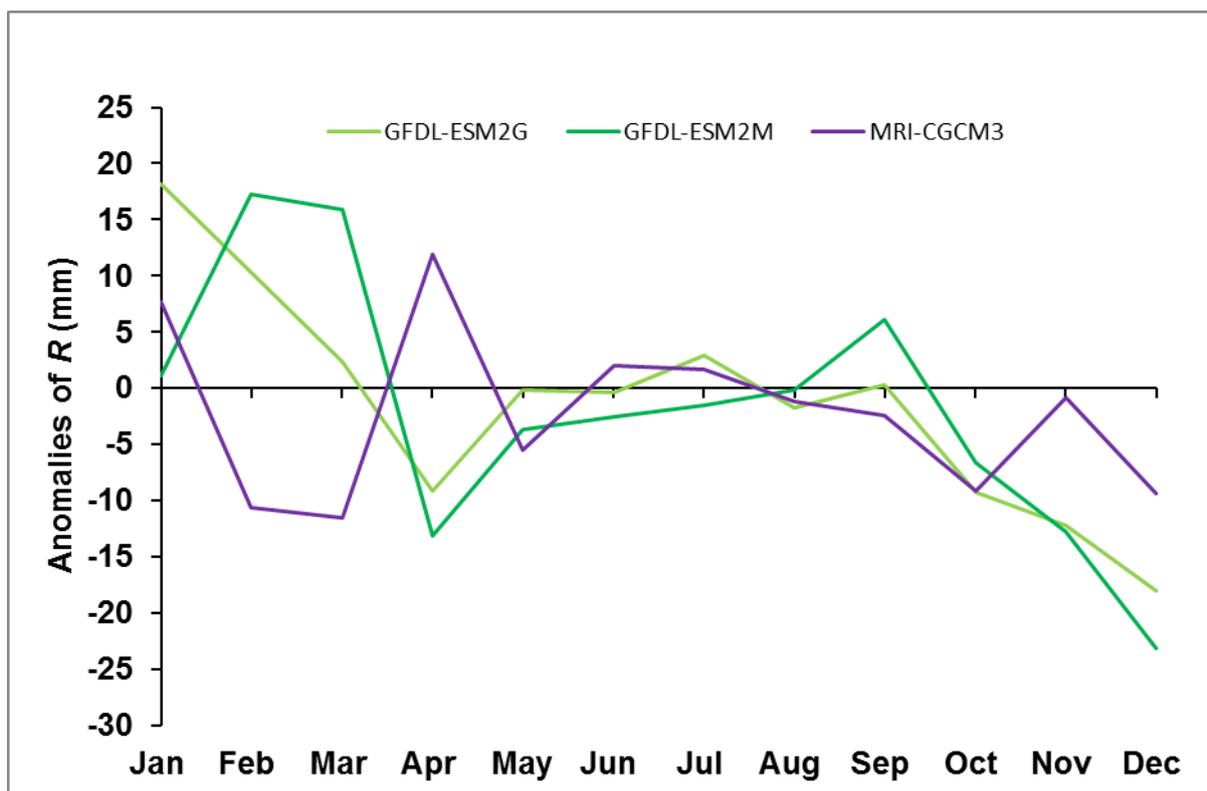


Figure 3.5 Projections of mean monthly anomalies for R for the period 2040-2070 under RCP4.5

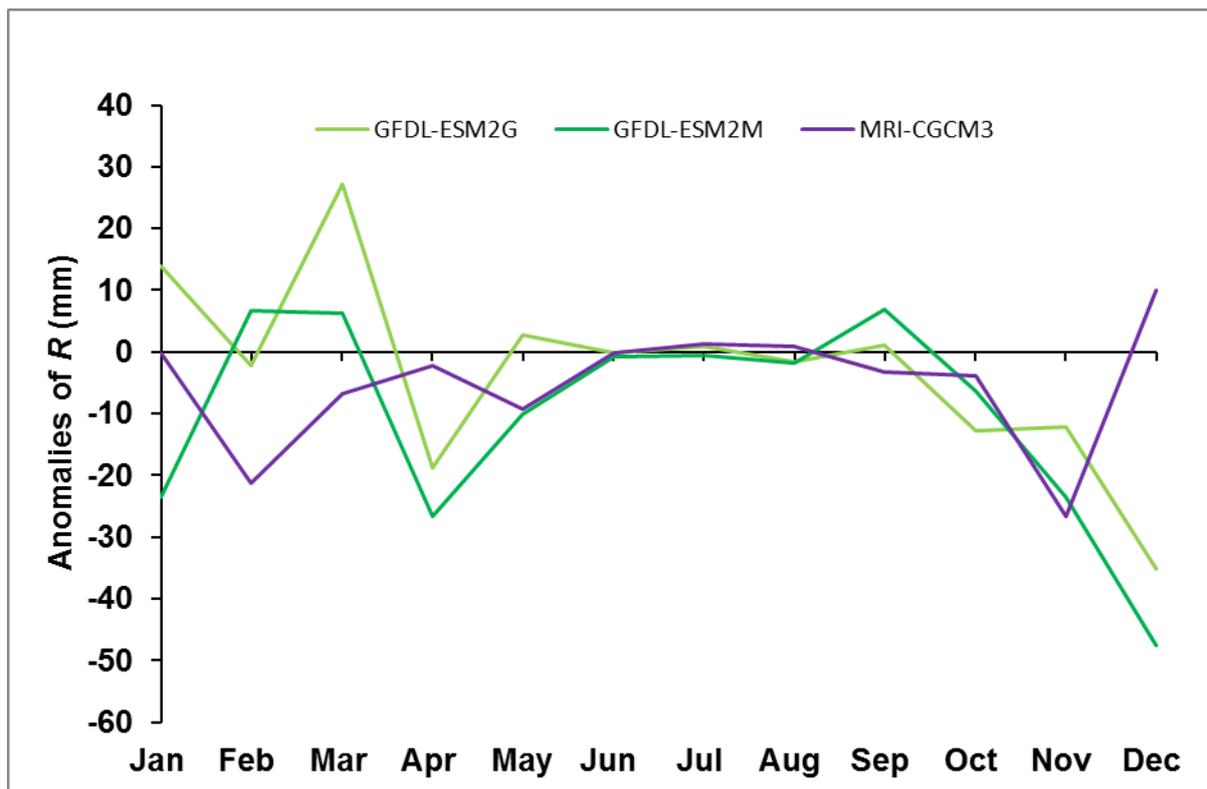


Figure 3.6 Projections of mean monthly anomalies for *R* for the period 2040-2070 under RCP8.5

The best three models selected for simulating *R* under RCP4.5 were GFDL-ESM2G, GFDL-ESM2M and MRI-CGCM3. The same models were also selected for simulating *R* under RCP8.5. Figure 3.5 and Figure 3.6 show the mean monthly rainfall change projections by the three models. There was a wide variation in the predictions by the three models mainly in the months of January-April

where the spread of rainfall change projections is large. However, the three models agreed in the direction of rainfall change in the months of October-December under both climate change scenarios supporting findings by Masanganise *et al.* (2014b)

iii. **Analysis of PDFs for T_{min} and T_{max}**
 PDFs are shown in Figure 3.7 to Figure 3.10

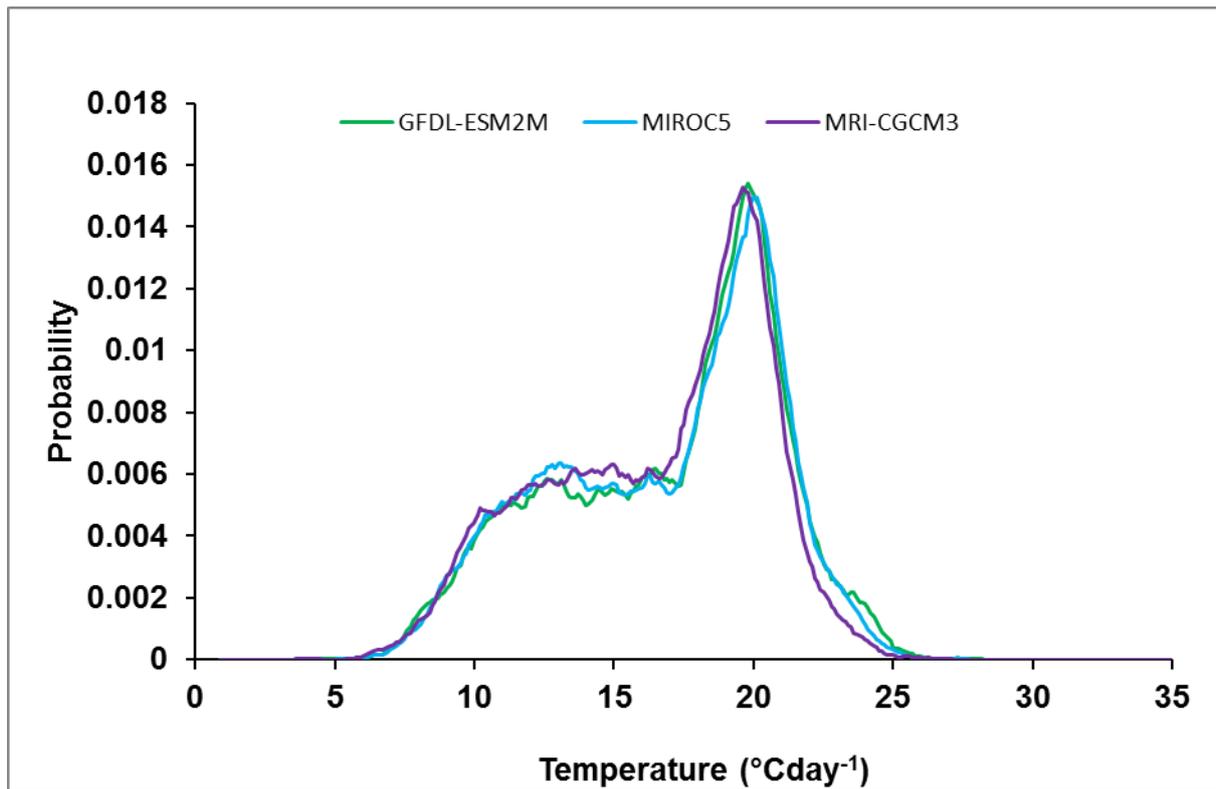


Figure 3.7 Probability density functions of the three models for T_{min} for the period 2040-2070 under RCP4.5

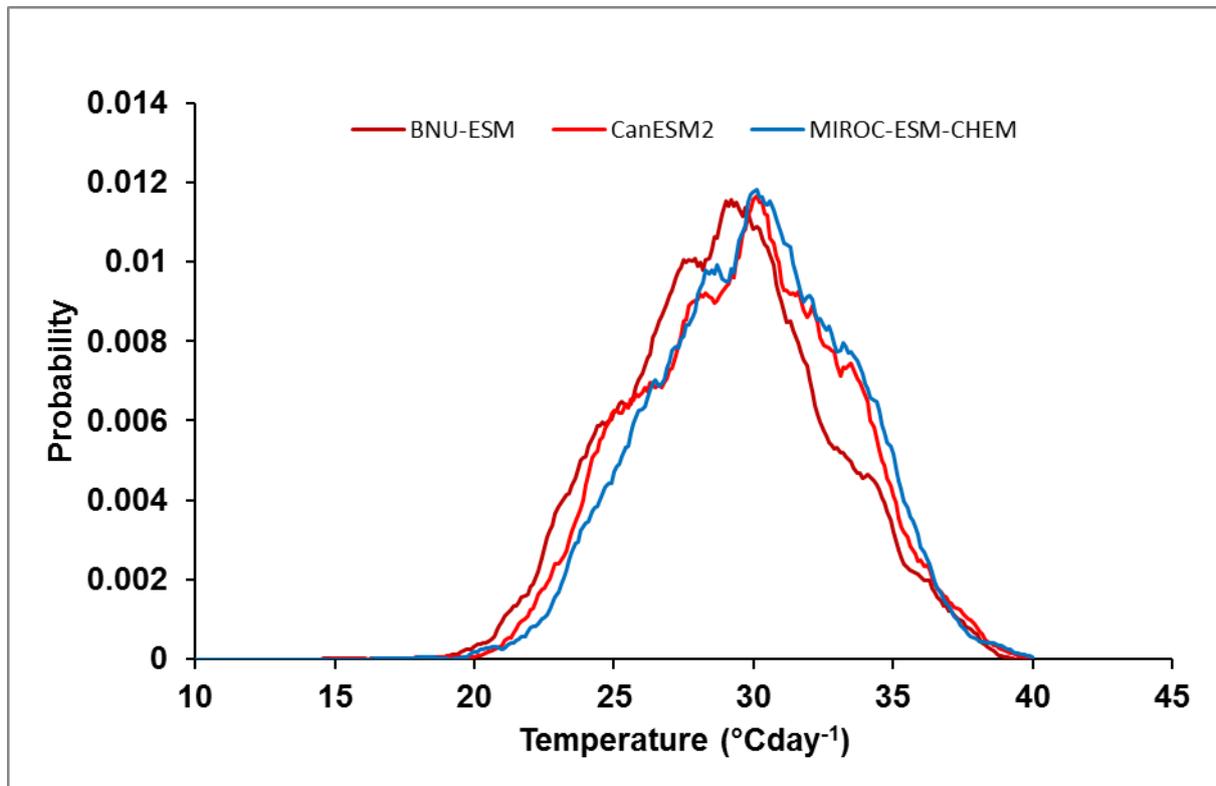


Figure 3.8 Probability density functions of the three models for T_{max} for the period 2040-2070 under RCP4.5

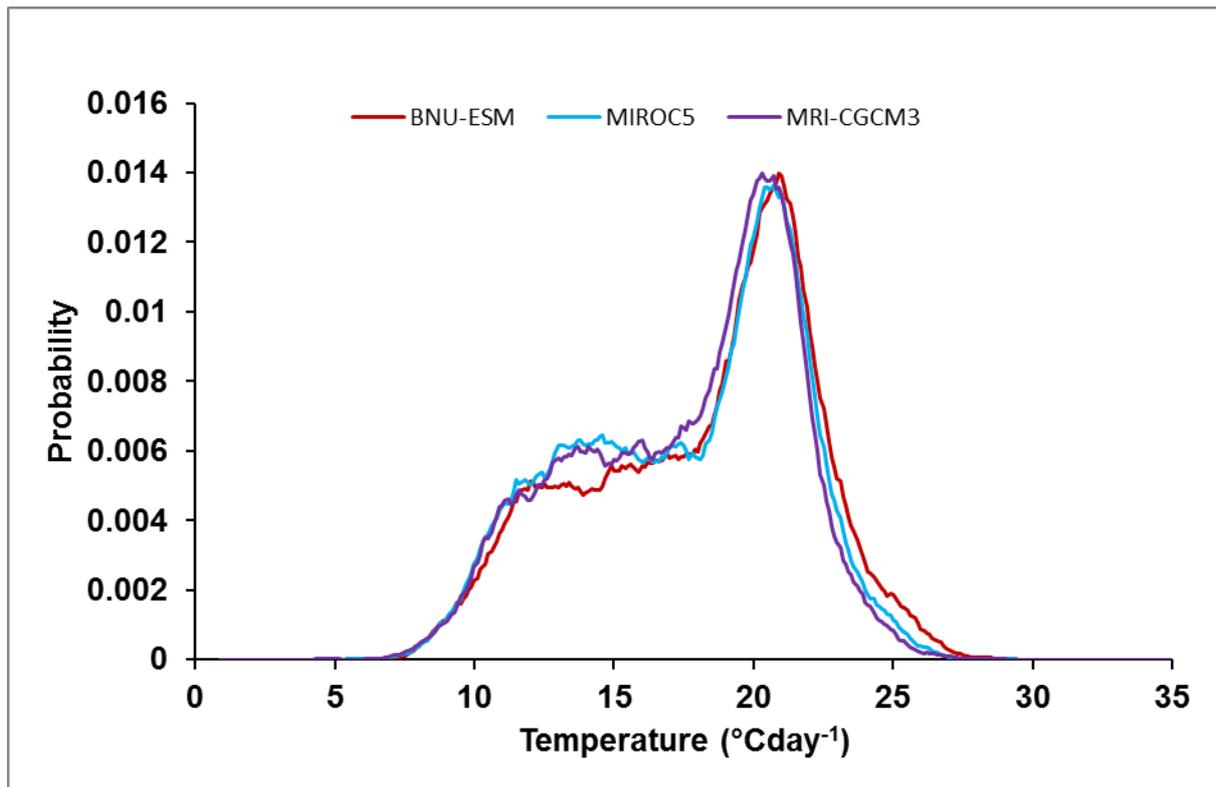


Figure 3.9 Probability density functions of the three models for T_{min} for the period 2040-2070 under RCP8.5

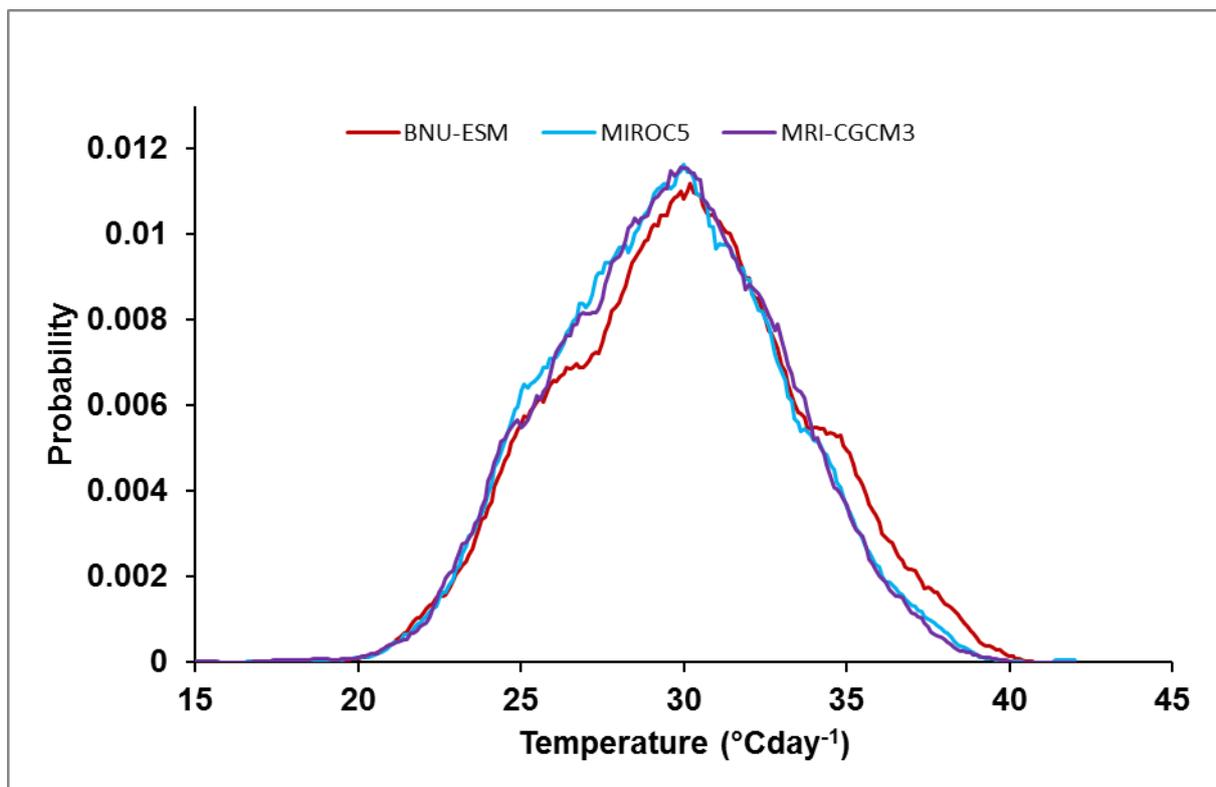


Figure 3.10 Probability density functions of the three models for T_{max} for the period 2040-2070 under RCP8.5

Figure 3.7 to Figure 3.10 show the PDFs for T_{min} and T_{max} for each climate change scenario. Overall, the shapes of the PDFs are in agreement

with each other, an indication that the 3 models predicted similar trends. In Figure 3.9 and Figure 3.10, PDFs for the MIROC5 and MRI-CGCM3 are

almost overlapping. This is in agreement with time series plots in Figure 3.3 and Figure 3.4. In general, there was an increase in the amount of overlap of the PDFs when three best models were used as compared to the amount of overlap reported in

Masanganise *et al.* (2014b) in which all the 10 models were used.

iv. Analysis of PDFs for *R*

PDFs are shown in Figure 3.11 and Figure 3.12

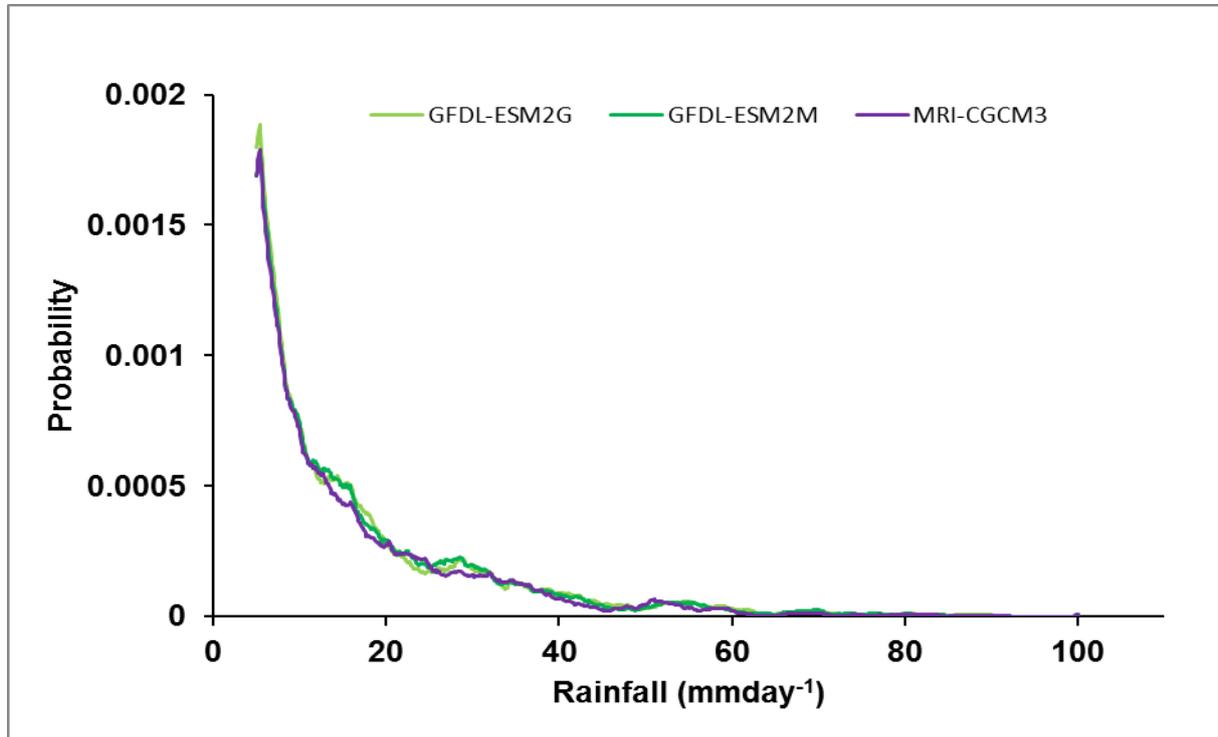


Figure 3.11 Probability density functions of the three models for *R* for the period 2040-2070 under RCP4.5

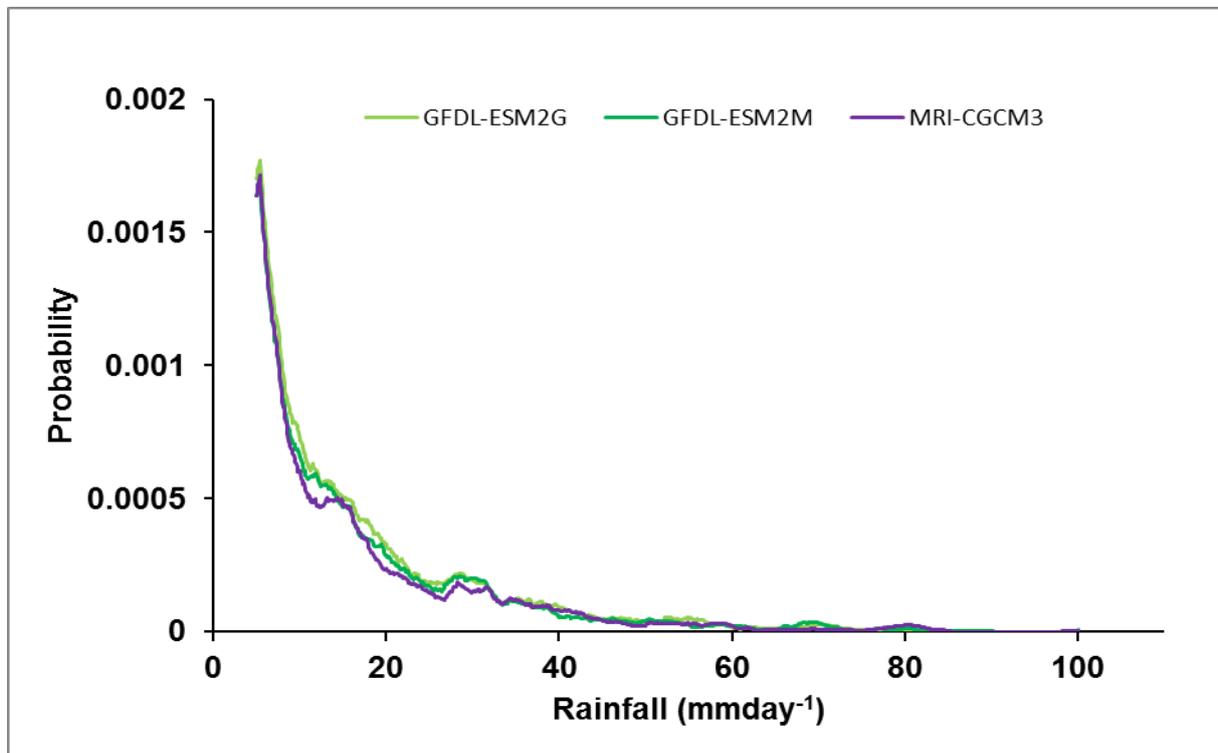


Figure 3.12 Probability density functions of the three models for *R* for the period 2040-2070 under RCP8.5

Figure 3.11 and Figure 3.12 show the PDFs for *R* for the two climate change scenarios. Models tend to agree at the extremes of the distribution as shown by the PDFs clustering in these regions. In between the extremes, PDFs are widely separated indicating some level of disagreement in predictions. Rainfall is difficult to predict than

temperature (Pitman and Perkins, 2008) and it is expected that there would be considerable uncertainty in the projections of rainfall using climate models.

v. Analysis of variance (ANOVA) and multiple pair wise comparison.

Table 2 Analysis of variance for predicting T_{min} under RCP4.5

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	899.278	2	449.639	28.354	.000
Within Groups	538634.433	33966	15.858		
Total	539533.711	33968			

We found significant differences ($p < 0.05$) among the three models in predicting T_{min} . The test

statistics are shown in Table 2. We then carried out multiple pair wise comparison.

Table 3 Multiple pair wise comparison of the three models for predicting T_{min} under RCP4.5

I-Model	J-Model	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
GFDL-ESM2M	MIROC5	.118	.054	.080	.00	.24
	MRI-CGCM3	.389*	.053	.000	.26	.51
MIROC5	GFDL-ESM2M	-.118	.054	.080	-.24	.01
	MRI-CGCM3	.271*	.052	.000	.15	.40
MRI-CGCM3	GFDL-ESM2M	-.389*	.053	.000	-.51	-.26
	MIROC5	-.271*	.052	.000	-.40	-.15

*. The mean difference is significant at the 0.05 level.

The statistics in Table 3 showed significant differences ($p < 0.05$) between MRI-CGCM3 and GFDL-ESM2M models. The models MIROC5 and MRI-CGCM3 were also significantly different ($p < 0.05$). However, no significant differences were

observed between the MIROC5 and the GFDL-ESM2M model ($p > 0.05$). Also see Figure 3.7 for pictorial differences. The MRI-CGCM3 model may be excluded in predicting minimum temperature under RCP4.5.

Table 4 Analysis of variance for predicting T_{max} under RCP4.5

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	6026.939	2	3013.470	235.897	.000
Within Groups	433899.301	33966	12.775		
Total	439926.240	33968			

There were significant differences ($p < 0.05$) among the three models in predicting T_{max} under RCP4.5 as shown in Table 4.

Table 5 Multiple pair wise comparison of the three models for predicting T_{max} under RCP4.5

I-Model	J-Model	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
BNU-ESM	CanESM2	-.682*	.048	.000	-.80	-.57

	MIROC-ESM-CHEM	-1.012*	.047	.000	-1.12	-.90
CanESM2	BNU-ESM	.682*	.048	.000	.57	.80
	MIROC-ESM-CHEM	-.330*	.047	.000	-.44	-.22
MIROC-ESM-CHEM	BNU-ESM	1.012*	.047	.000	.90	1.12
	CanESM2	.330*	.047	.000	.22	.44

*. The mean difference is significant at the 0.05 level.

Multiple pair wise comparison showed significant differences ($p < 0.05$) between all of the three possible pairs as shown in Table 5. The

amount of overlap in Figure 3.8 also supports this. If the models are to be used for making predictions, they have to be applied independently.

Table 6 Analysis of variance for predicting T_{min} and T_{max} under RCP8.5

		Sum of Squares	df	Mean Square	F	Sig.
T_{min}	Between Groups	1936.562	2	968.281	60.837	.000
	Within Groups	540600.027	33966	15.916		
	Total	542536.589	33968			
T_{max}	Between Groups	1543.572	2	771.786	61.179	.000
	Within Groups	428484.739	33966	12.615		
	Total	430028.311	33968			

Significant differences ($p < 0.05$) were obtained among the three models in predicting both T_{min} and

T_{max} under RCP8.5. The test statistics are shown in Table 6.

Table 7 Multiple pair wise comparison of the three models for predicting T_{min} and T_{max} under RCP8.5

Dependent Variable	I-Model	J-Model	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
T_{min}	BNU-ESM	MIROC5	.482*	.054	.000	.35	.61
		MRI-CGCM3	.528*	.053	.000	.40	.65
	MIROC5	BNU-ESM	-.482*	.054	.000	-.61	-.35
		MRI-CGCM3	.046	.052	.764	-.08	.17
	MRI-CGCM3	BNU-ESM	-.528*	.053	.000	-.65	-.40
		MIROC5	-.046	.052	.764	-.17	.08
T_{max}	BNU-ESM	MIROC5	.456*	.048	.000	.34	.57
		MRI-CGCM3	.449*	.048	.000	.34	.56
	MIROC5	BNU-ESM	-.456*	.048	.000	-.57	-.34
		MRI-CGCM3	-.007	.046	.998	-.12	.10
	MRI-CGCM3	BNU-ESM	-.449*	.048	.000	-.56	-.34
		MIROC5	.007	.046	.998	-.10	.12

*. The mean difference is significant at the 0.05 level.

Multiple pair wise comparison showed that there were significant differences ($p < 0.05$) in the prediction of T_{min} by the BNU-ESM and MIROC5 models as shown in Table 7. Similar results were obtained for the BNU-ESM and MRI-CGCM3 models. However, no significant differences

($p > 0.05$) were observed between the MIROC5 and the MRI-CGCM3 models. This is in agreement with the results shown in Figure 3.9. The same trend was observed in the prediction of T_{max} by the three models as shown in Table 7 (also see Figure

3.10). The BNU-ESM model may be excluded in predicting both T_{min} and T_{max} under RCP8.5.

Table 8 Analysis of variance for predicting R under RCP4.5

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	401.948	2	200.974	3.087	.051
Within Groups	2211533.046	33966	65.110		
Total	2211934.994	33968			

The three models were not significantly different ($p>0.05$) in predicting rainfall under RCP4.5. The three models GFDL-ESM2G, MRI-

CGCM3 and GFDL-ESM2M may be used concurrently.

Table 9 Analysis of variance for predicting R under RCP8.5

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	764.560	2	382.280	6.261	.002
Within Groups	2073592.791	33964	61.053		
Total	2074357.351	33966			

The three models were significantly different ($p<0.05$) in predicting rainfall under RCP8.5.

Table 10 Multiple pair wise comparison of the three models for predicting R under RCP8.5

I-Model	J-Model	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
GFDL-ESM2G	GFDL-ESM2M	.18910	.10616	.206	-.0622	.4405
	MRI-CGCM3	.36745*	.10403	.000	.1213	.6136
GFDL-ESM2M	GFDL-ESM2G	-.18910	.10616	.206	-.4405	.0622
	MRI-CGCM3	.17834	.10130	.215	-.0615	.4182
MRI-CGCM3	GFDL-ESM2G	-.36745*	.10403	.000	-.6136	-.1213
	GFDL-ESM2M	-.17834	.10130	.215	-.4182	.0615

*. The mean difference is significant at the 0.05 level.

Multiple pair wise comparison indicated significant differences ($p<0.05$) between the GFDL-ESM2G and MRI-CGCM3 models under the RCP8.5. The GFDL-ESM2G and GFDL-ESM2M models were not significantly different ($p>0.05$). Similarly, the GFDL-ESM2M and the MRI-CGCM3 models were not significantly different ($p>0.05$) in predicting rainfall under RCP8.5. Linking statistical results and PDFs in Figure 3.12, the GFDL-ESM2G model predicts higher values of rainfall; MRI-CGCM3 predicts low values of rainfall while GFDL-ESM2M predicts moderate values. We recommend the use of the three models to allow for comparison of predictions. Table 11 is a summary of the selected models under different RCPs.

Table 11 Summary of selected models

Climatic variable	Selected models	Comment
RCP4.5		
Minimum temperature	MIROC5 and GFDL-ESM2M	MRI-CGCM3 excluded
Maximum temperature	BNU-ESM, CanESM2 and MIROC-ESM-CHEM	All models predicted differently
Rainfall	GFDL-ESM2G, MRI-CGCM3 and GFDL-ESM2M	No significant differences
RCP8.5		
Minimum temperature	MIROC5 and MRI-CGCM3	BNU-ESM excluded
Maximum temperature	MIROC5 and MRI-CGCM3	BNU-ESM excluded
Rainfall	GFDL-ESM2G, GFDL-ESM2M and MRI-CGCM3	High, moderate and low predictors respectively

IV. CONCLUSIONS

Climate projections of the mid-century were analysed using a subset of global climate models from the Coupled Model Inter-comparison Project 5. The projections were based on moderate and high climate change scenarios. All the three models used projected a rise in temperature by about 1 °C in the period 2040-2070 relative to the 1980-2010 reference period. However, in some cases, some models were excluded because they predicted differently. The three models used to simulate rainfall change were found to be consistent in simulating extremes. We therefore recommend that such models be used by sectors that are vulnerable to extreme rainfall such as drought and floods.

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Biodegradability and Biocompatibility of Polymers with Emphasis on Bone Scaffolding: a Brief Review

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Abstract- Biomaterials constitute a class of materials that are used extensively in biological systems, particularly in medical research involving scaffolding material. Various polymeric materials fall within this category, and are largely biodegradable, although various applications and particularly, bone scaffolding, involves the use of non-biodegradable polymeric materials such as PMMA that are not biodegradable. Blends of non-biodegradable and biodegradable polymers have been employed in bone implant and regenerative studies; while the biodegradable component disintegrates over time to be replaced by osteogenic or native cells, the non-biodegradable component contributes to the structural integrity of the tissue.

Index Terms- Biodegradable Polymers, Biopolymers, Polymer Biodegradation, Renewable Resources

I. INTRODUCTION

According to Mihov and Katerska (2010), biomaterials are artificial or natural materials used in biological systems. One of the major avenues in medical applications and research on biomaterials concerns tissue regeneration. In natural tissues, cells are distributed in a three dimensional organization, which requires that materials used mimic their natural geometry. In tissue engineering, these materials are used as scaffolds to grow new tissue, either in vivo or in vitro (Langer and Vacanti, 1999). Scaffolds are used to promote or provide an environment that promotes cell growth in a manner that results in the synthesis of new tissue by the body, and are defined as three dimensional porous solid biomaterials that: (i). promote cell-biomaterial interactions, cell adhesion, (ii). permit sufficient transport of gasses, nutrients, and regulatory factors for cell survival, proliferation and differentiation, and (iii). are biodegradable at a rate comparable to the rate of tissue regeneration (Dhandayuthapani et al., 2011).

I. A BRIEF REVIEW OF BIODEGRADABLE POLYMERS

A comprehension of terminology involved is essential in estimating the nature and type of polymers that could be employed in scaffolding applications. The terms biodegradable polymer and biopolymer have often been used interchangeably, leading to misconceptions with regards to their relationship to this day. According to Fakhouri et al. (2013), biopolymers are polymers synthesized under natural conditions within cells of microorganisms via complex metabolic processes catalyzed by

enzymes, a definition that is not far off from that of Chandra and Rustgi (1998), apart from a minor variation; Chandra and Rustgi assert that biopolymers are typically formed within cells of organisms, and not just microorganisms, during growth cycles.

According to Greer (2006), the term biopolymer itself refers to polymers resulting from renewable resources, principally carbohydrate and protein based substrates. The author further contends that most biopolymers are biodegradable, and include corn starch, sugar, wood pulp and soy protein.

Thus, depending on the point of reference, a biopolymer can either be a polymer from biomass (agro-resources), obtained by microbial production, or synthesized from monomers derived from biological processes. The common ground to these contentions is the term 'renewable resource'.

Biodegradable polymers, on the other hand, encompass polymers (both natural and synthetic) that degrade due to microbial action. There is a lack of consensus among researchers on a universal definition of polymer biodegradation and the nature of end products that would render a polymer biodegradable, apart from a lack of correlation between timescales adopted by various researchers (Gautam, 2007). Confusions arising led to legal repercussions as early as the 90's with regards to ambiguous environmental advertising (Narayan et al., 1999). Thus, the need for standards based organizations to take the lead.

ASTM D 6400-12 (2012) defines a biodegradable plastic as 'a plastic in which the degradation results from the action of naturally occurring microorganisms such as bacteria, fungi and algae.' ASTM 883-12 (2012) regards a degradable plastic as one that undergoes a significant change in chemical structure under specific environmental conditions. Whereas, the ASTM sub-committee D20.96 proposal defines degradable plastics as plastic materials that undergo bond scission in the backbone of the polymer through chemical, biological, and/or physical forces in the environment at a rate which leads to fragmentation or disintegration of the plastics (Chandra and Rustgi, 1998). This definition broadens the spectrum for polymers that may be rendered biodegradable.

II. POLYMERIC BIOCOMPATIBLE MATERIAL IN SCAFFOLDING

Polymeric materials possess the right qualities for tissue regeneration, including comparable strength and hardness to surrounding tissue, light weight, biocompatibility and biodegradability (Washburn et al., 2002). Synthetic polymers are commonly used as biocompatible materials owing to their

modifiable properties (Puskas and Chen, 2004). Biocompatible polymers can either be made into devices, or are coated onto devices to reduce risk of rejection by the human body. Other applications include implants (bone pins and screws), catheters and dialysis tubing, vascular graft, membranes for oxygenation and detoxification, injectable drug delivery and porous scaffolds for regenerative tissue engineering (Shastri, 2003).

The criteria for selection of a polymeric material for incisive medical applications include its ease of processing, mechanical strength, biological inertness, blood compatibility, tissue adhesivity and permeability of oxygen (Shastri, 2003). The choice of a polymer in a given application, as is the convention in polymer technology and engineering, is to tradeoff properties deemed unnecessary for the particular application.

Polymer biodegradability was noted as a quality possessed by polymers employed in tissue engineering applications, particularly in its application as scaffolds. However, this hasn't always been the main factor. Not all polymers applied in medical applications necessarily need to be biodegradable. For instance, polymethyl methacrylate, or PMMA, is a non-biodegradable polymer that possesses a good degree of compatibility with human tissue, and has been used as scaffolding material (Liu et al., 2009) and 2D cell cultures for many years (Jager and Wilke, 2003). It has therefore found applications specifically in permanent structures, such as bone tissue regeneration and bone structural enhancement. It manifests low toxicity and is used as scaffolding to deliver mechanical stability following its implantation (Downes et al., 1994). Over the years, electrospun PMMA fibers have been used to form 3D tissue engineered scaffolds with good cellular adhesion (Wei and Sampathi, 2011; Zhang and Sun, 2005).

Polymeric scaffolds are usually rendered porous by blending them with salts, whereby the salt component is bleached out following solvent casting upon drying the solution. The salt crystallites possess controllable sizes, and leave behind pores/voids in the polymer matrix with dimensions in the order of or larger than cellular dimensions (Ishaug et al., 1994).

Osseointegration refers to direct structural and functional connection between an ordered, living bone, and the surface of a load carrying implant, where there isn't progressive relative movement between the implant and the bone matter in direct contact (Mavrogenis et al., 2009). In this case, the implant may well be scaffolding that aims to affect the regeneration of tissue in the affected area. The concept involves the seeding of autologous osteogenic cells throughout the scaffold (Hutmacher et al., 2007). Autologous osteogenic cells refer to cells involved in the development, growth or repair of bone, which originate from the same person.

III. POLYMER BLENDS AND COPOLYMERS IN BONE SCAFFOLDING

Multiphase polymer blends, where one component is biodegradable while the other isn't, has been employed in bone implant and regenerative studies; while the biodegradable component disintegrates over time to be replaced by osteogenic or native cells, the non-biodegradable component contributes to the structural integrity of the tissue. Such has been the case in studies involving poly(L-lactide) and PMMA blends (Le et al.,

2006). Higher molecular weights of the permanent component (non-biodegradable PMMA) would improve mechanical properties undoubtedly. However, Tai et al. (2007) studied the effect of molecular weight on PGLA scaffolds, and found that pore sizes decreased with increased molecular weight.

Notwithstanding, scaffolding in bone repair applications should mimic properties at the bone repair site, including mechanical properties of the bone. Typical PMMA bone cements have compressive strengths in the range of 75-115MPa and moduli of elasticity at 1700-3100MPa, far exceeding those of trabecular bones, at 5-10MPa and 50-100MPa respectively. However, the mechanical properties of bones depend on the type of bone being investigated. For instance, cortical bones exhibit compressive strengths in the range of 130-225MPa, with a modulus of 17-20GPa (Hedberg and Mikos 2001).

Thus, an important avenue for consideration is the use of multi-phase polymer blends and copolymers, each with one biodegradable and another non-biodegradable component, as potential bone scaffolding material, with the non-biodegradable component serving as a permanent structure within the repair site to perform as a load bearing media with comparable mechanical properties to that of the surrounding bone tissue. As tissue regeneration progresses, the biodegradable or biosorbable component would disintegrate and disappear, leaving behind the structurally enhancing non-biodegradable component.

The presence of the non-biodegradable component in blends and copolymers could not only effect the disintegration rates of the biodegradable component, but also, the integrity of the non-biodegradable component. As such, a brief review on polymer biodegradability is necessary.

IV. CONCLUSION

Research on polymeric scaffolding in bone tissue regeneration and fortification employing biodegradable/non-biodegradable copolymers is virtually lagging, but poses an important avenue for consideration. Bone scaffolding employing either biodegradable, non-biodegradable, or blends of biodegradable and non-biodegradable polymers, has proven feasible and successful. The permanent (non-biodegradable) component would provide the required structural integrity, while the non-biodegradable component would generate pores upon disintegration and be replaced by osteogenic cells, paving the way for tissue regeneration that would be structurally fortified by the non-biodegradable but biocompatible polymer. An important avenue of consideration in further studies involving copolymers includes the effect of molecular weight of component segments towards the effectiveness of the material as a novel scaffolding biomaterial.

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Extraction and Potential of Cinnamon Essential Oil towards Repellency and Insecticidal Activity

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Abstract- The potential of Cinnamon essential oil as a natural insecticides and ants repellent was studied. *Cinnamon cassia* bark was extracted using hydrodistillation and soxhlet extraction method with three different solvents i. e. petroleum ether, hexane and dichloromethane. All extraction was carried out for 6 hours at 1 atm. The highest yield of cinnamon oil was obtained by soxhlet extraction in dichloromethane, followed by hexane and petroleum ether were 5.22 %, 3.84 % and 3.71 %, respectively. While only 1.82 % yields of cinnamon essential oil extracted when using hydrodistillation method. The volatile compounds of cinnamon essential oil were identified using GC-MS analysis. The results indicated that 9 major volatile compound were presence such as alcohols, aldehydes, alkenes, carboxylic acids, ether, ester and ketone in the cinnamon essential oil extracted by hydrodistillation. Trans-cinnamaldehyde was found to be the major volatile compound with the highest percentage of 86.67 % by soxhlet extraction using hexane. The repellency and insecticidal activity of cinnamon oil by hydrodistillation method obtained was directly exposed to specimen i.e., ants. The repellency and insecticidal activity of cinnamon essential oil was compared through different concentration of fabricated repellency paper. As a conclusion, solvent extraction shows an effective method on cinnamon essential oil extraction with positive insecticidal and repellent activity on ants.

Index Terms- Cinnamon essential oil, GC-MS, trans-cinnamaldehyde, repellent, insecticidal activity, soxhlet extraction, hydrodistillation

I. INTRODUCTION

Essential oils are volatile natural complex secondary metabolites which has a strong odor and have a generally lower density than water (Bruneton, 1999; Bakkali et al., 2008). Approximately, 3,000 essential oils are known out of which 300 that have been commercialized for cosmetics, pharmaceuticals, perfume industries (Bakkali et al., 2008) and pesticidal potential (Franzios et al., 1997; Chang and Cheng, 2002).

Cinnamon is a spice collected from the bark of several trees from the genus *Cinnamomum* and Lauracea family that is used in sweet and savoury foods. According to Vangalapati et. al (2012), *Cinnamon Cassia* (*C. Cassia*) has the strong and spicy-sweet flavour. *Vietnamese cassia* (*Saigon cinnamon, Cinnamomum loureiroii*) and *Chinese cassia* (*Cinnamomum aromaticum*) are the sweetest and strongest varieties. As stated by Janick and Jules, (2011), the name cinnamon comes through the Greek *kinnámōmon* from Phoenician. In Sinhala, Sri Lanka, cinnamon

is known as kurundu which was recorded in English in the 17th century as Korunda (Knox and Robert, 2008). In Indonesia, where cinnamon is cultivated in Java and Sumatra, it is called kayu manis ("sweet wood") and sometimes *cassia vera*, the "real" *cassia* (Samat and Bell, 2009).

Repellent is defined by Fried et al. (2007) as substances that cause insect to turn away. Repellent have been used to prevent insects or specifically in this study, the ants from harming or annoying human daily life as they always swarm over host's food especially food that have been left on tables or being uncovered. Ant repellent is used to prevent the ants from invading the houses and spoiling the foods. Chemicals and poisonous substances are effective, but can bring harmful in the kitchen, around children and pets. One of the example of carcinogenic chemical that have been used which either repell or kill the ants is N,N-diethyl-3-methylbenzamide (DEET). Therefore, an alternative natural repellent from cinnamon oil have been developed to replace the carcinogenic chemical repellent.

In this study, the extraction of the cinnamon essential oil was carried out by hydrodistillation in a Clavenger-type apparatus in accordance with the method of Wang et al. (2009) with slight modification and using Soxhlet extraction in accordance with the method of Mustafa and Hilal (2004) using three different solvents which are dichloromethane (DCM), hexane and petroleum ether. The cinnamon essential oil was analyzed using gas chromatography–mass spectrometry (GC-MS) to determine the chemical compound especially the cinnamaldehyde. The cinnamon essential oil was also used in this study to test for the repellency and insecticidal activity of the ants.

II. METHOD

Material and Chemicals

The Bark of *Cinnamon cassia sp* used in this study was purchased from a local supermarket. All solvents and chemical used such as hexane, dichloromethane, petroleum ether and anhydrous sodium sulphate were analytical grade.

Sample Preparation

Fresh bark sample was washed and air-dried, and then the dried sample was ground into powder . Then, the sample was stored in a drying oven for further analyses. In order to compare the extraction yield of cinnamon essential oil obtained, different extraction methods were used. Extraction of cinnamon oil was carried out using hydrodistillation and Soxhlet extraction with hexane, dichloromethane and petroleum ether as the solvents.

Extraction of cinnamon oil using Hydrodistillation

The cinnamon essential oil was extracted by using hydrodistillation with a Clevenger type apparatus (Wang et al., 2009) with slight modification. About 30 gm of precisely weighed of cinnamon bark powder has been put into 500 mL distillation flask with four boiling chip and 300 mL of distilled water was poured into the flask. They were immersed for 1 hr, followed by heating at 100 °C for 6 hrs. Then, the distillate was transferred to a 250 mL conical flask. Then, the volatile compounds was extracted from the water phase three times using dichloromethane and dehydrated over anhydrous sodium sulphate for 30 min and filtered through a mid-speed filter paper. The cinnamon oil obtained was concentrated and stored at 4 °C for further analyses. The percentage yield of cinnamon essential oil has been calculated using the following formula.

$$\text{Percentage of essential oil} = \frac{\text{Essential oil weight}}{\text{sample weight}} \times 100 \quad (1)$$

Extraction of Cinnamon Essential Oil using Soxhlet Extraction

The extraction of cinnamon essential oil was carried out using Soxhlet extraction method. An approximately 30 gm of cinnamon powder was placed into the extraction thimble and covered with glass wool to prevent floating. The round bottom flask containing boiling chips was weighed. Then 250 mL of hexane was poured into the round bottom flask. The soxhlet was heated at 65 °C at 1 atm for 6 hrs (Mustafa and Hilal, 2004). The same method was applied to the other two solvents which are dichloromethane and petroleum ether. The heating temperature was changed to 60 °C for petroleum ether and 40 °C for dichloromethane. The percentage yield of oil was calculated using equation 1.

GC-MS Analysis

The determination of active component of volatile compound in essential oil of the plant performed on various 4000 GC/MS/MS model. Column CP8944 30 m x 0.25 mm x 0.39 mm was used for separation. The oven temperature was raised from 40 °C to 230 °C at constant heating rate of 5 °C min⁻¹. The active compound in essential oil was identified using the attached software.

Preparation of Fabricated Repellency Paper

The paraffin wax was cut into smaller pieces and placed into the double boiler pan and set up to the high heat. After that, the essential oil of cinnamon was poured into the melted paraffin wax in the percentage concentration of 5 %. Then, a piece of packaging paper was dipped into the melting paraffin and cinnamon mixture. The paper was quickly lifted out of the wax and the paper was dried in less than a minute. The steps were repeated with different concentration of cinnamon essential oil which were 10 %, 15 %, and 20 % v/v. Fig. 1 showed the fabricated repellency paper for further analysis.



Figure 1: Fabricated Repellency Paper

Repellency Test

In the repellency test, the open exposure method has been applied. Ants were placed in the investigation area that contained different concentration of fabricated repellency paper and control paper (without cinnamon oil). The repellency of the ants will be recorded every 15 min for a total of 1 hr. After 1 hour, the percentage repellency was calculated by following formula according to Liu et al., (2006).

$$\text{Repellency (\%)} = \frac{(C - E)}{T}$$

C is the ant number in control paper, E is the ants number on fabricated repellency paper and T is the total insects in the investigating area. The calculated percentage of repellency was compared between different concentration of fabricated repellency paper and control paper.

Insecticidal test

The method of Appel *et. al* (2004) was slightly modified to determine the effectiveness of the cinnamon active paper in repelling or terminating the ants. In investigating the insecticidal activity of cinnamon, the close exposure method have been used. The fabricated repellency paper with their different concentrations of cinnamon essential oil was placed in the plastic containers and a control paper as a standard. Ants was transferred into covered container. The container was sealed by the wrapping plastic. Mortality was recorded every 15 min for a total of 90 min.

III. RESULTS AND DISCUSSION

Percentage Yield of Cinnamon Essential Oil via Hydrodistillation and Soxhlet Extraction

In this study, two methods of extraction were used to extract cinnamon essential oil for 6 hours extraction time using hydrodistillation and Soxhlet extraction method. Three different solvents were used in Soxhlet method which are petroleum ether (PE), hexane and dichloromethane (DCM). Comprehensive comparison of the cinnamon essential oil obtained by these methods were revealed in Fig. 2.

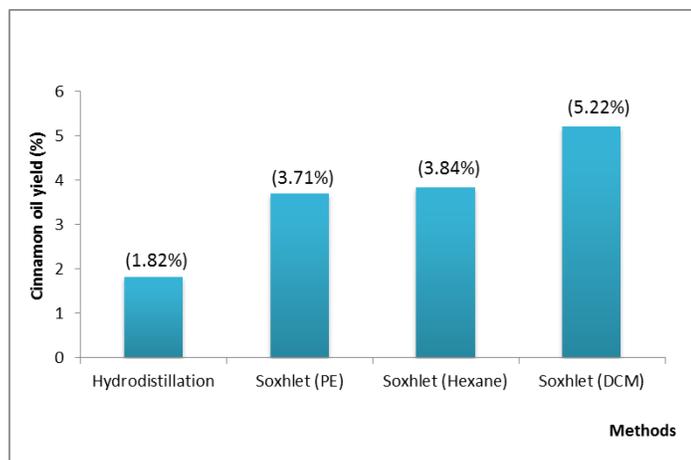


Figure 2 : Percentage yield of cinnamon essential oil via different extraction methods

Figure 4.1 indicates the essential oil yields of cinnamon bark using different extraction methods. The extraction by using soxhlet with different solvents, i.e. petroleum ether, hexane and dichloromethane was shown the significant differences between the percentage of yield obtained by the three solvents. The results showed that the highest percentage yield of cinnamon essential oil was by using dichloromethane followed by hexane and petroleum ether were 9.11 %, 3.84 % and, 3.71 %, respectively. These results were comparable with the previous study which showed that dichloromethane gave higher extracted yield due to hexane has highest selectivity (Slavco et al.,1998).

Extraction of cinnamon essential oil was also carried out by hydrodistillation method with conditions at ambient pressure of 1 atm, at temperature of 80 °C and extraction time of 6 hrs. Cinnamon essential oil obtained via this method showed slightly higher about 1.82 % compared to Wang et al., (2009) which reported about 0.78-1.54 % only. Whereas Li et al., (2012) reported 1.3 % of oil yield when the cinnamon bark were extracted. From these results, the extraction method using the Soxhlet extraction gave higher percentage of cinnamon essential oil yield compared to hydrodistillation method.

GC-MS Analysis

The aim of this section is to qualitatively analyse volatile compounds in cinnamon essential oil using GC-MS. About 9 major volatile compounds, including alcohols, aldehydes, alkenes, carboxylic acid, ether, ester and ketone were detected in the cinnamon essential oil of *C.cassia* bark using hydrodistillation showed in Table 1. *Trans*-cinnamaldehyde was confirmed to be the major component with the highest area percentage of 84.97 %. The other main components included, 1,2-naphthalenedione, Ethanone and Borneol with area percentages of 9.03 %, 1.11 % and 1.03 %, respectively. Furthermore, up to 13 volatile compounds were identified from *C.cassia* essential oil using Soxhlet method. *Trans*-cinnamaldehyde was the leading active volatile compound observed for 3 different solvent extraction used i.e., hexane, DCM and petroleum ether at 86.67 %, 68.47% and 79.43 %,

respectively. Another main compounds were found in cinnamon oil i.e., 2H-1-benzopyran-2-one, 3-methyl-4-undecene, and 3-phenyl-2-propenal.

Table 1: Volatile compound identified from the cinnamon essential oil using different extraction method

Compounds	Area (%) volatile compounds by different extraction method			
	Hydro-distillation	Soxhlet Extraction		
		Petroleum ether	Hexane	DCM
Alcohol				
Borneol	1.03	-	-	-
3-cyclohexene-1-methanol	0.44	-	-	-
Bicyclohexane-2-ol	-	-	0.01	-
p-menth-1-en-8-ol	-	0.15	-	-
3-cyclohexen-1-ol	-	0.07	-	-
13-cyclohexene-1-methanol	-	-	-	0.07
Aldehyde				
<i>Trans</i> -cinnamaldehyde	84.97	68.47	86.67	79.43
Benzaldehyde	-	-	-	0.35
3-phenyl-2-propenal,	-	2.31	-	2.76
2-cyclopentene-1-butanal	-	-	0.05	-
Phenylglyoxal	-	-	0.04	-
Benzenepropanal	-	-	0.16	-
4-(2-methylcyclohex-1-enyl)-but-2-enal	-	-	-	-
Alkene				
Copaene	0.66	-	-	0.08
α -cubebene	-	0.31	0.67	-
<i>Trans</i> - α -Bergamotene	-	0.15	0.17	-
Caryophyllene	-	-	0.17	-
α -Calacorene	-	-	0.03	-
3-methyl-4-undecene	-	1.13	-	-
Alkane				
Dodecane,1-fluoro	-	0.06	-	-
Carboxylic acid				
Benzoic acid	0.24	-	-	-
Acetic acid	-	-	0.16	-
Propionic acid, thio-,S-isopentyl ester	-	0.26	-	-
Ester				
Phenbromate	0.18	-	-	-
Ether				
Methoxymethylbenzene	0.17	-	-	-
Benzenepropanoyl bromide	-	0.23	-	-
Eucalyptol	-	0.04	-	-
Ketone				
Ethanone	1.11	0.06	-	-
1,2-Naphthalenedione	9.03	-	-	-
2H-1-Benzopyran-2-one	-	10.59	9.86	6.51

Cheng et al.,(2006) stated that cinnamaldehyde was the active compound in the cinnamon essential oil that has excellent inhibitory effect in controlling the red imported fire ant. The

percentage of the cinnamaldehyde obtained was compared with various method of extractions showed in Fig. 3.

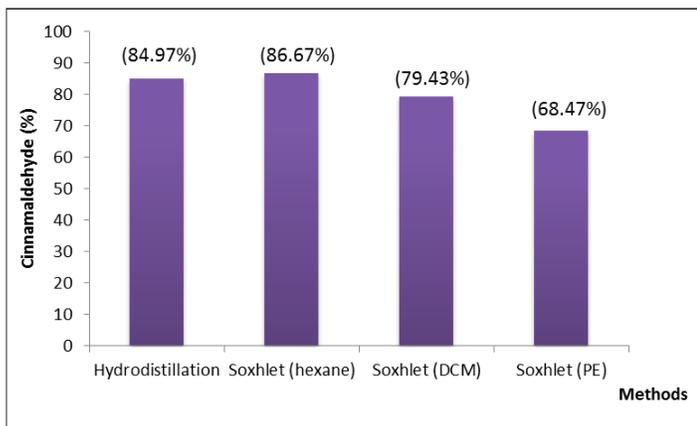


Figure 3 : Percentage of cinnamaldehyde from cinnamon essential oil via different extraction methods.

Based on Fig. 3, the cinnamaldehyde obtained by hydrodistillation was 84.97 % . It showed significant differences than the percentage of cinnamaldehyde reported by Li et al., (2012) which was 77.21 % . The results obtained from Soxhlet extraction method, the highest percentage of cinnamaldehyde was from the extraction using hexane which at 86.67 % followed by dichloromethane at 79.43 % and petroleum ether at 68.47 % of cinnamaldehyde. It is due to hexane was known to have the lowest polarity index compared to petroleum ether and dichloromethane. It is much more convenient to use hexane as it is highly non polar solvents and suitable to extract non polar substance such as oil. From these results, hydrodistillation method was almost as good as Soxhlet extraction using hexane method in obtaining high percentage of cinnamaldehyde.

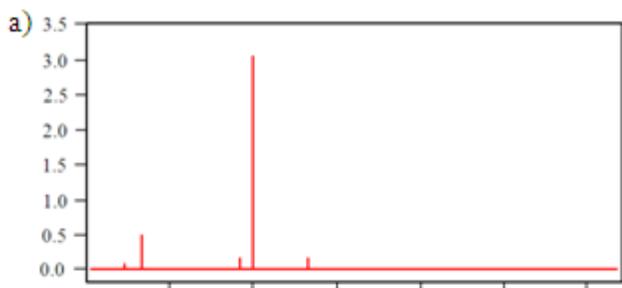
In Fig. 4 spectrum chromatography of cinnamon essential oil and the retention time of cinnamaldehyde in the different extraction methods used in extraction of cinnamon essential oil. From the chromatogram, the retention time for all the cinnamaldehyde present in the cinnamon essential oil using various extraction methods were quite similar which at the average of 19.761 min at retention time.

Figure 4: Spectrum chromatography and retention time of cinnamaldehyde in different type of extraction methods; (a) hydrodistillation, (b) hexane, (c) DCM, (d) petroleum ether.

Repellency and Insecticidal Activity

This repellency activity has been carried out to determine the repellency of ants toward fabricated repellency paper with the cinnamon essential oil applied on paper . While, insecticidal activity was carried out in a closed container for 90 min of exposure of 20 ants to the cinnamon essential oil and cinnamon powder paper. Mortality based on number of ants that died were recorded.

Repellency Test on Fabricated Repellency Paper



The repellency of ants toward paper coated with mixture of paraffin wax and cinnamon essential oil known as fabricated repellency paper were studied and shown in Fig. 5. The repellency activity was determined and compared by different concentration of cinnamon essential oil mixed in constant volume of paraffin wax.

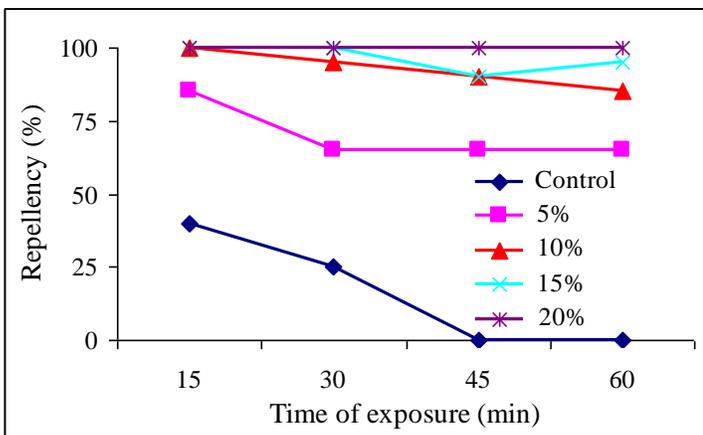


Figure 5: Repellency of ants on paper coated with mixture of cinnamon essential oil and paraffin wax

The results showed that the percentage of repellency increased with increasing concentration of cinnamon essential oil. At concentration of 20 % cinnamon essential oil, all ants completely repelled after 15 min and it continuously gave 100 % of repellency after 60 min. When concentration decreased to 15 %, the repellency also decreased to 95 % after 60 min. Similar trend also observed for 10 % of cinnamon essential oil with a constant decrease in repellency from 100 % starting at 15 min to 85 % after total of 60 min. The concentration decreased to 5 % and the percentage of repellency also decreased to 65 % after 30 minutes and the percentage keep constant after 60 minutes. The repellency of control was 40 % at first 15 minutes and it declined until the repellency for control was 0 %. The results indicate that 20 % of cinnamon essential oil provide highest repellency performance.

Insecticidal Test on Fabricated Paper

The mortality of the ants were determined by different concentrations of fabricated repellency paper. Mortality of 20 ants were determined over 90 minutes of close exposure and the results were shown in Fig. 6.

An increased in concentration of cinnamon essential oil causes the mortality to increase. At concentration of 20 % cinnamon essential oil, it can terminated the ants completely after 90 min. This result was comparable to the study by Cheng et al.,(2006) that reported the cinnamaldehyde killed all the red ants after 90 minutes of exposure. Followed by 15 %, 10 % and 5 % of cinnamon essential oil gave the percentage mortality of 65 %, 50 % and 25 %, respectively after 90 min of close exposure.

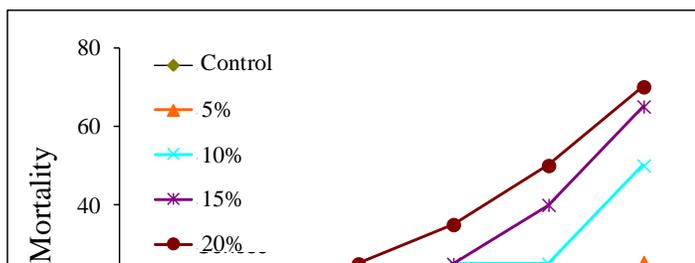


Figure 6: Mortality of ants by using cinnamon essential oil and paraffin wax mixture coated onto paper with different concentrations

III. CONCLUSION

Hydrodistillation and Soxhlet extraction with different solvents which are hexane, dichloromethane and petroleum ether were successfully carried out to obtain the cinnamon essential oil yield from bark of *C.cassia*. Soxhlet extraction using dichloromethane as a solvent extraction shows the highest yield of cinnamon oil followed by hexane and petroleum ether were 5.22 %, 3.84 % and 3.71 %, respectively. While only 1.82 % yields of cinnamon essential oil extracted when using hydrodistillation method. GC-MS analysis indicated the apparent difference in the volatile compound compositions of cinnamon essential oil between various extraction methods. The total numbers of volatile compounds identified from hydrodistillation method, Soxhlet extraction using hexane, petroleum ether and dichloromethane were 9, 11, 13 and 6 respectively. Trans-cinnamaldehyde was found in the cinnamon essential oil extracted by each method, which was also the major volatile component that responsible for repellency and insecticidal activity of ants. Highest percentage of cinnamaldehyde obtained was from Soxhlet extraction using hexane followed by hydrodistillation method, Soxhlet extraction using dichloromethane and the lowest using petroleum ether at 86.67 %, 68.47 % and 79.43 %, respectively. However, hydrodistillation method was almost as good as Soxhlet extraction using hexane method in obtaining high percentage of cinnamaldehyde.

In both repellency and insecticidal activity of ants, cinnamon essential oil shown a positive result which can repel and kill ants at certain concentrations. The highest concentration of cinnamon essential oil gave the highest mortality and repellency percentage and will be the effective and environmentally benign agents in ants control.

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Pilot Study of ‘Similarity’ in Judaism, Christianity and Islam and Its Relationship with Globalization

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Abstract- The factor ‘similarity’ is important in multiple ways in interpersonal relations and can be relevant to globalization, the study of similarities among Judaism Christianity and Islam, if exist, can help to facilitate globalization. To study such similarities a questionnaire based on the similarities mentioned in Torah (Jews) Gospel (Christians) and Quran (Muslims) was prepared and disseminated to the similar groups belonging to all the three faiths and after commuting the scores on similar choices the scores compiled. It was found that above 80% of the respondents from all the three groups irrespective of gender, religion and knowledge about religion maintained similar attitudes towards the hypothesized statements based on ‘similarity’. A very large *p*-value within the groups confirms the hypothesis that the proportion is same in all the three groups and the homogenous behavior exists among the groups in case of ideologies.

Index Terms- Similarities, Judaism, Christianity, Islam, globalization

I. INTRODUCTION

Many studies prove that the factor ‘similarity’ is important in multiple ways in interpersonal relations Griffith and Veitch (1974) in (Papalia and Olds, 1985) found that people wanted to keep the ones most like them and wanted to get rid of the ones least like them. ‘Both friends and spouses tend to be similar in race, age, socio-economic status, religion, education, intelligence, values and leisure activities’ (Papalia and Olds, 1985). Moreover, it was found that, ‘Man who feel romantically inclined towards a women overestimate the similarity of her ideas and interests to their own’ (Myers, 1993). Further more it was proved that ‘figures similar to each other we group together. We see the triangles and circles as vertical columns of similar shapes, not as horizontal rows of dissimilar shapes’ (Myer, 2004) and ‘some ones similarities to us make the person seem more attractive’ (Myers, 1993). Moreover, it was found that ‘similarity generally has a positive effect on attraction, it is reasonable to expect that people help those who are like themselves’. ‘Studies in real life stress in Israel show that ‘attachments styles’ help ‘people benefit from social support’ although ‘too much similarity can sometimes be threatening and cause potential helpers to blame the victim’. (Baron et al:1998).

One of the objectives of ‘globalization’ after cold war is to find out ways to develop good and healthy relationship among the peoples of globe. Judaism, Christianity and Islam are three important religions of world and people believing these faiths are a significant part of world population. So discovery of a factor

‘Similarity’ among these three faiths can be helpful in many ways to promote globalization and the harmony of the world brining the people of all the three faiths further close to each other for Griffith found in (Abraham 1995) that when someone attitude ‘affirms’ our own we feel ‘pleasant’ and ‘pleasure’ leads to happiness and majority likes happiness furthermore Abraham 1995 found while decision making we consider ‘others’ and ‘similarities’ in that context are likely to be helpful for judgments about ‘others’ and would serve to remove ‘conflicts’ (Hellriegel and Slocum: 1976) Moreover, Smeaton, Byrne, and Murnen 1989 in (Baron et al: 1998) conclude that during interaction each person evaluates the other on the basis of ‘proportion of similar attitudes’ Cole et al, 1997 in (Baron et al: 1998) found that ‘individuals whose attachment pattern is secure are more likely to cope effectively with stress through support seeking than are those with ambivalent or avoidant attachment patterns and since ‘pleasure’ is a reward and ‘pleasant emotional state exists when two people like each other and agree about some topics’ Newcomb 1961 in (Baron et al: 1998). In that manner the study is likely to promote globalization for Byrne 1971, Byrne and Clore, 1970, Byrne and Griffith 1966, Byrne and Rhamey, 1965 in (Abraham 1995) found that, ‘we like those others who are associated with reward’. (Abraham 1995) and ‘pleasure’ or ‘happiness’ if it is associated with the ‘similarities’ is a reward in itself, above all human problem solvers are often strongly governed by similarity: (Anderson: 1980) and solving a problem to a some degree is a rewarding behavior for ‘knowing’ that ‘ I have done a good thing is also a reward’ (Batson:1995). The study is also likely to help to reduce ‘contrast error’ that refers to the general tendency on the part of a rater to judge others in a manner opposite from the way in which he perceives himself’ (Blum, Naylor: 1984) if it exists in anyway.

II. METHOD

To determine and inquire about the factor ‘similarity’ the authentic source available was the religious books of three faiths, Torah (Jews), Gospel (Christians) and Quran (Muslims). (Since the original version of Torah was not available so Jew scholars and the representatives of Jew organizations and a few professors of comparative religion in US were approached through email. Later Bible published in USA was included in the study that includes both Torah and Gospel after conforming from the scholars belonging to the religions confirmed that authentic versions of both Torah and Gospel are included in Bible). The review of the literature revealed a notable similarity among the teachings of all the three faiths some of the similarities found are:

Creation of World: In the beginning God created the heavens and the earth. (1 Beginning or '*Bereishith*' in Jewish terminology) Bible

He is Who created for you all that is in the earth. Then turned He to the heaven and fashioned it as seven heavens. (29- The Cow) Quran

Creation of Man: God created man in its own image (27 Beginning) Bible

He hath created man (3 The Beneficent) Quran

God appoint Messengers, *Moses (God's Messenger to Jews) Jesus (God's Messenger to Christians) Muhammad (God's Messenger to Muslims)*

The LORD said to Moses," Speak to the Israelites and say to them, 'I am the LORD your God' (Leviticus or *Vayiqra* in Jewish terminology 18-3) Bible

And you ,my child (Jesus), will be called a prophet of the Most High: for you will go on before the Lord to prepare the way for him, to give his people the knowledge of salvation through the forgiveness of their sins' (Luke-76-77) Gospel Bible

He hath revealed unto thee (Muhammad) the Scripture with truth, confirming that which was (revealed before it, even as He revealed the Torah and the Gospel. (3- The Family of Imran) Quran

Kindness

Do not take advantage of a widow or an orphan (Exodus 22-22) Bible

'Blessed are the meek, for they will inherit the earth. (Matthew 5-5) Gospel

Therefore the orphan oppress not. (The Morning Hours: 9) Quran

Idolatry

Then the LORD said to Moses," Tell the Israelites this: You have seen for yourselves that I have spoken to you from heaven: 'Do not make any gods to be alongside me: do not make for yourselves gods of silver or gods of gold' (Exodus: 22-23 p. 72) Bible

"A third angel followed them and said in loud voice: 'If anyone worships the beast and his image and receives his mark on the forehead or the hand, he, too will drink of the wine of God's fury, which has been poured full strength into the cup of his wrath, He will be tormented with burning sulfur in the presence of holy angles and of Lamb. (Revelations: 9: 10 p.875) Gospel

Those who believe do battle for the cause of Allah: and those who disbelieve do battle for the cause of idols, So fight the minions of the devil. Lo! the devils strategy is ever weak.(76: Women p. 94) Quran

III. PROCEDURE

A questionnaire was disseminated among subjects of equal number to all three faiths following (Kerlinger 1964) recommendation for 'questionnaire' for such studies. The

questionnaire consisting of 11 questions containing 4 multiple choices each reflecting general attitudes towards , God, creation of Universe, man, appointment of prophets, places , religious practices like reciting holy books, moral values like truth and kindness, ideas about life after death, social approval and disapproval for social and religious groups for example 'idolatry' were made. Among the four options in each question one option was purely based on the agreed upon the general facts presented in all the three religious books known as 'Scripture' including Torah (Jews) Gospel (Christians) and Quran (Muslims) to find out that how much 'similarities' still exist in the followers of three faiths. After finalizing the questionnaire it was completed by a sample of 30 subjects consisting of 10 subjects from each religion including 5 males and 5 females, among these 5 with the background of sufficient knowledge of their faith and 5 with average knowledge about their faith irrespective of gender. Mr. Kamal Chughti an associate of Government of Punjab: Pakistan helped to get the required representative sample of Christians. Muslim sample was selected from departments of Islamic Studies and Arabic, GC University Faisalabad with the help of Professor Dr. Shahid Mehboob Rana the Vice Chancellor. Since the data about Jews was not available in Pakistan so 'Sashwm' a group of GC students arranged to get the questionnaires for Jews filled by post with the help of their friends in Australia those delivered the questionnaires to their Australian Jew friends and returned these to the researchers after completion.

IV. RESULTS

It was found that above 80% of the respondents from all the three groups belonging to three faiths irrespective of gender maintain similar preferences towards the hypothesized statements based on similarity. A very large *p*-value within the groups confirms the hypothesis that the proportion is same in all the three groups.

V. DISCUSSIONS AND CONCLUSIONS

Significant homogeneity was found among the groups to select the hypothesized items while reflecting their views about God, idolatry, appointment of prophets, religious practices like reciting holy Scripture, following social and moral laws like 'kindness' and 'speaking truth', life after death, creation of man on the earth and constituents of man

The results reflect that Torah, Gospel and Quran the religious books of all the three religions Judaism, Christianity and Islam known as 'Scripture' contain contents and possess the potential that can be helpful to find out 'similarities' among these three religion. Moreover, the pilot study reflects that people belonging to these three faiths irrespective of gender and religious knowledge react to these 'similarities' in significantly similar manner.

However a few variations from general trends were also observed. An interesting finding of the study was that all Jews responding to the question, Torah is? Unanimously selected the item, b. a book about religion instead of hypnotized, A word of God as selected both by Christians and Muslims. Since Jews are a religion as well as a race so perhaps they have their own sacred

version of Torah available with them that to them may not be common and assessable or available to non Jews for Clark 1995 found in (Sternberg;2003) that 'meanings of words are determined by conventions'. However in general the pilot study reflects that if the similarity among the religion of Scripture would be explored on large scale and with the help of representative sample and than would be communicated to the people belonging to all the faiths in an affective manner than it would not only help to promote further harmony and understanding among the people having faith in God rather it would certainly contribute positively towards the on going process of globalization.

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Design and Development of Seat Belt Alert System with Ignition Interlocking in Four Wheeler

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Abstract- This paper clearly explains about the safety and control systems in the car . Most of the accidents are occurred because of violation of rules . Result of this major accidents happened .In our day-to-day life we are careless in our safety while driving in vehicles for this we have to introduce some techniques to do these precautions compulsory . Such a new technique is explained in this paper.While driving car wearing seat belt is important that can safe our life during accident periods .But most of us are careless to wear seatbelt .

When accidents that careless mistake makes loss of life of driving person and near person . more injuries for driving person and near person only than back sitting persons .



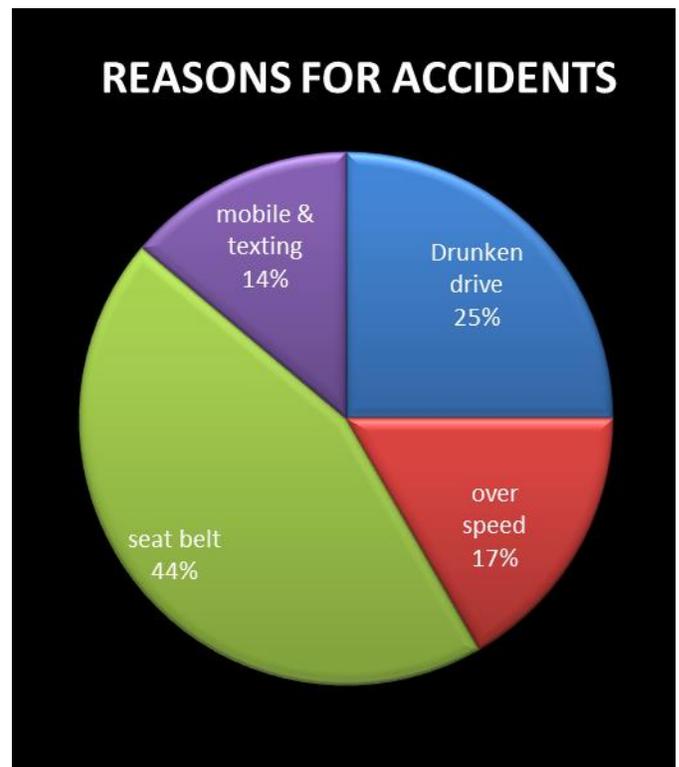
I. STATISTICS FOR THE CAUSE OF ACCIDENTS (TAKEN FROM WHO)

Every year the lives of almost 1.24 million people are cut short as a result of a road traffic crash. Between 20 to 50 million more people suffer non-fatal injuries, with many incurring a disability as a result of their injury.

Road traffic injuries cause considerable economic losses to victims, their families, and to nations as a whole. These losses arise from the cost of treatment (including rehabilitation and incident investigation) as well as reduced/lost productivity (e.g. in wages) for those killed or disabled by their injuries, and for family members who need to take time off work (or school) to care for the injured.

There are few global estimates of the costs of injury, but an estimate carried out in 2000 suggest that the economic cost of road traffic crashes was approximately US\$ 518 billion. National estimates have illustrated that road traffic crashes cost countries between 1–3% of their gross national product, while the financial impact on individual families has been shown to result in increased financial borrowing and debt, and even a decline in food consumption.

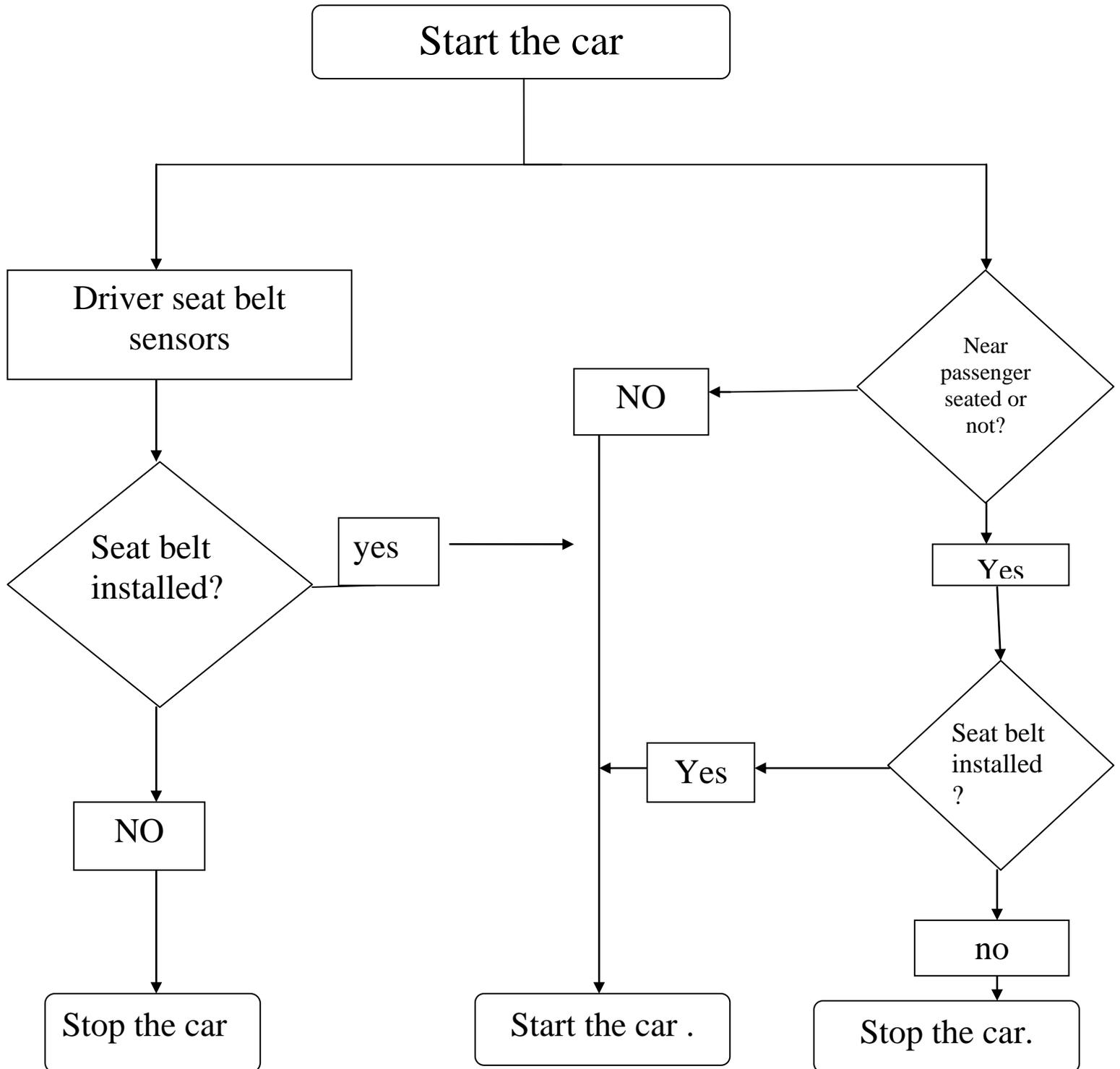
Road traffic injuries have been neglected from the global health agenda for many years, despite being predictable and largely preventable. Evidence from many countries shows that dramatic successes in preventing road traffic crashes can be achieved through concerted efforts that involve, but are not limited to, the health sector.



II. HOW TO REDUCE ACCIDENTS ?

We can avoid accidents by wearing a seat-belt reduces the risk of a fatality among front-seat passengers by 40–50% and of

rear-seat passengers by between 25–75%. For this we have to make a controlling system by which wearing seat belt is made as compulsory. The operating principle of the controller is explained in the below flow chart.

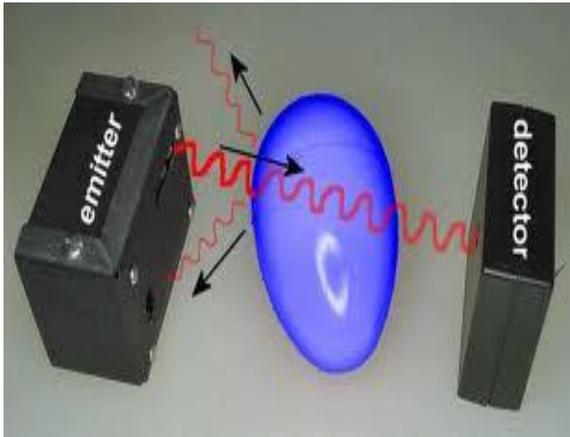


This technique is to detect that the seat belt was installed successfully or not .If the driver tries to start the car the controlling system checks that the driver worn seat belt or not if he / she worn then car will start if no car will not start . then the controlling system checks that the near passenger is seated or not . if nobody was there then car will start . if anybody was seated then the controlling system checks that the person worn seatbelt or not if yes car will start if not car will not start.

micro controller is connected with ignition system this helps to start the car only if the seat belts are installed perfectly. Microcontroller is connected with a alarm to give alarm to the passengers if they did not installed their seatbelts . below pictures clearly explains the working mechanism of our controlling system

III. HOW WOULD BE THIS POSSIBLE?

This control system can be made by using IR sensors to detect that the seatbelt is installed successfully .These IR sensors are attached with both driver seatbelt and with near seatbelt.

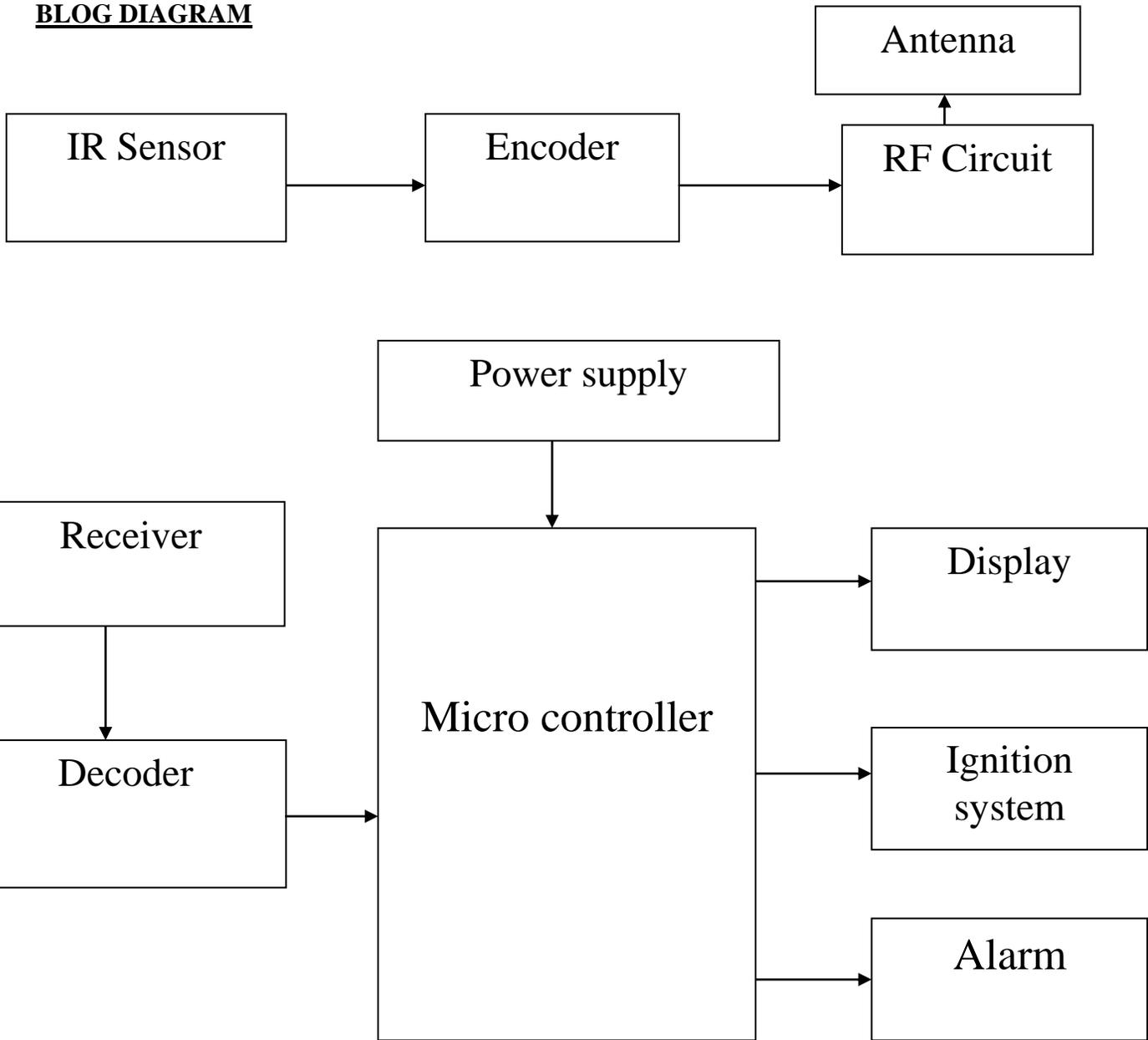


The seat belt is placed between the IR emitter and detector . The seat belt is teared horizontally at the center after leaving some length this helps to receive IR rays from the emitter by the detector to complete the circuit and it is encoded to RF circuit it converts it into radio frequencies . the radio frequencies are transmitted through antenna.

These radio frequencies are received by a receiver and it is decoded to micro controller . Microcontroller is programmed and it is connected with display to indicate to the passengers. And



BLOG DIAGRAM



Such a system is used to detect that the seat belt was installed successfully or not for the driver seat. Wearing seatbelt for the near passenger is too important. First of all we have to find that the passenger was seated or not for this we are going to place less tension springs from this we can find that the passenger was seated or not. If there is no passenger was seated then car starts if the driver worn seat belt. If any passenger was seated at there then similar controlling system is used to detect that the person was installed seatbelt or not. If that person worn seatbelt and car starts if not seatbelt installed successfully then the car will not start.

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By using such a control system we can avoid the death in accidents. Such control system should be used in all vehicles. This control system is very cheap in cost.

IV. CONCLUSION

The road accidents are now proving to be one of major losses of human resources although the accident are not fully solved but the losses from the accident can be avoided by wearing the seat belts. By ensuring the seat belt it can be used very effective in saving the man life.

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John Updike's Indian Connection

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I. INTRODUCTION

S is the title of John Updike's unusual novel. This novel was the third in the Scarlet Letter Trilogy. The title itself arouses curiosity. Why only S? What does it stand for? One gets the answers only after reading the novel. The novel is in the form of letters sent by a woman to her husband, daughter, mother and a friend. She signs the letters by different names. To her husband she is simply S. To others she is either Sarah Worth or Kundalini or simply K. She is the protagonist of this novel. What is she? She is a woman who has deserted her house in search of spiritual peace. She is living in a spiritual commune with her guru. The story of her past and present is gradually unfolded through these letters. The reader comes to know about her personality, her married life, her frustrations and her life at the religious commune through these letters. Her final findings are revealing but not rewarding. Is she enlightened or is she disillusioned at the end of her quest? At least we get her impressions. We learn that her name is Sarah which stands apart. She calls herself S because she wants to free herself from her name. She is unhappy in her marriage and so lives away from her family and she wants to forget her past and everything associated with her married life. She lives wholly in the present and refuses to think about future. S is symbolic of her intense desire to get away from her former personality.

Updike has made it clear in author's note that some details of the novel were based on the reports on 'Rajneeshpuram' in Oregon Magazine. He has interwoven facts with fiction. Swami Arhat or the guru of S. is similar to Rajneesh in many aspects. It becomes very clear after reading the novel that the author has made a careful study of some books on Yoga and oriental mythology.

But that happens to be the background. The fiction is the author's imagination. It is his attempt to study the deep layers of feminine psyche. Updike's women characters have come a long way. Their journey began with his first book *The Same Door*. In the beginning their voice could be faintly heard. In *Rabbit Redux* and *Museums and Women* they made their appearance felt. In *A Month of Sundays* and *Marry Me* they became aggressive. Updike turned them into witches in *The Witches of Eastwick*. And their journey still progressed in S.

The reader finds that Updike's women characters have reached a new height in S. She is searching her own identity. She is trying to develop her personality. She is groping her way out. She seems determined. She is not uncertain or totally submissive. She is not only an object of pleasure but she is out to enjoy the pleasure. She has given up the petty fears of morality, the social status and the family attachments. S. is representative of this woman against the background of religious commune and oriental philosophy. Updike has taken full notice of the women's movements and the feminist critics.

The novel begins with a letter to Charles, Sarah's husband. She has not informed him about anything but has simply left the house with some money and a hired car. She has left house after twenty two years of married life together. For these twenty two years she writes.

"Through my thirties I was shamelessly happy about being me, being part of us. I loved our renovations. I grisly enjoyed doing battles with the aphids on the roses and the chinch bugs under the sods and the garden boys with their headphones and their lazy stoned smiles. I even loved those famously dreaded suburban cocktail parties, going in the car with you and in the door on your arm and then us separating and coming together at the end. I loved you, my eternal date, the silent absent centre of my storm of homemaking, the self important sagely doctor off in his high rise palace." (S page30)

Her husband, a busy doctor wanted her to be an ideal housewife. He wanted her to host the parties, look after the household duties. S thinks that she was a nonentity in her husband's house. So she decides to desert him and the family. She was 'too stoical, too puritan too much a creature of her society for solitary rebellion'. So she tells her husband that she will change everything including her name. She wants to sever all previous bonds and wants to dissociate herself.

But can she dissociate? Are the family bonds so easy to sever? No. Right in the first letter the reader comes to know that she is very fond of the things she wants to forget. She loves her husband in spite of his neglecting her. She had been caring for him for such a long time that detachment is difficult.

She has left all her relatives in search of an identity. She is after the spiritual truths. But she finds it very difficult. In her letter to her daughter she is very tender. Something moves her to her very foundations. She gives reasons for her strange behavior. She tries to give reasons for her strange behavior. She tries to give her motherly advice. She has fears in her mind that her child may misunderstand her. Updike has made a very careful study of the woman's mind.

"We of the frailer sex have to have some wild hope, something to go on. Otherwise a million years of slavery has conditioned us to huddle by the hearth, stony as it is, and pound some more millet, and get pounded in turn by way of thanks, and commune with the moon. I speak as one of my generation, that come of age just as fifties ended I was nineteen when Lee Harvey Oswald shot them dead and then by twenty I was married to your father and working too hard to support him really to notice that a revolution is going on." * (page 12)

She suggests here that she missed a revolution when she was busy in household chores. She wants her daughter to understand her despair and frustration. She wants her to know

Her hopeless situation as a devoted wife without any identify of her own. She thinks that her past was a sheer waste.

She adopts different tones while writing to different people. To her husband she is very blunt. With her daughter she becomes soft. Her mother's heart melts out when she addresses her. And when she writes to her friend Midge she is very open. She pours out the deepest feelings of her heart. She also sends tapes with her letters to this friend of hers because she knows that there are less chances of misunderstanding with her friend, who knows her well.

The reader comes to know about her religious adventures, her guru and the other community members. The commune she lives in believes in free sex. They have no reservations about that. The commune has no objection to drugs also. For S this is very much ordered life or routing life. She had been bound to the moral code but now she finds no chains at all. For her it is like a bird who has suddenly found freedom after spending years in cage. She was not aware that such freedom existed anywhere. In a worldly sense her life was so far perfect but now her very concepts change. In the company of Swami Arhat and his band she has a realization. She looks at the world in a new light. Midge is her close friend so she reveals everything to her without any reservations. In her tapes and letters she gives the account of her encounter with a rapist, who is in the ashram in the guise of a sanyasi (a monk). She has sexual relations with one other ashramite. What makes her letter typical is that she requests her friend to keep her sexual adventures secret from her husband. It is because she has respect for her husband and she loves him. She has deserted him but she cannot totally dissociate herself from him or her family.

She gives detailed description of Sami Arhat and her conversation with him. He gives her the name of Kundalini or the latent power. (According to Pantanjali the ancient Yoga guru, the Prime Energy resides at the base of the spinal cord in a serpentine form. It has to be awakened with the Yoga practices under the supervision of a guru.) His obsession with worldly things and women is apparent from the very beginning. She does not think that it is wrong. She accepts it in a normal way. She describes it in her own way.

“You say 'Saham' you are she.”
“Saham. I am she.”

“Great Kundalini, stand so I may meditate upon your body, each glistening particle, each cell of skin, each hair and gland. Think with me of your body cell by cell, as something greater than galaxies, greater than the entire jewel tree. You are like Bodhisattva standing in the land of Bliss, in Sukhavati. You are infinitely tall, infinitely splendid.

“You are immensely radiant, Amitabha. You are Amitayas, forever enduring.”

“Mm. That feels nice. Ticky but nice.” * (page 160)

And what follows is fit to be in any porno book. It is not meant to. The description is fitting to the part of the story. Updike goes on giving such things because his themes are related to them. Why does S give description? She and through her Updike wants to point out the difference between her past and present.

The difference between her husband's lovemaking and Arhat's is that Arhat's Lovemaking makes him an equal partner.

His is a religious affair. His constant talking and quoting Sanskrit texts gives her a sense of satisfaction calling her his eternal shakti gives her a feeling of elevation. Her husband loved her as his wife but Arhat loved her as 'Vishesh Rati' or as an extraordinary Female. She expresses on her experience in these words.

“But, my God, the gentleness of the force that comes off him, it's like an oil bath, it's like the shot of whisky we used to take working its way into our blood, all churned up, these first few minutes. And once he slipped out of what can I call it? - his master hood his cosmic distance, and perched forward on that big silver threaded armchair he uses as a sort of throne to grab my ass, I had this incredible wave of pity, of wanting to open myself the way I used to do to little Pearl, to become this brainless fountain of life. I mean, the vibes I got was not so much that he needed to fuck me as feed on me, the way he says we all feed on him. With Vikshipta there really was this sensation of his wanting to sock it to the whole world and I was there under him as a kind of delegate, and the joy of it all for me was my ability to “take it” to absorb the fury and make it into something positive-but with the Arhat' idea of being a jivanmukta was that you needed nothing.” * (page 17/18)

She describes her encounters with Vikshipta, one ashramite and Arhat in this paragraph. She goes on living there. She becomes adept in the ashram terminology. Sukha, Dukha, Prakriti, eternal Purusha etc. are freely used by her. In the meanwhile her husband, daughter and friend all try to persuade her into coming back. The lawyers keep pestering her because she has come away with some money. In her answers she tries to convince all that whatever she did was right. Her pragmatic mind does not forget anything. From her mother's letters she comes to know that she (her mother) is flirting with some old retired admiral. She tries to tell her mother that the admiral might be after her money and she should keep him at an arm's length.

Her daughter is away in England and she is infatuated with some Dutch boy. At this time her husband is trying to convince his daughter that S. has run away. In her letters to Pearl S. rhetorically tells her daughter that it was she who cared for her. Her father and the entire male society have always tried to dominate the female society.

Then comes the time when S. comes to know that Swami Arhat is an American. He is not an Indian but had lived for some time in India and had studied Indian holy books to give the impression that he is a Hindu. (Updike has confused Hindu and Buddhist texts.) This is some revelation, a sort of eye opener. She does not have the feeling of cheating. She is not shocked but a bit disturbed. Whatever might be his origins, she feels that she has received something wonderful from him. He opened new horizons for her. He gave her a new image and changed her personality thoroughly. His manners, quotations and his calling her Shakti have given her new meaning to understand life. She is a remarkable character.

Her uniqueness is her boldness and her presence of mind. Updike has created a number of women characters but S. stands out. The witches in The Witches of Eastwick are also bold but there is wickedness in them. S is bold in her adventures but she is not wicked. Updike has carefully conceived her. She is kind and loving. She has no malice towards anybody. As soon as she arrives in the commune she confronts Durga, the old companion

of the Swami, who finds the new arrival a threat to her authority. And her fears are not groundless as S soon becomes the favourite disciple of the Swami. But at the later stage of the novel Durga and S become friends. She has love for her husband who treats her as a domestic servant. She even writes kind letters to a convict, who is serving a sentence in a jail. She has concern for her mother. Her letters show that. Similarly she is aware of her duties as a mother. Her letters to her husband Charles are outwardly dry but if we read between the lines we find that she is very much attached to him and the memories of her days with him are evergreen in her mind. When she learns that he is marrying her friend Midge, her reactions are typical and they show how much pains Updike has taken to build her character.

She writes,

“Charles, I can’t express how serene and benign I feel about you and me. Parting is an illusion. Loss is an illusion, just as is gain. We shed our skins but something naked and white and ‘amara’ slithers out and is always the same things can’t be undone, it would seem. There is a gain in it ‘prakriti’, an arrow of time. We get tired. Do remember and remind the despicable Gilman that whether or not this divorce goes through is to me matter of utter indifference. Having known the Arhat’s divine love I am not in the market (unlike needy old you) for any further attachments. I need to be still and feel now I have acquired the means to be still.” *51(page 228/229)

Alinga is one ashramite with whom S has special relationship. In some ways she resembles her daughter so she has maternal feelings towards her but in some letters it seems that S. has homosexual relations with this girl. It is a delicate relation. Her maternal feelings and her yearning for a good companion are combined together. It shows that S is hungry for love and it is natural because she has spent many years without any real affectionate friend. As she herself tells, her mother was a dominating type and her father a kind but wife-fearing man. She had to give up education to get married. That was at the age of twenty. Her husband Charles is a doctor who being always busy has no time for romantic interlude. She suspected that he has affairs with the nurses. Her only daughter is away from her.

Pearl is in England. This has made her life colourless and dull. For twenty two years she has been suffering and tolerating the humdrum of life. Then she hears about Arhat and his commune. There she learns the real body language. In her contact with the different ashramites she gains something. She learns new meaning of love or ‘Luff’ as the Swami pronounces it. She complains about none even at the time when she learns that the Swami is not a Hindu at all. Alinga’s relations with her open new dimensions for her. She is having new experiences. Alinga’s relations with her open new dimensions for her. She is Alinga’s ‘dark prince’ and for her Alinga is like her daughter.

“She – Alinga, of course-is I believe thirty-one and has been around the world several times since leaving Car Rapids and arriving here, and I know you and she could share as much through her, my dear elf child I often feel drawn towards you. She can be very irreverent, even about the Arhat, and you would enjoy that with your wicked sense of humour...” *(page 77)

S is a pathetic story of a woman. Like all Updike’s women characters, she happens to be a middle class American woman. She has that suburban mentality in her. Her feelings and

reactions are not extra ordinary. They are like any other woman but what makes her different is her Indian connection. Outwardly this may sound absurd but it is not. It is a serious attempt. For example this Arhat’s tape is enough.

“Servasem eva mayanam, strimayaiva vishishyate.” This is from an ancient Mahayana text and says, “Of all forms of illusions woman is the most important.” For Buddha and his followers, a woman is the portal of release. She is that within the world which takes us out of the world. She is that being through who is made manifest the Karuna, the compassion, of nirvana of non-being. She is the living wonder of the world.”*(page 91)

What follows is a description of a woman and her body and an attempt to give spiritual meaning to all those things. S is trying to learn this shakta terminology in which a woman is worshipped like a goddess. The sex and body language is part of the ritual S becomes an active participant in it. There is more to it. Compared to Alinga, she is an old lady. She is mature. She is in her forties. Yet she feels that the ashram and the ashramites have given new dimensions to her personality. There is Christianity in here and there is Hinduness in her. She is strangely Indian in some ways. And Arhat finds these elements in her and that makes the novel different.

AUTHORS

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A Study on the Impacts of Corn cultivation (*Zea mays* (L.) Family – Poaceae) on the properties of Soil

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Abstract- Maize or Corn (*Zea mays* L.) is the most important cereal in the world after wheat and rice. It possesses high nutritive value and is important as a coarse grain. In Sri Lanka, this crop has cultivated, around 30,000ha and local consumption is around 200,000mt annually. Further, Maize is an easily grown crop and the cultivation has been popular among farmers as a cost effective crop with limited fertilizers. This Crop earns a reasonable foreign exchange as it is used as infant foods. Maize has a higher leafy mass and higher vegetative growth within shorter period of time than the other monoculture crops. Therefore, like for many other cereal crops, it is worthwhile in studying the environmental impacts due to this plant. Many researchers have shown that soil is the most affected environment due to monoculture plants. But no proper studies on soil quality changes due to this maize crop have been conducted in Sri Lanka. Therefore, it is high time for us to initiate this kind of preliminary study directing relevant authorities to implement suitable extensive research in this area. The objectives of the present study were to find out how soil properties have changed due to corn cultivation, to assess whether soil is under stress or degraded (reduced soil quality) and to suggest suitable measures to restore the soil or improve the soil quality. This study attempted to examine the level of soil deterioration occurred over the time and some impacts on soil quality during different growth stages of maize such as beginning stage, growing stage, blooming stage and after harvesting stage. Some selected soil characteristics (physical, chemical and biological) of maize sites were tested and soil samples of adjacent forest in Anuradhapura district were used as a control. Soil moisture, soil conductivity, soil organic carbon (SOC), soil nitrate and soil microbial biomass were higher in the natural forest than maize plantation. Bulk density, air content, soil permeability, coarse sand and fine sand content were higher in the maize plantation than the natural forest. It is obvious that maize planted soil is under stress or leading to some soil quality degradation. Therefore, necessary measures should be applied to avoid further damage and restore the soil quality for future generations.

Index Terms- Microbial biomass, bulk density, soil quality, degradation, monoculture crops

I. INTRODUCTION

The present world production of maize is about 335million tons and maize belongs to the genus *Zea* and tribe mayease [1]. Large quantities of maize are imported for fodder, as a staple food of man, a livestock feed, a raw material for many industrial products such as infant foods and as an export product to earn

foreign currency [2]. Further this crop has been introduced to many areas in the country by many local and foreign companies. This plant shows very high vegetative growth within short period of time [3]. So the scientists feel that some sort of soil quality deterioration should be there and that could lead to severe soil degradation. Further, no proper studies have been conducted to investigate whether there is any impact on the soil quality due to this monoculture maize plantation, especially in Sri Lanka. Several studies have been carried out in other countries and they have indicated intensive soil quality changes due to corn cultivation. Maize has a large number of cultivars with different maturity periods and with different tolerance levels to environmental condition. Maize can be grown on a wide variety of soils, but well drained, deep, silt loams with adequate organic matter is the most suitable.

Soil is a valuable resource and the importance of soil has made the scientist to attempt in identifying its functions (sustains biological activity, diversity and productivity, regulates and partition water and solute flow, filters, buffers, degrades, immobilizes and detoxifies organic and inorganic materials including industrial and municipal wastes and atmospheric deposition stores and cycles nutrients and other elements within the biosphere) [4].The integration of growth-enhancing factors that makes a soil productive has often been referred to as "soil quality". The Soil Science Society of America (1984) defines soil quality as an inherent attribute of a soil which is inferred from soil characteristics or indirect observations (e.g., compactability, erodibility, and fertility). Soil quality is the capacity of a soil to function within an ecosystem and sustain biological productivity, maintain environment quality and promote plant and animal health [5]. The chemical and biological soil quality indicators for agro ecosystems which are useful in evaluating the soil quality status owing to their early reaction to soil condition change [6]. Among these indicators, microbial and biochemical properties have been widely reported for measuring the soil quality [7].

Soil quality can decline for many reasons. Not just wind and water erosion but also such degradative processes as nutrient losses from runoff and leaching, depletion of soil organic matter, crusting, compaction, and desertification. It can also decline through the accumulation of toxic substances such as residual pesticides. The maintenance or restoration of soil quality is highly dependent on organic matter and an array of beneficial macro organisms and microorganisms that it supports. The proper and regular addition of organic amendments such as animal manures and crop residues can effectively offset many of these degradation processes. It also is the best way to develop a biologically-active soil that requires less energy for producing crops; increases the resistance of plants to pests and diseases; and

enhances the decomposition of toxic substances such as residual pesticides [8]. Soil microorganisms and invertebrates play a vital role in the decomposition of organic matter and nutrient cycling, and could be important indicators of soil quality. Improved soil quality is generally indicated by increased infiltration, macro pores, aggregate size and stability, soil organic matter, and aeration, and by decreased soil resistance to tillage and root penetration, and decreased runoff and erosion [9].

Soil physical conditions have an influence on crop yield and it can be determined by **Soil Condition Index (SCI)**. Extractable P and K, pH, Soil organic matter (SOM), active C, water-stable aggregates, bulk density, penetrometer resistance and microbial bio mass/ diversity were measured for the determination of **Soil Quality Index (SQI)**. It is a good indicator to assess the soil quality and impacts of agricultural practices on the physical, chemical and biological fertility of soil. Microbial community also responds to these changes.

Soil deterioration/degradation is soil quality becoming reduced and not suitable for plant growth. The mechanisms that initiate soil deterioration/degradation are grouped as physical, chemical and biological. Chemical mechanisms are mainly related with the Fertility depletion. It is the qualitative and quantitative reduction of nutrients present in the soil. It occurs when the components which contribute to fertility are removed and not replaced and leading to poor crop yields. In agriculture, depletion can be due to excessively intense cultivation and inadequate soil management. Soil fertility decline is a major biophysical problem of any crop production. Biological degradation is mainly related with the depletions of the vegetation cover, organic matter and the total biomass including the microorganisms [10]. When certain human disturbances as a result of cultivation are happening in any soil environment, it is obvious that soil fertility decline could be increased. Crop rotation and organic management practices are thought to have positive impacts on the microbial biomass which is responsible for the release of nutrient from soil through the processes of mineralization and decomposition by the saprophytic bacteria, fungi and some protozoan [11].

Some researches done on soil quality studies due to monoculture maize based system in the world have indicated that bulk density and moisture content were changed. Soil physical, chemical, biological properties and overall index were evaluated when considering the effect of *Zea mays* on soil [12]. Soil Organic Matter (SOM) was depleted and poor structure was also noted due to harvesting of corn (*Zea mays* L.) [13]. Soil compaction enhanced by inappropriate soil management due to corn cultivation [14].

Not only the Corn, but also other monoculture plantations affected on the quality of soil negatively or positively. The efficiency of legume cover crops to improve some soil quality parameters in the short run was studied as compared to maize-based systems. It was observed that Microbial Biomass Carbon (MBC) was increased significantly by 50.7% and 86% under legume based condition an also due to supply of great quantities of readily decomposable organic matter to the soil, from legume based treatments [15].

Very few studies have been carried out to study the effects of monoculture plantations on soil quality in Sri Lanka. Periyapperuma and Abeynayake (1989) reported some valuable

information regarding some soil properties of a natural forest and an adjacent monoculture (pine plantation) in the wet zone (southern province of Sri Lanka [16].) A notable decline in the percentage organic matter and moisture holding capacity in the surface soil (0-3cm) of the pine plantation compared to a natural forest was observed. In another study by Ratnayake & Jayasekara (2000), it was reported that Nitrogen, Phosphorous, Potassium, Calcium contents and Cation Exchange Capacity (CEC) were very low in the monoculture showing that mixed species are more effective in soil rehabilitation [17]. Weerasinghe (2012) found out that soil microbial biomass is declining with land degradation, chena cultivation and also with monocultures of Teak and Eucalyptus [18].

II. MATERIALS AND METHODS

Two already harvested maize sites (New site- maize cultivated for the first time, Old site- maize cultivated in continuously for 10 years) were selected in Thirappane in order to understand the impact of corn plants on soil over the time. Another Corn grown site was selected in Eppawala in Anuradhapura to study the soil quality deterioration with different growth stages. Soil samples (30X30X30 cm³) were collected randomly in polythene bags and tied with sufficient air [19]. Ten soil samples of each study site were tested for all physical (% moisture content, sand content and permeability), chemical (pH, conductivity, Cation Exchange Capacity, Organic Carbon[20], Nitrate[21] and phosphate content[22]) and biological (soil microbial biomass[23] and total bacterial count) parameters using standard methods given in Anderson and Ingram (1998) [21]. In addition, Air content was measured in the field and fresh soil core samples were collected for bulk density measurements using the same plots. Six soil samples were obtained from dry mixed evergreen forest in Anuradhapura (adjoining to the three study sites) randomly as a control. Finally, the results were analyzed using a one way ANOVA with Minitab statistical software Package [24].

III. RESULTS AND DISCUSSION

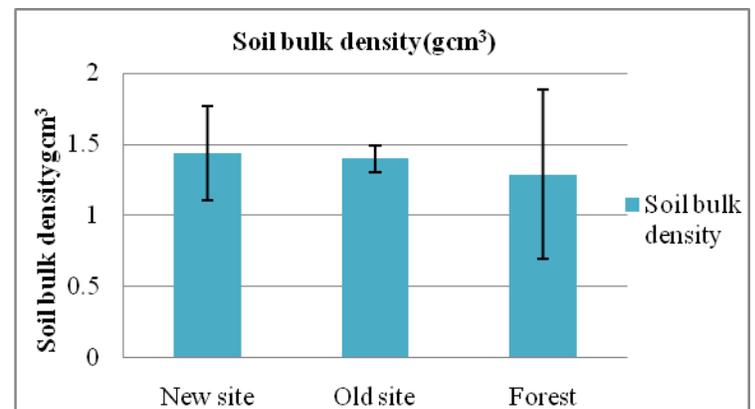


Fig 3.1- Bulk density changes with time

The data clearly shows that Bulk density has increased due to the Corn plantation within one year compared to the

control(forest) indicating some sort of structural changes(1.28 – 1.45gcm³)while observing slight decrease of bulk density over the ten years(1.45 – 1.38gcm³). Even though results are not significant (P=0.835), these changes could be an indication of either compaction during site preparation or reduction of organic matter with the monocultures as reported by Blanco *et.al.*(2009)[25].

land use and management compared with that in clay [27]. This could be due to increased damage of soil structure and pore size due to erosion and lack of undergrowth in the maize plantation.

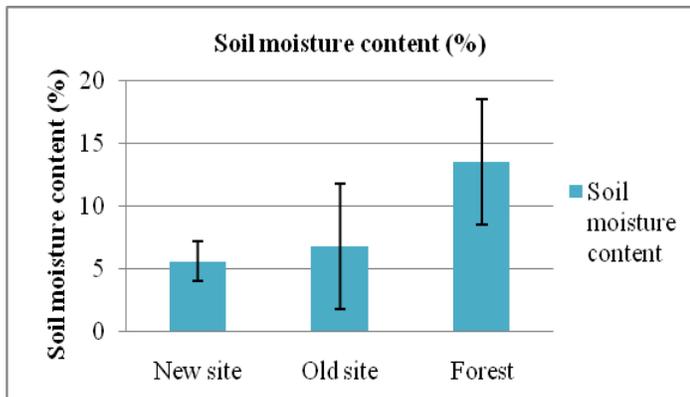


Fig 3.2 – Changes of soil moisture content with time

Moisture content has significantly decreased (13.5 to 5.61 % P = 0.017) within a year of Corn plantation. This is a serious threat by Corn cultivation and careful attention should be given to this drastic drop. This may be due to the exposure of land for heavy sunlight leading to high evaporation or due high vegetative upper biomass of Corn plants. This type of change within one year could affect on the survival of biological organisms thus creating poor biologically deteriorated soil [26].

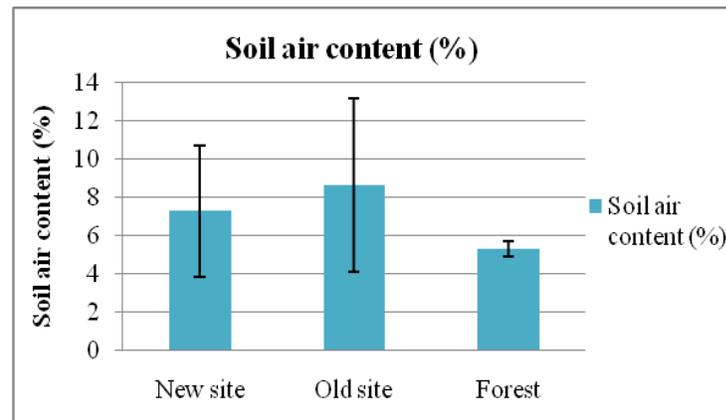


Fig 3.4 - Changes of percentage air content with time

The data clearly indicated that % air content has significantly increased (P=0.477) over the time both after one year and ten years. These results further endorse the increased coarse sand and fine sand content over the time reported in this study. It is obvious the presence of more air and less moisture with more sand content. As reported by Jagadamma(2009), the organic matter content of soil under Corn could be reduced over the time due to erosion and the absence of underground growth [28]. This also could be a result of reduced soil organic carbon due to fast growth and erosion as reported by Armand(2008) [6].

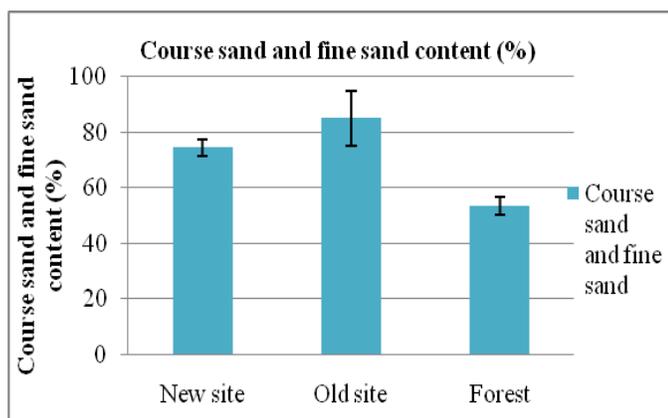


Fig 3.3 - Course sand and fine sand content of different sites

Coarse an fine sand content of soil within one year have significantly increased (P=0) from 53.8(natural) to 74.5%. It was further increased over the ten years indicating changes in soil structure with monoculture plantation as reported by. However, physical fractionation of the soils into size and size/density fractions clearly showed the effect of land use and management on the quantity and quality of Soil organic Matter(SOM). Elliot *et.al* (2000) showed that organic matter associated with the sand and silt fractions appeared to be more sensitive to changes in

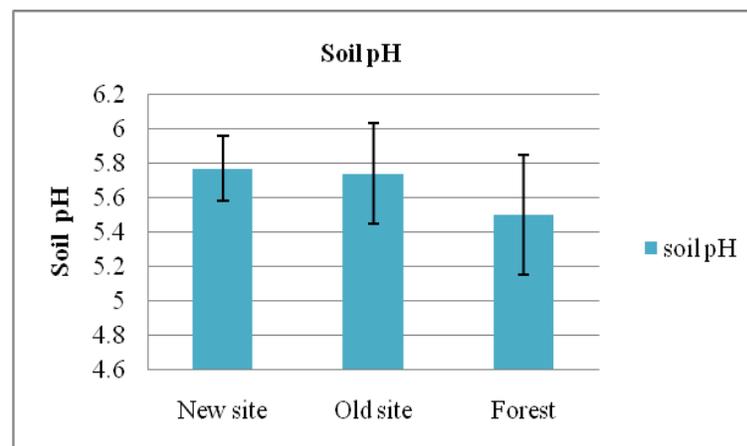


Fig 3.5 – Changes of soil pH with time

Soil pH has increased from 5.43(natural forest) to 5.77 by the end of one year indicating less microbial activity due to low soil organic matter (P=0.291). As explained by Armand(2008), single plantations always lead to create less acidic soil due to reduced moisture, low decomposition rates resulting low microbial activity[6]. No reasonable change of pH has been observed after ten years of continuous cultivation. pH changes may cause problems with nutrient absorption and retention as explained by Joan(2000)[29]. Since the pH of tropical forests is

always towards acidic side, this development of less acidic condition is not favourable for biological organisms[29].

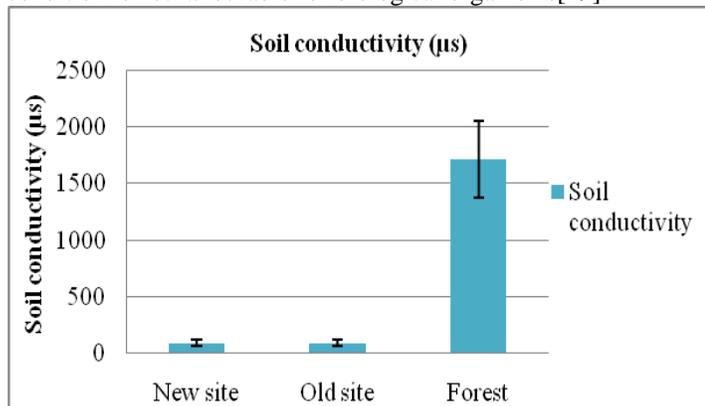


Fig3.6 – Changes of soil conductivity with time

Soil conductivity has been significantly decreased ($P=0$) by the end of first year from 1705 μs to 93.4 μs with no change over the ten years thereafter. This drastic drop clearly indicates the less availability of charged ions in the soil system. These results very well endorse the data obtained for pH giving further assurance on the non availability of nutrients due to less decomposition rates.

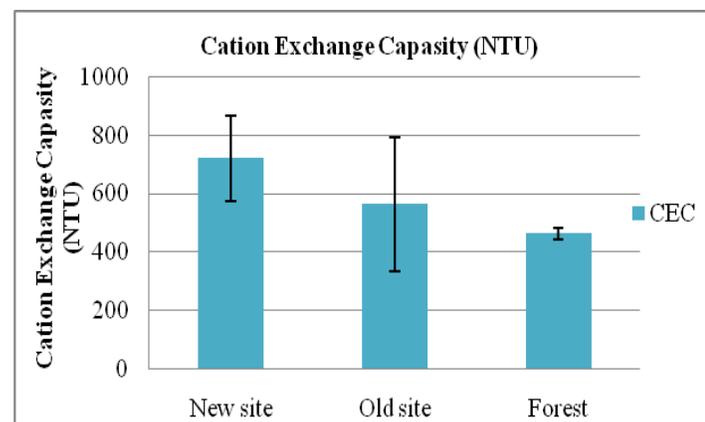


Fig 3.7 – Changes in Cation Exchange Capacity (CEC) with time

CEC in soil has significantly increased ($P=0.067$) from natural site(470NTU) to one year maize site (719.1) at 10% level ($P<0.1$). CEC of ten year old site is still higher than the forest indicating some sort of problem with anthropogenic activities on forest. This could be related to high application of fertilizers in to the maize plantation especially in the first year and slowly stabilizing with the subsequent years to have a lesser CEC. As reported by Eludoyin and Wokocha(2011) [30] cultivated soils are well supplemented with fertilizers and do not give a clear picture of real status of soil as mobilizations of ions are presumably superficial. This kind of fast ion exchange is obvious with high growth ate shown by Maize plants.

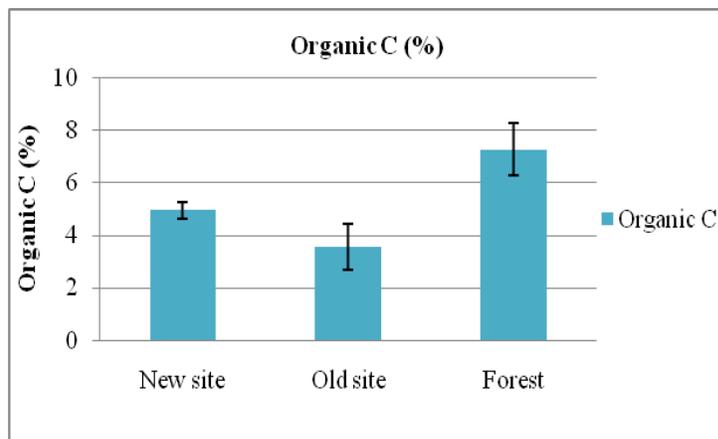


Fig 3.8 - % Organic Carbon of different sites

The data clearly shows that Organic Carbon content has significantly decreased ($P=0$) from forest(7.15%) to one year old (4.94%) indicating drop in soil quality with respect to Organic Matter which is the base for nutrients in soil. This further reduced over the time up to 3.55%. The reasons could be increased surface runoff, large amount of organic matter absorbed from soil by the maize due to its high upper biomass [29] and disrupted organic matter decomposition. According to Eludoyin & Wokocha(2011) [30] & Abiala *et.al.*(2013) [31] when a virgin soil is brought under cultivation or cropping, Organic Carbon content generally declines because the amount of organic matter returned to the soil decreases sharply. Nye and Greenland(1960) [32] Areola(1984) [33] and Agboola(1973) [34] have further endorsed this decline and confirmed that the decline could be due to erosion and leaching to degrade the soil[29].

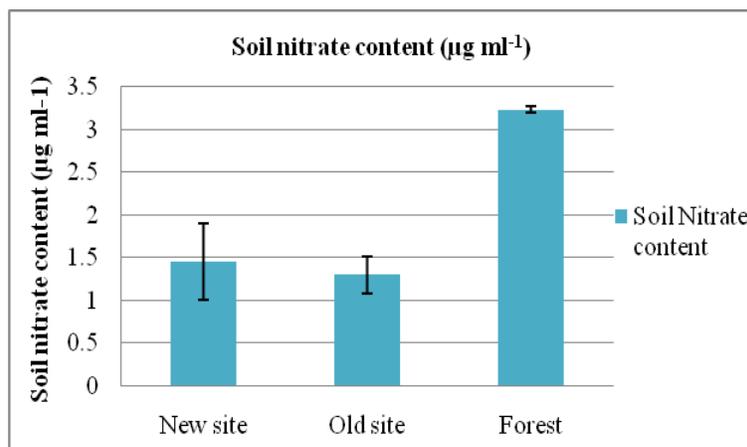


Fig 3.9 – Changes of soil nitrate content

Nitrate content has significantly decreased ($P=0$) from forest (3.25 $\mu\text{g ml}^{-1}$) to one year old (1.45 $\mu\text{g ml}^{-1}$) and further less(1.30 $\mu\text{g ml}^{-1}$) in ten years' time. This amount of old site is clearly lower than the forest indicating a significant variation. The possible reasons for the decreased of nitrate content could be high growth rate of Maize plants. Aweto(1981a) reported that lower nitrate concentrations under Maize plantations reflected the organic matter diminution as organic matter has a direct

influence on it[35]. Leaching and erosion due to less undercover and less moisture due to monoculture environment could also be a reason for reduced nitrate over the time. Kowal and Kassam(1978) stressed the nitrogen status of the soil is closely associated with the soil organic matter as it is the major source of soil nutrients [36]

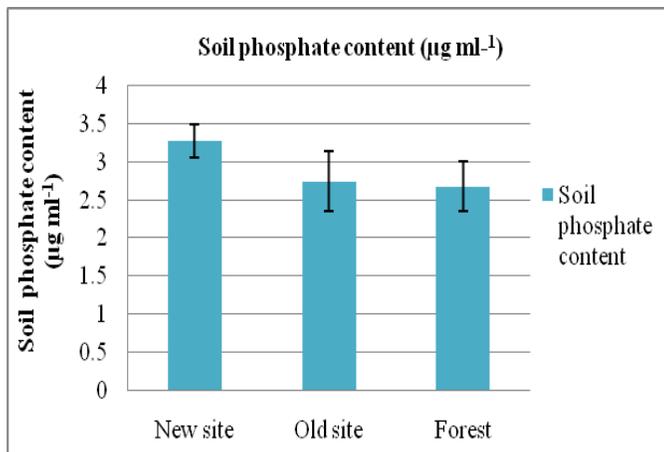


Fig 3.10 – Changes of phosphate content in different sites

The Phosphate content has significantly increased ($P=0.003$) from natural forest($2.70\mu\text{g ml}^{-1}$) to one year old corn plantation($3.27\mu\text{g ml}^{-1}$). When other results are considered together, there is no reason for this increase other than fertilizer application. Most fertilizers are enriched with phosphate and once they add, amounts of available phosphate go up. However, results clearly indicated that contents are going down over the time [30]. This may be due to the high absorbance by the plant. As reported by Du Preez(1999), labile fraction of soil phosphate obtained through fertilizers is decreasing with time due to the formation of stable products in soil [37].

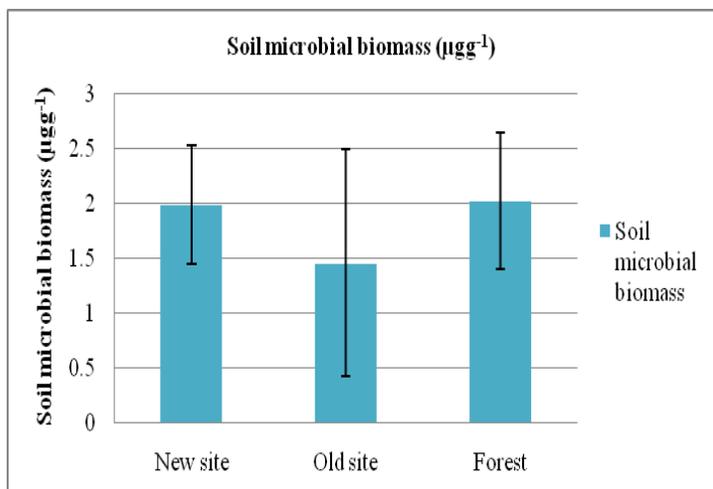


Fig 3.11 – Changes of soil microbial biomass over the years

Soil microbial biomass basically represents the activity of soil organisms[31]. The data indicated that microbial biomass has not been changed in the first year of corn cultivation indicating that corn monoculture has no much impact on the

microbial biomass of soil. However, many studies have pointed out that surface microbial biomass is highly affected by various cultivations(Wander, (1999)[39] & Weerasinghe(2012) [18]. However, microbial biomass has decreased ($P=0.301$) over the ten years ($2.00 - 1.45\mu\text{g g}^{-1}$) giving an indication that activity of microorganisms are reducing with continuous use of land for the same monoculture[6] even though the values are not significant. Reasons could be leaching nutrients with increased runoff, continuous use of fertilizers and pesticides and reduced soil organic matter.

IV. CONCLUSIONS

- It is obvious that the properties of soil have been changed leading to soil quality deterioration as a result of this maize (corn) cultivation over the number of years.
- Soil organic carbon content, Cation exchanging capacity, soil conductivity, Bulk density and microbial biomass of the soil seem to be the best indicators to determine the soil quality reduction and soil deterioration with maize monoculture cultivation.
- The results show that the soils in maize plantation have deviated from the natural forest soil conditions.
- It is important to find the consistency of the results by increasing the number of replicates and the number of plots.
- Based on the observations on soil properties, mulching and organic amendments could be applied as fertilizers to restore the soil or improve the soil quality.

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Review on Cluster-head Election Mechanisms for Clustering Based Routing in Mobile Ad-hoc Network

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Abstract- Wireless Ad hoc network is a set of wireless devices which move randomly and communicate with other node via radio signal. Ad-hoc networks may be logically represented as a set of clusters by grouping together nodes on the basis of different criteria such as 1-hop and k-hop that are in close boundary with one another. Clusters are formed by diffusing node identities along the wireless links. Different heuristics employ different policies to elect cluster heads. Several of these policies are biased in favour of some nodes. As a result, these nodes should greater responsibility and may deplete their energy faster, causing them to drop out of the network. Therefore, there is a need for load-balancing among cluster-heads to allow all nodes the opportunity to serve as a cluster-head. In this paper, different cluster head election mechanism are discussed in the one hop clustering approach.

Index Terms- Ad-hoc Network, Cluster-head, NWA, WCA, EWCA

I. INTRODUCTION

Mobile Ad Hoc Network (MANET) is a mobile, multi-hop wireless network, which does not need pre-existing infrastructure or centralized administration. Every node in the network is serving as a router, which means that every node is able to forward data to other nodes. There are many applications of ad hoc networks, for example meetings or conventions, electronic email and file transfer, and emergency disaster relief personnel coordinating efforts after a hurricane or earthquake [1, 2]. Dynamic routing is the most important issue in MANET's. In flat structure exclusively based on proactive and reactive routing algorithms cannot perform well in a large dynamic MANET. That means, with the increase in size of the networks, flat routing schemes do not scale well in terms of performance. In order to cope with these problems by grouping a number of nodes into an easily manageable set known as cluster [4, 3]. The previous research on mobile ad-hoc network has heavily stressed the use of clustering algorithm because clustering simplifies routing and can improve the performance of flexibility and scalability in the network.

Several clustering algorithms have been proposed to increase scalability, improve bandwidth utilization, and reduce delays for routing strategies. In a clustering structure, the mobile nodes in a network are divided into several virtual zones (clusters). Every mobile node may be assigned a different status or function, such as cluster-head, cluster-gateway, or cluster-member. The cluster-head can be used as a repository for the knowledge of the cluster and as a coordinator of the cluster

operations. Cluster-gateway is a border node in communication range for more than one cluster. Summarized cluster information is sent to the neighbouring cluster-heads via gateways [5, 6]

II. BACKGROUND

This section describes the basic cluster head selection mechanism for the one hop clustering.

A. Lowest-ID Algorithm

In this algorithm [11, 13] each node is assigned a distinct ID and the clusters are formed following the steps given below:

- Periodically a node broadcasts the list of nodes that it can hear (including itself).
- A node, which only hears nodes with ID higher than itself, becomes a Clusterhead (CH).
- The lowest-ID node that a node hears is its clusterhead, unless the lowest-ID specifically gives up its role as a clusterhead.
- A node, which can hear two or more clusterheads, is a Gateway.
- Otherwise the node is an ordinary node.

Major drawbacks of this algorithm are its bias towards nodes with smaller ids which may lead to the battery drainage of certain nodes, and it does not attempt to balance the load uniformly across all the nodes.

B. Highest-Degree Algorithm

The Highest-Degree Algorithm, also known as connectivity-based clustering algorithm, was originally proposed by Gerla and Parekh [12, 14], in which the degree of a node is computed based on its distance from others. A node x is considered to be a neighbor of another node y if x lies within the transmission range of y . The node with maximum number of neighbors (i.e., maximum degree) is chosen as a cluster-head. The neighbors of a cluster-head become members of that cluster and can no longer participate in the election process. Any two nodes in a cluster are at most two-hops away since the cluster-head is directly linked to each of its neighbors in the cluster. Basically, each node either becomes a cluster-head or remains an ordinary node (neighbor of a clusterhead).

Major drawbacks of this algorithm are the number of nodes in a cluster is increased, the throughput drops and hence a gradual degradation in the system performance is observed, and another limitation is the reaffiliation counts of nodes are high due to node movements and as a result, the highest-degree node (the current clusterhead) may not be re-elected to be a clusterhead

even if it loses one neighbor. All these drawbacks occur because this approach does not have any restriction on the upper bound on the number of nodes in a cluster.

C. Node-Weight Algorithm

Basagni et al. [15, 16] proposed two algorithms, namely distributed clustering algorithm (DCA) and distributed mobility adaptive clustering algorithm (DMAC). In this approach, each node is assigned weights (a real number above zero) based on its suitability of being a cluster-head. A node is chosen to be a cluster-head if its weight is higher than any of its neighbor's weight otherwise, it joins a neighboring cluster-head. The smaller ID node id is chosen in case of a tie. The DCA makes an assumption that the network topology does not change during the execution of the algorithm. To verify the performance of the system, the nodes were assigned weights which varied linearly with their speeds but with negative slope. Results proved that the number of updates required is smaller than the Highest-Degree and Lowest-ID heuristics. Since node weights were varied in each simulation cycle, computing the cluster-heads becomes very expensive and there are no optimizations on the system parameters such as throughput and power control.

D. Weighted Clustering Algorithm

The Weighted Clustering Algorithm (WCA) was originally proposed by M. Chatterjee et al. [7, 5,9]. It takes four factors into consideration and makes the selection of clusterhead and maintenance of cluster more reasonable. As is shown in equation (1), the four factors are node degree, distance summation to all its neighboring nodes, mobility and remaining battery power respectively. And their corresponding weights are w_1 to w_4 . Besides, it converts the clustering problem into an optimization problem since an objective function is formed.

$$W_v = w_1 \Delta v + w_2 D_v + w_3 M_v + w_4 P_v \quad (1)$$

Although WCA has proved better performance than all the previous algorithms, it lacks a drawback in knowing the weights of all the nodes before starting the clustering process and in draining the CHs rapidly. As a result, the overhead induced by WCA is very high.

III. RELATED WORK

A. Enhancement Weighted Clustering Algorithm (EWCA)

- Principles of Algorithm :

In proposed algorithm election, cluster-head is adaptive invoked based on moving of nodes or changing the relative distance between the nodes and cluster-head. Election is repeated until all of node must be as a member of any cluster or as a cluster-head. In Load-balancing, assume that there are a predefined threshold number of mobile nodes that a cluster can cover. When the number of cluster's members is too large, that may produce a small number of clusters which make bottleneck of a MANET and reduce system throughput. Moreover, too-small cluster's member may produce a large number of clusters and thus resulting in extra number of hops for sending a packet from source to destination, and longer end-to-end delay. When a cluster size exceeds its predefined limit, election procedure is repeated to adjust the number of mobile nodes in that cluster. If

the distance between cluster-head and cluster member is within the transmission range, that with result a better communication.

The relative distance between nodes affects the consumption of the battery power. It is known that more power is required to communicate through a larger distance. Since cluster-heads have the extra responsibility to send packets to other nodes, they consume battery power more than ordinary nodes.

Mobility is one of the most important challenges of MANETs, and it is the main factor that would change network topology. A good electing cluster-head does not move very quickly, because when the cluster-head changes fast, the nodes may be moved out of a cluster and are joined to another existing cluster and thus resulting in reducing the stability of network. There are many mobility models known such as Random Way Point Model (RWP), Random Way Point on Border Model (RWBP), Random Gauss Markov (RGM) model, and Reference Point Group Mobility model (RPGM). In our algorithm we used Random Way Point Model [8,10].

B. An Adaptive Broadcast Period Approach

In this paper, an efficient distributed clustering algorithm is introduced which uses both location and energy metrics for cluster formation. Our proposed solution mainly addresses cluster stability, manageability and energy efficiency issues. Also, unlike existing active clustering methods, our algorithm relieves the network from the unnecessary burden of control messages broadcasting, especially for relatively static network topologies. This is achieved through adapting broadcast period according to mobile nodes mobility pattern. The efficiency, scalability and competence of our algorithm against alternative approaches have been demonstrated through simulation results.

C. Reliable Node Clustering for Mobile Ad Hoc Networks

In this paper, author use probabilistic analysis to guide proposed clustering algorithm towards more reliable clusters. We also use scatter search to perform clustering while considering various Performance metrics. Experiment results show that our clustering approach produces more reliable clusters than prior approaches.

D. Survey of Clustering Schemes in Mobile Ad hoc Networks

In this paper, author present a study and analysis of some existing clustering approaches for MANETs that recently appeared in literature, which we classify as: Identifier Neighbor based clustering, Topology based clustering, Mobility based clustering, Energy based clustering, and Weight based clustering. We also include clustering definition, review existing clustering approaches, evaluate their performance and cost, discuss their advantages, disadvantages, features and suggest a best clustering approach.

E. Efficient Flooding with Passive Clustering (PC) in Ad Hoc Networks

In this paper author introduced a novel clustering scheme, called Passive Clustering that can reduce the redundant rebroadcast effect in flooding. We demonstrate the efficiency of the proposed scheme in the AODV (Ad hoc On demand Distance Vector) routing scheme.

F. Inter-Domain Routing for Mobile Ad Hoc Networks

Inter-domain routing is an important component to allow interoperation among heterogeneous network domains operated by different organizations. Although inter-domain routing has been well supported in the Internet, there has been relatively little support to the Mobile Ad Hoc Networks (MANETs) space. In MANETs, the inter-domain routing problem is challenged by: (1) dynamic network topology due to mobility, and (2) diverse intra-domain ad hoc routing protocols.

In this paper, we discuss how to enable inter-domain routing among MANETs, and to handle the dynamic nature of MANET.

IV. CONCLUSION

Clustering is the best solution for reducing flooding routing packets in mobile ad hoc network to adapt itself for its dynamic nature. Selecting Coordinators for clusters is a research issue in the area of wireless ad hoc networks. Cluster-head can be selected by computing quality of nodes, which may depend on connectivity, mobility, battery power etc. Significant performance improvement can be achieved by combining the effect of several performance factors.

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Highly Improved Handoff Performance in MIMO-Enabled CBTC System

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Abstract - Communication-Based Train Control (CBTC) system is an automated train control system to ensure the safe operation of rail vehicles using data communication. Bidirectional wireless train-ground communications is used to transfer control data between trains and wayside equipment. Wireless local area network (WLAN) based CBTC has impact on train control performance while taking handoff decisions. This may leads to communication interrupt and long latency. Inorder to minimize the handoff latency and to improve the performance, a handoff scheme in CBTC system based on WLANs with multiple-input-multiple-output is proposed. In this channel estimation errors and the tradeoff between MIMO multiplexing gain and diversity gain are considered in making handoff decisions. Handoff decisions and physical layer parameters are optimised to improve the train control performance in CBTC systems. The handoff problem is formulated as a partially observable Markov decision process (POMDP), and the optimal handoff policy can be derived to minimize the handoff latency. The handoff decision and physical layer parameters adaptation problem is formulated as a stochastic control process. Simulation result shows that the proposed approach can significantly improve the control performance in CBTC systems.

Index Terms - CBTC, Train Control, multiple-input-multiple-output (MIMO), wireless local area network (WLAN)

I. INTRODUCTION

WITH the rapid population explosion, there is a strong desire around the world to improve the rail transit speed and capacity. Being a key subsystem in rail transit systems, communications-based train control (CBTC) is an automated train control system using high capacity and bidirectional train-ground communications to ensure the safe operation of rail vehicles. It can improve the utilization of railway network infrastructure and enhance the level of safety and service offered to customers. CBTC is a modern successor in a traditional railway signaling system using track circuits, interlocking, and signals.

Train-ground communication is one of the key technologies in CBTC systems. Wireless networks, such as Global System for Mobile communications - Railway (GSM-R) and Wireless Local Area Networks (WLANs), are commonly used to provide bidirectional train- ground communications. For urban mass transit systems, IEEE

802.11a/b/g based WLANs are a better choice due to the available commercial-off-the-shelf equipment and the philosophy of open standards and interoperability. There are several WLAN-based CBTC systems deployed around the world, such as Las Vegas Monorail from Alcatel and Beijing Metro Line 10 from siemens.

Building a control system over wireless networks is a challenging task. Ideally, the data transfer over the communication links should be accurate, timely, and reliable. However, a communication network inevitably introduces random packet delay and losses. The problem is more pronounced in CBTC systems, where the

communication environment is complex between a fast moving train and ground. Particularly, when a train moves away from the coverage of a WLAN access point (AP) and enters the coverage of another AP along the railway, a handoff procedure occurs. This handoff process may result in communication interrupt and long latency, which could severely affect train control performance, train operation efficiency, and the utilization of railway network infrastructure.

The communication availability and latency requirements in CBTC systems are very stringent. Trains and ground equipment communicate with each other and expect a response within a time constraint after sending a request. Long communication latency, which leads to delayed response, could cause train derailment, collision, or even catastrophic loss of life and/or assets. Therefore, minimizing train-ground communication latency is aspired, so that rapid responses can be facilitated while a train is moving at high speed.

Several schemes have been proposed to decrease WLAN handoff latency. Most of previous works in optimizing WLAN handoffs focus on making more efficient scanning process, since it is shown that over 90% of the time in the handoff process is spent in the scanning stage. A SyncScan technique is proposed in [13], in which appropriate time synchronization is required between APs and clients. A topology-inferencing technique in both clients and APs is proposed in [14] to improve the scanning process.

The schemes previously proposed work for single radio mobile clients requires coordination/cooperation between APs and mobile clients, which may make it difficult to implement them in CBTC systems. There are also some schemes using multiradio in mobile clients trying to reduce the WLAN handoff latency. Adya *et al.* [1] proposed a protocol to allow multiradio mobile nodes in a mesh network to potentially establish two separate wireless links between a pair of nodes. This work primarily focuses on improving the efficiency of wireless mesh networks, which is different from the CBTC systems.

There are some works in the literature about MIMO design in non-CBTC environments. A MIMO-enabled medium-access control (MAC) protocol is proposed to utilize MIMO multiplexing capability to mitigate interferences. It is shown in [15] that the Transmission Control Protocol performs better with a more reliable link provided by the MIMO diversity gain, whereas the spatial multiplexing scheme outperforms in the high-SNR regions. There are also intermediate MIMO working modes, where we can simultaneously achieve part of the diversity gain and part of multiplexing gain. Lee *et al.* [7] studied the optimal tradeoff between MIMO diversity gain and multiplexing gain in ad-hoc networks.

A handoff scheme in CBTC systems based on WLANs with multiple-input-multiple-output (MIMO) technologies is proposed to improve the handoff latency performance. MIMO-enabled WLANs have been increasing in popularity due to the fact that multiple antennas can achieve higher data rate, compared to conventional single-antenna systems. The recent IEEE 802.11n standard aims to significantly improve the physical link data rate up to 600 Mb/s with MIMO technologies. Although the data rate has been improved in MIMO-enabled WLANs, the handoff latency performance may not be satisfactory when MIMO-enabled WLANs are used in high-speed CBTC systems. In particular, the tradeoff between MIMO diversity gain and multiplexing gain [17], which is a physical-layer design parameter, should be carefully designed according to the fast-changing signal-to-noise ratios (SNRs) from successive APs when a train is moving at high speed.

MIMO system in CBTC environments, have distinct characteristics, such as high speed mobility with frequent handoffs and stringent latency requirements. In addition, most WLAN handoff decision algorithms are based on the quality of the received signals from successive Aps. However, when a train is moving at high speed, the channel state derived from channel estimations may not be accurate, which will result in wrong handoff decisions. This will further increase the communication latency in WLAN-based CBTC. Channel estimation errors and MIMO working mode is considered to improve the handoff latency performance in MIMO-enabled CBTC systems. The distinct features of this work are given here.

- 1) CBTC train-ground communication system based on MIMO-enabled WLANs is proposed.
- 2) The dynamic wireless channel is modeled as a finite state Markov process. With channel estimation errors, the channel state cannot be accurately observed.
- 3) Based on the inaccurate channel state information, the station adapter (SA) on a train makes handoff decisions and adapts physical-layer MIMO parameters to minimize the communication latency.

- 4) The handoff decision and physical-layer parameter adaptation problem is formulated as a partially observable Markov decision process (POMDP).

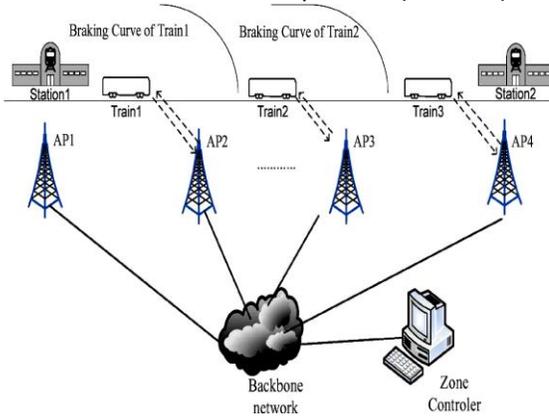


Fig. 1. Communication based train control system

- 5) Extensive simulation results based on real field channel measurements are presented. It is illustrated that the proposed scheme can significantly improve the handoff latency performance in CBTC systems.

II. CBTC TRAIN-GROUND COMMUNICATION BASED ON MIMO-ENABLED WLANS

In this section, we first present an overview of CBTC and its train-ground communication systems. We then present the proposed CBTC train-ground communication system based on MIMO-enabled WLANs.

A. Overview of CBTC Train-Ground Communication Systems

CBTC system consists of five subsystems. They are Automatic Train Supervision (ATS) subsystem, Automatic Train Operation (ATO) subsystem, Automatic Train Protection (ATP) subsystem, Zone Controller (ZC) subsystem, and train ground communication subsystem. Central control automatic train supervision (ATS) permits the dispatcher to monitor the entire system and issue commands manually or automatically, to change the routing, performance, and station dwell times of trains according to an operation schedule.

The ATS may have a finer resolution as to where CBTC trains are located at all times. The ATS station is a means of monitoring and controlling the system at a specific wayside location (most commonly, a station location). In other words the ATS subsystem makes timetables for each train; it sets the trip time between two stations. The ATP subsystem on the train calculates the real time braking curve according to the newest received MA. Based on the trip time given by ATS and other performance indices, such as energy savings, and passengers comfort, the ATO subsystem derives an optimized guidance trajectory.

Fig. 1 shows a simple CBTC with a WLAN-based train-ground communication system. In CBTC systems, continuous bidirectional wireless communications between each station adapter (SA) on the train and the ground access point (AP) are adopted instead of the traditional fixed-block track circuit. The railway line is usually divided into areas. Each area is under the control of a ZC and has its own wireless transmission system. The identity, location, direction and velocity of each train

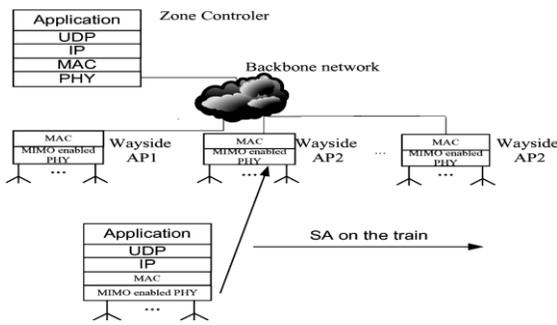


Fig .2. CBTC system based on MIMO-enabled WLAN

are transmitted to the ZC .The wireless link between each train and the ZC must be continuous to ensure the ZC knows the location of all the trains in its area at all times. Based on the locations of all the trains and other obstacles along the railway, the ZC transmits a Movement Authority (MA) to each train. An MA of a train is the zone from the tail of the train to the obstacle in front of the train.

Once the train velocity reaches the target velocity on the service braking curve or emergency curve, the ATP subsystem will start service or emergency braking prior to ATO subsystem to protect the train from traveling out of its MA.

Train–ground communication systems are primarily designed to connect each component of CBTC systems: ZCs, APs along railways, and train aboard equipment. A basic configuration of a WLAN-based train–ground communication system is shown in Fig. 1. Following the philosophy of open standards and interoperability [12], the backbone network of the train–ground communication system includes Ethernet switches and fibre-optic cabling that is based on the IEEE 802.3 standard. The wireless portions of the train–ground communication system, which consist of APs along the railway and SAs on the train, are based on the IEEE 802.11 series standard. When a train moves between successive APs, the received SNR rapidly changes. The communication latency will be a serious problem when the SA is in deep fading. Furthermore, when a train moves away from the coverage of an AP and enters the coverage of another AP along the railway, the handoff procedure may result in long latency. To minimize the latency, we present a train–ground communication system based on MIMO-enabled WLANs to improve the handoff performance.

B. Proposed CBTC Train–Ground Communication System Based on MIMO-Enable WLANs

Fig. 2 describes the proposed CBTC train–ground communication system based on MIMO-enable WLANs. The application-layer data packets being encapsulated in the User Datagram Protocol are then transferred between trains and wayside equipment using Internet Protocol and WLANs with IEEE 802.11 MAC and MIMO-enabled physical layer

A critical issue in the aforementioned system is the handoff decision policy (i.e., when to perform a handoff) and the corresponding physical-layer parameter adaptation policy (i.e., the tradeoff between MIMO diversity gain and multiplexing gain). In high-speed environments, wireless channels are dynamically changing. If these policies are not carefully designed, long communication latency may occur, which will significantly affect the performance of CBTC systems. Therefore, an efficient handoff decision policy and a physical-layer parameter adaptation policy are needed to decide at which time to trigger handoff and what physical-layer parameters should be used.

III. COMMUNICATION LATENCY OPTIMIZATION IN THE PROPOSED CBTC TRAIN–GROUND COMMUNICATION SYSTEM

A. Communication Latency in MIMO-Enabled WLANs

The diversity gain and spatial multiplexing gain can be realized with a MIMO system, and there is a fundamental tradeoff between them [17]. For each spatial multiplexing gain r , the best diversity gain $d^*(r)$ is the supremum of the diversity gain achieved over all schemes. With long enough block lengths, the optimal multiplexing-diversity tradeoff $d^*(r)$ is given by the piecewise-linear function connecting the points $(r, d^*(r))$ for $r = 0, 1, \dots, \min(M_A, M_S)$ [17].

$$d^*(r) = (M_A - r)(M_S - r) \tag{1}$$

Where M_A and M_S are the number of transmit and receive antennas, respectively, and they map to the number of wayside AP and train SA antennas. Optimal tradeoff performance can be achieved with a family of carefully designed codes. If the wireless link from the train SA to the wayside AP has an average SNR γ , with a multiplexing gain r , the link data rate $C(r)$ and Bit Error Probability $BER(r)$ can be approximated as

$$BER(r) = K_p * \gamma^{-d(r)} \tag{2}$$

$$C(r) = K_c * r * \log_2(\gamma) \tag{3}$$

Where K_c and K_p are positive constants for different coding schemes, and the multiplexing gain r and diversity gain $d(r)$ satisfy the optimal tradeoff equation. Given the link BER, the corresponding Frame Error Rate (FER) is derived as $FER = 1 - (1 - BER)^{L_{fr}}$ where L_{fr} is the MAC layer frame length in bits.

First, calculate the communication latency when no handoff happens. Consider carrier-sense multiple access with collision avoidance (CSMA/CA) as the MAC method since it is most commonly used in WLAN systems. In CSMA/CA systems, a window-based backoff mechanism is used such that a node that is willing to transmit will sense the medium first, and if the medium is not free, it will uniformly choose a backoff time at random from the interval $[0, CW + 1]$, where CW is the contention window and the initial value is equal to CW_{min} . CW will be doubled if the subsequent transmission attempt fails until it reaches CW_{max} .

There are two causes of packet transmission failure in WLANs. One is the packet collision where two nodes simultaneously transmit. The other one is the channel error, where a packet is received without packet collisions and is corrupted due to low SNR. Although the SA on a train is in the common communication coverage area of two APs, it can only associate with one of the two APs. Furthermore, there is only one SA in each AP cell in CBTC systems, which is due to the fact that trains must keep a distance that is far enough between each other to guarantee safety. There is no other competing SA within each AP cell. Therefore, the packet delay is mainly due to packet retransmissions caused by packet losses but not the packet collision.

With packet loss caused only by channel error, when a packet is transmitted n times in the MAC layer, the corresponding packet delay in $T_{MAC}(n)$ CSMA/CA systems can be calculated as follows:

$$T_{MAC}(n) = T_{aifs} + T_{data} + T_{sifs} + T_{ack} + T_{aifs} + T_{backoff(1)} + T_{aifs} + T_{data} + T_{sifs} + T_{ack} + T_{aifs} + T_{backoff(2)} + T_{aifs} + T_{data} + T_{sifs} + T_{ack} + \dots + \dots + T_{aifs} + T_{backoff(n-1)} + T_{data} + T_{sifs} + T_{ack} + T_{transfer} \tag{4}$$

Where T_{aifs} is the arbitration interframe space (AIFS), T_{sifs} is the short interframe space (SIFS), T_{ack} is the time needed to transmit the acknowledge frame, $T_{backoff(i)}$ is the backoff time of the retransmission at i times, $T_{transfer}$ is the propagation time of the data, and T_{data} is the time needed to transmit a data frame, which is given by

$$T_{data} = \frac{L_{fr}}{C(r)} \tag{5}$$

With the n times packet delay $T_{MAC}(n)$, the average communication latency $T_{average}$ with maximum retransmission time R is given by

$$T_{average} = (1 - FER) * T_{MAC}(0) + (FER(1 - FER) * T_{MAC}(1) + \dots + FER^{R-1}(1 - FER) * T_{MAC}(R - 1)) \quad (6)$$

The average MAC-layer packet transmission delay is dependent on the physical-layer transmission data rate and the retransmission time. Given a certain SNR, a higher multiplexing gain r will give a higher capacity link, which contributes to the time T_{data} needed to transmit a data frame. However, the diversity gain d will decrease with the increase in multiplexing gain. The corresponding FER increase will lead to an increasing transmission time that, ultimately, brings in more overhead. Therefore, one of the aims in our communication latency model is to find the optimal multiplexing gain r to minimize the latency when no handoff happens, and the optimization problem is given as

$$\gamma^* = \operatorname{argmin} T_{average}(\gamma) \quad (7)$$

In the following, the communication latency model when a handoff happens is derived. Fig. 3 shows us a simple view of the 802.11 WLAN handoff procedures, which is followed by most 802.11 mobile stations [11]. As shown in the figure, the handoff procedure can be divided into three steps, i.e., probing (also referred to as scanning), authentication, and reassociation.

Six packets are transmitted between the SA and AP before the handoff ends, and the average time needed to finish the handoff is approximately $6 * T_{average}(r) + T_{process}$, where $T_{average}(r)$ is the communication latency given above and $T_{process}$ is the processing time in the AP and SA before they send new packets.

The SA will continue to periodically send probe packets with the period T_{period_probe} until it gets in to

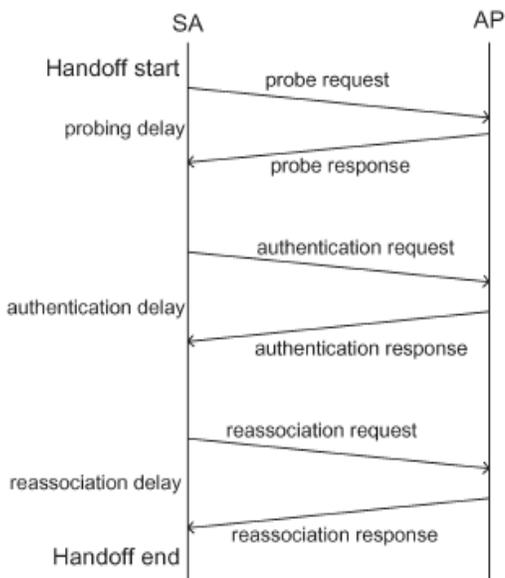


Fig .3. Handoff procedure

the authentication phase. If any one of the authentication and reassociation packets is lost, the handoff procedure will start from the beginning. It will take a long time before the SA starts over again and that time is referred as T_{wait} .

The average handoff latency $T_{average-handoff}$ is then derived as

$$T_{average_handoff} = (1 - PLR)^2 * \{(1 - PLR)^4 * [6 * T_{average}(r) + T_{process}] + [1 - (1 - PLR)^4] * [6 * T_{average}(r) + T_{process} + T_{wait} + [1 - (1 - PLR)^2] * \{(1 - PLR)^4 * [6 * T_{average}(r) + T_{process} + T_{period-probe}] + [1 - (1 - PLR)^4] * [6 * T_{average}(r) + T_{process} + T_{period-probe} + T_{wait}]\}\}$$

(8)

Where *PLR* is the packet loss rate, which is dependent on the FER and retransmission time *n*. Assume that the handoff failure happens at most once in the above equation due to the fact that the probability that two successive handoffs both fail is very small. Another aim in our communication latency model is to find the optimal multiplexing gain to minimize the latency when a handoff happens.

$$\gamma^* = argmin T_{average-handoff}(\gamma) \tag{9}$$

B. Stochastic Formulation of the Proposed CBTC Train-Ground Communication System

Markov decision process (MDP) provides a mathematical framework for modeling decision making in situations where outcomes are partly random and partly under the control of a decision maker. In the proposed CBTC train-ground communication system, the SA on the train makes handoff decisions at specific time instances according to the current state *s(t)*, and the system moves into a new state based on the current state *s(t)*, as well as the chosen decision *a(t)*. Given *s(t)* and *a(t)*, the next state is conditionally independent of all previous states and actions. This Markov property of state transition process makes it possible to model the optimization problem as an MDP. Furthermore, in CBTC systems, due to channel sensing and channel state information errors, the system state cannot be directly observed. As a result, the optimization problem as a POMDP is formulated, in which it is assumed that the system dynamics are determined by an MDP. However, the underlying state can only be observed inaccurately or with some probabilities.

A Partially Observable Markov Decision Process (POMDP) is a generalization of a Markov Process Decision. A POMDP models an agent decision process in which it is assumed that the system dynamics are determined by an MDP, but the agent cannot directly observe the underlying state. Instead, it must maintain a probability distribution over the set of possible states, based on a set of observations and observation probabilities, and the underlying MDP.

In POMDP model, the SA on the train has to make a decision whenever a certain time period has elapsed. These instant times are called decision epochs. The optimal optimization policy can be obtained from value iteration algorithms in this formulation. Using the POMDP derived policy, a channel state is observed at every decision epoch. Based on the observation, the system jointly considers the multiplexing gain *r* in the physical layer and decides whether to make a handoff action to minimize the communication latency. To obtain the optimal solution, it is necessary to identify the states, actions, state transition probability, observation model, and reward functions.

1)Action, State, and Observation: In CBTC train-ground communication system, the SA on the train first has to decide whether the connection should use the current chosen AP or connect to the next AP. (We assume that the SA on the train will not be in the coverage of three successive APs.) Second, the multiplexing gain in the physical layer should be decided. We assign every AP along the railway with a distinct number. Let *M* be the AP that covers the SA; then, the other one is *M + 1*. The current composite action *a(t) ∈ A* is denoted by

$$a(t) = \{a_n(t), a_r(t)\} \tag{10}$$

Where $\alpha_h(t)$ is the handoff action, and $\alpha_r(t)$ is the multiplexing gain action ($0 < \alpha_r(t) < \min(M_A, M_S)$). $\alpha_h(t) = M + 1$ means handoff to the next AP; $\alpha_h(t) = M$ means stay in the old AP. The current composite state $s(t) \in S$ is given as

$$s(t) = \{\gamma_1(t), \gamma_2(t), \xi(t)\} \quad (11)$$

Where $\gamma_1(t)$ and $\gamma_2(t)$ are the measured SNR from two successive APs, respectively; and $\xi(t)$ is the currently used AP. $\xi(t) \in \{M, M + 1\}$ because the currently used AP is completely decided by the current action.

The composite observation $\theta(t) \in \Theta$ is defined as

$$\theta(t) = \{\hat{\gamma}_1(t), \hat{\gamma}_2(t), \hat{\xi}(t)\} \quad (12)$$

Where $\hat{\gamma}_1(t), \hat{\gamma}_2(t)$ and $\hat{\xi}(t)$ are the observation of $\gamma_1(t), \gamma_2(t)$, and $\xi(t)$ respectively; and they have the same space as the state space.

2) State Transition Model and Observation Model: Given the current state $S(t) = \{\gamma_1(t), \gamma_2(t), \xi(t)\}$, the current observation $\theta(t) = \{\hat{\gamma}_1(t), \hat{\gamma}_2(t), \hat{\xi}(t)\}$ and the chosen action $a(t)$ the probability function of the next state $S(t+1) = \{\gamma_1(t+1), \gamma_2(t+1), \xi(t+1)\}$ is given by

$$P(s(t+1) | s(t), (\theta(t), a(t))) = P[\gamma_1(t+1) | \gamma_1(t)] * P[\gamma_2(t+1) | \gamma_2(t)] * P[\xi(t+1) | \xi(t), a(t)] \quad (13)$$

where $P[\gamma_1(t+1) | \gamma_1(t)]$ and $P[\gamma_2(t+1) | \gamma_2(t)]$ are the channel state transition probabilities for the two wireless links, respectively; and $P[\xi(t+1) | \xi(t), a(t)]$ is the currently used AP transition probability. The channel state transition probabilities for the two wireless links can be derived from the received SNRs measured in field tests. The AP that will be used after the decision epoch is dependent on the current handoff decision action. Given the current handoff decision action $\alpha_h(t)$, the AP that will be used in the next epoch must be $\alpha_h(t)$. Therefore, the currently used AP transition probability is simply derived as,

$$P[\xi(t+1) | \xi(t), (\theta(t), a(t))] = \begin{cases} 0, & \text{if } \alpha_h(t) \neq \xi(t+1) \\ 1, & \text{if } \alpha_h(t) = \xi(t+1). \end{cases} \quad (14)$$

Given the channel estimation errors, the SA is not able to have full knowledge of the channel information. Assume that the channel estimation error has a Gaussian distribution with zero mean and δ^2 variance. At a particular time epoch, the observed channel gain is

$$\hat{\gamma} = \gamma_m + w \quad (15)$$

Where $\hat{\gamma}$ is the actual channel gain and w is a Gaussian random variable with zero mean and δ^2 variance. The receiver then quantizes

3) Reward Function: As shown in Fig. 2, after the SA on the train establishes a wireless link to a new AP, the new AP needs to tell the ZC that the SA is associated with it. Afterward, the packets sent from the ZC to the SA will go through the new AP, instead of the old AP. Therefore, aside from the communication latency caused by the WLAN, there is an extra latency caused by the wired part between the ZC and the APs, such as propagation, processing, and queuing delays. The total end-to-end communication latency should be the sum of all these delays in both the wireless part and the wired part.

The latency in the wireless part when a handoff occurs is $T_{average_handoff}$. The latency in the wired part depends on several factors in real systems, such as the distance between the ZC and the APs, the size of the network, the processing power of network nodes, etc. Parameter K to represent the latency caused in the wired

Notation	Definition	Value
τ	Time between successive epochs	50 ms
T_{aifs}	Arbitration interframe space	9 μ s
T_{sifs}	Short interframe space	9 μ s
T_{ack}	Time required to send an ACK	20 μ s
CW_{min}	Minimum contention window	16
CW_{max}	Maximum contention window	1024
ζ	Shadowing fading standard deviation	8
P_{noise}	Noise power	-100 dbm
$T_{process}$	Processing time before sending new packets	10 ms
T_{wait}	Time for the SA to start over a new handoff	1000 ms

part when a handoff occurs. Different values of K are used to evaluate the performance of the proposed scheme. Considering the current link latency the reward function is defined as

$$\begin{cases} 1/(T_{averagehandoff}(a_r(t)) + K), & \text{if } a_h(t) \neq \xi(t) \\ 1/(T_{average}(a_r(t))), & \text{if } a_h(t) = \xi(t) \end{cases} \quad (16)$$

TABLE 1

SIMULATION
 PARAMETER
 S



IV. SIMULATION RESULTS AND DISCUSSIONS

NS2.29 simulator is used for the simulations. Consider a simulation scenario with a train moving between successive APs. The average distance between two successive APs is 600 m. The train speed is 80 km/h. The main parameters used in the simulations are shown in Table I. Simulation examples are used to illustrate the performance of the proposed scheme. First the FSMC model obtained from real field test data is discussed. The performance improvement of the POMDP optimization algorithm is given next. The simulation results shows that the proposed method reduce the delay while taking handoff by observing the channel information and received signal to noise ratio.

A. Received SNR

In the field test, the SNR from two successive Aps is measured. An AirMagnet Wi-Fi analyser is used as the SNR measurement instrument. The measurement instrument's antenna was put in the same place as the SA's antenna on the train. The measurement instrument travelled with the train when the train was in real operation. The measurement sampling rate was set as 1000 Hz. The measured SNR from two successive APs is shown in Fig. 4.

B. Performance Improvement

Compare the POMDP policy performance in the proposed MIMO-enabled CBTC system with the performance in traditional CBTC systems without MIMO technology. The communication latency in our proposed MIMO-enabled CBTC system is always better than the system without MIMO technology. This is because the MIMO diversity gain decreases the packet loss probability during the handoff procedure, and the MIMO multiplexing gain decreases the time needed to transmit a packet. The decreased packet loss probability and packet transmission time both contribute to the communication latency performance improvement.

Fig. 4. Received SNRs from two APs

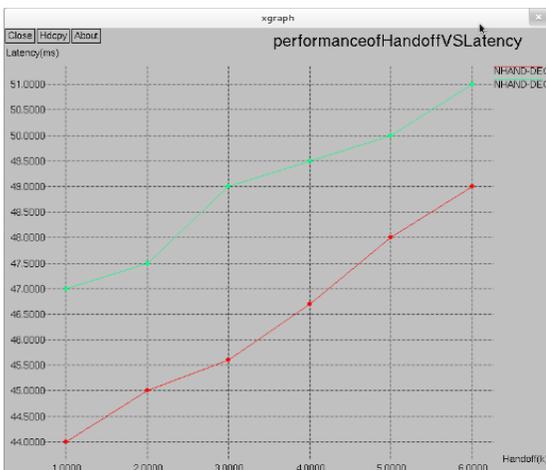


Fig .5. Performance improvement compared to MIMO disabled system

V. CONCLUSION

Train-ground communication is one of the key technologies in CBTC systems. The handoff process in WLANs has significant impacts on the train control performance in CBTC systems. CBTC systems have stringent requirements for wireless communication latency. The dynamic radio propagation environment and frequent handoffs can cause significant communication latency in WLAN-based CBTC. In the proposed method, a CBTC train-ground communication system based on MIMO-enabled WLANs has been presented. Wireless channel estimation errors and MIMO working mode was considered to improve the handoff latency performance in CBTC. Based on the inaccurate channel state information, handoff decisions have been made, and physical-layer MIMO parameters have been adapted to minimize the communication latency. The problem has been modelled as a POMDP. POMDP policy always gives the better average handoff latency compared with other policies. Simulation results have been presented to show that the proposed POMDP-based policy can significantly decrease the average handoff latency in CBTC systems.

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Supplements Effect of Virgin Coconut Oil and Albumin Capsules (Catfish protein) on TB Patients Receiving Multi Drugs Therapy-DOTS Strategic in BBKPM Makassar, Indonesia

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Abstract-Pulmonary tuberculosis is a global problem requiring 6-month MDT-DOTS continuous treatment. This time based treatment along with the combination of VCO nutritional supplement and/or Catfish-extracted albumin has shown a significant benefit on improving immune response, accelerating the conversion of BTA sputum, increasing nutritional states and improving chest X-ray imaging in people with active pulmonary TB. This study aimed to compare the changes in pulmonary TB patients treated MDT-DOTS combined with supplemented VCO and/or albumin with that in the MDT-DOTS placebo group. The experimental study was designed by using two pre and post test groups with double blind randomized controlled trial. Eighty (80) participants met with study inclusion and were randomly distributed in the experimental groups. The study result has shown significant improvements in all observed variables among the experimental groups receiving the combination of MDT-DOTS with VCO and/or Catfish-extracted albumin. These are including *accelerating the conversion of BTA sputum* (VCO i.e. $p < 0.00$; Catfish-extracted albumin i.e. $p < 0.04$; and VCO + Catfish-extracted albumin i.e. $p < 0.00$), *increasing nutritional state* (VCO i.e. $p < 0.03$; Catfish-extracted albumin i.e. $p < 0.003$; and VCO + Catfish-extracted albumin i.e. $p < 0.01$) and improving chest X-ray imaging (VCO i.e. $p < 0.04$; Catfish-extracted albumin i.e. $p < 0.003$ and VCO + Catfish-extracted albumin i.e. $p < 0.001$). MDT-DOTS treatment combined VCO nutritional supplement and/or Catfish-extracted albumin capsules could accelerate the conversion of sputum smear, could improve nutritional status and improve chest X-ray imaging.

Index terms; MDT-DOTS, Supplement VCO and albumin capsules, sputum smear conversion, nutritional status, chest X-ray imaging

I. INTRODUCTION

World Health Organization (WHO) reported that pulmonary TB disease remains a global health problem because it cause the death 1.40 million. People world widely Indonesia was ranked the world's third most 242 655 cases of pulmonary TB, the incidence rate of 450 per 100,000 population, the prevalence rate of 680 per 100,000 population as well as the cause of death of 65 per 100,000 and ranks 21th out of 27 countries with high cases of MDR / XDR [1].

The principle of pulmonary TB treatments patients is anti-tuberculosis drugs and the improvement of the immune system that will add a strong function bactericid and bacteriostatic. DOTS treatment strategy to break the chain of transmission of pulmonary TB cure rate at least 85-95% [2] as well as sputum smear conversion takes an average of between 8 to 12 weeks. In Latvia DOTS treatment BTA sputum conversion rate below 12 weeks [3].

Fast time sputum smear conversion in pulmonary tuberculosis treatment is influenced by these factors: nutrition status, balanced nutrition [4, 5, 6]. Malnutrition status causes decreased immune response against TB infection in individuals lung [7, 8], so the risk of conversion failure 8.861 times greater than the normal nutritional status and pulmonary tuberculosis patients with severe malnutrition have an increased risk of conversion failure 30.918 times greater than the normal nutritional status [9].

Suppression of the immune system cellular nutritional status is less characterized by a decrease in the number of CD4 + cells and the levels of IFN- γ in patients infected with the germs of TB [10]. Cells CD4 + T very important in the continuing generation against pathogenic germs pulmonary TB by stimulating Th1 producing IFN- γ to activate alveolar macrophages [11]. Supplementing nutrients such as macro and micro albumin capsules (protein catfish) which is rich in albumin protein, essential amino acids, vitamins and minerals [12] or

Virgin Coconut Oil (VCO) of material Glycerol monolaurate (GML) effect of anti tuberculosis tb [13], anti-inflammatory [14], improve appetite and weight gain in patients with pulmonary tuberculosis infection [15].

II. MATERIAL AND METHODS

2.1 Research design

Observational study with analytical quantitative applied an approach of Randomized Quasi-Experimental with two-group pre-test and post-test control double-blind design. Population sample is a clinical diagnosis, sputum smear (+), X-Ray chest (+) and meets the criteria for inclusion, "accidental sampling method", patients visiting 1st Maret 2013 to December 31st, 2013 at BBKPM Makassar. Those 80 samples were divided into 4 groups: Group I: 20 samples, MDT-DOTS + capsule albumin (protein catfish), Group II: 20 samples, MDT-DOTS + Virgin Coconut Oil (VCO), Group III: 20 samples, MDT-DOTS + VCO + Capsules albumin (protein catfish) and Group IV: 20 samples, MDT-DOTS + placebo. Determination of the serial number of the subjects carried out by order of the visit. All patients treated with the DOTS strategy, supplemented albumin dose capsules 3 times per day and VCO 2 capsules 3 times a dose of 2 tablespoons per day, for 2 months in the control PMO (treatment supporter).

2.2 Evaluated Variables

Sputum smear

Examined early diagnosed early, then every week for 8 weeks (2 months). Specimens of sputum: any morning-when, the staining method "Ziehl Neelsen", by laboratory personnel when

BBKPM Makassar. Sputum smear positive: At least 2 of 3 specimens of sputum smear positive outcome any morning-when, 1 specimen of sputum smear positive result and chest X-ray showed a picture of tuberculosis, 1 specimen any morning-when results are positive and smear-positive TB bacteria culture, one or more sputum specimens positive result after 3 sputum specimens (SPS) in the previous examination results are smear negative and there is no improvement after antibiotic treatment of non OAT. Sputum smear negative sputum specimens SPS if 3 sputum smear examination results are negative.

2.3 Nutritional status

Checking BMI (Body Mass Index) in early diagnosis for each month for 6 times the measurement (6 months), by measuring height and weight, nutrition carried out by officers in Makassar BBKPM to calculate the BMI, use scales ZT-120 "HEALTH CARE" brand "SMIC", the result is calculated BMI using the following formula:

$$\text{Body Mass Index (BMI)} = \frac{\text{Body weight (kg)}}{\text{Body height (m)}^2}$$

- 1) Poor nutrition state (IMT < 18,5)
- 2) Good nutrition state (IMT ≥ 18,5-25,0)

2.4 Chest X-ray examination and data analysis:

Chest X-ray start and end of treatment to see a picture of the lesion cavity, tubercles and fibrosis, read by a radiologist physicians in BBKPM Makassar. Management and data analysis with qualitative research program SPSS. Because categorical measurement scale (ordinal, continuous ratio and ratio of natural zero), then the use of comparative hypothesis test > 2 unpaired (Kruskal Wallis, paired T test) and a comparative test of more than 2 groups of pairs (Wilcoxon test).

III RESULT AND DISCUSSION

3.1 Population Characteristics

Table 1. Characteristics of study population base on sex, age and type of work,

Sample Characteristics		Research group				p
		DOTS+ Placebo (%)	DOTS + Albumin (%)	DOTS+ VCO (%)	DOTS+VC +Albumin (%)	
Sex	Male	65	50	55	65	0,707
	Female	35	50	45	35	
Age	15 – 24	15	19	16	14	0,958
	25 – 64	80	75	80	81	
	65 – 70	5	6	4	5	
Type of work	not working / housewife	40	35	40	40	0,825
	civil servants	0	10	5	10	
	private /entrepreneur	35	30	35	35	
	farmers / fisherman	5	10	0	0	
	The driver / Labor	5	10	5	5	
	Student	15	5	15	10	

p: Chi square test

3.2 Acceleration of AFB sputum conversion

Description of study population is analysis between independent variables in all experimental groups, significant acceleration of sputum conversion in all experimental groups i.e. MDT-DOTS+VCO group ($p=0.00$); MDT - DOTS + albumin capsules (Catfish protein) group ($p=0,004$) and MDT-DOTS + VCO plus albumin capsules group ($p=0.00$), but not in MDT-DOTS placebo control group ($p=0.068>0.05$).

Analysis of the most powerful treatment groups to accelerate time AFB sputum conversion. MDT-DOTSsupplemented group albumin capsules plus VCO compared placebo has a strength of 3,8 times faster AFB sputum conversion with a significance of value $p = 0.000$. MDT-DOTS group supplemented VCO has a power of 2,1 times faster AFB sputum conversion than placebo with a significance of p value = 0.000. MDT-DOTS supplemented group albumin capsules has strength 1.4 times faster AFB sputum conversion, compared to placebo with a significance of p value = 0.004.

3.3 Improvement of nutritional state

This study shows significant improvement of nutritional state in all experimental groups i.e. MDT-DOTS+VCO group ($p=0.019<0.05$); MDT-DOTS+albumin capsules (Catfish protein) group ($p=.000<0.05$) and MDT-DOTs + VCO and albumin capsules group ($p=0.00$), but not in MDT-DOTS placebo (control group) ($p=0.083>0.05$).

Analysis of the treatment groups at the most to improve the nutrition state.MDT-DOTS supplemented group albumin capsules plus VCO has a strength 1.8 times more than placebo with a significance of p value = 0.021. MDT-DOTS supplemented group albumin capsules has strength of 0.7 times more improve the nutrition state of patients compared to placebo with a significance value of $p = 0.037$. MDT-DOTS group supplemented VCO has 0.6 times stronger improves the nutrition state of patients compared to placebo with a significance value of $p = 0.044$.

3.4 Improvement of chest X-ray imaging

The study also demonstrates a significant improvement of chest X-ray imaging in all observed experimental groups i.e MDT-DOTS+VCO group ($p=0.046<0.05$); MDT-DOTS+albumin capsules (Catfish protein) group ($p=.003<0.05$) and MDT-DOTs + VCO and albumin capsules group ($p=0.001<0.05$) while those in MDT-DOTS placebo control group does not show any significant improvement ($p=0.083>0.05$).

Analysis of the treatment groups at most repair chest X-ray imaging. MDT-DOTS supplemented group albumin capsules plus VCO has a strength of 0.4 more compared to placebo with a significance of p value = 0.008. MDT-DOTS group supplemented albumin capsules has a strength 0.2 stronger compared than placebo with a significance of value $p = 0.012$. MDT-DOTS group supplemented VCO has a strength of 0.1 times stronger compared than placebo with a significance of p value = 0.025.

IV. DISCUSSION

4.1 Acceleration of AFB sputum conversion

Albumin capsule is proven to have positive effect on accelerating the conversion time of BTA sputum because it contains several essential amino acid, mineral (Ca, Mg, Fe, Cu, Zn, Mn, Ni and Co, Se and phosphor) as well as vitamin A, C, D, E and B complex (vitamin B12 in particular) [12].Glutamate contained in the albumin capsules will facilitate the increasing of CD4+ cytokine level. A study conducted by [16]showed that CD4+ cytokine plays a crucial role in stimulating the helper 1 cell producing IFN- γ which is subsequently activating macrophage alveolar.Th macrophage alveolar will stimulate the response of CD4+ T lymphocyte to produce IFN- γ during the active state of pulmonary tuberculosis [17]. Micro nutrients (e.g.: Zn) and vitamins such as vitamin A contained in albumin capsules are able to stimulate Th1 cell in producing IFN- γ among pulmonary TB childs patients [18]. This finding is supported by [19] who stated that Vitamin A and Zn significantly magnify the effect of tuberculosis regimen after the second week of treatment period and also accelerate the time AFB sputum conversion. Similar finding was observed in a study conducted by [20]. This study showed that Zn and Vitamin D affecting the immune level of pulmonary TB patients. Moreover, administering vitamin A, B complex, C, E and selenium at a dose of 6-10 daily in a month leads to an increase in CD4+ cytokine and a decrease in having the potential risk of extra pulmonary TB[21]. Another Catfish-protein experimental study by [22]conducted at

BBPKM of Makassar shows that consuming Catfish-albumin capsules for 60 days may accelerate the conversion of BTA sputum in pulmonary TB patients.

New pulmonary TB patients receiving MDT-DOTS treatment combined with VCO supplement may accelerate the time needed for AFB sputum conversion. This possibly occurs since VCO has contained amazing long-chain saturated fatty acid i.e. Glycerol Monolaurat which acts as a potent bactericide for pulmonary TB which is in turn prohibiting the replication and reproduction of Mycobacterium TB [23]. Investigated the role Mycobacterium TB in vitro. By adding Monolaurat glycerol into study setting, the researchers then observed that the bacteria were able to morphologically modify their structure in such ways to prohibit cell division [13]. It has also been proven that VCO supplement can amplify potential bactericide effect of Mycobacterium TB [24]. Finally, another study by [25] found similar finding with previous VCO studies. He concluded that VCO has a capacity to improve the activity of body hormone and to actively increase receptor sensitivity in facilitating the action of Th1 and Th2 in producing IFN- γ . It has been reported in one animal experimental study that VCO supplementation in rats can increase the number of lymphocyte due to leukocyte differentiation to normalize the level of basophil and neutrophil [26].

4.2 Improvement of nutritional state

It has been believed that Catfish-albumin capsules can increase body mass index which is more likely to alter the nutritional state afterwards. This effect is caused by the action of several essential amino acids, vitamins and minerals found in it. Administering the extraction of catfish protein to the pulmonary TB patients has shown a beneficial effect on increasing the albumin level up to 0.6 grams followed by gaining in body weight as well as an increase in the intake of energy, protein, carbohydrate and fibres [12]. The essential amino acids especially lysine, methionine, glycine and arginine can increase patient's appetite and act as an additional source of body fat, mineral salt, vitamins and UGF (Uncharacterized Growth Factors). Another Catfish experimental study, which also used Catfish-extracted albumin, demonstrated that consuming this supplement may have several effects on altering disorder in patients with HIV-AIDS. These are including improving serum albumin level of patients with HIV-AIDS, increasing the whole energy intake, altering food appetite, improving nutritional state and increasing leaning body mass [27].

The new pulmonary TB patients who received MDT-DOTS+VCO treatment have shown a significant improvement on their nutritional states. One possible underlying mechanism for this improvement is linked to some positive effects of Monolaurat glycerol found in VCO. Monolaurat glycerol contained in VCO downgrades protein catabolism and is acting as protein deposit which is in turn inhibiting the oxidative process of amino acids providing more energy and protein for body muscles. This protein in turn facilitates the secretion of glucagon subsequently activates adeniladenilat to finally produce cAMP. With the presence of cAMP, the phosphorylation phase of cell metabolism will be normally activated for regulating targeted-gland secretion and enzymatic as well as hormonal activities [28]. According to [29] VCO can stimulate nutritional absorption in such a way to help treating both malnutrition and mal-absorption syndrome. Furthermore, VCO improves the absorption of water-soluble vitamins, minerals and protein influencing the time healing and nutritional state of the patients. Another benefit of VCO to be mentioned is that it can help the patients to quickly regain their body weight by increasing energy turn over [23, 30]. Finally another VCO study by [15] which investigated the effect octanoid acid contained in VCO mentioned that octanoid acid of VCO has similar benefit as stated in previous study; therefore it is concluded that this supplement can be used to treat pulmonary TB patients with severe malnutrition.

4.3 Improvement of chest X-ray

MDT-DOTS combined with albumin capsules can be effective on treating pulmonary TB patients as indicated by significant improvement in their chest X-ray imaging. During active pulmonary inflammation process, an increasing in number of ROS and reactive nitrogen intermediate (RIN) substance due to the rising level of oxidative stress subsequently causes a decreasing in antioxidant level significantly. This situation will finally alter the response of immune system and becomes a good indicator towards drugs intoxication [31]. Similar findings are also found in several ROS-associated with pulmonary TB studies [32, 33, 34, 35].

This study concludes that antioxidants (micro-nutrients) supplementation as an adjuvant therapy helps in reduction of oxidative stress and promotes recovery of patients [36]. Since pulmonary TB has been commonly linked to poor nutritional state a way which may exaggerate the increasing level of ROS substance [32] and representing the severity level of diseases, therefore providing a proper anti oxidative adjuvant therapy such as Catfish albumin capsules becomes an advisable option [33]. As it is mentioned in Reddy, albumin protein is able to boost the amount of antioxidant in the targeted cell, accelerating the healing process and inhibiting pulmonary tissue damaging due to Mycobacterium TB activated ROS-associated inflammation process. Moreover,

albumin protein is plasma's major component which has a capacity to bind either the divalent cation of free fatty acid molecules or oksochloride hydrogen [37].

To sumup, based on all the facts mentioned previously, pulmonary TB patients receiving MDT-DOTS combined with VCO supplement have shown a significant improvement on their chest X-ray imaging. This is due to the anti oxidative effect of VCO in increasing the level of anti oxidant[38, 39, 14].

IV. CONCLUSION

From this experimental research and supported by the existing literatures, the following conclusions can be made:

1. Consumption of albumin capsules (Catfish protein) accelerated the conversion of BTA sputum, increased nutritional state and improved chest X-ray imaging in pulmonary TB.
2. Consumption of Virgin Coconut Oil (VCO) accelerated the conversion of BTA sputum, increased nutritional state and improved chest X-ray imaging in pulmonary TB.
3. Consumption of albumin capsules (Catfish protein) combined with VCO accelerated the conversion of BTA sputum, increased nutritional state and improved chest X-ray imaging in pulmonary TB.
4. The experimental groups that received Catfish extracted-albumin combined with VCO demonstrated better accelerating in the conversion of BTA sputum, increasing in nutritional state and improving on chest X-ray imaging in pulmonary TB compare to those in control placebo group.
5. The experimental group that received only Catfish extracted-albumin compared to VCO group demonstrated better accelerating in the conversion of BTA sputum, increasing in nutritional state and improving on chest X-ray imaging in pulmonary TB.

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Trait effect in different days to flowering groups of rice cultivars as described by path analysis

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Abstract- Days to flowering determines some agronomic traits of rice cultivars. One agronomic trait of rice may effect on another trait in different degrees in yield determination. The quantitative effect of one agronomic trait on another trait is not constant in different days to flowering (DF) groups of rice. In the present study one hundred sixty-four rice cultivars with different days to flowering were grouped as 70- 80-, 90- and 100- days to flowering. Agronomic traits of 80 plants in 4 plots of individual rice cultivars were evaluated in field conditions. Path analysis was done to understand the effect of one trait on another trait in different DF groups of rice cultivars separately. It was found that effect of number of total tillers on number of fertile tillers and effect of number of total spikelets/panicle on number of fertile spikelets/panicle were equally higher in each DF group. Effect of bio mass, number of tillers, panicle length and number of spikelets/panicle on the final yield greatly varied with the DF groups. The negative effect of plant height on harvest index was also varied in DF groups. Effect of panicle length on panicle weight was exceptionally highest in the 80 DF group while the effect of bio mass weight on harvest index was highest in 90 DF group. It can be concluded that the effect of a trait on the yield and on other traits in rice change with the days to flowering of the rice cultivars.

Index Terms- Trait effect, days to flowering, traditional rice cultivars, Sri Lanka

INTRODUCTION

Transition of apical bud in to floral bud demarcates the initiation of reproductive stage of rice in its growth cycle. Number of days taken for this transition determines the heading date or days to flowering of any rice cultivar (Yano et al., 2001). Maturity of rice is said to be controlled by three different types of genes namely genes controlling photoperiod sensitivity, genes determining vegetative growth and genes deciding the total number of internodes (Li et al. 1995). These all types of genes determine the crop duration, crop architecture and the final grain yield of rice.

Final grain yield of rice is determined by the total effect of yield attributing traits including days to flowering. The changing pattern of total effect of traits in different days to flowering rice groups must be studied to understand whether the selection criteria of rice cultivars for breeding programs must be decided according to the days to flowering group of rice or not.

Among many agronomic characteristics, days to flowering, plant height and yield potential determine the economical production of any crop including rice (Xue et al. 2008). Plant height is the main determining factor of plant architecture which directly affect on the final yield. Other than the plant height number of tillers/plant, number of grains per panicle and grain weight also directly affect on the final yield of rice (Surek and Baser, 2003; Selvaraj et al. 2011; Babu et al. 2012).

Variation of days to flowering in rice shows its adaptation to different agro-climatological zones. Onset of monsoon rains, short day conditions, light intensity and temperature fluctuations are the considerable factors for selection of a rice cultivar for a said agro-climatological zone. Days to flowering in rice is determined by the length of basic vegetative growth phase and photo period sensitivity of the rice cultivar (Yano et al, 1997). Basic vegetative growth phase and days to flowering were controlled by many already identified genes such as Ef-1 and Se-1-Se-7 (Yakoo et al. 1980, Poonyarit et al. 1989). Genetic studies of rice have found that flowering time gene named Hd1 regulates days to flowering by inducing flowering in short-day conditions and inhibiting flowering in long day conditions (Lin et al. 2000). Different genes involved in flowering time in rice have reported in several studies (Yakoo et al. 1980; Yamagata et al., 1986; Okumoto and Tanisaka, 1997). This genetic differentiation has created a broad variation in days to flowering among rice cultivars. A quantitative trait loci named DTH8 was found to regulate yield, plant height and days to flowering in rice (Wei et al. 2010). There are several alleles of DTH8 and type 4, type 5, and type 6 alleles of DTH8 were studied by Wei et al. (2010). The results showed that all transgene-positive plants with type 4,-5, and-6 alleles of DTH8 were tall and late flowering with large panicles, whereas all transgene-negative plants have phenotypes with opposite features (Wei et al., 2010). This finding proves that tall and late flowering characters of rice inherit together if the late flowering is determined by DTH8.

Since panicles those start flowering earlier score higher filled grain percentages exhibiting higher sink efficiency than the panicles start flowering late in the season, the late flowering reduces dry matter accumulation in grains (Mohapatra et al. 1993). This emphasizes that the flowering date affects on the final grain yield of rice in a given season.

Effect of yield attributing traits on the final grain yield of rice has been extensively studied (Zahid et al. 2006; Prasad et al. 2001; Yang et al. 2007; Selvaraj et al. 2011). Effect of each trait in different days to flowering rice groups must yet to be revealed.

Traditional rice gene pool in Sri Lanka consists of more than 2000 accessions. Exploring this secondary gene pool is very important for identifying new genes for broadening the gene pool (Aggarwal et al. 2002; Brondani et al. 2006; Jayamani et al. 2007; Thomson et al. 2007). There is a wide variation of days to flowering in traditional rice gene pool in Sri Lanka. The present study was carried out to understand the trait effect of different days to flowering groups of traditional rice cultivars in Sri Lanka.

Path analysis partitions the total effect of the causal trait in to direct and indirect effect which is important for plant breeders to identify promising traits to be considered as a selection criterion of rice (Bhatti et al. 2005; Togay et al. 2008; Ali et al. 2009). In this study path analysis was carried out to understand the effect of a trait on another trait in rice in different days to flowering groups.

MATERIALS AND METHODS

One hundred sixty four traditional rice genotypes (Table 1) collected from Plant Genetic Resources Center (PGRC), Gannoruwa, Sri Lanka were geminated and planted in nursery beds. Two week old seedlings were transplanted in the experimental field at the Faculty of Agriculture, Mapalana, Kamburupitiya, Sri Lanka according to a complete randomized block design with four replicates. Each replicate consisted of three lines and each line consisted of twenty seedlings with 15 cm X 20 cm spacing. Proper weed and pest management strategies were followed during the cropping season and the field was properly covered by a birds' nest to minimize the bird attack on the yield.

Table 1 Days to flowering of studied rice genotypes

Acc. No.	Name	Acc. No.	Name
3416	<i>A 6-10-37</i>	3613	<i>Lumbini</i>
3482	<i>Akuramboda</i>	3718	<i>Mada Thawal</i>
3611	<i>Bala Kaharamana</i>	3650	<i>Madabaru</i>
3598	<i>Bala Ma wee</i>	3570	<i>Madael</i>
3496	<i>Bala Ma wee</i>	3508	<i>Madael Galle</i>
3651	<i>Balakara</i>	3514	<i>Madael Kalutara</i>
3550	<i>Bathkiri el</i>	3670	<i>Madoluwa</i>
3415	<i>BG 34-8</i>	3662	<i>Mah Sudu Wee</i>
3409	<i>BG 35-2</i>	3511	<i>Maha Murunga Badulla</i>
3410	<i>BG 35-7</i>	3721	<i>Manamalaya</i>
3652	<i>Buruma Thavalu</i>	3519	<i>Manchel Perunel</i>
3606	<i>Chinnapodiyana</i>	2349	<i>Mas Samba</i>
3131	<i>Dahanala 2014</i>	3435	<i>Matara wee</i>
3726	<i>Dandumara</i>	3214	<i>Matholuwa</i>
3681	<i>Dandumara</i>	3506	<i>MI 329</i>
3676	<i>Dena wee</i>	3571	<i>Miti Riyan</i>
3407	<i>Dewaraddiri</i>	3591	<i>Mudukiri</i>
3687	<i>Dewaradderi</i>	3438	<i>Murunga wee</i>
3146	<i>Dewaradderi 26081</i>	3490	<i>Murungakayan 101</i>
3504	<i>Dik wee 328</i>	3489	<i>Murungakayan 3</i>
3567	<i>Dingiri Menika</i>	3394	<i>Muthu Samba</i>
3882	<i>Dostara Heenati</i>	3645	<i>Muthumanikam</i>
3383	<i>EAT Samba</i>	3427	<i>Naudu wee</i>
3589	<i>Gangala</i>	3136	<i>Pachchaiperumal 2462-11</i>
3498	<i>Geeraga Samba</i>	3487	<i>Palasithari 601</i>
3423	<i>Giress</i>	6863	<i>Papaku</i>
4726	<i>Gonabaru</i>	3417	<i>Periamorungan</i>
3691	<i>Gunaratna</i>	3395	<i>Podi sudu wee</i>
3518	<i>H 10</i>	3666	<i>Podisayam</i>
3451	<i>Halabewa</i>	3573	<i>Pokkali</i>
3688	<i>Handiran</i>	3654	<i>Pokuru Samba</i>
3641	<i>Heendik wee</i>	3639	<i>Polayal</i>
3610	<i>Heendikki</i>	3661	<i>Polayal</i>
3588	<i>Heenpodi wee</i>	3639	<i>Polayal</i>

3677	<i>Herath Banda</i>	3071	<i>Polayal</i>
3678	<i>Hondarawala</i>	3486	<i>Puwakmalata Samba</i>
3646	<i>Induru Karayal</i>	3669	<i>Rajes</i>
3658	<i>Ingrisi wee</i>	3668	<i>Ranruwan</i>
3616	<i>Jamis wee</i>	3655	<i>Rata wee</i>
3612	<i>Jamis wee</i>	4178	<i>Rathumadilla</i>
3595	<i>Kaharamana</i>	3517	<i>Seeraga Samba Batticaloa</i>
3440	<i>Kaharamana</i>	3516	<i>Seevalee Ratnapura</i>
3642	<i>Kahata Samba</i>	3614	<i>Sinnanayam</i>
4834	<i>Kallurundoivellai</i>	3497	<i>Sinnanayan 398</i>
3647	<i>Kalu gires</i>	3389	<i>Sivappu Paleusithri</i>
3653	<i>Kalu Karayal</i>	3477	<i>Sudu Goda wee</i>
3673	<i>Kaluhandiran</i>	3665	<i>Sudu Karayal</i>
3713	<i>Kalukanda</i>	3510	<i>Sudu wee Ratnapura</i>
3734	<i>Kanni Murunga</i>	3469	<i>Sudu wee</i>
3447	<i>Karabewa</i>	3397	<i>Suduheenati</i>
3463	<i>Karayal</i>	3660	<i>Suduru</i>
3686	<i>Karayal</i>	3572	<i>Suduru Samba</i>
3480	<i>Karayal</i>	3594	<i>Suduru Samba</i>
3607	<i>Kiri Murunga wee</i>	3671	<i>Suduru Samba</i>
3479	<i>Kiri Naran</i>	3698	<i>Surumaniyan</i>
3674	<i>Kirikara</i>	3507	<i>Suwanda Samba</i>
3720	<i>Kirikara</i>	3562	<i>Thunmar Hamara</i>
3434	<i>Kokuvellai</i>	3664	<i>Tissa wee</i>
4841	<i>Koopen Sivappu</i>	3160	<i>Valihandiran</i>
3675	<i>Kotathavalu</i>	4819	<i>Vellainellu</i>
3659	<i>Kotathavalu</i>	3401	<i>Wanni Heenati</i>
3679	<i>Kottakaram</i>	3735	<i>Weli Handiran</i>
3982	<i>Kuru Wee</i>	3615	<i>Yakada wee</i>
3656	<i>Kuruluthudu</i>	3445	<i>Yakada wee</i>
3638	<i>Lumbini</i>	3756	

Data were collected in 80 plants of four replicates. Data on plant height (cm), number of tillers/plant, number of fertile tillers/plant, panicle length (cm), panicle weight (g), number of spikelets/panicle, number of fertile spikelets/panicle, 100 grain weight (g) and yield/plant (g) and days to 50% flowering were recorded during the experiment. Total effect of yield attributing traits on grain yield was estimated by total effect dissected by Path analysis. Path analysis was performed using IBM SPSS AMOS statistical software (SPSS Inc., 2011). The changing pattern of effect of one trait on another trait with days to flowering was described by an equation with the R^2 using the most fitted line for the two variables.

RESULTS AND DISCUSSION

Days to flowering of rice cultivars given in table 1 was evaluated at the field conditions when the flowering of the individual rice cultivars reached at 50%. The days to flowering of rice cultivars varied from 78-107. The average values of 80 rice plants on ten different agronomic traits were used for path analysis of different days to flowering groups of rice (Table 2). The effect of individual trait dissected by the path analysis is given in table 2. The changing pattern of total trait effect as analysed by SPSS AMOS in different days to flowering group is given in table 3.

Effect of days to flowering on plant height:

The maximum effect of days to flowering on plant height was recorded in 70 DF group while it was gradually reduced up to 90 DF (Table 2). Only at 90 DF the effect of days to flowering on plant height was negative (Table 2A). It can be concluded that in 70 DF, 80 DF, and in 100 DF cultivars, days to flowering positively affects on the plant height but not in the 90 DF cultivars. However it has been reported an interaction between heading date and plant height (Yu et al. 2002). Some specific genes delay heading and increase plant height and panicle size (Xue et al. 2008). Though agronomic characters of rice is largely controlled by environmental factors, the plant height is least affected by the environment (Hittalmani et al. 2003). Hence the changes in effect of days to flowering on plant

height with days to flowering must be due to the genetic differentiation in rice. This relationship can be explained by the equation $y = -0.27\ln(x) + 0.406$ ($R^2=0.022$).

Effect of plant height on number of tillers:

Tiller number of rice directly affects on the final grain yield capacity. A significant negative correlation in between plant height and tiller number was reported by Yang et al. (2006). Present study showed a sigmoid relationship in between plant height and tiller number with a minimum and a maximum value at 80 DF and 90 DF respectively (Table 3B). Tiller number per plant is a quantitative trait with a relatively low heritability (Xiong 1992). Hence the number of tillers are affected by the environment greatly.

Effect of number of tillers on number on fertile tillers:

Interestingly the number of tillers equally affects on number of fertile tillers from 70 DF to 90 DF but this effect was little reduced in the 100 DF group (Table 3C). Though tiller number per plant determines the panicle number per plant (Lie et al. 200) determination of number of fertile tillers is not greatly affected by days to flowering in rice.

Effect of plant height on panicle length:

According to the path analysis the maximum effect of plant height on the panicle length was recorded at the 100 DF group (Table 3D). Though it has been reported that plant height and panicles/plant had high positive indirect effect on yield/plant (Chakraborty et al. 2010), there was no records on total effect of plant height on panicle length.

Effect of number of fertile tillers on filled grain percentage:

This is a parabolic relationship with higher values at 70 DF group and 100 DF group (Table 3E). Spike number is closely related to rice tillering (Xue et al., 2008). Therefore, reducing productive tillers may affect on improving rice grain filling in 80 DF and 90 DF group.

Effect of plant height on harvest index and bio mass:

There was a positive effect of plant height on harvest index in 70 DF group, while this became negative in 100 DF group (Table 3F). It is obvious that the harvest index has an inverse relationship with the plant height as the plant height directly affects on the above ground bio mass. The minimum effect of plant height on bio mass was at 80 DF group while it was maximum at 100 DF group (Table 3G). This must be due to long vegetative growth phase which accumulates dry matter weight in the rice plant in 100 DF group. Mao et al. (2005) observed that QTLs which have pleotropic effects on yield and/or yield related traits. Dissection of genetic relationship of plant height, yield and bio mass is complicated when the pleotropic QTLs control the effect.

Effect of filled grain percentage on hundred grain weight:

There was a negative effect of filled grain percentage on hundred grain weight in 70 DF group to 90 DF group (Figure 3H). This might be the reason that the filling during short period of time leads incomplete grain filling without reaching spikelets' maximum weight. However, Jeng et al. (2006) showed a rapid filling rate even in a shorter grain-filling period in cultivar SA419.

Effect of panicle length on panicle weight:

Effect panicle length on panicle weight was maximum at 80 DF group while this was negative in 100 DF group (Table 3I). This explains that in 80 DF cultivars long panicles increase the panicle weight but in 100 DF cultivars, the long panicles do not increase the panicle weight. Failure in increasing filled grain percentage with the panicle length would be the reason for this. Jeng et al. (2006) has extensively studied the effect of panicle structure on the grain filling of rice where they reported that the even within a panicle the amount of grain filling differs with the place to where the spikelet is attached in the panicle.

Table 2. Trait effect of different days to flowering groups of rice

70 DF				80 DF				90 DF				100 DF			
PH	<---	DF	0.474	PH	<---	DF	0.151	PH	<---	DF	-0.06	PH	<---	DF	0.192
NT	<---	PH	0.136	NT	<---	PH	-0.479	NT	<---	PH	0.34	NT	<---	PH	0.073
NFT	<---	NT	0.938	NFT	<---	NT	0.933	NFT	<---	NT	0.93	NFT	<---	NT	0.808
PL	<---	PH	0.116	PL	<---	PH	-0.19	PL	<---	PH	0.19	PL	<---	PH	0.429
FGP	<---	NFT	0.506	FGP	<---	NFT	0.255	FGP	<---	NFT	0.17	FGP	<---	NFT	0.563
HI	<---	PH	-0.225	HI	<---	PH	-0.475	HI	<---	PH	-0.41	HI	<---	PH	-0.842
BM	<---	PH	0.306	BM	<---	PH	0.198	BM	<---	PH	0.47	BM	<---	PH	0.68
HGW	<---	FGP	-0.99	HGW	<---	FGP	-0.946	HGW	<---	FGP	-0.83	HGW	<---	FGP	0.439

PW	<---	PL	0.041	PW	<---	PL	0.682	PW	<---	PL	0.26	PW	<---	PL	-0.038
YLD	<---	PL	0.417	YLD	<---	PL	0.217	YLD	<---	PL	0.08	YLD	<---	PL	0.143
YLD	<---	NFT	-0.367	YLD	<---	NFT	0.262	YLD	<---	NFT	-0.22	YLD	<---	NFT	0.438
YLD	<---	BM	0.532	YLD	<---	BM	0.379	YLD	<---	BM	0.7	YLD	<---	BM	0.4
YLD	<---	DF	-0.381	YLD	<---	DF	0.224	YLD	<---	DF	0.01	YLD	<---	DF	-0.048
YLD	<---	NT	0.507	YLD	<---	NT	0.026	YLD	<---	NT	0.25	YLD	<---	NT	-0.31
YLD	<---	NS	0.263	YLD	<---	NS	0.358	YLD	<---	NS	-0.21	YLD	<---	NS	1.11

DF:Days to flowering, PH: Plant height, NT: Number of total tillers, NFT: Number of fertile tillers, PL: Panicle length, FGP: Filled grain percentage, HI: Harvest index, BM:Bio mass, NS:Number of spekelets, HGW:hundred grain weight, YLD:yield/plant, PW: panicle weight

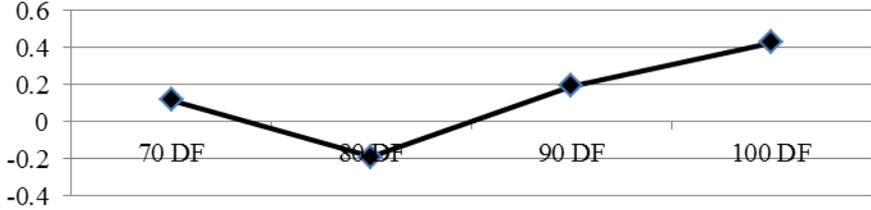
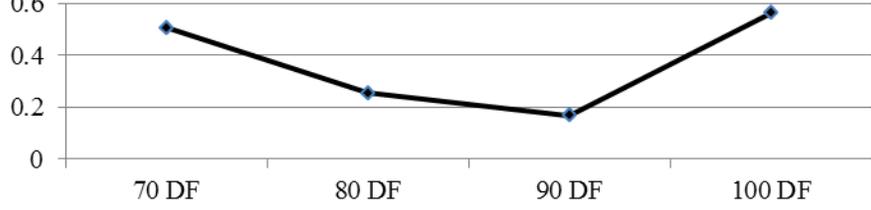
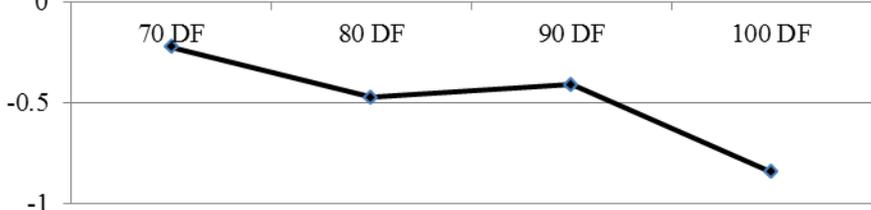
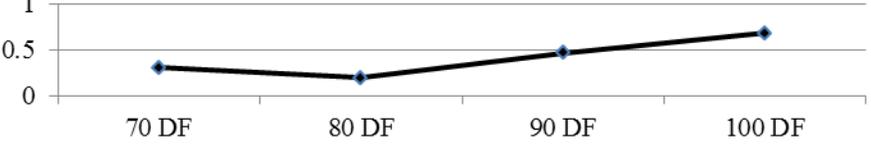
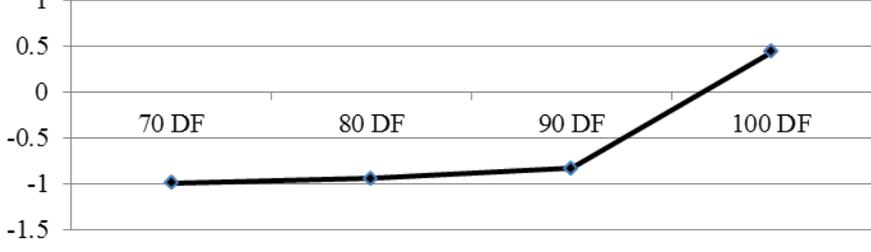
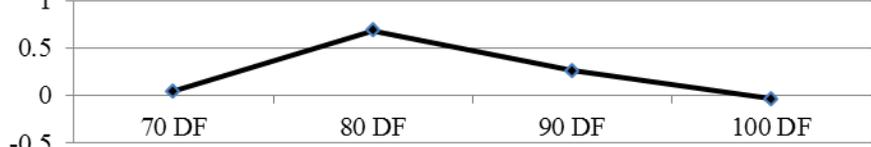
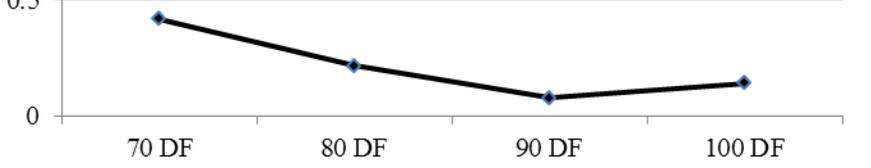
The changing pattern of trait effect in rice with days to flowering is given in table 3.

Effect of different traits on yield:

The maximum effect of panicle length and number of tillers on final grain yield was recorded at 70 DF group while the maximum effect of DF and number of total tillers were recorded in 80 DF group (Table 2). Only the trait bio mass recorded the maximum effect on the final grain yield in 90 DF group while number of fertile tillers recorded the maximum effect on yield in 100 DF group (Table 2, Table 3J-Table 3O). The collective effect of these all traits must be considered in each DF group to come to a conclusion to decide which parameters must be considered as selection criteria in different DF groups in rice.

Table 3 Changing pattern of trait effects in different DF groups

<p>Trait effect Eg; Effect of Days to flowering on plant height (PH <---DF)</p>	<p>Changing pattern of trait effect in different days to flowering (DF) groups of rice. The equation for the relationship between days to flowering and trait is given with the R² value in each graph.</p>
<p>A. PH<---DF *y = -0.27ln (x) + 0.406 R²=0.022</p>	
<p>B. NT<---PH *y = 0.086x² - 0.368x + 0.291 R² = 0.134</p>	
<p>C. NFT<---NT *y = -0.07ln (x) + 0.960 R² = 0.459</p>	

<p>D. PL<---PH $*y = 0.221\ln(x) - 0.038$ $R^2 = 0.270$</p>	
<p>E. FGP<---NFT $*y = 0.340e-0.00x$ $R^2 = 0.000$</p>	
<p>F. HI<---PH $*y = 0.086x^2 - 0.368x + 0.291$ $R^2 = 0.134$</p>	
<p>G. BM<---PH $*y = 0.221\ln(x) - 0.038$ $R^2 = 0.270$</p>	
<p>H. HGW<---FGP $*y = 0.340e-0.00x$ $R^2 = 0.000$</p>	
<p>I. PW<---PL $*y = 0.078x - 0.245$ $R^2 = 0.163$</p>	
<p>J. YLD<---PL $*y = 0.820\ln(x) - 1.233$ $R^2 = 0.520$</p>	

<p>K. YLD<---NFT *y = 0.008x² + 0.151x - 0.413 R² = 0.421</p>	
<p>L. YLD<---BM *y = -0.01ln(x) + 0.511 R² = 0.002</p>	
<p>M. YLD<---DF *y = 0.078x - 0.245 R² = 0.163</p>	
<p>N. YLD<---NT *y = -0.01ln(x) + 0.511 R² = 0.002</p>	
<p>O. YLD<---NS *y = 0.320ln(x) + 0.125 R² = 0.123</p>	

*The equation of the most fitted line which explains the changing pattern of the trait effect with the DF

CONCLUSIONS

Days to flowering positively affected on the plant height in 70 DF, 80 DF, and 100 DF cultivars but not in 90 DF cultivars. There was a sigmoid relationship in effect of plant height on tiller number in different DF groups. However, days to flowering did not greatly affect on number of fertile tillers in rice. At 100 DF group, plant height affected on the panicle length in its maximum capacity. In 80 DF and in 90 DF groups, fertile tillers weakly affected on filled grain percentage than that of in 70 DF and 100 DF group where the effect was prominent. Plant height in 100 DF group affect on bio mass greatly than that of in other DF groups. Hundred-grain-weight was negatively affected on filled grain percentage in 70 DF, 80 DF and in 90 DF groups but not in 100 DF group.

In 70 DF group, panicle length and number of tillers effected on the final yield greatly than those of in the other DF groups. In 80 DF group, the maximum effect of DF and number of total tillers on the final grain yield were prominent. The only trait which recorded the maximum effect on the final yield in 90 DF group was the bio mass while in 100 DF group, number of fertile tillers affected on the final grain yield greatly than that of in other DF groups. The collective effect of these all traits must be considered in each DF group to come to a conclusion to decide which parameters must be considered as selection criteria in different DF groups in rice.

Studying the effect of different traits of rice in different days to flowering groups is of great significance in breeding higher-yielding rice varieties in future, using improved techniques. Findings of trait effect in different DF groups in rice may help for such studies in future.

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