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Study on the fecundity of *Cyprinus carpio communis* (Linnaeus, 1758, introduce)

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Abstract- Mature specimens ranging in weight from 47.00g to 4450g and in length from 145mm to 610mm were used. Weight of ovary in the fish fluctuated from 4.0 g to 707 g with a mean value of 33.47. Absolute fecundity of samples varied from 3173 to 629230 and the relative fecundity varied in the range of 21.00 - 223.00 with a mean value of 91.17. The mathematical relationship of fecundity with other variables viz: fish length, fish weight, ovary weight and ovary length, and between fish weight and ovary weight and ovary length was calculated. The computed relationships were found to be highly significant especially between fecundity and fish weight ($r=0.953, p<0.01$) and fecundity and ovary weight ($r=0.998, p>0.01$). The values of regression coefficient (b) and correlation coefficient (r) were computed separately.

Index Terms- *Cyprinus carpio communis*, Fecundity, Relationships, Gonadosomatic Index

I. INTRODUCTION

The Chinese carp was introduced in Kashmir in 1956 and since then this fish has shown remarkable adaptation in various water bodies of the state, and soon began to constitute a major fishery of flat land temperate waters of Kashmir (Fotedar and Qadri 1974; Vass *et al.*, 1984). According to Das (1970, 91) the hardy mirror carp formed almost 75% of the fish catch in Dal and Wular lakes.

Feeding and breeding biology of Kashmir fish has been attempted by a number of workers (Malhotra, 1966; Das and Subla, 1969; Subla and Das, 1970; Jan and Das, 1970; Jyoti and Malhotra, 1975; Raina, 1978; Sunder, 1984; Sunder *et al.*, 1984; Sunder and Subla, 1985; Yousuf and Pandit, 1992; Kulkarni *et al.*, 1994; Yousuf and Firdous, 1997 and 2001; Yousuf *et al.*, Koops *et al.*, 2004). Sindhe and Kulkarni 2005; Shatunovskii 2006; Bhuiyan *et al.*, 2006

The present study was under taken from Dal Lake, which is situated between 34° 5' and 34° 6' N latitude and 74° 8' and 74° 12' E longitude at an altitude of 1584m above sea level. During the present investigations, eight sites were selected for collection of fish in four different basins of the Dal Lake, one peripheral and one central from each basin viz., Hazratbal, Nishat, Gagribal and Nageen.

II. MATERIAL AND METHODS

The fisherman used traditional cast net with different mesh sizes. Fish identification was done with the help of standard taxonomic works (Day, 1878; Hora, 1936; Mukerji, 1936; Kullander *et al.*, 1999)

After various body measurements the fishes were sacrificed and both the ovaries were taken out carefully. The moisture was thoroughly wiped out from the ovaries with a blotting paper. The length and weight of ovaries was noted down with complete care. The collected ovaries were then placed in 10% formaldehyde for at least 24 hours to bring hardness of eggs, so as to make easy and accurate calculation of sticky eggs. This was followed by drying of eggs on blotting paper for 1 – 2 hours, three sub-samples of one gram each from anterior, middle and posterior parts of ovary were weighed on a sensitive mono-pan balance (Anamed-Modal No.Mx-730) and then eggs were counted carefully by gravimetric method. The mean number of eggs then was multiplied by gonad weight and the total number of eggs per gonad was obtained, i.e. absolute fecundity of fish. Relative fecundity was determined by the ratio of total number of ova and total weight of fish.

In order to assess the gonadal development of fish the Gonadosomatic index of the fish was calculated as per formula:

Gonadosomatic Index:

$$\text{Go.S.I} = \frac{\text{Weight of gonad}}{\text{Total weight of fish}} \times 100$$

III. RESULTS

A. The Ovary Features

Ovary of *C.c.communis* was bilobed and the two lobes of the ovary were almost of same size. The shape and size of ovary did not remain same throughout the year but it was found to be dependent on the different stages of sexual maturity of the female. White coloured stripe like gonads were observed during early immature stages which grow in size and ultimately become yellow in colour during mature stages of development. Fish in high state of maturity either ripe or pre-spawning phase was selected for the determination of fecundity

Relationship between fecundity (F) and fish length (TL)

The scatter diagram revealed a linear (Figure 1) relationship between fecundity and fish length and the coefficient of correlation was significant at 1% level ($P<0.01$). The relationship between fecundity (F) and total length (TL) is expressed by the equation:

$$F = -11617 + 582 \text{ TL} \quad (r=0.742, p < 0.01)$$

A logarithmic transformation gives the straight-line regression of log fecundity on log length,

$$\text{Log } F = -3.53 + 3.26 \text{ Log } TL$$

Fecundity and Fish Weight (FW)

The data pertaining to fish weight (Somatic + gonadal) and absolute fecundity revealed a linear relation (Figure 2) between the two parameters, which was expressed mathematically as:

$$F = -219 + 109 \text{ FW} \quad (r = 0.953, p < 0.01)$$

$$\text{Log } F = 1.80 + 1.05 \text{ Log } FW$$

Fecundity and ovary length

Fecundity showed an increase with an increase in the length of ovaries (OL). A significant linear relationship was observed (Figure 3) which was expressed by the equation:

$$F = -37497 + 779 \text{ OL}$$

or

$$\text{Log } F = 0.531 + 1.96 \text{ Log } OL$$

Fecundity and Ovary Weight (OW)

A highly significant linear relationship was found between the two parameters (Figure 4) which was expressed by the equation,

$$F = 1271 + 767 \text{ OW} \quad (r = 0.998, P < 0.01)$$

or

$$\text{Log } F = 2.92 + 0.994 \text{ Log } OW$$

Ovary weight (OW) and fish weight (FW)

A highly significant relationship was found between the two variables (Figure 5) the obtained equation was as:

$$\text{OW} = -7.15 + 0.142 \text{ FW} \quad (r = 0.954, P < 0.01)$$

or

$$\text{Log } OW = -1.15 + 1.07 \text{ Log } FW$$

Ovary length and fish weight

A significant positive correlation was found between the two variables (Figure 6), expressed by the equation,

$$\text{OL} = -66.1 + 0.0580 \text{ FW} \quad (r = 0.660, P < 0.01)$$

or

$$\text{Log } OL = -0.977 + 0.396 \text{ Log } Fw$$

Figure 1: Relationship between fish length and fecundity in *C.c. communis*

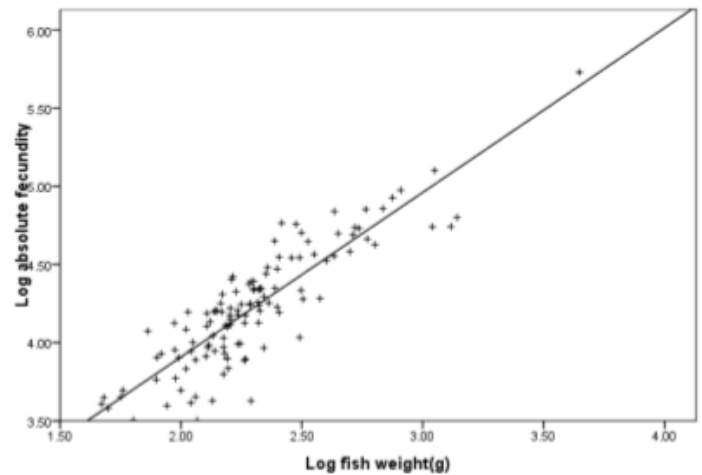


Figure 2: Relationship between fish weight and fecundity in *C.c. communis*

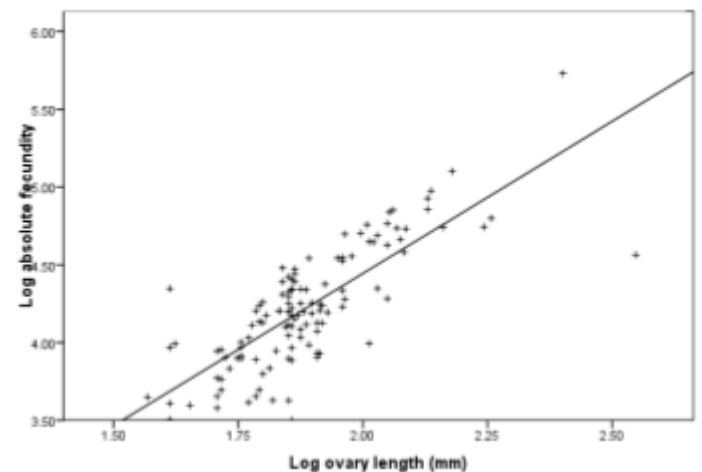


Figure 3: Relationship between ovary length and fecundity in *C.c. communis*

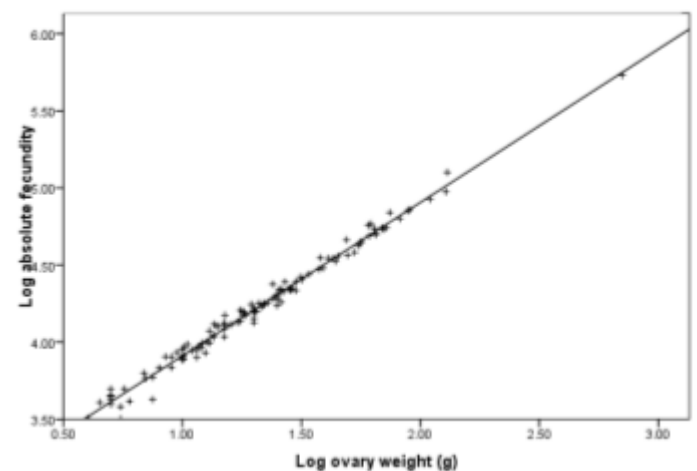
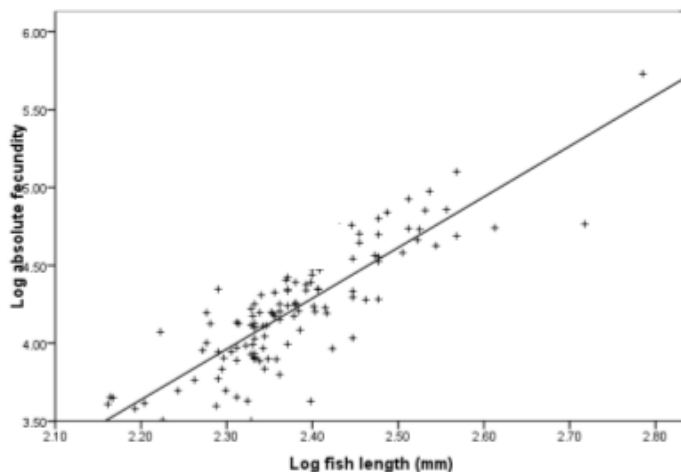


Figure 4: Relationship between ovary weight and fecundity in *C.c. communis*

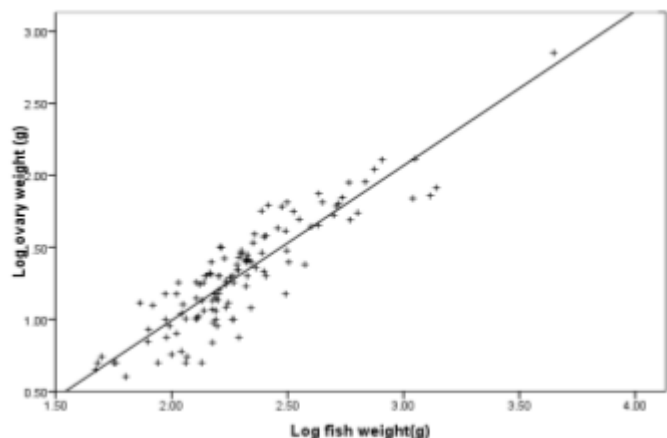


Figure 5: Relationship between fish weight and ovary weight in *C.c. communis*

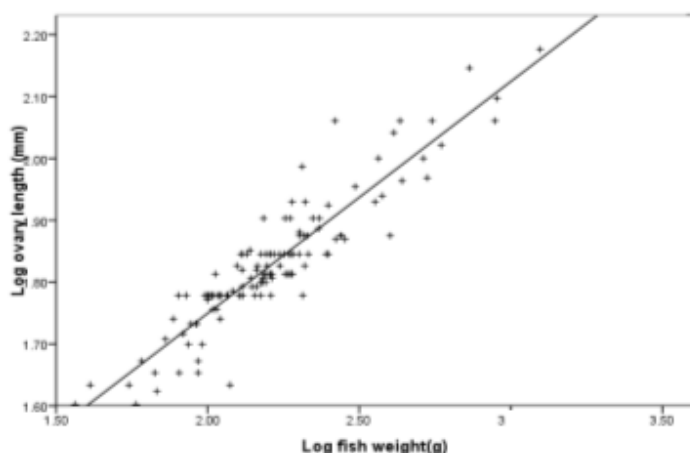


Figure 6: Relationship between fish weight and ovary length in *C.c. communis*

GONADOSMATIC INDEX

The gonadosomatic index (Go. S.I.) fluctuated from minimum of 2.302 in June to 11.363 in March. As far as the Go. S.I. of this fish was concerned; it exhibited variations in different months of the year (Figure 7). The Go.S.I. values decrease during April to June which suggests that fish has completely spawned and no more gonadal mass lies in the ovary. The length group IV recorded the minimum Go. S.I. value of 5.96, whereas the highest length group VII attained the maximum Go. S. I. of 8.46.



Figure 7 Monthly fluctuations in Go.S.I. of *C.c. communis*

Table 1: Fluctuation in Go.S.I. of various length groups in *C. c. communis*

Type of index	I	II	III	IV	V	VI	VII
Length groups	141- 179	180- 219	220- 259	260- 298	299- 336	337- 374	375- 414
Gonadosomatic index	6.16	7.0	7.57	5.96	6.14	7.216	8.46

IV. DISCUSSION

Study on fecundity forms an important part of fishery science as it has direct bearing on fish production and exploitation. Nikolskii (1965) stated that "fecundity is a specific feature that arises during the evolution of a new species adapted to a certain environment and is directed towards the continuance of the species".

The present investigations revealed a significant linear relationship between absolute fecundity and fish weight, fish length, ovary weight and ovary length. Linear relationships of fecundity with body measurements were also reported by Swarup (1962); Jhingran (1968); Varghese (1973), (1976); Rao et al. (1979), and Pathani, (1981); Bhuiyan et al (2006).

Different fishes exhibit different reproductive potential in terms of fecundity. Norman and Greenwood (1963) reported that *Molva* produces as many as 28,361,000 eggs; *Gadus* 6,652,000, while in case of Stickle backs the number of eggs ranges from 30 to 100 per female per season. Fecundity is known to vary within species with latitude and location (Cushing 1968; Mann et.al., 1984) and also with spawning time (Ware, 1975). On the basis of fecundity it was found that *C. carpio* dominated over the endemic species in terms of reproductive potential (Das and Malhotra 1964; Singh and Das 1969; Bowerman, 1975).

The studied fish was found to spawn during spring although the gonads were fully mature at the start of winter. But because of

severe winter of Kashmir the gonads show inactivity or gonadal diapause (Egami, 1959 and Hisoaka and Firlit, 1962 Malhotra, 1966 and Jyoti, 1973) which remains upto the middle of February.

V. CONCLUSION

In conclusion it can be said that *C. carpio* was the most fecund fish in the lake and showed adaptability to wide range of habitats (Das and Singh, 1969; Malhotra and Jyoti, 1974; Yousuf and Pandit 1992).

The exotic common carp *C. carpio* benefited from the changing environmental conditions in the lake and got well established in the lake within a short span of time. However, recently it has been observed that even this species is declining in number as the pollution level in lake is increasing unabated. While comparing the previous work of Das and Singh, (1969) with the present work there was recorded a decrease in absolute fecundity of *C. c. Communis*. This may be attributed to the declining environmental quality, which leads to physiological stress in the fish.

REFERENCES

- [1] Bhuiyan, A. S.; Islam K. and Zaman T. (2006). Fecundity and ovarian characteristics of *Puntius gonionotus*. *J. Biol – Sci.* **14**: 99 – 102.
- [2] Bowerman, M. R. (1975). Concern over spread of carp in Southern Australia. *Aust. J. Fisheries.* **34**(3): 4-7
- [3] Cushing, D. H. (1968). A study in population dynamics. *Fishery Biology*: Madison, Milwaukee, and London. University of Wisconsin Press. 200.
- [4] Das, S. M. and Malhotra, Y. R. (1964). Studies on the comparative fecundity of some Kashmir fishes. *Ichthyologica*
- [5] Das, S. M. and Subla, B. A. (1963). The ichthyofauna of Kashmir part-I History, topography, origin, ecology and general distribution. *Ichthyologica*, **2**(1-2): 87-106.
- [6] Das, S. M. and Subla, B. A. (1969). The mechanism of feeding in nine Kashmir fishes with comparative account of the standard mechanism in a herbivore an omnivore and a carnivore. *Kash. Sci.* **VI**(1 – 2): 121 – 130.
- [7] Day, F. (1878). The Fishes of India, being a Natural History of the Fishes known to inhabit the seas and fresh waters of India, Burma and Ceylon. Reproduced in 1958, London; William Downen and sons, 778 pp.
- [8] Egami, N. (1959) *J. Fac. Sci. Tokyo Univ. Zool.* **8**: 539
- [9] Hisoaka, K. K. and Firlit, C. F. (1962), *Copeia*, (4): 788
- [10] Hora, S. L. (1936). Yale North Indian Expedition, Article XVIII. Report on fisheries, part I, Cobitidae. *Mem. Conn. Acad. Sci.* **10**: 299-321
- [11] Jan, N. A. and Das, S. M. (1970). Qualitative and Quantitative studies on the food of eight fishes of Kashmir Valley. *Ichthyologica* **10**: (1-2): 20 – 26.
- [12] Jhingran, V. G. (1968). Synopsis of biological data on *Catla catla* (Hamilton); *FAO Fisheries Synopsis.* (32). 100pp.
- [13] Jyoti, M. K. (1973). Studies on the feeding and gonadal cycles of some fishes of Jammu and Kashmir State. Ph. D. Thesis. University of Jammu, 242.
- [14] Jyoti, M. K. and Malhotra, Y. R. (1975). Seasonal variations in feeding of *Nemachilus Kashmirensis* (Hora). *Matsya* **1**: 53-58.
- [15] Koops, M. A.; Hutchings, J. A. and McLntyre, T. M. (2004). Testing hypothesis about fecundity, body size and maternal condition in fishes. *Blackwell synergy Fish and Fisheries.* **5** (2): 120 – 130.
- [16] Kulkarni, R. S.; Rafiq, D. and Patil, M. (1994) studies on the fecundity of a freshwater fish, *Channa punctatus* (Bloch) from different aquatic bodies. *Him. J. Env. Zool.* **18**: 142-145.
- [17] Kullander, S. O. Fang, F.; Dellling, B. and Ehlander, E. (1999). The fishes of the Kashmir Valley, pp. 99-168 In: *River Jehlum, Kashmir valley*, impacts on the aquatic environment. (Linhart Nyman eds.).
- [18] Malhotra, Y. R. (1966). Breeding in some fishes of Kashmir valley. *Ichthyologia* **V**(1-2): 53-58.
- [19] Mann, R. H. K.; Mills, C. A. and Crisp, D. T. (1984). Geographical variation in the life history tactics of some species of fresh water fish. In: pp. 17-186. *Fish reproduction strategies and tactics*, (Potts, G. W.; Wooton, R. J., ed. London, Academic press).
- [20] Mukerji, D. D. (1936). Yale North India expedition, Article 18. Report on Fishes part 2 Sisoridae and Cyprinidae. *Mem. con. Acad. Sci.* **10**: 323-359.
- [21] Norman and Greenwood (1963). A History of fishes. Lond. (Ernest Benn) 213-216.
- [22] Pathani, S. S. (1981). Fecundity of mahaseer *Tor putitora*. *Proc. Indian. Acad. Sci. (Anim. Sci.)*. **90**(2): 253 – 260.
- [23] Raina, H. S. (1987). A biological note on the introduced common carp in the temperate waters of Kashmir: *Indian. J. Fish.* **34** (1): 114 – 119.
- [24] Rao, C.; Nagendra, N. R. and Rahman, K. V. K. (1979). An analysis of the fecundity in the Cyprinid fish *Puntius dorsalis* (Jardón) All India seminar on Ichthyology. 11pp.
- [25] Shatunovskii, M. I. (2006). Some patterns of age and geographical variation in fish fecundity. *Journal of Biology Bulletin.* **33**(2): 195-198
- [26] Sindhe, V. R.; Rafiq, Md.; Satish, S. V. And Kulkarni, R. S. (2002). Fecundity of the freshwater fish *Channa punctatus* (Bloch) from three aquatic bodies. *J. Environ. Biol.* **23** (4): 429-32.
- [27] Singh, H. and Das, S. M. (1969). Seasonal changes in the morphology of the ovaries of *Crossocheilus lateus punjabensis* (Heckle) Cypriniformes. *Kashmir Sci.* **VI** (1 - 2): 131 – 136.
- [28] Sindhe, V. R.; Rafiq, Md.; Satish, S. V. And Kulkarni, R. S. (2002). Fecundity of the freshwater fish *Channa punctatus* (Bloch) from three aquatic bodies. *J. Environ. Biol.* **23** (4): 429-32.
- [29] Singh, V. and Shrivastava, P. (1982). Fecundity study of three Indian Major carps. *Indian Journal. Zoology.* **10** (1): 29 – 36.
- [30] Subla, B. A. and Das, S. M. (1970). Studies on the feeding habits, the food and the seasonal fluctuation in feeding in nine Kashmir fishes. *Kash. Sci.* **VII**(1-2): 25-44.
- [31] Sunder, S. (1984). Dietary habits of *Schizothorax curvifrons* (Heckel) from river Jehlum Kashmir. *Himalayan Research and Development* **3**(11): 17 – 23.
- [32] Sunder, S.; Kumar, K. and Raina, H. S. (1984). Food and feeding habits and length weight relationship of *Cyprinus carpio specularis* of Dal Lake, Kashmir. *Indian. J. Fish.* **31**(1): 90 – 99.
- [33] Sunder, S. and Subla, B. A. (1985). Food of Juveniles of *Schizothorax curvifrons* (Heckel). *Bull. Env. Sci.* **2** (1): 34-36.
- [34] Swarup, K. (1962). The fecundity of Indian Shad, *Hilsa Ilisha*, *J. Zool. Soc.* **13**: 108-112.
- [35] Varghese, T. J. (1976). Studies on the fecundity of *Coilia ramcarati* (Ham. – Buch). *Proc. Indian Acad.* **83**: 47-54
- [36] Ware, D. M. (1975). Relationship between egg size, growth and natural mortality of larval fish. *J. Fish. Res. Board Can.* **32**: 2503-2512.
- [37] Yousuf, A. R. and Pandit, A. K. (1992). Breeding biology of *Schizothorax niger* (Heckel), pp. 55-62. In: *Current Trends in Fish and Fishery Biology and aquatic ecology*. (Yousuf et al., eds). Kashmir University. Srinagar.
- [38] Yousuf, A. R. and Firdous, G. (1997). Food spectrum of crucian carp, *carassius carassius* in Anchar lake. *Oriental Sci. ISSN 0971-703 X*.
- [39] Yousuf, A. R. and Firdous, G. (2001). Food spectrum of Mirror carp in a deep mesotrophic Himalayan lake. *J. of Research and Development* **1**: 60 – 66.
- [40] Yousuf, A. R.; Bhat, F. A.; Mehdi, D.; Ali, S. and Ahangar, M. A. (2003). Food and feeding habits of *Glyptosternon reticulatum* (McClelland & Griffith) in torrential streams of Kashmir Himalayas. *J. Res. Dev.* **3**: 123-133.

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Actinobacterial diversity of mangrove environment of the Bhitharkanika mangroves, east coast of Orissa, India

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Abstract- Studies on actinobacteria of marine habitats gaining international importance due to its proven abilities of novel compound production. Information on actinobacteria of the mangrove environments is less and hence the present study was carried out in the different mangrove environment of Bhitharkanika, Orissa. A total of 116 actinobacterial colonies were recorded from 30 mangrove and marine sediment samples of Bhitharkanika mangrove environment east coast of Orissa. Among them, 67 isolates were morphologically distinct on the basis of colour of spore mass, riverside colour, aerial and substrate mycelia formation, production of diffusible pigment, sporophore morphology. Forty three isolates were assigned to the genus *Streptomyces*, *Saccharopolyspora* (5), *Nocardiopsis* (5), *Micromonospora* (3), *Actinomadura* (5), *Actinomycetes* (1), *Actinopolyspora* (5).

Index Terms- women entrepreneurs, micro-enterprise, management styles, need for training.

I. INTRODUCTION

The term "Actinobacteria" gram-positive organisms that tend to grow slowly as branching filaments, resembling fungi, as their filamentous growth forms mycelial colonies (Kathiresan, 2008). Among all actinobacterial groups the streptomycetes represent as the dominant group and are best known for their ability to produce antibiotics. However, ecological role of actinobacteria in the marine ecosystem is still understudied. However, the various marine resources such as mangroves, coral reefs, seaweeds and seagrasses and different marine environment like coastal, offshore and deep sea are presently considered as the best resources for isolating novel actinobacteria (Felseke et al., 1997, Greimon et al., 2003 and Rheims et al., 1999). Similarly, striking advances have been made in marine microbial ecology using molecular techniques and metagenomics that leads new insights into marine actinobacterial biodiversity and biogeography. Having with this in mind, present study was carried out in the mangrove ecosystem of Bhitharkanika, Orissa to comprehend the diversity of actinobacteria.

II. MATERIALS AND METHODS

A. Isolation of actinobacteria, the samples were collected from 5 stations of Bhitharkanika mangroves

The area of Bhitharkanika mangrove forest spread over an area of 1712 ha divided into three major blocks Dangmal 636 ha., Kakranasi 310 ha., and Thakurdia 272 ha. (Chadha & Kar, 1999). Bhitharkanika and Dangmal Blocks constitute the core area. This area influenced by many rivers such as Dhamra, Hansua,

Brahmani, Baitarani, and their tributaries. These sites experience tide of semi diurnal type with mean tidal amplitude of 1.66 M.

Inserting a pre sterilized (with alcohol) polyvinyl corer (10cm dia.) into the sediments. The central portion of the top 2 cm sediment sample can be taken out with the help of a sterile spatula. This sample was transferred to a sterile polythene bag and transported immediately to the laboratory. The sediment samples thus collected are air dried aseptically for further use. Physico-chemical characteristics of the samples collected from the sites where samples collected for microbial analysis were tested. Various environmental parameters such as temperature, transparency, salinity, pH, dissolved oxygen etc. were recorded from the 5 stations Bhitharkanika. Air and sediment temperatures were measured with a mercury thermometer with $\pm 0.02^{\circ}\text{C}$ accuracy. Sediment pH was measured by soil pH Tester (Model DM – 13, Takemura Electric Works Ltd., Tokyo, Japan). After taking sediment samples by using Peterson grab, they were transferred to clean polythene bags, then air-dried and used for the analysis of sediment composition and organic carbon. The textural analysis of the sediments was carried out by the combined method of sieving and pipette analysis after taking known quantity of sample by coning and quartering method. Dry sieving was done using Ro-Tap sieve shaker for 15 minutes (Folk, 1966). Fine particles were separated by pipette method, as proposed by Krumbein and Pettijohn (1938). The organic carbon content in the sediment samples was determined by using the standard method of el Wakeel and Riley (1956).

For the study of trace metals, known quantities of sediment samples were taken and were oven dried at 110°C for 24 hours and ground with the help of a mortar and pestle. The samples were digested with concentrated perchloric acid and nitric acid (1:3) based on the standard procedures of Topping (1973) and Watling (1981). The supernatant was analyzed in the Inductively Coupled Plasma Mass Spectrophotometer (ICP-MS). The amount of oil (petroleum hydrocarbon) present in the sea water was calculated using the method given in APHA (1971). The pesticide residue in the seawater was analysed by using the standard method of Grasshoff et al. (1999).

For microbial analyze, after a week, the sediment samples were incubated at 55°C for 5 min (Balagurunathan, 1992). Then, 10-fold serial dilutions of the sediments were prepared, using filtered and sterilized 50% seawater. One ml of the serially diluted samples was plated in the Kuster's Agar (Siva Kumar, 2001) in triplicate petriplates. To minimize fungal contamination, all agar plates were supplemented with 50 ug/ml of nystatin. The actinobacterial colonies that appear on the petriplates were counted from 5th day onwards, upto 28th day. All the colonies that are growing on the petriplates was separately streaked in petriplates, subcultured, ensured for their axenicity and

maintained in slants. The correlation and co-efficient analysis between physic-chemical parameters of sediment and actinobacterial population was also made using SPSS package.

III. IDENTIFICATIONS

Classical approaches for classification make use of morphological, physiological, and biochemical characters. The classical method described in the identification key by Nonomura (1974) and Bergey's Manual of Determinative Bacteriology (Buchanan & Gibbons, 1974) is very much useful in the identification of streptomycetes. These characteristics have been commonly employed in taxonomy of streptomycetes for many years. They are quite useful in routine identification. Chemotaxonomy is the study of chemical variation in organisms and the use of chemical characters in the classification and identification. It is one of the valuable methods to identify the genus of actinobacteria.

IV. CULTURAL AND MORPHOLOGICAL CHARACTERISTICS

The growth and colony characters Chromogenecity of the aerial mycelium is considered to be an important character for the grouping and identification of actinobacteria Tresner, (1974) and Lakshmanaperumalswamy, (1974). (Colour of aerial mycelium, riverside pigment, melanoid pigment. Soluble pigment and diffusible pigment) in all strains (BKM-1 to BKM-68). ISP-I, ISP-II and ISP-VII Shrilling and Gottlieb (1966), Sivakumar (2000) and inoculated 37°C were studied. The shape of mycelium and spore chains of strains grown ISP-II medium were observed by using light Photomicroscope.

A. Analysis of whole cell hydrolysates

The isomers of diaminopimelic acids and sugar type were determined as methods described by Sivakumar (2001). Diaminopimelic acid (a mixture of LL, DD and meso isomers, sigma chemical Co). Were used as standards. A mixture of amino acids (glycine, asparagines, cysteine, leucine and alanine) and a mixture of sugars (glucose, galactose, mannose and xylose) were used to determine the type of amino acids and type of sugars respectively.

V. BIOCHEMICAL CHARACTERISTICS

The media and procedures used for determination of biochemical characteristics were those described by Sivakumar (2001), Shirling and Gottlieb (1966), Tresner *et al* (1968), Williams *et al* (1969).

VI. RESULT AND DISCUSSION

The Bhitarkanika sanctuary is bounded by river Dhamra in the north, the river Hansua to the west and Bay of Bengal on the eastern and southern sides. The sanctuary encompasses 35 km sea coast known as 'Gohirmatha Coast' from Dhamra mouth to Barunei, the mouth of river Hansua. The area has about 200 km. of water body inside the sanctuary and falls in the deltaic region of the river Brahmani, Baitarani, and their tributaries. The estuarine rivers- Brahmani, Baitarani, Kharasrota, Dhamra, Pathasala, Maipura, Hansua, and Hansina during their course flow into the Bay of Bengal are further crisscrossed by numerous creeks, channels, and nullahs, thus providing the

peculiar ecological niche for the growth, development of rich and varied mangrove life forms, both flora and fauna along with their associates (Mishra *et al.*, 2005). Our study revealed that the microbial ecology of the sampling sites of the Bhitarkanika is influenced by the chemical nature of the soil. A very typical pattern of soil sediment characteristics of almost all of the samples were observed, that is low in organic carbon and moderately high in salinity. The soil pH was ranging from slightly acidic to slightly alkaline (pH range 6.5 to 7.0). So, this nature of the sediment nutrients and also plenty of microbial population especially with actinobacteria.

In the present study, a total of 116 microbial strains were isolated from five stations of the Bhitarkanika mangrove environment. Of the 67 isolates 43 strains are identified as the genus *Streptomyces* followed by *Sacharopolyspora* (5), *Nocardiopsis* (5), *Micromonospora* (3), *Actinomadura* (5), *Actinomycetes* (1), and *Actinopolyspora* (5). The maximum number of actinobacteria isolates (from sediment samples) was recorded in Kola creek (nearest terrestrial, starting in the mangrove area) (13) followed by Bhitarkanika (14), Baguludia (estuarine canal and dens mangrove) (11), Kalibanjdia (Island of dharma river and dens mangrove) (17) and Thanidia (Mangrove) (13) (Table 1). The recognition and isolation of streptomycetes colonies were greatly facilitated by their spore forming property and pigmented aerial growth on the surface spread plates (Table 2). Of the 116 colonies belongs to 67 colonies were isolated, maximum number of actinobacterial colonies was higher population density in dens mangrove area sediment (30), mangrove area sediment (25) and near terrestrial and mangrove area (12) (Table 1).

The micro morphologically observations of the strains BKM-1 to BKM-67 reveal that all these belongs to the genus *streptomyces*. The predominance of streptomycetes in any actinobacterial population is a well known fact (Alexander, 1961). The analysis all compounds in the present study has revealed the dominance of streptomycetes in the sediments of the Bhitarkanika mangrove environment. In spite of the little attention to the diversity of actinomycetes in marine habitats even though these organisms have been studied in more detail than members of other groups of prokaryotes due to their biotechnological importance (Goodfellow *et al.*, 1988; Veigh *et al.*, 1994; Bull *et al.*, 2000). Though the marine environment has been proved as one of the potent sources for actinobacteria, very less attention has been paid to explore the mangrove environment. Occurrence and distribution of bacteria and fungi have been well studied in the mangrove environment. However, such studies on actinobacteria in the mangrove area are much lacking (Rathnakala and Chanrika 1993; Balagurunathan, 1992; Lakshmanaperumalswamy, 1978). Hence the present investigation has been carried out to pre-illuminate the lacuna similar to this investigation (Sivakumar *et al.*, 2005). Also isolated 91 stations of actinobacteria from the sediments of Pichavaram mangrove environment. This study also adds to the support that for the predominance of streptomycetes in the isolated actinobacterial population.

The occurrences of actinobacteria in water and sediments of marine environment has been reported by Grein and Mayers (1958), Weyland (1969) and Walker and Colwell (1975). Grein and Meyers (1958) have also reported that Streptomycetes was the dominant genus collected, while species of *Nocardia* and *Micromonospora* constitute about 20% of the total number of

isolates. Similarly, Streptomycetes accounted 90 -95% of the total actinomycetes found in various soil types (Lechevalier, 1964; Lechivalier and Lechivalier, 1967; Rangaswamy et al., 1967, Lakshmanaperumalswamy, 1952 and Sivakumar, 2001). This is clearly supported in the present study and 80% Streptomycetes genus and 20% other genus (*Sacchropolyspora Nocardiosis* , and *Micromonospora*) were recorded.

Even though a number of reports are available on the occurrence and distribution of actinobacteria by depends upon

the pigment formation (Lakshmanaperumalswamy, 1974), this is the first study has been carried out in the Bhitarkanika mangrove ecosystem. Hence, there are 67 species isolates of actinobacteria belong to different genera recorded from Bhitarkanika mangrove ecosystem, though it is not depicted a complete picture of actinobacteria diversity from this environ. So, further study will provide the more information about this actinobacterial diversity.

Table 1: Actinobacterial diversity recorded from the Bhitarkanika mangroves environment

Sampling environment	Location	No. of samples		No. of actinobacteria isolated						
				Streptomycetes	S a c c h a r d o p o l y s p o r a	N o c c a r d i o p s i s	M i c r o m o n o s p o r a	A c t i n o m o d u r a	A c t i n o m o d u r e s	a c t i n o p o l y s p o r a
Near terrestrial and mangrove area	Kola creek	5	15/12	7	1	1	-	-	-	3
Mangrove area	Bhiterkkanika	6	23/14	9	1	1	1	2	-	-
	Baguludia	5	27/11	7	2	1	-	-	-	-
Dense mangrove area	Kalibhanchidi a (island)	8	25/17	13	-	2	1	2	-	2
	Thanidia (new island)	6	26/13	7	1	-	1	1	1	-
Total			116/67	43	5	5	3	5	1	5

Table.2. Streptomycetes species recorded from the Bhitarkanika mangroves

Strain Name	Aerial mycelium colour	Reverse said colour	Diffusible pigment	Colony size (mm)	Actinomycetes Species Name
Near terrestrial and mangrove area					
BKM1	White	Brown	-	2.5	streptomycetes sp.
BKM 2	White	Light brown	-	3.0	Streptomycetes sp.
BKM 3	White	yellow	-	4.0	Streptomycetes sp.
BKM 4	Light green	Yellow	-	3.5	Actinopolyspora sp.
BKM 5	Dull white	White	-	2.5	Nocadiopsis sp.
BKM 6	Pale white	Yellowish white	-	6.5	Streptomycetes sp.
BKM 7	white	Dark brown	-	5.0	Actinopolyspora sp.
BKM 8	Dull	Dark yellow	-	5.5	Streptomycetes sp.

BKM 9	White	Dark yellow	-	6.0	Streptomyces sp.
BKM 10	Ash	yellowish	-	4.5	Actinopolyspora sp.
BKM 11	White	Dark brown	-	3.5	Streptomyces sp.
BKM 12	White	Dark brown	-	3.0	Saccarapolyspora sp
Dens mangrove area					
BKM 13	Dark ash	Light ash	-	6.0	Actinomadura sp.
BKM 14	White	Brown	-	7.0	Streptomyces sp.
BKM 15	White	Light brown	-	6.5	Sacaropolyspora sp.
BKM 16	Ash	Dull yellow	-	5.0	Streptomyces sp.
BKM 17	White	Yellow	-	4.0	Streptomyces sp.
BKM 18	White	Dark brown	Brown	4.5	Streptomyces sp.
BKM 19	Milky white	Light yellow	-	3.5	Sacaropolyspora sp.
BKM 20	Powdery Light	Yellow	-	3.0	Streptomyces sp.
BKM 21	ash	Yellow	-	5.0	Nocardiopsis sp.
BKM 22	Light yellow	Brown yellow	-	5.0	Streptomyces sp.
BKM 23	Yellowish	Brown	-	6.5	Actinomadura sp.
BKM 24	white	Yellowish brown	-	4.5	Streptomyces sp.
BKM 25	White	Yellow	-	4.0	Streptomyces sp.
BKM 26	Yellowish	Dark ash	-	2.5	Micromonospora sp.
BKM 27	white	Yellow	-	2.0	Streptomyces sp.
BKM 28	White	Brown yellow	-	3.5	Streptomyces sp.
BKM 29	White	Brown	-	6.0	Streptomyces sp.
BKM 30	White	Brown	-	7.0	Streptomyces sp.
BKM 31	Yellowish	Light yellow	-	5.0]	Sacaropolyspora sp.
BKM 32	white	Yellow	-	5.5	Streptomyces sp.
BKM 33	White	Yellow	-	6.5	Streptomyces sp.
BKM 34	White	Peal yellow	-	3.5	Streptomyces sp.
RBM 35	White	Light ash	-	7.5	Streptomyces sp.
BKM 36	Light green	Yellow	-	6.0	Nocardiopsis sp.
BKM 37	Peal white	White	-	5.0	Streptomyces sp.
Estuarine mouth and mangrove area					
BKM 38					
BKM 39	Dull white	Light yellow	-	4.5	Streptomyces sp.
BKM 40	Yellow white	Yellow	-	3.5	Micromonospora sp.
BKM 41	Pale white	Yellowish	-	3.5	Streptomyces sp.
BKM 42	Pale white	Yellow	-	4.0	Actinomadura sp.
BKM 43	White	Brown	-	5.0	Streptomyces sp.
BKM 44	Ash	Light brown	-	6.5	Actinomycetes sp.
RBM45	White	Brown	-	6.0	Streptomyces sp.
BKM 46	Dark ash	Dull ash	-	5.5	Streptomyces sp.
BKM 47	Milky white	Yellow	-	2.5	Nocardiopsis sp
BKM 48	White	Light yellow	-	3.5	Streptomyces sp.
BKM 49	Gray	Yellowish white	-	5.0	Streptomyces sp.
BKM 50	White	Dark brown	-	6.5	Actinopolyspora sp.
BKM 51	White	Light black	-	5.5	Streptomyces sp.
BKM 52	Yellowish	Dark yellow	-	6.0	Streptomyces sp.
BKM 53	white	yellowish	-	3.5	Actinopolyspora sp.
BKM 54	Light ash	Yellow	-	3.0	Streptomyces sp.
BKM 55	White	Light yellow	-	3.0	Streptomyces sp.
BKM 56	Yellowish	Brown	-	4.0	Actinomadura sp.
BKM 57	white	Light brown	-	4.5	Streptomyces sp.
BKM 58	White	Dark yellow	-	6.0	Streptomyces sp.
BKM 59	Milky white	Light Yellow	-	6.5	Micromonospora sp

BKM 60	White	Light brown	-	5.0	Streptomyces sp.
BKM 61	Milky white	Dark yellow	-	5.5	Streptomyces sp.
BKM 62	Milky white	Light white	-	2.5	Sacaropolyspora sp.
BKM 63	White	Yellowish	-	2.0	Streptomyces sp.
BKM 64	White	Brown	-	3.5	Actinomadura sp.
BKM 65	Peal white	White	-	6.5	Streptomyces sp.
BKM 66	Light ash	Dark yellow	-	4.5	Streptomyces sp.
BKM 67	White	White	-	4.0	Nocardopsis sp.
	White	White	-	3.5	Streptomyces sp.

Table.3. Correlation co-efficient between Physico-chemical properties of mangrove sediments and total actinobacterial population

	pH	Sand	Silt	Clay	POC	TSS	Cd	Cr	Cu	Fe	Mg	Mn	Ni	Pb	Zn	^{TA} _P
pH	1															
Sand	-0.3406	1														
Silt	0.3688	-0.9423	1													
Clay	-0.5.117	-0.4577	0.1392	1												
POC	0.0865	-0.8770	0.9497	0.1093	1											
TSS	-0.9270	0.3361	-0.2460	-0.3314	0.0249	1										
Cd	0.4511	-0.3417	0.4152	-0.2375	0.2128	-0.2257	1									
Cr	0.3261	0.4828	-0.4338	-0.4109	-0.6307	-0.1954	0.6074	1								
Cu	0.115	0.2626	-0.5132	0.4896	-0.6708	-0.3297	0.1572	0.5551	1							
Fe	0.2343	-0.8650	0.8938	0.2663	0.9249	-0.2101	-0.0336	-0.7586	-0.6332	1						
Mg	0.2725	0.5215	-0.4250	-0.5429	-0.5956	-0.0967	0.6043	0.9880	0.4324	-0.7502	1					
Mn	-0.2700	-0.4496	0.6482	-0.3294	0.8229	0.4709	0.0050	-0.5966	-0.9227	0.6844	-0.4859	1				
Ni	0.1701	0.6153	-0.5152	-0.5737	-0.6548	-0.0026	0.5209	0.9722	0.4221	-0.8116	0.9922	0.4838	1			
Pb	-0.0940	0.9675	-0.9093	-0.4590	-0.9188	0.0991	-0.2413	0.6043	0.3383	-0.8644	0.6264	0.5727	0.6980	1		
Zn	0.6008	0.0622	-0.1473	0.0702	-0.4310	-0.5878	0.6755	0.8379	0.7477	-0.4681	0.7534	0.7247	0.6872	0.2430	1	
TAP	0.2295	-0.4800	0.7446	-0.5489	0.7547	0.0879	0.4300	-0.1735	-0.8195	0.6049	-0.0704	0.8276	0.1168	0.4736	0.2730	1

*Significant $p < 0.05$

VII. FREQUENCY

Frequencies of identified genera of actinobacteria, in various mangrove environments. The frequency of the genus *Streptomyces* was (43) followed by *Actinopolyspora* (5), *Saccharopolyspora* (5), *Nocardiopsis* (5), *Micromonospora* (3), *Actinomadura* (5), *Actinomycetes* (1) (Table 1). Among the genera recorded, in the present study, *Streptomyces* was the most predominant when compared to other genera. The dominance of *Streptomyces* among the actinomycetes especially in soils has also been reported by many workers (Moncheva et al., 2002; Jensen et al 1991; Balagurunathan et al., 1996; You et al., 2005). Besides *Streptomyces*, the genera most frequently appeared on media were *Actinopolyspora*, *Saccharopolyspora*, *Nocardiopsis*, *Micromonospora*, *Actinomadura*, *Actinomycetes* occurred very rarely and also as a pathogen Waksman, 1967.

In spite of the fact that the actinobacteria have wide distribution they show variation in their population dynamics. In the present investigation it was found that there was correlation co-efficient between physico-chemical properties of sediment and total Actinobacterial population (TAP). It revealed that the significant positive correlation between Zing and pH ($r = 0.600$; $P < 0.05\%$) sand and phosphorus ($r = 0.967$; $P < 0.05\%$), particulate organic carbon and silt ($r = 0.949$; $P < 0.05\%$), ferrous

and particulate organic carbon ($r = 0.924$; $P < 0.05\%$), Zing and cadmium ($r = 0.675$; $P < 0.05\%$) magnesium nickel and magnesium ($r = 0.992$; $P < 0.05\%$), total actinobacterial population and manganese ($r = 0.827$; $P < 0.05\%$), magnesium and chromium ($r = 0.988$; $P < 0.05\%$), iron and copper ($r = 0.747$; $P < 0.05\%$), ferrous and manganese ($r = 0.684$; $P < 0.05\%$), phosphorus and nickel ($r = 0.698$; $P < 0.05\%$) (Table 3). Similar type of study was reported by Mansour 2003; Lakshmanaperumalsamy et al.1986; Jiang and Xu1996; Saadoun and Al-Momoni1996 has studied the pH, moisture, organic matter, nitrogen and phosphorous content of the soils and correlated with actinomycetes population. The correlation between salinity, pH and organic content of mangrove sediments and actinobacterial population has been reported by Sivakumar 2001. That the variation in temperature, pH and dissolved phosphate showed insignificant values, but variation in total nitrogen and organic matter was significant in the population in Alexandria. Hence it could be concluded that though actinomycetes are ubiquitous, their population dynamics are often influenced by the available nutrients and the physico-chemical conditions of the ecosystem.

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REFERENCES

- [1] M. Allgaier, and H.-P. Grossart. Diversity and seasonal dynamics of *Actinobacteria* populations in four lakes in northeastern Germany. *Appl. Environ. Microbiol.* 2006. **72**:3489–3497.
- [2] M. Alexander, (Ed.), Introduction to soil Microbiology. Burgess publishing and sons, Inc., New York
- [3] R. Balagurunathan, 1992. Antagonistic actinomycetes from Indian shallow sea sediments with reference to a β -unsaturated γ -lactone type of antibiotic from streptomycetes griseobrunneus (P-93) Ph.D thesis. Annamalai University, India. 82pp.
- [4] E. Baldacci, C. Spalla and A. Grein, The classification of the Actinomycetes species (Streptomycetes). *Arch. Microbiol.*, 1954, 20:347-357.
- [5] R.E. Buchanan and V. Gibbons, Bergey's manual of determinative bacteriology (Eighth edition). The Williams and Wilkins Co., Baltimore, 1974, pp. 747 - 842.
- [6] S. Chadha and C.S. Kar, Bhitarkanika, Myth and Reality. Nataraj Publishers, Dehradun, India, C.S.1999.
- [7] A. Felske, H. Rheims, A. Wolterink, E. Stackebrandt, and A. D. Akkermans., Ribosome analysis reveals prominent activity of an uncultured member of the class *Actinobacteria* in grassland soils. *Microbiology* 1997, 143:2983–2989.
- [8] K. Getha, S. Vikineswary, W. H. Wong, T. Seki, A. Ward, and M. Goodfellow, Evaluation of *Streptomyces* sp. strain g10 for suppression of *Fusarium* wilt and rhizosphere colonization in pot-grown banana plantlets. *J. Ind. Microbiol. Biotechnol.* 2005., 32:24–32.
- [9] N. B. Ghanem, S. A. Sanry, Z. M. El-Sherif and G. A. A.El-Ela, Isolation and enumeration and marine actinomycetes from seawater and sediments in Alexandria. *J. Gen. Appl. Microbiol.* 2000, 46: 105–111.
- [10] A. Grein, and S. P. Meyers, Growth characteristics and antibiotic production of actinomycetes isolated from littoral sediments and materials suspended in seawater. *J. Bact.*, 1958, 76:457-468
- [11] F. Gremion, A. Chatzinotas, and H. Harms, Comparative 16S rDNA and 16S rRNA sequence analysis indicates that *Actinobacteria* might be a dominant part of the metabolically active bacteria in heavy metal-contaminated bulk and rhizosphere soil. *Environ. Microbiol.* 2003, pp. 5:896–907.
- [12] P.R. Jensen, R. Dwight and W. Fenical, Distribution of actinomycetes in near-shore tropical marine sediments. *Appl. Environ. Microbiol.* 1991, pp. 57: 1102-1108.
- [13] P. Lakshmanaperumalsamy, Studies on Actinomycetes with Special Reference to Antagonistic *Streptomyces* chin. *j. oceanol. Limnol.* 1978, 26(2), 2008 Vol.26 176 from Sediments of Porto Novo Coastal Zone. Ph.D. Thesis, Annamalai University, India, 192 p.
- [14] R. Loria, J. Kers, and M. Joshi. Evolution of plant pathogenicity in *Streptomyces*. *Annu. Rev. Phytopathol.* 2006, 44:469–487.
- [15] H.A. Lechevalier and M. P. Lechevalier, Biology of actinomycetes. *Ann. Rev. Microbiol.* 1967, pp. 21:71-100.
- [16] H. A. Lechevalier, The actinomycetes. In: Henkelekan, H. and N. C. Dondero eds. Principles and Application in Aquatic Microbiology. John Wiley, New York, 1964, p.230- 253.
- [17] L. A. Maldonado, J. E. Stach, W. Pathom-aree, A. C. Ward, A. T. Bull, and M. Goodfellow, Diversity of cultivable actinobacteria in geographically widespread marine sediments. *Antonie van Leeuwenhoek*, 2005, 87:11–18.
- [18] P.K. Mishra, J. R. Sahu and V. P. Upadhyay, Species diversity in Bhitarkanika mangrove ecosystem in Orissa India, *J. Ecol., App.* 2005, Vol, 8 (1):73-87.
- [19] M.J.M. Ndonde and E. Semu, Preliminary characterization of some Streptomycetes Species from four Tanzanian soils and their antimicrobial

potential against selected Plant and animal pathogenic bacteria. *World J. Microbiol, Biotechnol.* 2000, 16:595–599,

- [20] C. H. Nakatsu, N. Carmosini, B. Baldwin, F. Beasley, P. Kourtev, and A. Konopka, Soil microbial community responses to additions of organic carbon substrates and heavy metals (Pb and Cr). *Appl. Environ. Microbiol.* 2005, 71:7679–7689.
- [21] H. Nonomura, Key for classification and identification of 458 species of the *Streptomyces* included in ISP. *J. Ferment. Technol.* 1974, 52: 78 - 92.
- [22] T.G. Pridham, and H. D. Tresner, Streptomycetaceae Waksman and Henrici, 1943, 339. In *Bergey's Manual of Determinative Bacteriology* (Eighth edition) The Williams and Wikins co., Baltimore, 1974, pp. 747.
- [23] R. Shinobu, Physiological and cultural study for the identification of soil actinomycete species. *Men. Osaka Univ. B. Nat.Sci.*, 1958, 7:1-76.
- [24] G. Rangaswami, G. Oblisami and R. Swaminathan, Antagonistic actinomycetes in the soils of south India, Phoenix Press, Visveswarapuram, Bangalore, India. 1967, Pp.156.
- [25] H. Rheims, A. Felske, S. Seufert, and E. Stackebrandt. Molecular monitoring of an uncultured group of the class *Actinobacteria* in two terrestrial environments. *J. Microbiol. Methods*, 1999, 36:65–75.
- [26] K. Sivakumar, Actinomycetes of an Indian mangrove (Pichavaram) environment: An inventory. Ph D thesis, Annamalai University, India, 2001, p. 91.
- [27] K. Sivakumar, Introduced mammals in Andaman and Nicobar Islands (India): A conservation perspective. *Aliens*, 2004, 17: 11.
- [28] J. E. Stach, and A. T. Bull, Estimating and comparing the diversity of marine actinobacteria. *Antonie van Leeuwenhoek*, 2005, 87:3–9.
- [29] S. A. Waksman, Species concept among the actinomycetes with special reference to The genus *Streptomyces*. *Bacteriol. Rev.* 1957, **21**: 1-29.
- [30] S. A. Waksman, (ed), The Actinomycetes, Vol I. Nature, occurrence and activities, 1959.
- [31] Williams and Wilkins Co., Baltimore.
- [32] J.D. Walker, R.R. Colwell, L. Petrakis, Evaluation of petroleum-degrading potential of bacteria from water and sediment. *Appl Microbiol.* 1975, Dec; **30**(6):1036–1039.
- [33] Weyland, Actinomycetes in North sea and Atlantic sediments. *Nature*, Lond, H., 1969, pp. 223:53

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Social Networking as an emerging tool of communication

A study of Facebook usage by Kashmiri Print Journalists

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Abstract- Social networking sites including Facebook are changing the way journalists interact. Journalists use social networks to gather and disseminate information as it takes seconds to reach the masses. The current study is conducted to examine the utility of the most commonly used social networking site, Facebook, in collecting and reporting news by Print journalists in Kashmir.

Index Terms- Facebook, Kashmir, Journalists, News delivery, and News source.

I. INTRODUCTION

Social networking is emerging as a new and popular trend in the world of communications. It has made socialization simple. Facebook is one of the most widely used Social networking sites used by people from different walks of life in Kashmir. Like many other professionals, journalists in Kashmir have also started using Facebook. With the growing popularity of Facebook, journalists have begun to use these sites as alternative platforms for news delivery and dissemination.

An obvious reason for journalists doing so is the broad audience social networking sites have. A recent report by Hopkins (2010) shows that Facebook accounts for 3.52% of total traffic to news media websites, only behind Google (17.32%), Yahoo (7.98%), and MSN (4.43%). Facebook is a major referral site directing traffic to news and media sites. Some users follow hyperlinks on social network sites to news sites. In fact, some of the links are provided by news media sites because a growing number of news organizations, including newspapers, have begun maintaining their own presence on social networking sites. Journalists maintain their presence on social networking sites for a variety of reasons, such as delivering headlines of news stories, promoting events, and collecting user generated content (Lewis, 2009). Since Facebook is simple to use, journalists consider it as an easy mode of communication. The current study is an attempt to find how the advent of Facebook as a journalistic tool has had an impact on news gathering and news dissemination by the professional print journalists in Kashmir.

II. LITERATURE REVIEW

Journalists benefit from SNSs since they provide rich sources of naturalistic behavioral data (Golder, Wilkinson & Huberman, 2007). Lori Schwab, Executive Director of the Online News Association (as cited in Wilson, 2008) articulates that Facebook is used by journalist for themselves as well as in their profession

and has become a central fact of their online life. A study by Raymond and Lu (2011) on "Reporting on the Reporters: Facebook and Journalists" found that Journalists use Facebook not only for typical social networking reasons but also for purposes that are beneficial to their work. Many journalists use Facebook and other SNSs to assist them in their story research and investigation, finding story ideas, staying in touch with family and finding out information about others. The study of Chandha (N.A) on "Social networking sites and social ties: do they help forge new ties or simply revive old ones?" found that social media especially Facebook has helped media professionals to get leads on stories, interact with people who were probably at the place where news event was taking place and get information. Arrival of Facebook has brought some interesting trends to Indian journalists as it helped them with the stories and leads during breaking news events. Facebook is being used by scholars and journalists in gathering information for news stories as it is a much faster approach than traditional media (Jarad, 2007). For some journalist Facebook is an effective tool of communication as it helps them to keep in touch with what concerns the public in a particular community and all over the world (Al Ezzi, El-Sheikh, Hamdy, Kamal, & Mahfouz, 2008).

III. OBJECTIVES

To ascertain the reasons Kashmiri print journalists have switched to Facebook.

IV. METHODOLOGY

This section consists of research model, data collection tool and population.

Research model: The researcher relied upon the survey method for the collection of data.

Data collection tool: To perceive the reasons Kashmiri print journalist drive to Facebook, an online questionnaire was administered. The questionnaire consists of two sections. The first section establishes the personal details of participants and the second section includes questions intended to determine the reasons journalists use Facebook in their day to day activities.

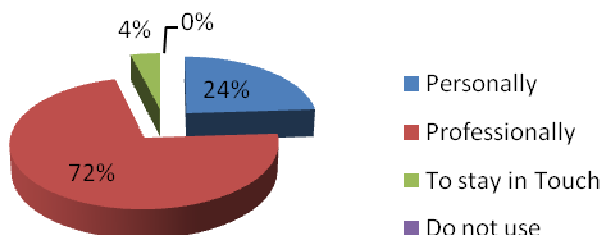
Population: online questionnaire was distributed randomly among fifty Print journalist of Kashmir. Most of them are working with national and local dailies.

V. RESULTS AND DISCUSSION

The analysis of the questionnaires administered online showed the following results:

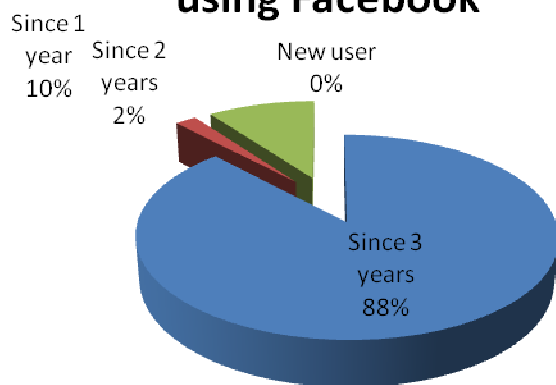
1. Among the journalists surveyed all use Facebook. 72% journalists use Facebook professionally, 4% use Facebook to stay in touch with friends and relatives and 24% use Facebook personally.

Journalists Use Facebook



2. 88% journalists have started using facebook 3 years back, 2% journalist has been using it since last 2 years and 10% journalists have been using it since last 1 year.

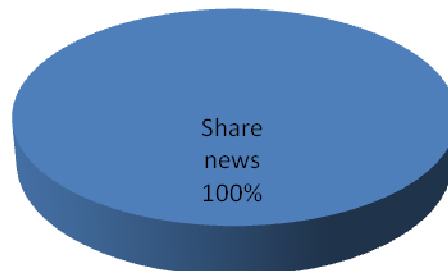
Journalists have been using Facebook



3. All the surveyed journalists share news through Facebook. All of them share the news that they find interesting

Do Journalists share news on facebook

Don't Share News
0%

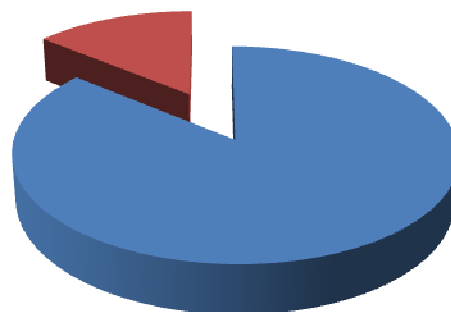


4. 86% journalists consider Facebook as good source of News while the remaining 14% do not consider it as a good source of News

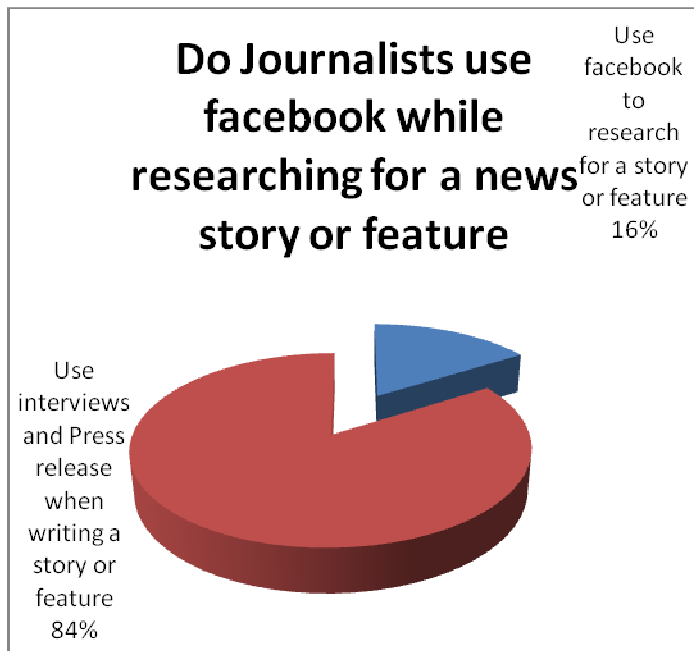
Is Facebook a good source of News?

facebook is not a good source of news
14%

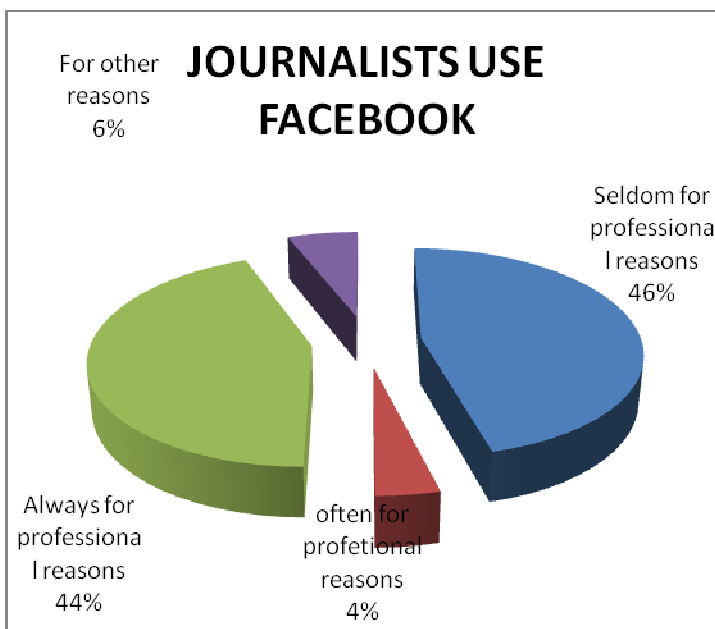
facebook is a good source of news
86%



5. Only 16% use Facebook as a first source when researching news and feature story, while 84% prefer to interview people or put their hands on a press release.



6. 46% journalists seldom join Facebook groups or like a page for professional reasons, 44% always do it for professional reasons and 4% said that they most often join a group or like a page for professional reasons. Remaining 6% had other reasons to join any group or like a page on Facebook.



7. All the journalists had an opinion that Facebook has an impact on their profession.

Some of the responses to the question how Facebook has had an impact on their profession:

- **“Facebook has helped journalists to connect well with the situation, to understand a general mood of things without fear of anything. It helps me sometimes in real**

time to know what has happened for example if protest has erupted or some gunfight has erupted people do write about it.”

(Azhar Qadri, Correspondent, Press Trust of India)

- **“Facebook has been a key source of information, platform for discussions, and a vast forum for ideological exchange. Being professionally associated with journalism, I see an extensive role being played by this social networking site especially in instant news delivery, which I feel is what prompts me every time to act on spot, and build a story around the details.”**

(lymon Majid, Works with Online news portal Kashmir Currents)

- **“Journalism seems in full vigor and action because of Facebook. The online media (e-zine) has gained momentum now, because Facebook has given it the readers, unlike earlier, when there was hardly anyone accessing online media. Facebook, undubiously, has laid the foundation of good things in me and indeed has exposed certain corners of my mind to a world where empires are so vibrant in morning but dashed in evening.”**

(Muddasir Peer, Correspondent, Kashmir Life)

- **“We can see almost all of the news organizations have their Facebook pages, I think that speaks all. There are portals which first update news on their Facebook pages then on their respective portals. Facebook has brought a complete change in the mind set of people and producers of news as well.”**

(Lubna Reshi, Reporter, Rising Kashmir)

VI. CONCLUSION

Most of the print journalists in Kashmir Use Facebook for professional reasons (sharing and collecting information) But do not rely completely on it.

Almost all the journalists maintain their presence on Facebook. The current study has brought us to the conclusion that most of the journalists are using Facebook to deliver news, suggesting that news dissemination through facebook has become a common practice. Although, they don't share every other information through facebook but most of them share news that they find interesting. The links they share on facebook are not necessarily of the websites of the organizations they work with.

Although, Journalists consider Facebook as an important news source but they don't completely rely on it. They prefer interviews and press releases to form the content of news for the newspaper organization they work with.

A majority of Kashmiri journalists join Facebook groups that are of some help in their professional lives. They even like the pages for professional reasons. These groups and pages on Facebook provide them a variety of information. Not only breaking news or news in real time, but some groups and pages

Facebook not only helps in collecting information but also to deliver it. What is important is not only the gathering and disseminating news through Facebook but the pace at which it is collected and delivered. Through Facebook print journalists come to know of events as they happen and deliver then at the same speed.

- [1] Al Ezzi, Mustafaia., El-Sheikh, Marwan Hussein., Hamdy, Dalia Mohamed., Kamal Eldin, Mahitab., & Mahfouz, Sherine Ahmed. (2008). Cyber activism in Egypt through Facebook. Retrieved from http://isaleh.uct.ac.za/Assets/PDFs/Cyber_Activism_in_Egypt_through_Facebook.pdf.
- [2] Chandha, Monica. (N.A). Social networking sites and social ties: do they help forge new ties or simply revive old ones? Retrieved from [http://www.edb.utexas.edu/edc385g_mchadha/links/social%20networking%20](http://www.edb.utexas.edu/edc385g_mchadha/links/social%20networking%20paper/Social%20)
- [3] Golder, S. A., Wilkinson, D., & Huberman, B. A. (2007, June). Rhythms of social interaction: Messaging within a massive online network. In C. Steinfield, B. Pentland, M. Ackerman, & N. Contractor (Eds.), *Communities and Technologies 2007: Proceedings of the Third*

- [4] Hopkins, H. (2010). Hitwise Intelligence - Heather Hopkins - North America. Retrieved from <http://weblogs.hitwise.com/us-heather-hopkins/>
- [5] Jarad, Lina. (2007). Palestinian Facebook Groups: Their Uses and Gratifications (Master's thesis, (Master's thesis, Miami University, Oxford, Ohio). Retrieved from http://etd.ohiolink.edu/view.cgi?acc_num=miami1250109519
- [6] Lewis, W. (2009). 10 Ways Newspapers are Using Social Media to Save the Industry. Retrieved from <http://mashable.com/2009/03/11/newspaper-industry/>
- [7] Raymond, Ronald K. & Lu, Yixin. (2011). Reporting on the Reporters: Facebook and Journalists. *Innovation Journalism* ,8(2). Retrieved from www.innovationjournalism.org
- [8] Wilson, Kelly. (2008, February-March). In your Facebook. *American Journalism Review* 30(1), 12-13. Retrieved from <http://ajr.org/articles.asp?id=44465>

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Evaluation of plant growth promoting attributes and lytic enzyme production by fluorescent *Pseudomonas* diversity associated with Apple and Pear

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Abstract- Replant problem is very serious problem which suppress growth and yield of apple and pear in all major fruit growing areas of the world. Fluorescent *Pseudomonas* has potential to synthesize different secondary metabolites with diverse PGPR activities which enhance soil fertility and promote plant growth. Under the present study twenty six *Pseudomonas* strains were isolated from the rhizosphere of apple and pear plants of their normal and replant sites and found that the *Pseudomonas* count was more in normal site as compare to replant site. They were further screened for the production of various PGPR activities and proteolytic enzymes production viz. protease, chitinase and glucanase. AN-1-UHF, AN-5-UHF, PN-7-UHF and PN-13-UHF were selected on the basis of their higher PGPR attributes and proteolytic activities. These strains were further found to be very efficient in antimicrobial activities.

Index Terms- *Pseudomonas*, PGPR, Proteolytic enzymes, Antimicrobial

I. INTRODUCTION

Replant disease is a serious problem which suppress growth and yield of fruits trees in all major fruit growing areas of the world. Catska *et al.*, [1] reported that a replant problem in apple and pear orchards appears to be related to soil and rhizosphere microflora. This problem is distributed worldwide and is often encountered in establishing new orchards on old sites [2]. Rhizobacteria that exert beneficial effects on plant growth and development are referred to as plant growth promoting rhizobacteria (PGPR) [3]. The exact mechanisms by which PGPR promote plant growth are not fully understood, but are thought to include, the ability to produce plant growth regulators, asymbiotic N₂ fixation, antagonism against phytopathogenic microorganisms by production of siderophores, antibiotics and cyanide solubilization of mineral phosphates and other nutrients [4]. More specifically, the soil-borne fluorescent *Pseudomonas* have received particular attention because of their capacity to produce a wide range of enzymes and metabolites [5]. Antagonistic or biocontrol activity of fluorescent *Pseudomonas* may also be due to the production of different types of cell wall degrading enzymes like chitinase, protease / elastase and β 1,3

glucanase. These enzymes are supposed to degrade the cell wall of various bacterial and fungal plant pathogens. The possible solution to the management of replant problem of horticulture crops is to introduce appropriate novel and important indigenous best plant growth promoting bioagent conferring maximum plant growth promotion and disease controlling activities. So isolation and preliminary characterization of indigenous fluorescent *Pseudomonas* diversity producing these lytic enzymes is important.

II. EXPERIMENTAL SET-UP AND PROCEDURE

2.1 Isolation of *Pseudomonas* sp. from the Rhizosphere of apple and pear

Collection of Soil Sample

Soil samples were collected from the rhizosphere soil of pear and apple orchards in university campus field under the consideration of "Deptt. Of Fruit Breeding and Genetic Resources", University of Horticulture and Forestry, Nauni, Solan (H.P), India.

Isolation and Identification

Fluorescent *Pseudomonas* sp. were isolated from soil samples and the proposed isolates were characterized on the basis of morphological biochemical and physiological tests as prescribed in Bergey's manual of systematic bacteriology [6].

2.2 Screening of fluorescent *Pseudomonas* isolates for lytic enzymes

1) ESTIMATION OF PROTEASE ACTIVITY

a) Plate assay (Qualitative)

All *Pseudomonas* sp. strains were screened out for proteolytic activity by well plate assay method on 1% skim milk agar plates. Plates were incubated at 37°C for 24-48 h and observed for proteolysis i.e. clear zone (mm dia) produced around the well (7 mm).

b) Quantitative Assay

Seventy two h old cell free culture supernatant screened as the crude enzyme source. Protease activity was assayed by the method of Morrihara *et al.*, [7] using 2.0% casein in 0.05 M Tris buffer pH 7.0 as a substrate. Casein solution 1ml was incubated with an equal volume of suitable diluted enzyme preparation at

37°C after 5 min the reaction was terminated by the addition of 3 ml of 5% of Trichloroacetic acid. The mixture was centrifuged at 5000 rpm for 10 min at 4°C and the supernatant was assayed for protein concentration by use of modified Folin phenol method [8] and the change in the optical density was measured at 660 nm.

2) CHITINASE ACTIVITY

All isolates of *Pseudomonas* sp. were screened out for chitinase activity by well plate assay method on chitin agar plate in which 1% of colloidal chitin was used. Plates were incubated at 37°C for 5-7 days and observed i.e. clear zone (mm dia) produced around the well (7 mm) or culture bit.

2.3 Screening of lytic enzymes producing Fluorescent *Pseudomonas* isolates for the production of other plant growth promoting activities

3) PRODUCTION AND ESTIMATION OF PLANT GROWTH REGULATORS

a) Auxins

Measurement of auxins was done by quantitative colorimetric method [9] with slight modifications. 2 to 3 drops of orthophosphoric acid was added to 2 ml supernatant and added 4 ml of salper reagent (1 ml of 0.5 M FeCl₃ in 50 ml of 30 % HClO₄; prepared fresh). This mixture was incubated for 1h in dark. Absorbance was measured at 535 nm. Concentration of indole acetic acid (IAA) was estimated by preparing calibration curve using indole acetic acid (IAA) as standard (10-100 µg/ml).

b) Gibberellins

The method of Holbrook *et al.* [10] with slight modifications was used for the determination of gibberellins. To 15 ml of supernatant, 2 ml of zinc acetate reagent (21.9 g zinc acetate + 1 ml of glacial acetic acid and volume was made upto 100 ml with distilled water) was added. After 2 minutes, 2 ml of potassium ferrocyanide (10.6% in distilled water) was added and was centrifuged at low speed (2000 rpm) for 15 minutes. To 5 ml of supernatant 5 ml of 30 per cent HCl was added and mixture was incubated at 20°C for 75 min. For blank 5 ml of 5 per cent HCl was used. Absorbance was read at 254 nm concentration of gibberellins was calculated by preparing standard curve by using gibberellic acid (GA₃) as standard (100-1000 µg/ml).

c) Bioassay of Cytokinins

Radish cotyledons expansion bioassay test was employed [11] for estimation of cytokinins like substances the radish seeds (*Raphanus sativus* L. cv Japanese white) were germinated in total darkness for 48 h. at 28°C. After removing the seed coat, smaller cotyledons were transferred to sterilized Petri dishes containing the test solution/ distilled water (control)/ standard (kinetin) on filter paper strips. 12 cotyledons were placed in each Petri dish and were included at 25°C under fluorescent light for 3 days. Then cotyledon on filter paper strips in Petri dish were blotted, dried and weighed. The bioassay response (final weight-initial weight) was expressed as increase in weight of cotyledons. Concentration of cytokinins present in the extract was calculated of by preparing standard curve by using kinetin as standard (100-1000 µg/ml).

4) PHOSPHATE SOLUBILIZATION

a) Plate Assay (Qualitative)

Pikovskaya's agar plates [12] with known amount of inert phosphorous source were prepared. In well plate assay method, 48hr old supernatant of culture was kept and plates were incubated at 28 ± 2°C for 48 hrs. Phosphate solubilization expressed in terms of mm diameter of solubilization zone produced around bit and phosphate-solubilizing efficiency (% PSE) was calculated. Plates were incubated at 28 ± 2°C for 48hrs and observed for solubilization zone produced around the well. Phosphate solubilization expressed in terms of Phosphate solubilization efficiency (% SE) calculated from equation

$$\frac{Z - C}{C} \times 100$$

Phosphate solubilization efficiency (% PSE) =

Where, Z= Diameter of yellow zone (mm)

C= Diameter of colony/bit (mm)

b) Liquid Assay (Quantitative Method)

Quantitative estimation of Phosphate solubilizing activity was done by spectrophotometric method [13, 14, 15]. To 5 ml supernatant 5 ml ammonium molybdate reagent (15 gm of ammonium molybdate in 400 ml distilled water and 342 ml of conc. HCl, total volume was made up to 1 L) was added along with shaking. 1 ml of working solution of chlorostannous acid (40%) (i.e. 0.5 ml of stock solution was added to 65.5 ml H₂O to make final 66 ml) was added. Stock solution was made by dissolving 10 gm SnCl₂.2H₂O/25 ml concentrated HCl. Total volume of reaction mixture was made 25 ml. O.D was measured at 660nm using red filter. Corresponding amount of soluble phosphorous was calculated from standard curve of potassium dihydrogen phosphate (KH₂PO₄; 0-10 ppm). Phosphate solubilizing activity expressed in terms of tricalcium phosphate solubilization, which in turn represents µg/ml of available orthophosphate as calibrated from the standard curve of KH₂PO₄ (0-10 µg/ml).

5) HCN PRODUCTION

Production of hydrogen cyanide (HCN) was checked according to Bakker and Schippers, [16]. All the *Pseudomonas* were streaked on pre-poured plates of King's medium B amended with glycine (1.4 g/l). Whatman No.1 filter paper strips were soaked in 0.5 per cent picric acid in 2 per cent sodium carbonate and were placed in the lid of each petriplates and then Petriplates were sealed with parafilm and were incubated at 30°C for 1-4 days. Uninoculated control was kept for comparison of results. Plates observed for change of color of filter paper from yellow (-) to dark brown (+++) to orange brown (+++++).

6) AMMONIA PRODUCTION

For the production of Ammonia method of Lata [17] was used. *Pseudomonas* sp. were grown in peptone water (5 ml) in tubes. Tubes were incubated at 30°C for 4 days. After 4 days, 1ml of Neissler's reagent was added to each tube. Presence of faint yellow colour (+) indicated small amount of ammonia and deep yellow (++) to brown color (+++++) indicated large amount of ammonia production.

7) ANTIFUNGAL ACTIVITY

Antifungal activity of each test isolate was checked by standard well/bit plate assay method [18, 19] using malt extract agar (MEA) plates. Plates were incubated at $28 \pm 2^\circ\text{C}$ for 3 - 5 days and observed for inhibition zone produced around the well. Antifungal activity expressed in terms of mm diameter of clear zone around the bit/well and also expressed in terms of per cent inhibition of fungal mycelium as calculating from equation:

$$\frac{C - Z}{Z} \times 100 = \% \text{ inhibition}$$

C : growth of mycelium in control
Z : growth of mycelium in treatment

8) ANTIBACTERIAL ACTIVITY

It was checked by well assay method [19]. Plates were incubated at 30°C for 24- 48 h and inhibition of growth around the well and expressed as mm diameter of zone produced around the well.

III. RESULTS

Twenty six fluorescent *Pseudomonas* sp. were isolated and their log cfu/g was taken. Bacterial and *Pseudomonas* sp. were found to be more in normal site as compare to replant site. In this study significant difference in total bacterial and total *Pseudomonas* communities in relation normal and replant sites of apple and pear orchards in university field area was observed.

Over all it was found that the *Pseudomonas* population was far less as compared to total population present in normal sites. The variation and less count of *Pseudomonas* may depend upon the genotype and age of plant and also due to the exhausted nutrient level that in turn affect the total bacterial as well as total *Pseudomonas* population in the rhizosphere soil. Yao *et al.*, [2] observed that population shift may be related to change in soil moisture, soil temperature, rhizodeposition and root turn over. According to Weller, [20] the surrounding environment i.e. rhizosphere soil type and nature of plant exudates and organic acids produced by plant roots also influences the nature and type of *Pseudomonas* sp. or other microorganism present in the soil.

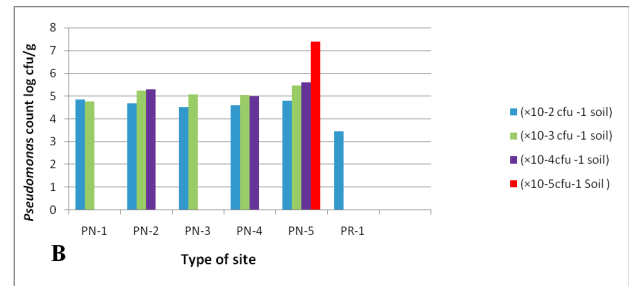
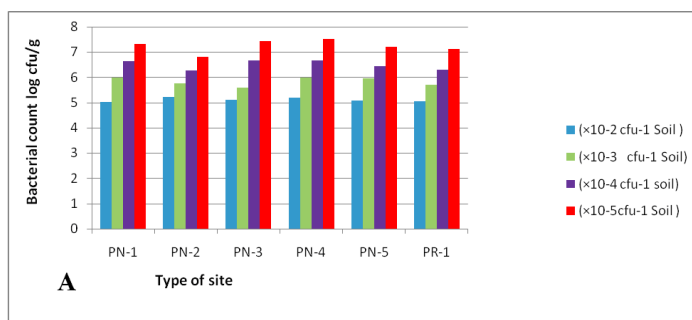


Figure 1: Population of Bacteria (A) and *Pseudomonas* (B) in normal and replant site.

3.1 Lytic Enzyme production

1) PROTEASE ACTIVITY

The production of proteolytic activity was shown by all the 26 isolates of *Pseudomonas* sp. isolated from the rhizosphere of both apple and pear growing in normal and replant sites (Table 1). Here, four isolates of apple showed activity in the range of 27–28mm other four in the range of 20–24 mm and rest four showed activity in the range of 15–19 mm diameter. While five isolates from pear showed activity in the range of 32–38 mm and nine showed activity in the range of 20–28 mm. Selected four isolates from apple and pear showed activity in the range of 24–25 mm and 32–38 mm respectively. Quantitatively six isolates from apple showed maximum activity in the range of 2–3 units/ml while other six isolates showed less activity in the range of 1.6–1.9 units/ml. Eight isolates of pear showed slightly more activity in the range of 3.0–5.5 units/ml. Four isolates showed activity in the range of 2.1–2.7 units/ml and two isolates activity in the range of 1.5–1.8 units/ml. Four strains selected for further study showed maximum activity in the range of 3.0–5.5 units/ml. They all were found to be statistically different from each other.

In agriculture, these proteases producing microorganisms have role as biological control agents for eradication of some fungal plant pathogens. The screening of isolates for protease production on skim milk agar plate according to Cattelan *et al.*, [21] showed that *Pseudomonas* isolates were positive for the proteolytic activities which supported the work done by our study.

2) CHITINASE ACTIVITY

The production of chitinase activity was not shown by all the 26 isolates of *Pseudomonas* sp. Among all of the *Pseudomonas* isolates only been shown by ten isolates ranging between 17–22 mm diameters of clear zone (Table 1). It was observed that there was statistical significance different between all the isolates of *Pseudomonas* sp.

We had similar findings with Chaiarn *et al.*, [22] who found that the ability of antagonistic bacteria to produce proteolytic enzymes, chitinase, β 1,3 glucanase and cellulose at low percentage and the composition of antagonistic mechanisms was specific for each isolate.

3) GLUCANASE ACTIVITY

Out of 26 isolates of *Pseudomonas* sp. isolated from the

rhizosphere soil of apple and pear none of them showed production of activity or clear zones on glucan agar plate (**Table 1**).

3.2 Screening for different PGPR activities:

1) P SOLUBILIZATION ACTIVITY

Pradhan and Sukla, [23] studied that phosphorous is one of the major nutrients, second only to nitrogen in requirement for plants.

So, in this study 26 isolates from the rhizosphere soil of apple and pear were screened for the production of phosphate solubilizing activity by well plate method on Pikovskaya's agar media (**Table 2**). The phosphate activity was expressed in terms of mm diameter of yellow zone produced around the bit/ well and also expressed as PSE%. By well plate assay method maximum production of phosphate solubilizing activity in terms of solubilization zones (mm diameter) was shown by PN-5-UHF

**Proteolytic activity / chitinase activity/ glucanase activity expressed in terms of mm diameters of clear zone produced around the well (mm) on skimmed milk / chitin and glucan agar plate respectively at 37°C for 48 h.*

and PN-11-UHF (38mm) and PSE (442.85%). Seventeen isolates showed phosphate solubilizing activity ranged between (25-37 mm) and (257.1-440.14%) where as seven isolates ranged between (23 -17 mm) and (42.8-228.57 %).

All isolates were tested for the phosphate solubilizing activity by spectrophotometric method in terms of inorganic tricalcium phosphate solubilization PVK in vitro and expressed as µg/ml of available phosphate. The result showed that maximum solubilization of inorganic phosphate and maximum release of phosphate was shown by fourteen isolates in the range of 110-200µg/ml. Eight isolates showed medium range of release of phosphate 52.5–90µg/ml where as four isolates showed minimum range of release of phosphate 30-47.5µg/ml. The four isolates selected for further study, that is two isolates from apple (AN-1-UHF and AN-5-UHF) and two from pear (PN-7-UHF and PN-13-UHF) showed production of phosphate solubilizing activity in the range of 25-28 mm and 32-38 mm by well plate and in the range of 195-200 µg/ml and 167.5-190µg/ml of available phosphorous respectively.

It was observed that there was statistically significant difference between all isolates of *Pseudomonas* sp.

Rodriguez and Fraga, [24] the use of phosphate solubilizing microorganisms as inoculant simultaneously increases the plant crop yield. They found strains from the genus *Pseudomonas*, *Bacillus* and *Rhizobium* species most powerful phosphate solubilizers and supported our findings.

2) PRODUCTION OF HCN BY ISOLATES

In addition of antibiosis mechanism that include the disease suppressing effect of siderophores and antibiotics, there are a number of different ways in which PGPR's can inhibit phytopathogen [18] that some *Pseudomonas* are able to synthesize HCN to which these *Pseudomonas* are themselves resistant that may be linked to the ability of these strains to inhibit some pathogenic fungi.

Almost all the isolates of *Pseudomonas* sp. showed HCN production on King's medium (**Table 2**). Out of 26 isolates of *Pseudomonas* sp. maximum production of HCN (+++++) has been shown by two isolates from apple and four isolates from pear viz. AN-1-UHF, AR-1-UHF, PN-1-UHF, PN-5-UHF, PN-9-UHF and PR-1-UHF. Rest of the nineteen isolates showed production of HCN with range (+++) to (++++).

Although, the role of HCN in disease suppression is not considered to be firmly established. The strains of fluorescent *Pseudomonads* in black pepper were found to produce volatile and non volatile metabolites including HCN [25] against fungal pathogens.

3) PRODUCTION OF AMMONIA

The increasing cost of petroleum products required in nitrogen

Table 1: Production of three lytic enzymes viz. protease, chitinase and glucanase by fluorescent *Pseudomonas* sp. Isolates

Plant	<i>Pseudomonas</i> isolates	Enzyme activity		
		Proteolytic assay		Chitinase assay
		Plate Clear zone (mm dia)* Well	Quantitative Units/ml	Plate clear zone (mm dia) Well
Apple	AN-1-UHF	27	2	18
	AN-2-UHF	27	2.2	17
	AN-3-UHF	27	3	20
	AN-4-UHF	24	1.81	0
	AN-5-UHF	28	3.0	0
	AN-6-UHF	15	1.6	0
	AN-7-UHF	17	1.7	19
	AN-8-UHF	20	1.9	20
	AN-9-UHF	22	2	0
	AR-1-UHF	19	1.9	0
	AR-2-UHF	21	2.1	0
	AR-3-UHF	18	1.7	0
	CD _{0.05}	1.68	1.231	1.08
Pear	PN-1-UHF	34	3.5	0
	PN-2-UHF	32	4.09	0
	PN-3-UHF	22	1.8	0
	PN-4-UHF	26	3.6	20
	PN-5-UHF	28	3.8	22
	PN-6-UHF	20	1.5	0
	PN-7-UHF	38	5.5	21
	PN-8-UHF	24	2.75	0
	PN-9-UHF	24	2.2	0
	PN-10-UHF	28	3.1	0
	PN-11-UHF	32	2.7	0
	PN-12-UHF	25	2.1	19
	PN-13-UHF	32	3.1	20
	PR-1-UHF	21	3.0	0
	CD _{0.05}	1.672	1.885	0.995

fertilizer production has focused attention on the development of biological system for nitrogen fixation in our study (**Table 2**) all the 26 *Pseudomonas* isolates showed ammonia production. Maximum production has been shown by seven isolates including AN-1-UHF, AR-1-UHF and AR-2-UHF from apple and PN-1-UHF, PN-5-UHF, PN-9-UHF and PR-1-UHF from pear (++++). Rest all of the isolates also showed production of ammonia in the range of (+++) to (++++).

As a part of our investigation, screening of ammonia producing Fluorescent *Pseudomonas* sp. for the development of economical and fermentation process for ammonia production is important. There is indirect evidence of usefulness of

Azotobacter free living N₂ fixing bacteria in crop improvement under tropical and sub tropical conditions especially with strains excreting high amount of ammonia in addition to a variety of growth promoting factor in presence of carbon rich root exudates [26].

4) PLANT GROWTH PROMOTERS

Pant growth promoting bacteria affected growth of plant by producing metabolites such as plant growth regulators that directly affect the plant growth by facilitating nutrient uptake by plants Kloepper, [27]; Glick, [28]. All 26 isolates were found to be very efficient in producing different plant growth regulators.

Table 2: Different PGPR activities shown by fluorescent *Pseudomonas* isolates

<i>Pseudomonas</i> isolates	Phosphate solubilization activity Assay			Product ion of HCN	Product ion of Ammonia	Plant growth regulators		
	Clear zones (mm dia)	S.E. %	Conc. (µg/ml)	Change in color (Yellow To Brown)		Auxins	Gibberellins	Cytokins
						conc. (µg/ml)	conc. (µg/ml)	conc. (µg/ml)
AN-1-UHF		257.1(2.410)	195	+++++	++++	5.2	222	130
AN-2-UHF	25	271.4(2.434)	47.5	+++	+	12.0	216	200
AN-3-UHF		257.14(2.410)	110	++++	++++	4.0	214	80
AN-4-UHF	26	285.1(2.455)	150	++++	++++	7.5	200	130
AN-5-UHF		300(2.477)	200	++++	++++	6.0	298	210
AN-6-UHF	25	257.1(2.410)	67.5	++++	++++	3.0	201	200
AN-7-UHF		228.57(2.359)	115	+++	++++	10.0	150	130
AN-8-UHF	27	228.57(2.359)	185	+++	+++	4.8	140	200
AN-9-UHF		214.0 (2.301)	60	++++	+++	5.8	160	80
AR-1-UHF	28	200(2.301)	45	+++++	++++	4.0	125	80
AR-2-UHF		157.1(2.196)	52.5	++++	++++	3.0	160	250
AR-3-UHF	25	142.82(1.632)	90	++++	+	6.0	146	50
	23				++++			
	23				++++			
	22							
	21							
	18							
	17							
CD _{0.05}	1.6852	0.0057	0.704			0.74 3	1.6852	48.67

PN-1-UHF	34		182.5	+++++	++++	3.0	152	130
PN-2-UHF	35	435.5(2.639)	170	++++	+	1.5	250	80
PN-3-UHF	30		147.5	++++	++++	3.5	230	300
PN-4-UHF	32	438.5(2.642)	80	+++	++++	1.0	240	300
PN-5-UHF	38		80	+++++	+++	0.75	245	200
PN-6-UHF	27	415.492.618)	40	++++	++++	0.80	200	130
PN-7-UHF	32		167.5	++++	+	11.0	300	300
PN-8-UHF	28	428.0(2.613)	182.5	+++	++++	0.75	240	270
PN-9-UHF	38		185.0	+++++	++++	4.0	170	270
PN-10-UHF	36	442.8(2.646)	80	++++	+++	11	180	130
PN-11-UHF	38		67.5	++++	++++	0.50	275	80
PN-12-UHF	30	285.71(2.455)	112.5	++++	+	0.80	230	200
PN-13-UHF	32		190	++++	++++	15	280	270
PR-1-UHF	22	428.2(2.632)	30	+++++	++++	2.0	130	80
		300(2.477)			++++			
		442.85(2.639)			++++			
		440.14(2.643)			++++			
		442.85(2.646)			+			
		415.4(2.618)						
		428.0(2.631)						
		214(1.982)						
CD _{0.05}	1.6322	0.0024	0.167			0.901	4.7796	7.142

Table 3: Antibacterial and antifungal activities best selected isolates of fluorescent *Pseudomonas* sp.

<i>Pseudomonas</i> isolates	Antibacterial activity (mm dia clear zone)			Antifungal activity (% Inhibition)			
	<i>Xanthomonas</i> sp.	<i>Bacillus Subtilis</i>	<i>Bacillus Cerus</i>	<i>Fusarium oxysporum</i>	<i>Dematophora</i> sp.	<i>Alternaria</i> sp.	<i>Pythium</i> sp.
Control	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AN-1-UHF	16		16	38(38.06)	41.53(38.33)		
AN-5-UHF	19	14	14	36.2(36.99)	46(42.71)	27.0(31.30)	31.42(33.91)
		15				31.0(33.83)	34.3(35.85)
PN-7-UHF	17		14	38.0(38.06)	0	36.5(37.17)	
PN-13-UHF	18	15	16	36.2(36.99)	44.6(41.86)	25.0(30.0)	30.0(33.21)
		16					34.2(35.79)
CD _{0.05}	1.88	1.88	1.88	(1.1170)	(6.4639)	(1.88)	(5.96)

Patten and Glick, [29] observed that production of auxins i.e. indole acetic acid (IAA) is wide spread among plant associated bacteria and promot plant growth. According to Elzar and Phinney, [30] gibberellins are endogenous hormone functioning

as plant growth regulators and influencing a range of developmental processes in plants including stem elongation, germination, dormancy, sex expression and fruit senescence. The above literature supported the work and the results obtained are

given below:

(a) Auxin Production

The maximum production of auxins among *Pseudomonas* isolates isolated from the rhizosphere of apple has been shown by seven isolates from apple viz, AN-1-UHF, AN-2-UHF, AN-4-UHF, AN-5-UHF, AN-7-UHF, AN-9-UHF and AR-3-UHF and three isolates from pear PN-7-UHF, PN-10-UHF and PN-13-UHF in the range of 5.2-15µg/ml (**Table 2**). Rest all the isolates show auxins production in the range of 0.50 – 4.8µg/ml.

It was observed that there was statistically significant difference between all isolates of *Pseudomonas* sp.

(b) Gibberellins Production

The production of gibberellins was shown by all the 26 isolates of *Pseudomonas* sp. varied in the range between 125-300µg/ml range (**Table 2**). The maximum gibberellin production was observed by sixteen isolates of *Pseudomonas* sp. ranged between 200-300µg/ml and were followed by six isolates that showed production in the range of 150-180µg/ml where as four isolates showed comparatively minimum production of gibberellins in the range of 125-146µg/ml. It was observed that there was statistically significant difference between all isolates of *Pseudomonas* sp.

(c) Cytokinin Production

Cytokinin production µg/ml was measured by raddish cotyledon expansion bioassay among the isolates of *Pseudomonas* sp. isolated from the rhizosphere of apple and pear, maximum production was shown by thirteen isolates (**Table 2**) out of 13, five isolates were from the rhizosphere of apple viz. AN-2-UHF, AN-5-UHF, AN-6-UHF, AN-8-UHF and AR-2-UHF and eight isolates were from rhizosphere of pear viz. PN-3-UHF, PN-4-UHF, PN-5-UHF, PN-7-UHF, PN-8-UHF, PN-9-UHF, PN-12-UHF and PN-13-UHF. The P-solubilization range between 200 - 300µg/ml followed by six isolates that all showed the 130µg/ml of production. Rest of the seven isolates showed less production of cytokinins that ranged between 50-80µg/ml.

It was observed that there was statistically significant difference between all isolates of *Pseudomonas* sp. Four isolates that is AN-1-UHF, AN-5-UHF, PN-7-UHF and PN-13-UHF were selected isolates for further characterization and they showed production of auxins between 5.2–11µg/ml, gibberellins between 222-330µg/ml and cytokinins between 210-300µg/ml.

4) Antimicrobial activity of partial purified protease by well plate bioassay

Best isolates were selected on the basis of PGPR activities and maximum production of proteolytic activities. They were further used for antifungal and antibacterial activities.

Inhibitory effect against various types of microorganisms may also be due to the lytic or cell wall degrading enzymes produced by the microorganisms [31]. Microbial proteases are increasingly recognized as important virulence factors for a variety of pathogens.

Some proteolytic enzymes especially elastase, subtilisin,

pronase also possess bacteriolytic properties against different gram positive and gram negative bacteria [31]. Several studies have demonstrated the production of Lytic enzyme production by rhizospheric bacteria were involved in the control mechanisms against plant root pathogens including *Fusarium oxysporum* and *Rhizoctonia Solani* [32].

In our study antimicrobial activity of proteolytic enzyme producing fluorescent *Pseudomonas* sp. were checked by well plate assay method against three indicator test bacteria viz. *Bacillus subtilis*, *Bacillus cerus*, *Xanthomonas* sp. on nutrient agar plate at 30°C for 48h (**Table 3**) and against four indicator test fungus viz. *Dematophora* sp., *Fusarium oxysporum*, *Alternaria* sp. and *Pythium* sp. (**Table 3**).

Antibacterial Activity against:

(a) *Xanthomonas* sp.

The maximum zone of inhibition against *Xanthomonas* sp. on pre-lawned nutrient agar plate was shown by AN-1-UHF (19mm) diameter followed by PN-13-UHF (18mm) and PN-7-UHF (17mm) and minimum inhibition zone was shown by AN-5-UHF (16mm).

(b) *Bacillus subtilis*.

The maximum inhibitory zone against *Bacillus subtilis* was shown by PN-13-UHF (16mm) diameter followed by PN-7UHF and AN-5-UHF (15mm) and minimum inhibition zone was shown by AN-1-UHF (14mm).

(c) *Bacillus cerus*.

The maximum inhibition zone was shown by partial purified fraction from AN-1-UHF and PN-13-UHF (16mm) and minimum inhibition zone was shown by AN-5-UHF and PN-7-UHF (14mm).

Antifungal activity against:

(a) *Fusarium oxysporum*

The maximum percent inhibition was shown by AN-1-UHF and PN-7-UHF (38.0%) followed by AN-5-UHF and PN-13-UHF (36.2%).

(b) *Dematophora* sp.

The maximum percent inhibition was shown by AN-5-UHF (46%) followed by PN-13-UHF (44.2%) and AN-1-UHF (41.53%) where as PN-7-UHF showed no inhibition against *Dematophora* sp.

(c) *Alternaria* sp.

The maximum percent inhibition was shown by PN-7-UHF (36%) followed by AN-5-UHF (31.0%) and AN-1-UHF (27.0%) where as PN-13-UHF showed minimum percent inhibition against *Alternaria* sp. (25%).

(d) *Pythium* sp.

The maximum percent inhibition was shown by AN-5-UHF (34.3%) and PN-13-UHF (34.2%) followed by AN-1-UHF (31.4%) whereas, PN-7-UHF showed minimum percent

inhibition against *Pythium* sp. (30%).

IV. CONCLUSION

Present study aims at the isolation and characterization of indigenous plant beneficial *Pseudomonas* species and its influence on the growth of pear and apple isolated from the normal and replant sites of rhizosphere of apple and pear so as to select and develop more efficient indigenous plant growth promoting and disease suppressing bioagents and also be used for production of lytic enzymes viz. protease, chitinase and β 1,3 glucanase. Microbial proteases are increasingly enzymes especially elastase, subtilisin, pronase also possess bacteriolytic properties against different gram positive and gram negative bacteria. Several studies have demonstrated the production of Lytic enzyme by rhizospheric bacteria which involved in the control mechanisms against plant root pathogens including *Fusarium oxysporium* and *Rhizoctonia Solani*. In this study 26 *Pseudomonas* strains were isolated from normal and replant sites of apple and pear plants and screened out for lytic enzyme activities and for different plant growth promoting activities. Maximum production of proteolytic activity was given by best selected isolates viz. AN-1-UHF, AN-5-UHF, PN-7-UHF and PN-13-UHF. Best selected isolates showed antimicrobial activity against bacterial and fungal pathogens.

REFERENCES

- [1] Catska V, Vancura V, Hudska G and Prikryl Z. 1982. Rhizosphere micro-organisms in relation to the apple replant problem. *Plant and Soil* 69:187-197.
- [2] Yao S, Merwin I A, Abawi GS and Thies JE. 2006. Soil fumigation and compost amendment alter soil microbial community composition but do not improve tree growth or yield in an apple replant site. *Soil Biology and Biochemistry* 38:587-599.
- [3] Ashrafuzzaman M, Hossen FA, Ismail MR, Hoque MA, Islam MZ, Shahidullah SM and Meon S. 2009. Efficiency of plant growth promoting rhizobacteria for the enhancement of rice growth. *African Journal of Biotechnology* 8:1247-1252.
- [4] Sarvanakumar D, Vijaykumar C, Kumar N and Samiyappan R. 2007. ACC deaminase from *Pseudomonas fluorescens* mediate saline resistance in groundnut plants. *Journal of Applied Microbiology* 102:1283-1292.
- [5] Sarvankumar D and Samiyappan R. 2008. Fluorescent *Pseudomonas* mixture mediate disease resistance in rice plants against rot (*Sarocladium oryzae*) disease. *Biocontrol* 54:273-286.
- [6] Kreig NR and Holf JG. 1984. Bergeys Manual of Systematic Bacteriology. William and Wilkins, Baltimore, USA.
- [7] Morihara K. 1964. Production of elastase and proteinase by *Pseudomonas aeruginosa*. *Journal of Bacteriology*. 88:745-757.
- [8] Bradford MM. 1976. A rapid and sensitive method for the quantitation of microgram quantities of protein utilizing the principle of protein-dye binding. *Analytical Biochemistry* 72:248-254.
- [9] Gordon SA and Paleg LG. 1957. Observation on the quantitative determination of indoe acetic acid. *Physiologia Plantarum* 10:37-38.
- [10] Holbrook AA, Edge WJW and Fremor TR. 1961. Spectrophotometric method for determination of gibberellin acid. In: Gibberellins 159-167. ACS Washington DC.
- [11] Letham DS. 1971. Regulator of cell division in plant tissue. XII A cytokinin bioassay using excised radish cytoledons. *Physiologia Plantarum* 25:391-396.
- [12] Pikovsakaya RE.1948. Mobilization of phosphorus in soil in connection with vital activity of some microbial species. *Microbiologia* 17:362-370.
- [13] Dickman SR and Bray RH. 1940. Colorimetric determination of phosphate. Indus and Engineering chemical Analytical Edition 12:660-665.
- [14] Bray RH and Kurtz LT.1945. Determination of total organic available forms of phosphorus in soil. *Soil Science* 23:343-353.
- [15] Olsen SR, Cole CV, Whatanable FS and Dean LA. 1954. Estimation of available phosphorus by extraction with sodium bicarbonate. *US Department of Agriculture* 939.
- [16] Baker AW and Schippers P. 1987. Microbial cyanide production in the rhizosphere in relation to potato yield reduction and *Pseudomonas spp.* Mediated plant growth stimulation. *Soil Biology and Biochemistry* 19:451-457.
- [17] Lata and Saxena AK. 2003. Characterization of plant growth promoting rhizobacteria. In: Training manual on Biofertilizer Technology (eds.) A K Saxena. IARI Delhi pp. 24-25.
- [18] Voisard C, Keel C, Haas D and Defago G. 1989. Cyanide production of *Pseudomonas fluorescens* helps suppress black root of tobacco under genotobiotic conditions. *EMBO Journal* 8: 351-358.
- [19] Fleming HP, Etchells JL and Costilow RH. 1975. Microbial inhibition by an isolate of *Pediococcus* from cucumber brines. *Applied Microbiology* 30:1040-1042.
- [20] Weller DM.1988. Biological control of soil borne plant pathogens in the rhizosphere with bacteria. *Annual Review of Phytopathology* 26:379-407.
- [21] Cattelan, ME, Hartel PG, Uhrmann JJ. 1999. Screening of plant growth promoting rhizobacteria to promote early soybean growth. *Soil Scence Society of American Journal*. 63:1670-1680.
- [22] Chaiham M, Chunhaleuchanon S, Kozo A and Lumyong S. 2008. Screening of rhizobacteria for their plant growth promoting activities. *Kmitl Sci. Tech.* 8.
- [23] Pradhan N and Sukla LB. 2006. Solubilization of inorganic phosphate by fungi isolated from agriculture soil. *African Journal of Biotechnology* 5:850-854.
- [24] Rodriguez H and Fraga R. 1999. Phosphate solubilizing bacteria and their role in plant growth promotion. *Biotechnology Advances* 17:319-339.
- [25] Diby P, Kumar A, Anandaraj M and Sarma YR. 2001. Studies on the suppressive action of fluorescent *Pseudomonads* on *Phytophthora capsici*, the foot rot pathogen of black pepper. *Indian Phytopathology* 54:515.
- [26] Narula N and Gupta KG. 1987. Detection of ammonia excretors on agar plates. *Zentralbl. Mikrobiology* 142:183-185.
- [27] Kloepper JWE. 1993. Plant growth promoting rhizobacteria as biological agents. In: Soil microbial ecology. Application in agricultural and environmental management, FB Metting (eds.), Marcel Dekker, New York. Pp 255-274.
- [28] Glick BR. 1995. The enhancement of plant growth by free living bacteria. *Canadian Journal of Microbiology* 4:109-117.
- [29] Patten C and Glick BR. 1996. Bacterial biosynthesis of indole-3-acetic acid. *Canadian Journal of Microbiology* 42:207-220.
- [30] Phinney BO. 1983 The history of gibberellins. In: The Biochemistry and Physiology of Gibberellins (Ed. Crozier A.) vol 1. Praeger Publishers USA pp 19-52.
- [31] Kaur M, Gupta M, Tripathi KK and Gupta KG. 1989. Lytic effect of *Pseudomonas aeruginosa* elastase on gram positive and gram negative bacteria. *Zentralblatt Bakt. International Journal of Microbiology* 127:153-157.
- [32] Nagraj Kumar M, Bhaskaran R and Velazhaban R. 2004. Involvement of secondary metabolites and extracellular lytic enzymes produced by *Pseudomonas fluorescens* in inhibition of *Rhizoctonia solani*, the rice sheath of blight pathogen. *Micrbiological Research* 159:73-8.

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Secure Biometric Authentication Using Recursive Visual Cryptography

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Abstract- Recursive Visual cryptography takes the idea from the basic scheme of Visual cryptography to hide multiple secrets recursively in the single image. [1] This paper proposes a scheme of recursive creation of shares using the basic scheme and embedding secrets into the shares. This results levels of share creation i.e. n - secrets equals $n/2$ levels. This paper also provides secured authentication for the user, using the Biometric authentication [6-7] Thus the proposed paper is implemented in any of the real time applications.

Index Terms- Recursive Visual Cryptography, Embedding secrets, Biometric authentication, Levels of shares.

I. INTRODUCTION

Internet is one of the most popular communication channels but is insecure. Since it is an open and insecure medium, malicious users can intercept data. The fast growth of online applications results in the data security problem. In order to achieve data security, users need secure communication methods for transmitting secret messages over the Internet. Encryption is well-known method for achieving data security. It transforms secret information into an encrypted form, which looks like a random message. Transformation procedure is called encryption process and the result is called cipher text. A computational device is required to perform decryption of the cipher text. Therefore, the cost or efficiency of the hardware, complex algorithms and mathematical computations increase to encrypt and decrypt the data.

Therefore, the cost increases and efficiency reduces. and mathematical computations increase to encrypt and decrypt the data.

II. DATA SECURITY

Security of data has been a major issue from many years. Using the age old technique of encryption and decryption has been easy to track for people around. Providing security to data using new technique is the need of the hour.

This project uses the technique of Visual cryptography and providing biometric authentication. Thus using the above technique Recursive Visual cryptography would be implemented.

A. Objectives

- To provide security in any real time application.

- To overcome and avoid cheating in real time applications.
- To store more than one secret at a time.
- To provide much more security by adding biometric authentication.

III. VISUAL CRYPTOGRAPHY

One of the best known techniques to protect data such as image is Visual cryptography. Naor and Shamir introduced the visual cryptography scheme as a simple and secure way to allow the secret sharing of images without any cryptographic computations. [1] VCS is a cryptographic technique that allows for the encryption of visual information such that decryption can be performed using the human visual system. [1]

The basic scheme is referred to as the -out-of- VCS which is denoted as VCS. Given an original binary image, it is encrypted in images, such that where a Boolean operation is is an image which appears as white noise, and is the number of noisy images.[2] It is difficult to decipher the secret image using individual's. The encryption is undertaken in such a way that one or more out of the generated images are necessary for reconstructing the original image. In the case of (2, 2) VCS, each pixel in the original image is encrypted into two sub pixels called shares. [1]

The paper proposes the scheme of share creation taken from $N \times N$ share creation; we hereby propose the scheme of 2×2 Share creation proposed in this paper.

Fig. 1 denotes the shares of a white pixel and a black pixel. Neither share provides any clue about the original pixel since different pixels in the secret image will be encrypted using independent random choices. [2] When the two shares are superimposed, the value of the original pixel can be determined. If it is a black pixel, we get two black sub pixels; if it is a white pixel, we get one black sub pixel and one white sub pixel. Therefore, the reconstructed image will be twice the width of the original secret image. [6]

Thus the scheme of Visual cryptography would be implemented.















Pixel	Probability	Shares		Superposition of the two shares	
		#1	#2		
	$p=0.5$				White Pixels
	$p=0.5$				
	$p=0.5$				Black Pixels
	$p=0.5$				

Figure 1: Pixel expansion scheme

IV. RELATED WORK

The topic of recursively hiding secrets within a share has been extensively researched. The scheme proposed in this paper applies to images and attempts to increase the efficiency of traditional VC to make it possible to hide extra secret information that serves as a steganographic channel. [2] The scheme involves recursive hiding of smaller secrets within a larger secret. It is obvious from the previous work that many thoughts have been given to the idea of recursive information hiding within visual cryptography. [2] However, the idea of embedding these types of recursive shares within the share and providing biometric security at the last level so that no previous shares would be recovered, to our knowledge, has never been considered.

V. OUR CONTRIBUTION

There are two main contributions that are discussed within this paper. The first deals with recursive creation of shares. This involves a recursive multiple resolution VC scheme which allows smaller secret to be hidden within one large share. [2]

The second contribution is providing biometric security to the last level of share, such that when the last share is authenticated the upper level of embedded secrets would be revealed. The Iris recognition algorithm would be used to provide biometric security to last level of client share. [3] The well known algorithm for Iris security the median metric algorithm would be implemented.

VI. PROPOSED MODULES

This paper proposes various modules. The models are based on the algorithm used at various stages, they are as follows:

Data storage and retrieval: For the purpose of authentication there would a server database which stores all the biometric images of the User, and the other information related

to the user. The other database would store all the shares created at the runtime. [5]

This is how the data would be manipulated and the proposed modules in this paper are as:

Module 1: Image processing

Converting images to grey scale:

Naor and Shamir mentioned the extension of their scheme to grayscale images. [1] That is, to represent the grey levels of the hidden image by controlling the way how the opaque sub pixels of the sheets are stacked together. If the number of colors is increased the contrast of the images would be reduced and therefore would not be useful in recursive visual cryptography. [4] For the deployment of recursive visual cryptography scheme we need to convert color images grey scale images.

In this module we would be identifying the secrets. These would be converted in grey scale image.

Module 2: Recursive Visual Cryptography

This method put forth has a secret image. Each secret is identified, two shares are created of that secret, as in the above figure. Share1 is stored at client side and share 2 is stored at server side. In the next level the secret image 2 is taken and this secret is embedded in the application side share. The share that is stored at the application side has a secret embedded in it. Now this secret and share is converted into 2 shares and one stored at the client side and one store the server side. [1] This method is followed recursively, such that at each level a secret would be embedded in the corresponding share. [2] Thus this is the method of recursive visual cryptography.

TABLE II TWO $N \times N$ SECRET SHARING MATRICES	
$C^0 = \begin{bmatrix} 1 & 1 & \dots & \dots & 1 \\ 0 & 0 & \dots & \dots & 0 \\ \vdots & \vdots & \ddots & \ddots & \vdots \\ \vdots & \vdots & \ddots & \ddots & \vdots \\ 0 & 0 & \dots & \dots & 0 \end{bmatrix}_{N \times N}$	$C^1 = \begin{bmatrix} 1 & 0 & \dots & \dots & 0 \\ 0 & 1 & 0 & \dots & 0 \\ \vdots & 0 & \ddots & \ddots & \vdots \\ \vdots & \dots & \dots & \ddots & \vdots \\ 0 & \dots & \dots & 0 & 1 \end{bmatrix}_{N \times N}$

Fig. 2: $N \times N$ secret sharing scheme

Algorithm:

Input: A $W \times H$ secret image $P, p(i,j)$ of P

Output: 2 shares $S^m, m=1$ to n ;

Process:

1. Generate sharing matrices C^0 and C^1 .
2. For each pixel $p(i,j), 1 \leq i < W$ and $1 \leq j < H$;
3. For l as the expanded pixel l to n ;
4. For $m=1$ to n
 - 4.1: If $\text{pixel}p(i,j)=0$ (White), the pixel value $S^m(i,j)=C^0(l,m)$
 - 4.2: If $\text{pixel}p(i,j)=1$ (Black), the pixel value $S^m(i,j)=C^1(l,m)$

Recursive storing of secrets:

1. For each S^m , S^{m+1} =next secret, $m=1$ to n .
2. E^m =Embedded secret in share C^m , m =Odd share;
3. Expand E^m using the 2X2 secret sharing scheme
4. Go to step 1 of RVC for each new secret
5. Store S^m , m =Even share stored at client side,
 S^m =Odd share stored at application side.

Our policy is to provide biometric authentication at the client end such that when biometric authentication is provided by the client the secret would be stacked on the application side here and the secret would be revealed.[3]

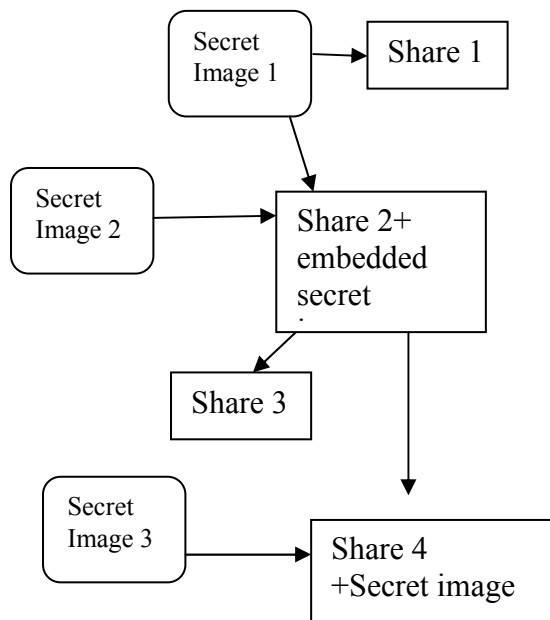


Fig. 3: Recursive Creation of shares

Module 3: Biometric Authentication

There are various techniques provided for authentication in general scheme. Biometric authentication is the scheme provided by recognizing the human visual identity recognition. We here would be implementing the iris recognition system.

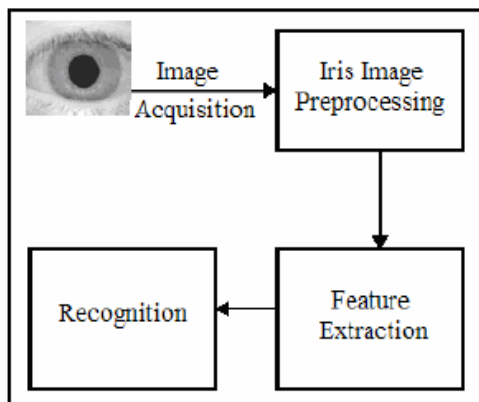


Fig. 4: Iris Recognition methodology

An efficient method for personal identification based on the pattern of human iris is proposed. [7] It is composed of image acquisition, image pre-processing to make a flat iris then it is converted into eigeniris and decision is carried out using only reduction of iris in one dimension. By comparing the Eigen irises it is determined whether two irises are similar. The results show that proposed method is quite effective.

A general iris recognition system is composed of four steps. Firstly an image containing the eye is captured then image is pre processed to extract the iris. Thirdly eigen irises are used to train the system and finally decision is made by means of matching.[8]

Methodology:

1. IMAGE ACQUISITION

In iris recognition image acquisition is an important step. Since iris is small in size and dark in colour, it is difficult to acquire good image. The colour image is captured. The image is then changed from RGB to gray level for further processing.

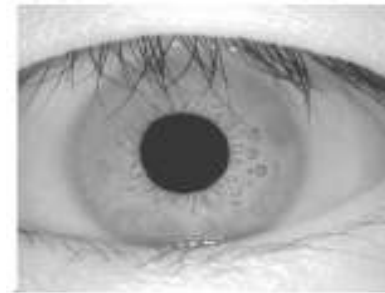


Fig. 5: Image Acquisition

First of all to separate the iris from the image the boundaries of the iris and pupil are detected. Since pupil is the darkest area in the image as shown in Figure 2; so a rough estimate of its center (C_x , C_y) is performed using the following formula:

$$C_x = \arg \min_x \left(\sum_y I(x, y) \right)$$

$$C_y = \arg \min_y \left(\sum_x I(x, y) \right)$$

where $I(x, y)$ is the iris image intensity at point (x, y) . To find the exact centre of the pupil, a part of image is binarized.

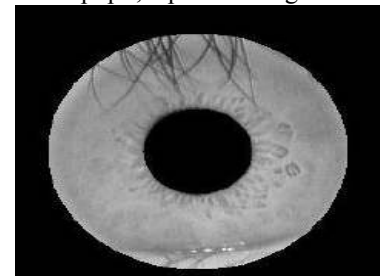


Fig. 6: Localized Iris Image

Then using the median matrix method the image pixel intensity would be calculated and median would be calculated and stored in the array. [7]

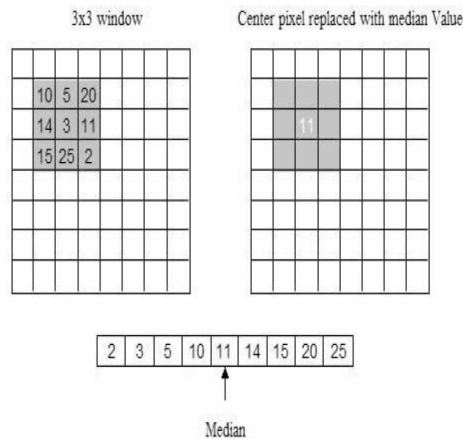


Fig7: Median matrix method

The algorithm used here is the median matrix method; here the edges of the biometric images would be detected by using edge detection algorithm.

During the authentication process the array would be attached and then customer would be authenticated.

Module 4: Decryption

After the biometric authentication is done the customer will give his part of the share. The two shares from the application side and the client side would be superimposed and if they match the secret would be revealed. [3] This would be done for each level and the embedded secrets at each level will also be revealed.

VII. ADVANTAGES

The advantages of such type of Recursive Visual cryptographic scheme are: Original image security is provided. Secure Authentication is provided. Chance of fake share creation is not possible. More than one image be kept as secret [2]. Recursive cryptography is first of the concepts to be implemented for security.

VIII. EXPERIMENTS AND RESULTS

Two shares are generated Share1 and Share2 as output of visual cryptography algorithm. One share along with username is kept by system and other is given on the user card. For authentication user provides share which is on the card. The share extracted from this card is superimposed with corresponding share that is stored in the database, generates the original image. From this Iris template image feature template is generated. Now this feature template is matched with Iris feature of newly provided eye image using hamming distance.

The most popular and commercial iris recognition system was developed by Daugman [7]. Following this many iris recognition systems are proposed by researchers [8]. As main

intent of this paper is providing security to the iris template in the database, image processing algorithm for iris feature extraction are derived from [8]. The working of proposed system is shown in figure 4 and 5. For enrollment a single eye image is taken from CASIA database. After performing segmentation, normalization and feature extraction feature template is generated. Iris template image (generated from feature template) and another binary image which is chosen by system administrator is given as input to the visual cryptography algorithm.

IX. CONCLUSION

We would be trying to build a secure intense project in which security would a major issue, thus making security with the intense algorithm of Recursive visual cryptography, and adding biometric authentication to it. Various approaches adopted by researchers to secure the raw biometric data and template in database are discussed here. In this paper a method is proposed to store iris template securely in the database using visual cryptography. Experimental results indicate that by applying visual cryptography techniques on iris template for more security, matching performance of iris recognition is unaffected with extra layer of authentication.

REFERENCES

- [1] Visual Cryptography Moni Naor and Adi Shamir EUROCRYPT -1994
- [2] Resolution Variant Visual Cryptography for Street View of Google Maps Jonathan ,WeirWeiQi YanQueen's University Belfast Belfast, BT7 1NN
- [3] Visual Cryptography for Biometric Policy, Arun Ross & Asem Othman IEEE-Information Forensics 2011
- [4] User friendly random grid based Visual Secret Sharing-Tzung Chen & Kai Hsiang Tsao, National Chiayi University, Taiwan ,ROC.
- [5] Fast and Efficient Visual cryptography for Medical Images-S.Manimurugan.K.Porukumaran, Anna University Coimbatore,India.
- [6] Progressive Visual Cryptography with Unexpanded shares-Young Chang Hou & Zen-Yu Quan, IEEE – Information Security and Forensics.
- [7] J. Daugman. "Biometric personal identification system based on iris analysis." United States Patent, Patent Number: 5,291,560, 1994.
- [8] Masood, K., D.M.Y. Javed and A. Basit, "Iris recognition using wavelet". In Proceedings of the International Conference on Emerging Technologies-ICET, IEEE Xplore Press.

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Assessment of performance evaluation of reed (*Phragmites karka*) in constructed reed bed (CRB) system for domestic sludge, Ujjain city

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Abstract- Sludge is created by modern societies as unavoidable byproducts as population growth, industrialization, urbanization, homeowners, modernization, residences, institutions and commercial and industrial establishments. The proper utilization and disposal of domestic sludge is one of the most critical issues facing today.

Performance of reed in a constructed reed bed system (CRBs) for domestic waste was evaluated. Removal efficiency of some physico-chemical parameters (pH, conductivity, organic carbon, organic matter, nitrate-nitrogen ($\text{NO}_3\text{-N}$), ammonium nitrogen ($\text{NH}_4\text{-N}$), total Kjeldahl nitrogen (TKN) and total phosphorus) in domestic waste emanating from residential areas in Ujjain city.

The size of CRBs were 35m length x 25m breadth and 50m depth and 12m diameter cemented tank were used for sludge treatment in the field. The CRBs was composed of a gravel bed supported below on a layer of puddled, local clay. Initially CRBs was planted with locally grown grass, *Phragmites karka* at the rate of 6 to 8 plants per m^2 . Parameters assessed in both the reed bed sludge complex initially and after 15 days. Sludge can be dewatered and converted into biomass and a low-grade compost without chemical addition or energy.

Removal rates of TOC (43-48%), TKN (58-61%), $\text{NH}_4\text{-N}$ (50%) and $\text{NO}_3\text{-N}$ as 58% were recorded. The data and results presented in this paper support the notion that CRB sludge treatment systems and the use of reed beds provide an efficient and ecological principle based an effective alternative for domestic sludge treatment.

Index Terms- cemented tank, constructed reed bed, cost effective, domestic sludge, *phragmites karka*, removal efficiency.

I. INTRODUCTION

In recent times, the treatment and disposal of domestic sludge has become a major challenge to the human being, prompting widespread research and development into its possible reuse. To date, most of the research efforts have been done to assess the feasibility of reusing the sludges in the construction and manufacturing industries¹⁻⁴.

Currently, some researchers try to find low-cost and environmental solution for septage handle and disposal like co-composting with organic waste, anaerobic digestion, settling ponds, settling/thickening tanks, sludge drying bed, constructed wetland⁵⁻¹¹.

The urban sludge in tropical developing countries are the worst victim of city, basically because of the widening gap between the increasing waste generation and unavailability of commensurating economical resources to address the issue through conventional technologies. Hence, biological machines may prove to be a novel tool for sustainable management of domestic sludge. Constructed Reed bed technology being natural biological systems operating solely on solar energy is low cost and almost negligible operation and maintenance¹²⁻¹⁴.

Reed bed technology utilizes the principle of plant uptake for sludge treatment, similar to constructed wetlands for wastewater treatment¹⁵⁻¹⁷. Reed beds provide sludge dewatering through plant uptake, evapotranspiration, and drainage. Reed beds chemically alter the sludge as the plants use nutrients and minerals in the sludge for growth. The final product is a well-decomposed, stabilized, humus-like residue suitable for land application¹⁸⁻¹⁹.

Sludge applied to reed beds is turned into a compost-like material that can be used as a soil conditioner. Reed beds act to dewater and reduce the organic content of the sludge, reduce the metals concentrations of the sludge, and stabilize the sludge for subsequent disposal. This is the result of the following: first, the reed root system provides oxygen to the sludge, which increases the activity and population of microorganisms that mineralize the sludge; second, the growth of the plants makes use of the nutrients, minerals, and water in the sludge²⁰. This paper under reference therefore is an attempt to evaluate the performance efficiency of CRBs with various parameters in domestic sludge.

II. MATERIALS AND METHODS

A field scale unit of Reedbed system was established at Institute of Environment Management and Plant Sciences, Vikram University in the southern area of Ujjain (75°43' E longitude 23°09' N latitude, 491m above mean sea level) in the state of Madhya Pradesh, Central India. The climate of the area is characterized with summer, monsoon, post-monsoon and winter seasons/ About 90% of the rainfall occurs during monsoon (mid June to mid September) and normal annual average rainfall 870mm. The average minimum temperature during winter varies between 7°C to 16°C. To achieve set objective study was carried out in two parts / phases:

I. Reed sludge bed construction

A. Site selection: Sampling sites were selected for sludge collection was Ravindera Nagar and Mahananda Nagar

residential colony. Sludge was collected from these sites and analysed for few physico-chemical characteristics following standard protocol²¹. Physical parameters i.e. pH, Density, Moisture content and chemical parameters i.e. nitrogen, phosphorus, organic carbon & matter, C/N ratio were analysed.

B. Design: After preliminary study design were done for sludge treatment. The size of the system were 35m length x 25m breadth and 50m depth and 12m diameter cemented tank were used for sludge treatment in the field. Three sets of design were taken for sludge treatment. One set is control where no sludge was added, in second set Ravindera Nagar sludge was added and in third set Mahananda Nagar sludge was added. In the system bottom layer is filled with gravel, pebbles, sand and soil then sludge was added and reed grows in the sludge.

C. Planting of Reed (*Phragmites karka*) Propagation – seed / seedling / rhizome / field collected plants. In each design / system reed plants from nursery were transplanted in 15- 20 number 2 month old plants for treatment of sludge.

D. Reed growth: i. Morphology (Root - Rhizome and Shoot length): The reed grass develop an extensive and dense root zone system, which spreads into the gravel beds of constructed wetlands. These plants absorb nutrients from the wetland bed through their root-rhizome system.

ii. Biomass production: It increased tremendously in root zone in both fresh weight and dry weight.

II. Evaluation of performance of the system with different Reed Sludge complex parameters

The treatment potential of reed was assessed through various parameters as studied in physico-chemical characteristics. Emphasis was made on organic carbon, organic matter, nitrate-nitrogen (NO₃-N), ammonium nitrogen (NH₄-N), total kjeldahl nitrogen (TKN) and total phosphorus. Fertility of Reed Sludge Complex was determined with following parameters analysis at 15days interval analysis.

III. RESULT AND DISCUSSION

Reed bed treatment systems are designed to optimize the microbiological, chemical, and physical processes naturally occurring in system. The microorganisms that flourish in these systems can naturally degrade a wide range of organic chemical products into simpler compound. Optimization of sludge management can help reducing sludge handling costs in wastewater treatment plants. Sludge drying reed beds appear as a new and alternative technology which has low energy requirements, reduced operating and maintenance costs, and causes little environmental impact.

Analysis results were presented in table 1 & 2 and fig 1 to 10. pH indicate decrease from 7.9 to 6.9 and 8.10 to 7.15 at Mahananda nagar and Ravindera nagar respectively. No seasonal variation observed in pH value. Conductivity and salinity analysis depict that significant decrease occurred after treatment. It reduces from 1.25 to 0.55mMho in Mahananda nagar sludge followed by Ravindera nagar sludge i.e. 1.30 to 0.60 mMho. Progressive organic matter removal and sludge stabilization in the beds was also observed. Organic carbon and matter reduces 44% in Ravindera nagar sludge while in Mahananda nagar sludge it was 26% only. This may be due to absorption of organic carbon by reed plants for growth and development. Total nitrogen as well as other form of it decreases in sludge treatment.

More reduction in total nitrogen in Mahananda nagar sludge followed by Ravindera nagar sludge. Phosphorus content also decreases in both experimental set up.

Constructed reed bed system (CRBs) typically require few months for growth of vegetation, biofilm establishment and sizeable time for development of litter and standing dead compartments¹. In the present study the root zone unit was established with 2 months old saplings of *Phragmites karka* (local reed grass) planted in the gravel bed with a density of six plants/m² covered the entire area within a period of three months. The availability of ample nutrients in the domestic sludge through the constructed reed bed system (CRBs) and tropical warm climate favors the growth of plants.

Nutrient removal during plant growing season averaged 60% for total nitrogen, 53% for Kjeldahl nitrogen, 73% for total phosphorus and 64% for organic matter. Removal remains acceptable in winter despite a slight decrease in efficiency. Finally, it should be remembered that Reed Beds are an effective, low-tech form of bioremediation for the treatment of municipal and others sludge. Reed Bed Technology is an effective process using plant life to help in the necessary process of treating some of the byproducts of human communities²².

IV. CONCLUSION

The purpose of this demonstration was to evaluate the effectiveness of a reed-bed sludge treatment system. Reed beds are capable of dewatering sludge to the same degree as a conventional sludge drying bed with several advantages. These include the ability to reduce the organic content and metals concentration of the sludge, and to stabilize the volatile elements of the sludge at a less expensive cost, compared to conventional treatment.

Reed bed technology involves the application of domestic sludge to beds that have been planted with a specialized species of reeds, in this case, *Phragmites communis*. Similar to constructed wetlands for wastewater treatment, reed bed technology uses plant uptake, in addition to evapo-transpiration, microbial decomposition, and drainage, to stabilize and dewater the sludge. Sludge applied to reed beds is turned into a compost-like material that can be used as a soil conditioner. Reed beds act to dewater and reduce the organic content of the sludge, reduce the metals concentrations of the sludge, and stabilize the sludge for subsequent disposal. This is the result of the following: first, the reed root system provides oxygen to the sludge, which increases the activity and population of microorganisms that mineralize the sludge; second, the growth of the plants makes use of the nutrients, minerals, and water in the sludge. They are simple to operate, without chemical additives or complex electronic controls, and are very low maintenance. Consequently, the energy and operational requirements of reed beds are very low.

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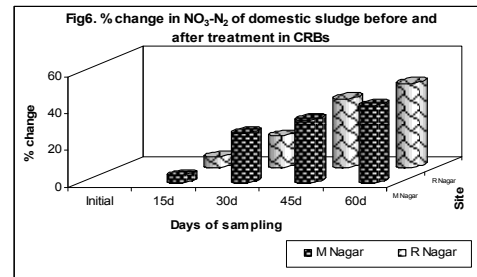
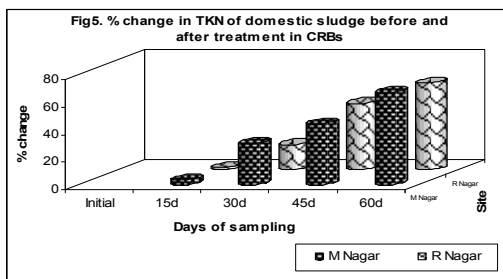
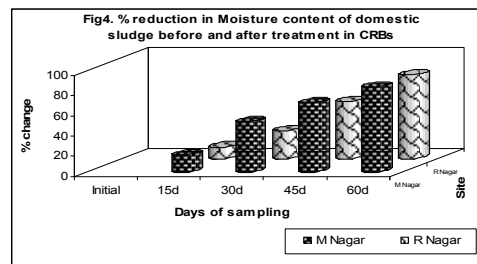
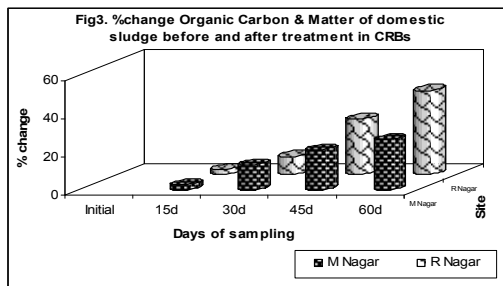
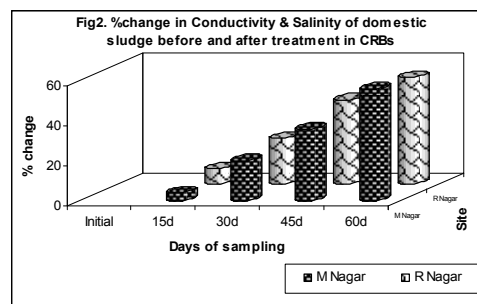
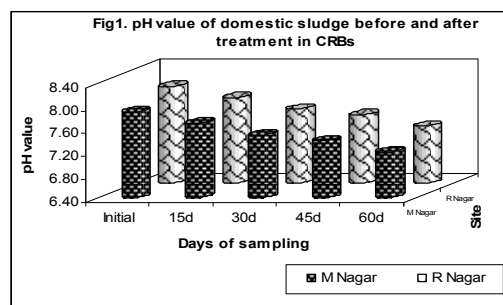
Table -1. Physico-chemical characteristic of Reed Bed sample analysis in domestic sludge of Mahananda nagar

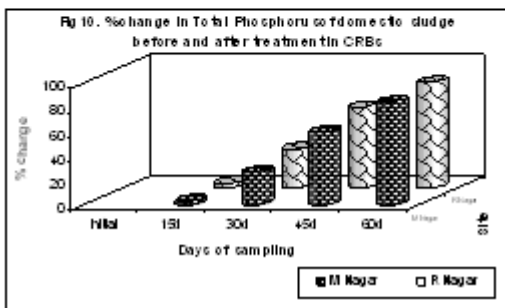
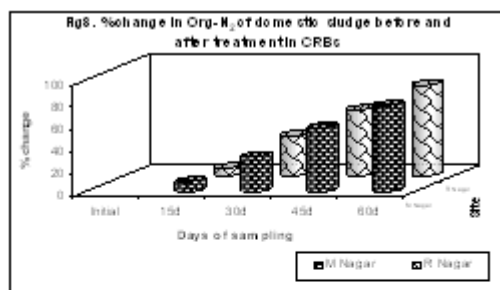
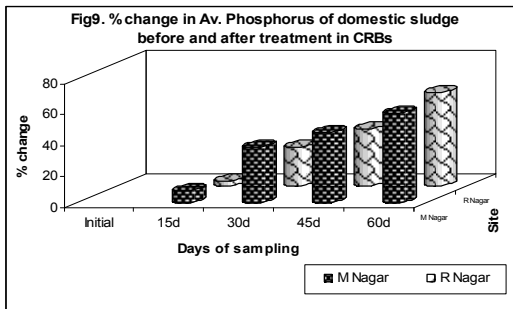
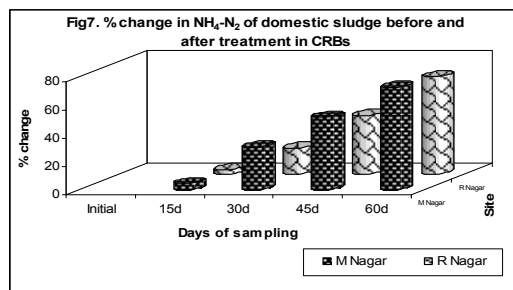
S.No.	Parameters	Initial	15d	30d	45d	60d
1	pH	7.90	7.70	7.50	7.40	7.20
2	Conductivity	1.25	1.20	1.00	0.80	0.55
3	Salinity	12.50	12.00	10.00	8.00	5.50
4	% OC	38.00	37.00	33.00	30.00	28.00
5	%OM	65.51	63.79	56.89	51.72	48.27
6	% Moisture content	70.00	58.00	35.00	22.00	11.00
7	Bulk density	1.75	1.71	1.62	1.53	1.41
8	TKN	37.10	35.70	25.90	20.60	12.17
9	NO ₃ -N ₂	2.96	2.85	2.16	1.95	1.72
10	NH ₄ -N	41.00	39.20	28.60	19.80	11.20
11	Org.-N	22.40	20.60	15.40	9.62	5.14
12	Av.P	6.40	5.90	4.10	3.50	2.70
13	TP	7.70	7.50	5.60	3.10	1.20

Table -2. Physico-chemical characteristic of Reed Bed sample analysis in domestic sludge of Ravindra nagar

S.No.	Parameters	Initial	15d	30d	45d	60d
1	pH	8.10	7.90	7.70	7.60	7.40
2	Conductivity	1.30	1.20	1.00	0.75	0.60
3	Salinity	13.00	12.00	10.00	7.50	6.00
4	% OC	42.50	41.40	38.50	30.10	23.70
5	%OM	73.27	71.37	66.37	51.89	40.86
6	% Moisture content	80.00	71.00	58.00	35.00	14.00
7	Bulk density	1.95	1.90	1.65	1.32	0.90
8	TKN	40.60	39.90	33.10	21.00	15.00
9	NO ₃ -N ₂	3.50	3.30	2.90	2.20	1.90
10	NH ₄ -N	42.70	41.30	34.80	24.90	13.20
11	Org.-N	24.60	22.90	15.80	10.10	4.60
12	Av.P	6.80	6.60	5.10	4.30	2.70
13	TP	7.50	7.20	5.10	2.50	1.00

Note: TKN : Total Kzeldhal Nitrogen, TP : Total Phosphorus.





REFERENCES

- [1] Billore, S.K., Singh, N. Sharma J.K., Dass, P. and Nelson, R.M. (1999). Horizontal subsurface flow gravel bed constructed wetland with *Phragmites karka* in central India. *Wat. Sci. Tech.*, 40(3), 163-171.
- [2] Billore, S.K., Singh, N. Sharma, J.K., Krishnamurthi, R., Kobayashi, T. and Yagi, R. (2000). Ujjain clay as low cost sealant and liner for artificial Ponding and bentonite alternative. *Current Science*, 78(11), 1381-1383.
- [3] Billore, S.K., Singh, N. Ram, H.K., Sharma, J.K., Singh, V.P., Nelson, R.M. and Dass, P. (2001). Treatment of a molasses based distillery effluent in a constructed wetland in central India. *Wat. Sci. Tech.*, 44(11-12), 441-448.
- [4] Billore, S.K., Ram, H., Singh, N., Thomas, R., Nelson, R.M. and Pare, B. (2002). Treatment performance evaluation of surfactant removal from domestic wastewater in a tropical horizontal subsurface constructed

wetland. In : *Proceedings of the 8th International Conference on Wetland Systems for Water Pollution Control*, Dar es Salaam, Tanzania, 16-19 Sept.

- [5] Koottatep T., Polprasert C., Oanh N.T.K., Heinss U., Montangero A., Strauss M. (2001). Potentials of vertical-flow constructed wetlands for septage treatment in tropical regions. *Advances in Water and Wastewater Treatment Technology*, 315-323
- [6] S K Billore, J K Sharma, N Singh, H Ram, P Dass. (2008). Restoration and Conservation of stagnant water bodies by grave-bed treatment wetlands and artificial floating reed beds in tropical India. *Water Pollution Control*. 408-414
- [7] Billore SK, Prashant, Sharma JK. (2009). Treatment performance of artificial floating reed beds in an experimental mesocosm to improve the water quality of river Kshipra. *Water Sci Technol.* 60(11), 2851-9.
- [8] Kengne I.M., Dodane P-H., Akoa A., Koné D. (2009). Vertical-flow constructed wetlands as sustainable sanitation approach for faecal sludge dewatering in developing countries. *Desalination*, 248(1-3), 291-297.
- [9] Valencia R., den Hamer D., Komboi J., Lubberding H.J., Gijzen H.J (2009). Alternative treatment for septic tank sludge: Co-digestion with municipal solid waste in bioreactor landfill simulators. *Bioresour Technology*, 100 (5), 1754-1761.
- [10] Tsalkatidou M., Gratzios M., Kotsovinos N. (2009). Combined stabilization ponds-constructed wetland system. *Desalination*, 248 (1-3), 988-997.
- [11] Troesch S., Liénard A., Molle P., Merlin G. and D. Esser (2009). Treatment of septage in sludge drying reed beds: A case study on pilot-scale beds. *Water Science and Technology*, 60 (3), 643-653.
- [12] Nielsen S. (2003). Sludge drying reed beds. *Water Science and Technology*. 48 (5), 101-109.
- [13] Koottatep T., Surinkul N., Polprasert C., Kamal A. S. M., Koné D., Montangero A., Heinss U., Strauss M. (2005). Treatment of septage in constructed wetlands in tropical climate: Lessons learnt from seven years of operation. *Water Science and Technology*, 51 (9), 119-126.
- [14] Ruiz T., Wisniewski C., Kaosol T., F. Persin (2006). Influence of organic content in dewatering and shrinkage of urban residual sludge under controlled atmospheric drying. *Process Safety and Environmental Protection*, 85 (B1), 104-110.
- [15] Cooper, P., Willoughby, N., Cooper, D.J., (2004) The use of reed beds for sludge drying. *Journal of the Chartered Institute of Water and Environmental Management*. 18 (2), 85 - 89.
- [16] Nielsen S. (2005). Sludge reed bed facilities: operation and problems. *Water Science and Technology*, 51(9), 99-107.
- [17] Nielsen S., Willoughby N. (2005). Sludge treatment and drying reed bed systems in Denmark. *Water and Environment Journal*, 19 (4), 296-305.
- [18] Meuleman A.F.M., Beekman J.Ph., Verhoeven J.T.A. (2002). Nutrient retention and nutrient-use efficiency in *Phragmites australis* stands after wastewater application. *Wetlands*, 22 (4), 712-721.
- [19] Shao L., He P., Yu G., He P. (2009). Effect of proteins, polysaccharides, and particle sizes on sludge dewaterability. *Journal of Environmental Sciences*, 21 (1), 83-88.
- [20] Jin B., Wilén B.M., Lant P. (2004). Impacts of morphological, physical and chemical properties of sludge flocs on dewater ability of activated sludge. *Chemical Engineering Journal*, 98 (1-2), 115-126.
- [21] APHA (1992). Standard Methods for the Examination of Water and Wastewater. *American Public Health Association*, Washington DC.
- [22] Uggetti E, Llorens E, Pedescoll A, Ferrer I, Castellnou R, García J. (2009). Sludge dewatering and stabilization in drying reed beds: characterization of three full-scale systems in Catalonia, Spain. *Bioresour Technol.* Sep;100(17):3882-90. Epub 2009 Apr 14.

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Searching Technique in Retrieving Software Reusable Components from a Repository

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Abstract- Software engineering is the establishment and use of sound engineering principles in order to obtain economically software that is reliable and works efficiently on real machines. These engineering principles are frequently getting changed in order to serve various software development organizations. And all the teams in an organization will follow only one process which is running in their respective company. So the components developed for a software product may be useful for them if they develop similar product in future. Even though the components of a developed product related to one firm, else's teams may require those components. So the components that are identified as re-usable are stored in a repository so that other teams can use them to serve in to get quality product. But to get the re-usable components from a repository we need to search so that we can get our needed component. In this paper, we are introducing a simple searching technique that may effectively retrieve required component from a repository. Here we are trying a web-based search to retrieve the desired component. For this, we are also using test case driven technique in order to meet the required component (means fits our purpose) to be appear in the resulted search based upon its behavior etc.

Index Terms- software reuse, component search, development cost and effort, test cases, web-based search

I. INTRODUCTION

As we know software development is nothing but a process to be followed by the development teams in order to develop the required product that can have good quality. Software engineering is the establishment and use of sound engineering principles in order to obtain economically software that is reliable and works efficiently on real machines [1]. These engineering principles are nothing but the road map that is to be followed by the development teams of an organization. There are different methodologies like waterfall, spiral model etc and also a specific methodology developed for a specific organization. Every software development company always tries to minimize the effort to develop a product and tries to make the product a high quality one. The components to be developed for a particular product can be costly in terms of person-month, LOC (Lines of Codes) etc. To develop these components indirectly result into more effort, high cost and sometimes less reliable. The software development teams develop the required product. There are various development processes available for them. Sometimes, organizations follow their own defined process for the development of a product. To develop a product or even a small component, it may require great effort, more time and high cost based on metrics like Source Lines of Code (SLOC) [2]. So the people of an organization always look up for the component

which can be reusable. The software reusable component is nothing but a component developed in a product and used in the development of other new product. The software reuse is meant to reduce cost, effort to develop the new product and also increase the quality of the newly developing product [3].

A. Software Reuse

Software Reuse is the process of using existing work products instead of building them from scratch [4]. Reuse is the use of work products (such as code, design and test) which are the products or by products of the software development process, without modification in the development of other software. It includes multiple reuse programs in different division within the same company so that it has been largely positive. It maintains the result into products can be used multiple times. And also, the reusability increases the productivity because it does not require much works for consumers (developers) [5].

Reuse impacts on software development in two distinct ways:

1. Development with reuse
2. Development for reuse

The first aims to develop products by reusing existing components. The second aims to address the issue of how to create components that are potentially reusable [6]. The existing reuse approaches include composition (Library-based reusable components) and generative [7]. The reusable components must be preserved at some place so that whenever we need them, we can just search for them and use them. Tracz [8] has pointed out that the industries have established component reuse in the form of a reusable library consisting of procedures, functions and objects.

B. Component Reuse Techniques

Khayati and Girauddin summarize the main techniques that are currently used to retrieve components from software repositories [9].

1. Natural Language Processing (NLP)
2. Signature Matching
3. Behavioral Retrieval

The NLP for component retrieval usually suffers from low recall (percentage of relevant results retrieved) for searches that are too specific or low precision (percentage of correctly retrieved results) for searches that are too general. Signature Matching tries to match the types of an operation's formal parameters but is fairly ineffective on its own because of its low precision. Behavioral retrieval uses randomly chosen "samples" to execute all operations in software library with a signature that matches the required one. Since the developer has to calculate the expected result by hand, the approach clearly has some similarity to what we call black-box testing today.

C. The Web-based Search Prototype

The procedure is having six steps:

- a) Define syntactic signature of desired component

- b) Define semantics of desired component in terms of test cases
- c) Search for candidate components with Google using a search term derived from (a).
- d) Find the source units which have the exact signature defined in (a)
- e) Filter out components which are not valid (i.e., compilable)
- f) Establish which components are semantically acceptable by applying the tests defined in (b).

1. Component Description

The first step in the component reuse process is to describe the services that the desired component is required to deliver. Most development processes involve the creation of a system design which contains a description of the system's components in a UML class diagram such as the one depicted in the figure 1. Since our approach uses regular software development artifacts that are created in most projects we believe that it will be easy to integrate with almost all mainstream development processes.

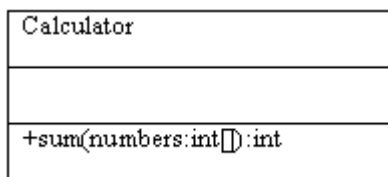


Figure 1: UML description of an example component

a) Syntactic Description:

A diagram such as that in figure 1 contains exactly the required syntactic description of the signatures of the operations supported by the component. In principle, any language has such syntactic description and would be acceptable, but in this paper we focus on Java since it is the widest spread programming language in Google search. Figure 1 shows a very good example of syntactic description of a very simple component to add together a sequence of integer numbers. The only operation required for this component is a method which receives an array of integers and returns an integer containing their sum. Most common UML Tools such as Rational Rose or Eclipse are able to generate Java code framework of the following kind from such a description.

```

public class Calculator
{
    public int sum(int[] numbers)
    {
    }
}
    
```

b) Semantic Description:

The description of the semantics is much more challenging. In fact, creating a complete and consistent description of the semantics of an operation is often as difficult as coding the implementation itself. The most common way to write operation semantics is to use pre- and post-conditions. The pre-condition defines what must be true for the operation to succeed, and the post-condition defines what effects the operation must have if it is invoked with pre-condition satisfied. The approach which is most widely used today to define and check whether an operation meets its expectations is testing. A set of test cases only describe

the semantics of an operation if it provides full coverage of the input and output space- something which is impossible in practice. However, in the absence of a mature technology for checking pre- and post-conditions, an incomplete set of test cases is a more useful description of semantics than nothing. Podgurski and Pierce showed that in general a maximum of twelve "samples" (i.e., test cases) is enough to discover operations purely with signature matching and random behavior sampling [10]. It seems that three tests are usually enough to discover an adequate component on the web. Table below illustrates some simple test cases that we used to check whether an implementation of the sum operation from previous section is satisfactory.

Table 1: Test cases for the sum operation

Input	Expected output
1 + 2 + 3	6
1 + 0 + -1	0
-1 + -2 + 1	-2

2. Candidate Discovery

In searching a component from a repository by using Google like search engine, there is an already specified technique by [11]. In this, augmenting the queries with some additional term can focus them on special topics and enhance their effectiveness. For example, when we are looking for Java components, the term "filetype:java" in conjunction with (in place of) "class" (as every Java file must contain the keyword class) improves the results significantly. So in this paper, we are enhancing this technique a little bit as we can add few more key terms such as "file-size: <int>", "use-count: <no. of repetitions>". This can improve the search as the user can only obtain his required component. The "file-size" term is a very crucial term as the reusable component must be as less as possible to faster the software or application in which it is used. There are also other advantages of having less-sized component in our application such as the application can be developed within no time, its size is also less, its fastness also increased and most importantly the cost and effort to develop the application drastically decreased. The syntax of the existing search technique is as follows:

Filetype: java -intitle: cus class "int sum int"

The syntax of our proposed search technique is as follows:

Filetype: java -intitle:cus class "int sum int" File-size: int use-count: "no. of rep" In our syntax, the attribute values of: File-size is the size of the reusable component, use-count is the number of times the component is searched and used. Its values usually like very frequent, frequent, rare and very rare, depending on a variable associated for it in the search program (such as, count). This variable value depends on the count variable in the repository.

After the search has made, the next step is to download the java classes returned by the search and process them further to detect those that:

- i. Contain exactly the right method signature
- ii. Are compilable Java sources

The (i) is achieved by taking the desired declaration as well as the downloaded source files in to consideration and comparing them with each other. Once a match is made, the body of the retrieved method is automatically copied and pasted into a

generated source file with the requested method header. The (ii) can simply be achieved by simply passing the generated source file through a Java compiler.

3. Candidate Evaluation:

a) Semantic Matching

After getting syntactically matching candidates or components, they need to be checked for semantic compatibility. As explained before, this is done by establishing whether or not the candidates satisfy the test cases defined in previous section. Here we use JUnit style test cases to our generated code, and if all of the test cases are passed, we assume that a correct version of the desired operation has been found.

b) Evaluation

The information retrieval normally evaluates search results by calculating recall and precision [12]. Here it is not possible since we easily reach a recall of 100% simply by looking at each of Google's search results. So the time required to retrieve a working method in our prototype implementation is usually under one minute. For example, the technique similar to this is used in [10] depicts an example. Consider a search for standard sorting components that sorts an array of integers from the smallest to the largest. Table 2 provides an overview of some method signatures whose implementations were easily found with that prototype:

Table 2: Example Prototypes of Different Program Components

Method	Signature
Addition	Int sum(int [])
Faculty	Long fac(int)
Body Mass Index	Float bmi(float, float)
Generic Sorting I	Int[] sort(String [])
Generic Sorting II	String[] sort(String [])
Quicksort	Int[] quicksort(int [])
Web-download	String download(String)
File-Reading	String loadTextFile(String)

This table demonstrates that "stateless" operations like mathematical functions or sorting algorithms can be discovered with relative ease when using straight-forward method names, parameter types and order.

II. CONCLUSION AND FUTURE WORK

In this paper, we are trying to load reusable components in a repository. We are established techniques to search a component from that repository effectively and speedily. But we are not concentrated on how to store reusable components in the repository. This can be done based on number of times a component is searched so far, so that we can have schemas in the repository for each and every component based on their frequent visit value. For example, we can have a schema for each of the previously defined values. And whenever the counter value is changed on a component, it will shift from one schema to other. Thus, we can reduce the search time since there is no need to search the entire repository, rather we can search only on the schema specified by the key term "use-count" [13]. And also we

can make use of sorting algorithms to store reusable components in a repository. We are also not concentrated on the reusable objects of a program. This is the discovery of "objects" which possesses multiple, interdependent operations and attributes that describe internal states of a product. This is a challenging problem than the specified one.

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REFERENCES

- [1] "Software Engineering: A Practitioner's Approach" by Roger S. Pressman, McGraw-Hill International Edition.
- [2] Albrecht, A.J., and J.E. Gaffney, "Software Function, Source Lines of Code and Development Effort Prediction: A Software Science Validation", IEEE Trans. Software Engineering, November 1983.
- [3] Wayne C. Lim, "Managing Software Reuse", Prentice-Hall, 1995.
- [4] "Software Reuse and its impacts on Productivity, Quality and Time-to-market", Eunjung Lee, Department of Computer Science, University of Houston.
- [5] W.C.Lim, "Effect of Reuse on Quality, Productivity and Economics", IEEE Software, Sept. 1994.
- [6] Sommerville. I and Ramachandran. M 1991: Reuse Assessment, First International Workshop on Software Reuse, Dortmund, Germany.
- [7] Biggerstaff, T.J. and Perlis, A.J. (Eds) 1989: Software Reusability, Vol 1 & 2, ACM Press, Addison-Wesley.
- [8] CAMP 1987: Common Ada Missile Packages, Final report, Airforce Armament Lab, Florida.
- [9] Khayati,O., Girauddin, J: "Component Retrieval Systems", Reuse in Object-Oriented Information Systems Design, OOIS workshop, 2002.
- [10] Oliver Hummel & Colin Atkinson: "Extreme Harvestin: Test Driven Discovery and Reuse of Software Components", IEEE,2004.
- [11] Baumann. S., Hummel. O.: "Using cultural Metadata for Artist Recommendations", Proceedings of the International Conference on Web Delivering of Music (Wedelmusic), Leeds, 2003.
- [12] Baeza-Yates R., Ribeiro-Neto B., Modern Information Retrieval, Addison Wesley, 2002.
- [13] Aho, Alfred V. and Jeffrey D. Ullman [1983], "Data Structures and Algorithms", Addison-Wesley, Reading, Massachusetts.

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Commonly used Media by Adolescent Girls to Seek Information Regarding Current Trends in Women's Physical Appearance

Ragini Mishra, Mrs. Vidya Dayal, Sudha Mishra

Abstract- The aim of research study was to find out behavior of adolescent girls as influenced by or in response to the influence of 'commonly used media by adolescent girls, to seek information regarding current trends related to women's physical appearance'. Purposively, from three schools 120 adolescents (60 early adolescent girls and 60 late adolescent girls) were randomly selected for the study in Kanpur city of Uttar Pradesh. A self constructed questionnaire was used to find out the most commonly used media (television, magazines, cinema and internet.), among adolescent girls, to seek information regarding current trends related to women's physical appearance according to the *age and socio-economic status* of adolescent girls. In Data was analyzed in terms of percentage, frequency and chi square (χ^2). Findings reveal that commonly used media by adolescent girls were television (91.67%), magazines (89.67%), cinema (81.67%) and internet (25.83%) respectively.

Index Terms- Media, Media Portrayal, Adolescents, Socio-Economic Status, Physical Appearance

I. INTRODUCTION

The Media appears to play a significant role in our lives. It is all around us, from the shows we watch on television or the websites we browse on the Internet or the music, entertainment or information that we access on the radio, to the books and magazines we read each day. Media today, has a wider coverage and viewer ship than perhaps a decade ago. It has reached every home, town and country. Mass media essentially means dissemination of information, idea and entertainment on a large scale by various means. It plays a vital role in spreading information, conducting propaganda, educating and enlightening people, strengthening national integration and creating national identity. By creating awareness, reinforcing ideas and providing real or ideal model of behaviour, media becomes a powerful vehicle in molding belief, attribute, value and life-style that can raise aspiration and better the standard of living. Botta (1999) refers to "The Social Comparison Theory", which posits that "people will (at some point in their lives) compare themselves and significant others to people and images whom they perceive to represent realistic goals to attain". Thus, we look to the media to help us define, explain and shape the world around us. Without always knowing it, we make automatic comparisons of ourselves, those close to us, and situations in our lives, after seeing images in the media. And as a result, after these comparisons, we are motivated to strive for, and achieve newfound goals and expectations.

Media especially, television, cinema and more recently the Internet, that provide information along with audiovisual experiences exert a powerful influence on the users since they affect the eyes, ears and the mind simultaneously. The moving images on especially the television and the Internet exert a feeling that the things are happening in front of the viewers. Also, since repetition and frequent reiteration of programmes is possible, ideas/information propagated through programmes on the television or accessed on website on the Internet, get instilled in the minds of the viewers. Often, people believe that what is propagated by the media is fully correct.

Since media is a forum of expression, the responsibilities of media are the stronghold of a democratic setup. Media is often associated with some negative points particularly, its role in propagating baseless ideas, unrealistic aspirations, unhealthy stereotypes, distorted truth, vulgarity, etc. On the other hand, media has also adopted corrective measures to counteract these negativities by projecting pros and cons related to various issues and through expression of views of experts from different fields.

Child development psychologists have also explained the significance of media from the point of view of children's development. Hurlock (), explains that mass media provides models of socially approved personality traits, which, children can use as models for their own personality development. For example, in matters of appearance, Hurlock maintains that children learn concepts of culturally approved stereotypes of the "right body build". Further, according to her, children create aspirations of what they would like to look like, or concept of ideal self or the physical self-concept, on the basis of either direct or indirect contacts they have with real people they admire or from the characters they observe and admire in the mass media. Berk (1990) explains that children acquire knowledge of sex-appropriate behaviour, appearance, occupations and achievements by observing others around them. For instance, the term "fairer sex" alluded to women, has been persistently projected as a stereotype of women by the media. For instance, the results of a market survey reported in newspaper article, pointed out that the user profile of fairness creams had got younger (age bracket 12-15 years), which was much less than a few years ago (The Times of India, Kanpur, April 8, 2009). The cause for consumption of fairness creams by teenagers for enhancing their physical appearance, was attributed to the high exposure they have of various media that propagate standards of beauty and emphasis on "fairness" or fair complexion is one such standard of physical appearance that has particularly influenced young adolescents girls and even boys.

The period of adolescence, a developmental transition between childhood and adulthood, entails major interrelated physical, cognitive and psychological changes that can make adolescents susceptible to the influence of media. The biological changes of puberty that signal the end of childhood, result in rapid growth in height and weight, changes in body proportions and form and attainment of sexual maturity. These changes can cause adolescents to worry about their appearance. This concern regarding their physical appearance becomes greater when adolescents receive messages from the mass media about specific standards of physical appearance attributed to men and women. For instance, increased activity of the sebaceous gland during puberty may give rise to pimples and blackheads causing concern in adolescent boys and girls.

Girls are usually dismayed at the appearance of even a slight amount of hair on the face or around the nipples, though this is normal (Papalia, Olds & Feldman, 1998). But as Tobin-Richards, Boxer and Petersen (1983) point out "Adolescent girls tend to be unhappier about their looks than adolescent boys, perhaps because of cultural emphasis on women's attributes. An early maturing girl may feel less attractive if her new curviness clashes with cultural standards equating beauty with thinness (Crockett & Petersen, 1987). She may feel dismayed if she sees herself changing for the worse, not for the better (Simmons, Blyth & McKinney, 1983).

Thus media portrayal of current trends related to men and women's physical appearances set up expectations about the way men and women should look that can either raise aspirations of adolescents to be as much as possible according to the cultural standards at a time when normal physical changes are taking place in their bodies or such portrayals lead them to feel dissatisfied with their physical appearance.

From the preceding discussion, it is evident that media portrayal of current trends related to physical appearance holds an awesome power to influence adolescents. The drive for thinness set off by media portrayal of 'size-zero' trend related to women's physical appearance is an example of how media influences adolescents. Current trends related to physical appearances of males and females keep changing from time to time and mass media keeps us abreast of such trends. Further the influence such current trends have on adolescents depends on the amount and kind of exposure that adolescents have of these trends. Many studies on the influence of media on body image of adolescents have been conducted. However, the influence of media on adolescents with respect to other aspects needs to be studied. Hence, present study was conducted to know most commonly used media by adolescent girls to seek information regarding current trends related to women's physical appearance.

II. OBJECTIVES

Commonly used media by adolescent girls to seek information regarding current trends related to women's physical appearance, with respect to the following –

- a. Age &
- b. Socio-economic status

III. RESEARCH METHODOLOGY

The sample comprised of 120 adolescent girls, were studying in different standards viz- IX, X and XI and were from different schools/colleges (R.B.R.D. Inter College, Nawabganj, P.P.N. Inter College Parade, & Swaraj India Public School, Kakadev) of Kanpur city of the Uttar Pradesh State. A *Random* selection of girls was done, ensuring that there were 60 early adolescent girls and 60 late adolescent girls. A questionnaire was therefore framed, to collect relevant information such as background characteristics of the respondents and most commonly used media, to seek information regarding current trends related to women's physical appearance according to the *age and socio-economic status of adolescent girls*. In order to analyze the data collected, *Percentage and Chi-square test* was used test the significance of association / dependency of attributes.

IV. RESULTS & DISCUSSION

As shown in below table 1 (a), out of the total sample of 120 adolescent girls, a majority of girls (91.67%) were using television to seek information about current trends related to women's physical appearance. Out of 60 early adolescence girls and another 60 late adolescence girls, a majority of both the early and late adolescent girls (93.33 % & 90.00 % respectively) were using television to seek information about current trends although the percentage of television users was higher in the case of early adolescence girls (93.33%) as compared to late adolescence girls (90.0 %). Further, the chi square value (0.0436 for 1 *df*) reveals that there is a non-significant relationship between use of television by adolescent girls and their age i.e. age of adolescence is not related or associated with girls' behavior of using television for seeking information about current trends. Both the younger and older adolescent girls were found to be using television for seeking the information. Mahajan and Singh (1997) studied the impact of media on lifestyle of adolescents in the age group of 12-18 years of age and found that media especially television and satellite channels certainly affected the lifestyle of individuals. They tend to buy the product advertised by media, irrespective of its cost. The way of presentation mattered in case of food items whereas in case of clothing, designer label mattered. The impact of television is vital because of its enormous potential as an audio-visual communicator. Television (T.V.) enables the creative man to communicate by combining motion, sounds, words, color, personality and stage setting to express and demonstrate ideas to large and widely distributed audience. T.V. advertisements usually play a role in either introducing a product reinforcing the familiarity to the product and also convincing to purchase the product. Advertisements are among the most visible of the marketing strategy and have been the subject of a great deal of attention in the last ten to fifteen years. Advertisement cannot only change emotions but give subliminal message. Advertising today seems to be everywhere and ever present exerting a far reaching influence on the daily lives of people. Advertisements develop self-concepts in order to induce purchase decisions. Television advertising employs attention grabbing trick such as catchy and pleasing music, lyrics, Jingles, humor and repeated messages. The impact of the advertisements is more on television than the print media or radio.

Table – 1: Percentage distribution commonly used media to seek information regarding current trends related to women's physical appearance, according to the *age of adolescent girls* -

S.N.	Questions	Response	Early Adolescents n=60		Late Adolescents n=60		Total N=120		Chi Square
			f	%	f	%	f	%	
1 (a)	T.V.	Yes	56	93.33	54	90.00	110	91.67	0.0436 for 1 <i>df</i>
		No	4	06.67	6	10.00	10	08.33	
1(b)	Magazine	Yes	52	86.67	55	91.67	107	89.16	0.7764 for 1 <i>df</i>
		No	8	13.33	5	08.33	13	10.83	
		No	47	78.33	51	85.00	98	81.67	
1(c)	Cinema	Yes	13	21.67	9	15.00	22	18.33	0.8905 for 1 <i>df</i>
		No	13	21.67	9	15.00	22	18.33	
1(d)	Internet	Yes	10	16.67	21	35.00	31	25.83	5.2627** for 1 <i>df</i>
		No	50	83.33	39	65.00	89	74.17	

**significant at 1%

*significant at 5%

Table-2: Percentage distribution of commonly used media to seek information regarding current trends related to women's physical appearance, according to the Socio-economic status of adolescent girls, -

S.N.	Questions	Response	Low Income n=35		Middle Income n=40		High Income n=45		Total N=120		Chi Square
			F	%	f	%	F	%	f	%	
2 (a)	T.V.	Yes	31	88.57	37	92.50	42	93.33	110	91.67	0.2678 for 1 <i>df</i>
		No	4	11.42	3	07.50	3	06.67	10	08.33	
2(b)	Magazine	Yes	32	91.42	35	87.50	40	88.89	107	89.16	0.00575 for 1 <i>df</i>
		No	3	08.58	5	12.50	5	11.11	13	10.83	
2(c)	Cinema	Yes	21	60.00	33	82.50	44	97.78	98	81.67	18.794** for 2 <i>df</i>
		No	14	40.00	7	17.50	1	02.22	22	18.33	
2(d)	Internet	Yes	5	14.29	10	25.00	16	35.55	31	25.83	4.6704 at 2 <i>df</i>
		No	30	85.71	30	70.00	29	64.45	89	74.17	

**significant at 1%

*significant at 5%

As shown in table 1 (b), out of the total sample of 120 adolescent girls, a majority of girls (89.67%) were using magazines for seeking information about current trends related to women's physical appearance. Out of the 60 early adolescent girls and 60 other late adolescent girls, a majority of both the early and late adolescent girls (86.67% & 91.67% respectively) were using magazines for seeking information about current trends, although the percentage of magazine users was higher in the case of early adolescent girls (86.67%) compared to late adolescent girls (91.67%). Further, the chi square value (0.7764 for 1 *df*) reveals that there is a non-significant relationship between use of magazines by adolescent girls and their age i.e. age of adolescence is not related or associated with girls' behavior of seeking information about current trends. Both the younger and older adolescent girls were found to be using magazines to seek the information.

As can be observed from table 1 (c), out of the total sample of 120 adolescent girls, a majority of girls (81.67%) were using cinema medium to seek information related to current trends in women's physical appearance. Out of the 60 early adolescent girls and 60 other late adolescent girls, a majority of both the early and late adolescent girls (86.67% & 91.67% respectively) were using the cinema for seeking information about current trends, although the percentage of cinema users was higher in the case of late adolescent girls (85.00 %) as compared to the early adolescent girls (78.33 %). Further, it can be observed from chi square value (0.8905 for 1 *df*) that there is a non-significant relationship between use of cinema by adolescent girls and their age i.e. age of adolescent girls is not associated with their behavior of using the cinema medium for seeking information about current trends. Both the younger and older adolescent girls were found to be using cinema for seeking the information.

As shown in table 1 (d), out of the total sample of 120 adolescent girls, a very low percentage of girls (25.83%) were using the Internet for seeking information about current trends in women's physical appearance. Out of the 60 early adolescent girls and 60 late adolescent girls, a low percentage of both the early and late adolescent girls (16.67% & 35.00% respectively) were using the Internet for seeking the information related to current trends although the percentage of Internet users was higher in the case of late adolescent girls (35.00%) compared to early adolescent girls (16.67%). Further, the chi square value (5.2627 for 1 *df*) also reveals a significant relationship between the use of Internet by adolescent girls and their age i.e. age of adolescent girls is associated with their behavior of using the Internet for seeking information about current trends.

As shown in table 2 (a), a majority of adolescent girls from the high income families (93.33%) were using television for seeking information about current trends related to women's physical appearance, followed by girls from middle income families (92.50%) and girls low income families (88.57%). Further, the chi square value (0.2678 for 1 *df*) reveals that there is a non-significant relationship between use of television by adolescent girls and their family income i.e. family income of adolescent girls is not related or associated with their behaviour of using television for seeking information about current trends. Rana (1995) undertook a study on T.V. advertisements and expressed that among the media, the impact of television advertisement on social behavior, including purchasing behavior was the greatest. The reason being that television has charm, instantaneous transmission capability and universality of appeal. Dhillon et al. (1997) investigated the factors affecting consumer behavior of durable goods and food items. Sample comprised of 150 females (75 each from rural and urban areas). The sources of information, the rural respondents gave primary importance were, advertisements through radio, followed by posters to some extent but were least affected by magazines. Urban respondents were affected the maximum by television and magazines.

The table 2(b), reveals that a majority of adolescent girls from the high income families (88.89%) were using magazines for seeking information related to current trends in women's physical appearance, followed by girls from middle income families (87.50%) and girls from low income families (91.42%). Further, the chi square value (0.00575 for 1 *df*) reveals that there is a non-significant relationship between use of magazines by adolescent girls and their family income i.e. family income of adolescent girls is not related or associated with their behavior of using magazines for seeking the information.

As can be observed from table 2 (c), that a majority of adolescent girls from the high income families (97.78%) were using cinema for seeking information related to current trends in women's physical appearance, followed by girls from middle income families (82.50%) and girls from low income families (60.00%). Chi square value (18.794 for 1 *df*) reveals that there is significant relationship between use of cinema by adolescent girls and their family income i.e. family income of adolescent girls is associated with their behaviour of using cinema for seeking information about current trends.

Table 2 (d), depicts that a low percentage of adolescent girls from all the three family income groups i.e. 35.55% from the high income group, followed by 25.00% from the middle income group and 14.29% from the low income group, were using the Internet for seeking information about current trends in women's physical appearance. Further, the chi square value (4.6704 for 1 *df*) reveals a significant relationship between the use of Internet by adolescent girls and their family income.

V. CONCLUSION

Media (television, magazines, cinema and internet) has become an integral part of modern society. It is the most convenient route to reach not only adult consumers but also the adolescents. Adolescents are manipulated by various means of media which promises that the product will do something special for them which will transform their life. The results of the study revealed that out of television, magazines, cinema and internet, T.V. was most commonly used media among adolescent girls to seek information related to current trends in women's physical appearance with respect to their age and socio-economic status.

REFERENCES

- [1] Aggarwal, M. 1983. Effect of Selected Factors On Quality of Buying Practices Of The Consumers. Unpublished M.Sc. Thesis, Baroda: M.S.University.
- [2] Amanda, J. H. (2004) Journal of Broadcasting and Electronic Media, Vol. 48, Issue 2, pp:196 - 217.
- [3] Andrist, C.L. (2003). "Media images, body dissatisfaction and disordered eating", The American Journal of Maternal / Child Nursing: Vol.28, Issue-2, pp : 119 - 123
- [4] Berk E. L. (2007). Child Development (seventh edition), p.p.175-179
- [5] Botta, A. R. (2003). Journal Sex Roles, vol. 48, Issue 9-10, p-10.
- [6] Cheung, C.K. and C. F. Chan. 1996. "Television Viewing and Mean World Value in Hong Hurlock E.B. (2003), Developmental Psychology (fifth edition) p.p.-222-231
- [7] Jennifer L. Derenne, M.D. and Eugene V. Beresin, M.D. (2006), Body Image, Media, and Eating Disorders, Acad Psychiatry Vol. 30, pp: 257-261
- [8] Kaur, H. and R. Kaur. 2002. "Fashion Awareness Among Rural and Urban Adolescents." Journal of Social Research. Vol. 43, Issue -1 pp:37-40.
- [9] Malathi, N.T. and R. K. Kumar. 1989. Effectiveness of mass media advertisements: A case study of Mysore City audience." Vidura Vol.26, Issue.1 pp: 26-27.
- [10] Practice Update from the National Association of Social Worker (November, 2001), 2 (4)
- [11] Saksena, G. 1990. "Advertising Through T.V., Social Implications." Journal of Indian Institute of Mass Communication, Vol. 25, Issue-1, pp: 44-4
- [12] The Times of India, Kanpur (April 8, 2009)
- [13] www.google.com
- [14] www.naswdc.org/practice/adolescent_health/ah0204.asp
- [15] www.sirc.org/publik/mirror.html

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Analysis of Vegas Using Network Simulator

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Abstract- Information sharing has become the basic need of time, and internet supports us to share the information in one of the fastest possible ways. Internet has emerged as the basic need of the time. Internet has influenced every part of our life. Shopping, communication, entertainment, business, information, education all aspects of one's life are available on internet. There has been a tremendous increase, almost an exponential rise, in the number of internet users in the recent times, which resulted in the form of congestion problem over the wide area network (WAN). Window size is an important parameter to avoid congestion. The basic idea of this work is to simulate TCP variant Vegas using NS2 at different delay times and window size, to find which is best suited window size for this variant, depending on the parameters like bandwidth and delay time.

Index Terms- RTT, AIMD, TCP/IP, FAST TCP, TCP RENO, TCP TAHOE, TCP VEGAS, cwnd.

I. INTRODUCTION

Transmission Control Protocol (TCP) is one of the core protocols of the TCP/IP Protocol Suite. TCP is used to provide reliable data between two nodes and works at the transport layer of the TCP/IP model. TCP operates at a higher level, concerned only with the two end systems, for example, a Web browser and a Web server. In particular, TCP provides reliable, ordered delivery of a stream of bytes from a program on one computer to another program on another computer. Besides the Web, other common applications of TCP include e-mail and file transfer. Among its other management tasks, TCP controls message size, the rate at which messages are exchanged, and network traffic congestion [1]. Different variants of TCP use different algorithms to control congestion over a network so as to provide communication of data on a wide area network like internet.

As the global Internet traffic increases, many popular sites are often unable to serve their TCP/IP workload, particularly during peak periods of activity. For example, Web servers for sports events are often swamped by requests during and after games. To address this problem, many sites allocate multiple server hosts to concurrently handle the incoming requests. To support workload sharing, they need a method to distribute the requests among the servers. Since network traffic is self-similar, with waves of heavy traffic at peak times, this requires dynamic feedback control. Commonly used TCP variant is TCP Reno and uses basic AIMD mechanism only to adjust their congestion window size. TCP Reno was the modified version of TCP Tahoe. These protocols are not scalable as the delay-bandwidth product of the network becomes larger [2] because additive increase is too slow and

multiple decreases is too fast. Basic TCP uses packet loss only to adjust the congestion window size.

So, TCP Vegas and FAST TCP were proposed to cope up the same problem. FAST TCP uses packet loss as well as queuing delay as the congestion control parameter and to adjust window after every RTT (Round Trip Time) [3], [4], [5-6].

II. CLASSIFICATION OF TCP PROTOCOLS

TCP protocols are differentiated from each others on the basis of their congestion control strategy and are classified as shown in Figure 1.

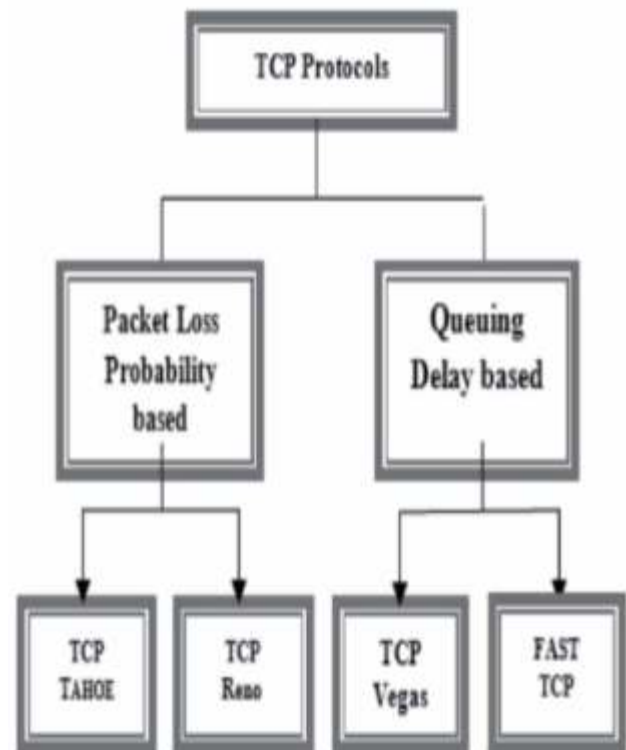


Figure 1: Classification of TCP Protocols

TCP is one of the core protocol used in the communication world. TCP uses basic AIMD (Additive Increase Multiple Decrease) algorithm for the congestion control over a network. TCP Tahoe, TCP Reno, TCP Vegas, FAST TCP are some TCP variants which uses different algorithms to control congestion [2], [7], [8].

A. Loss-based TCP protocols variants

These are the protocols which uses packet drop probability as the main factor for adjusting the window size. These variants of TCP use congestion control algorithms. There were developed initially and are still used. Loss based TCP protocols are more

aggressive than the delay based TCP protocols [9]. These are classified as TCP Tahoe and TCP Reno.

B. Delay-based TCP Protocols

Delay-based algorithms were developed so as to provide stable throughput at the receiver end. These TCP variants use congestion avoidance algorithms to avoid the packet loss and are less aggressive than packet loss based TCP protocols. Delay-based algorithms can maintain a constant window size, avoiding the oscillations inherent in loss-based algorithms [6]. However, they also detect congestion earlier than loss-based algorithms, since delay corresponds to partially filled buffers, while loss results from totally filled buffers. This can be either strength or a weakness. If the only protocol used in a network is delay-based, then the inefficiency of loss can be avoided; however, if loss-based and delay-based protocols share the network, then delay-based algorithms tend to be less aggressive. These are the protocols which uses queuing delay as the main factor for adjusting the window size. These variants were developed so as to provide stable throughput at the receiver end. These TCP variants use congestion avoidance algorithms to avoid the packet loss and are less aggressive than packet loss based TCP protocols. These are classified as TCP Vegas and Fast TCP.

C. TCP VEGAS

TCP Vegas is a congestion control or network congestion avoidance algorithm that emphasizes packet delay, rather than packet loss, to determine the rate at which to send packets. TCP Vegas detects congestion during every stage based on increasing Round Trip Time (RTT) values of the packets in the connection unlike Reno, Tahoe etc. which detect congestion only after it has actually happened via packet drops. The algorithm depends heavily on accurate calculation of the Base RTT value. TCP Vegas provides high throughput as compare to TCP Reno and TCP Tahoe.

TCP Vegas was proposed in 1994 with the claim that it can offer higher throughput than Reno and being able to achieve throughput improvement ranging from 37% to 71% compared to Reno [10]. It was developed at the University of Arizona by Lawrence Brakmo and Larry L Peterson. However, the performance of Vegas connection degrades significantly when they coexist with other concurrent Reno connections. Despite its limitations, an innovative idea in Vegas is that it uses a very simple mechanism to measure the network conditions.

- TCP Vegas uses packet delay to adjust the source rate rather than packet loss.
- TCP Vegas adjusts the source rate before actually packet is dropped.
- Queuing delay is the difference between baseRTT and avgRTT.
- TCP Vegas decreases the source rate in case of increase in queuing delay value and increases in case of decrease in queuing delay.

TCP Vegas increases or decreases the window size with fixed number of packets and it is less aggressive as compare to TCP Tahoe and TCP Reno. So, FAST TCP was proposed [11].

The difference between TCP Vegas and FAST TCP lies in the way in which the rate is adjusted when the number of packets stored is too small or large. TCP Vegas makes fixed size adjustments to the rate, independent of how far the current rate is from the target rate. FAST TCP makes larger steps when the

system is further from equilibrium and smaller steps near equilibrium [12]. This improves the speed of convergence and the stability [4], [13].

III. PROPOSED WORK

For the comparison of TCP Vegas at different window sizes, simulation is done for the dumbbell topology as shown in Figure 2, in which there are three source nodes (i.e. S1, S2 and S3) which are sending data to sink nodes (i.e. D1, D2 and D3) through a bottleneck link between nodes S0 and D0. Node S0 and node D0 acts as router which forward data to the sink nodes over the network. The delay for all the side links is kept constant, at 1ms as shown in Figure 2. Simulation can be done for different values of link capacities (C) but the results shown are only for C = 100 Mbps. Delay on the bottleneck link (i.e. X) is varied on bottleneck link and simulation is done for four values of X i.e. for X=8 ms, 18 ms, 48 ms and 98 ms, so as to make total delay from source node to the sink node equals to 10ms, 20ms, 50ms and 100ms respectively. Simulation is done for 100 seconds in every case and window size is varied as 200, 300, 400, 500, 600, and 700 and so on, so that the comparison can be made on the basis of the window size.

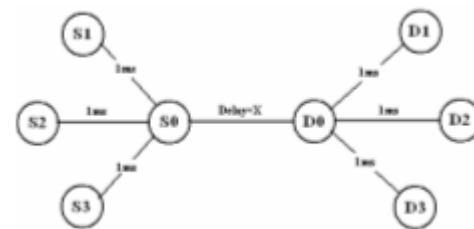


Figure 2: Dumbbell Topology

Here 3 source nodes are taken so as to generate congestion over the bottleneck link. All source nodes use FTP protocol (used on the Application layer of the TCP/IP layer model) to generate bulk amount of data. The source rate is controlled by the different congestion control algorithms used by different TCP variants. There are three active flows used during the simulation for the above mentioned topology: Flow_1 takes place between nodes S1 and D1 from 0 to 100 seconds. Flow_2 takes place between node S2 and D2 from 20 to 80 seconds and Flow_3 takes place between node S3 and D3 from 40 to 60 seconds.

The major responsibility is to develop the code in TCL, which can be simulated in ns2 and then to simulate TCP Vegas in ns2 and to generate a comparison on the basis of Bandwidth-delay product value.

Software used is ns or the network simulator (also called ns-2) is a discrete event network simulator.

- ns is popularly used in the simulation of various protocols. ns supports simulation for wired as well as wireless networks.
- Linux operating system (e.g., Fedora 9.0.x) or Ubuntu (GUI for Linux).
- Topology Used: Bottleneck or Dumbbell topology.

IV. RESULTS AND DISCUSSIONS

TCP Vegas at 10 ms Delay
and cwnd=200

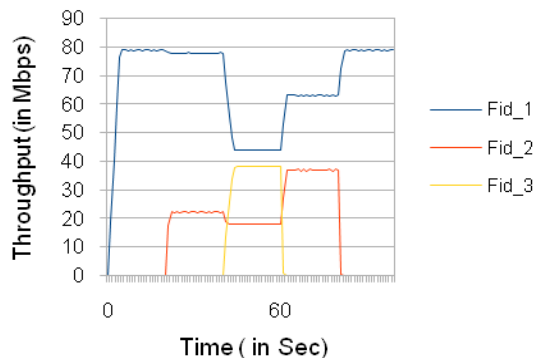


Figure 3(a)

TCP Vegas at 20 ms Delay
and cwnd=300

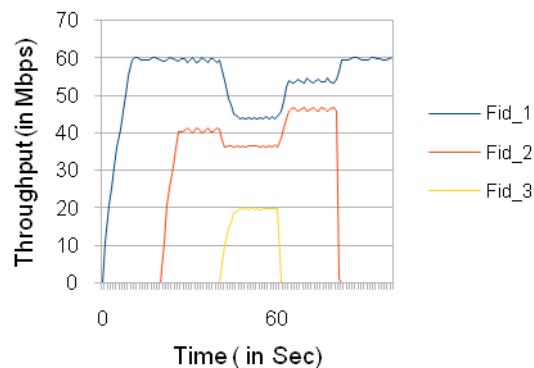


Figure 4(a)

TCP Vegas at 10 ms Delay
and cwnd=300

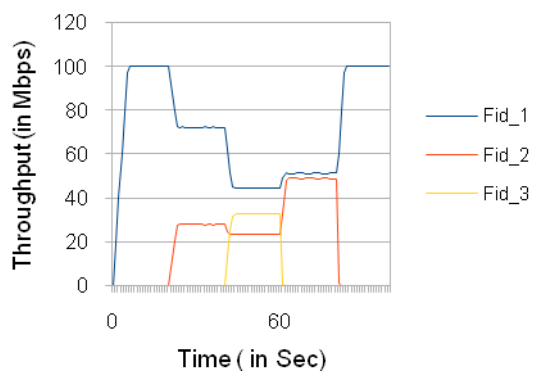


Figure 3(b)

TCP Vegas at 20 ms Delay
and cwnd=500

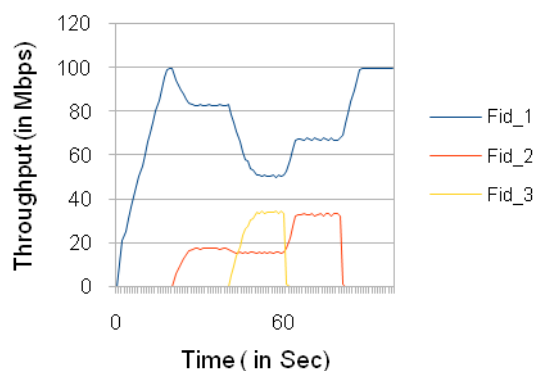


Figure 4(b)

TCP Vegas at 10 ms Delay
and cwnd=400

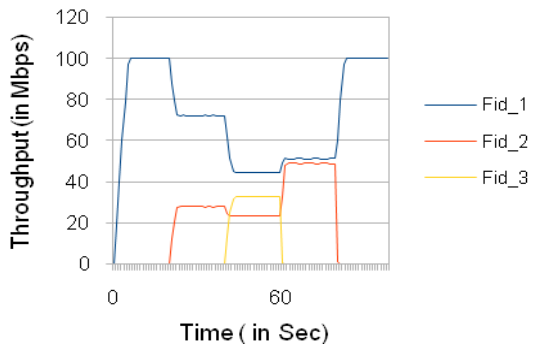


Figure 3(c)

TCP Vegas at 20 ms Delay
and cwnd=700

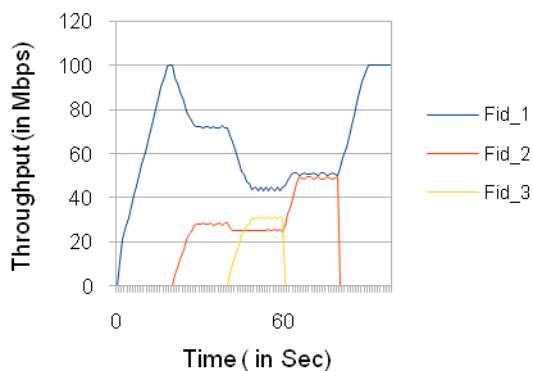


Figure 4(c)

Figure 3: TCP Vegas at delay of 10ms and window size (a) 200 (b) 300 (c) 400

Figure 4: TCP Vegas at delay of 20ms and window size (a) 300 (b) 500 (c) 700

TCP Vegas at 50 ms Delay
and cwnd=800

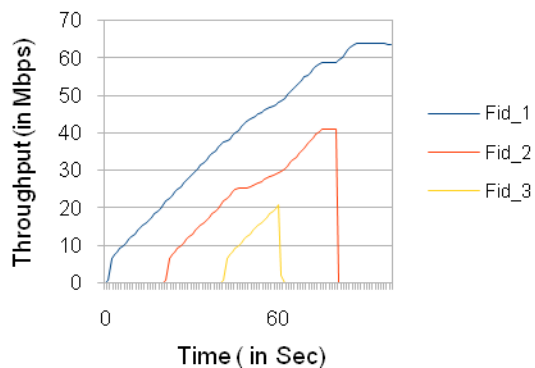


Figure 5(a)

TCP Vegas at 100 ms Delay
and cwnd=300

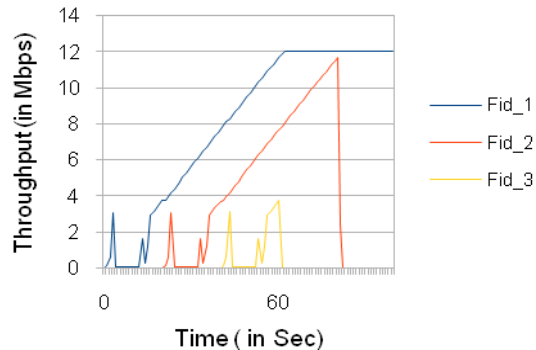


Figure 6(a)

TCP Vegas at 50 ms Delay
and cwnd=900

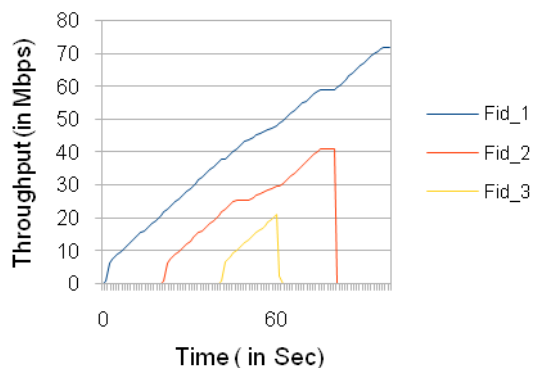


Figure 5(b)

TCP Vegas at 100 ms Delay
and cwnd=500

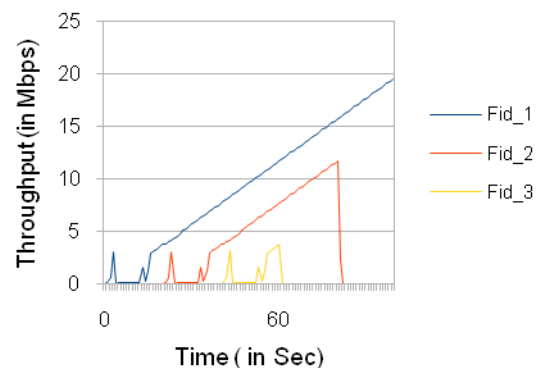


Figure 6(b)

TCP Vegas at 50 ms Delay
and cwnd=1000

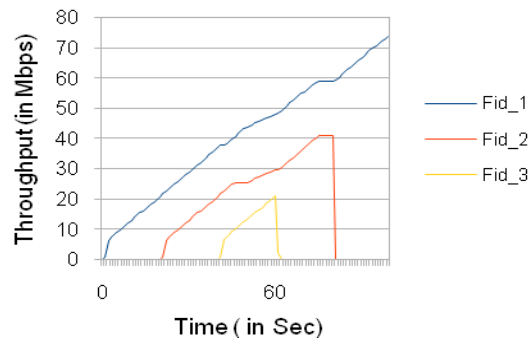


Figure 5(c)

TCP Vegas at 100 ms Delay
and cwnd=600

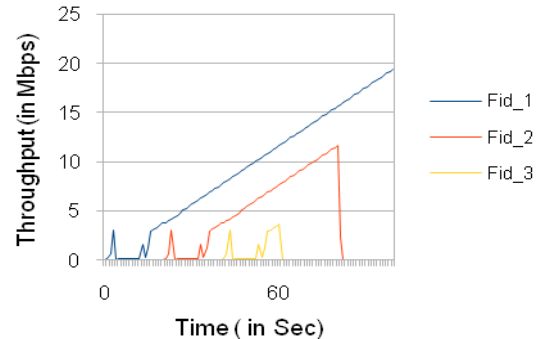


Figure 6(c)

Figure 5: TCP Vegas at delay of 50ms and window size (a) 800 (b) 900 (c) 1000

Figure 6: TCP Vegas at delay of 100ms and window size (a) 300 (b) 500 (c) 600

Table 1: Throughput of TCP Vegas at different window size and delay

Congestion window	Delay (ms)	TCP Vegas's Throughput (Mbps)
200	10ms	49.99
	20ms	36.71
	50ms	14.7
	100ms	5.2
300	10ms	53.8
	20ms	43.58
	50ms	20.27
	100ms	6.5
400	10ms	53.8
	20ms	47.81
	50ms	24.84
	100ms	7.12
500	10ms	53.8
	20ms	50.16
	50ms	28.51
	100ms	7.31
600	10ms	53.8
	20ms	49.37
	50ms	30.12
	100ms	7.31
700	10ms	53.8
	20ms	49.37
	50ms	31.62
	100ms	7.31
800	10ms	53.8
	20ms	49.37
	50ms	32.48
	100ms	7.31
900	10ms	53.8
	20ms	49.37
	50ms	32.85
	100ms	7.31
1000	10ms	53.8
	20ms	49.37
	50ms	32.87
	100ms	7.31

V. CONCLUSION AND FUTURE SCOPE

From the graphs obtained by simulation we obtain the value of throughput at different congestion window size and delay and the tabular representation of the data so obtained is shown in Table 1

Therefore from the graphs and the table, we conclude that

A. At 10 ms delay

This gives us almost constant throughput for each flow. But the problem here is that all sources does not get equal access to

the available bandwidth. The congestion window size should be greater than or equals to 300 because the difference between the throughput values for the different flows is smaller.

B. At 20 ms delay

The congestion window size should be greater than or equals to 600.

C. At 50 ms delay

The congestion window size should be greater than or equals to 1000 as the throughput is maximum.

D. At 100 ms delay

The congestion window size should be greater than 500 so as to achieve maximum throughput value.

- TCP Vegas provides the constant throughput for the different flows.
- When any source starts sending data, then it decreases the window size by constant size.
- Problem for TCP Vegas is the bandwidth is not shared equally by all the flows. Some sources get access to the maximum available bandwidth whereas others uses the available bandwidth.

For multiple flows over an internet connection, TCP Vegas can lead to oscillations in the throughput values.

For TCP Vegas, if two or more users wants to send the same amount of data, then this may require different amount of data depending upon the amount of bandwidth shared by the individual user or source.

REFERENCES

- [1] http://en.wikipedia.org/wiki/Transmission_Control_Protocol
- [2] Cheng Peng Fu, Bin Zhou, Jian Ling Zhang, "Modeling TCP Veno Throughput over Wired/Wireless Networks," IEEE COMMUNICATIONS LETTERS, VOL. 11 NO. 9, SEPTEMBER 2007.
- [3] C. Jin et al., "FAST TCP: From Theory to Experiments," IEEE Network, vol. 19, no. 1, pp. 4– 11, Jan./Feb. 2005.
- [4] J. Wang, D. X. Wei, and S. H. Low, "Modelling and Stability of FAST TCP," in Proc. IEEE INFOCOM 2005, Miami, FL, Mar. 2005.
- [5] C. Jin, D. Wei, and S. H. Low, "FAST TCP for high-speed long-distance networks," Internet draft draft-jwl-tcp-fast-01.txt. [Online]. <http://netlab.caltech.edu/pub/papers/draft-jwl-tcp-fast-01.txt>.
- [6] David X., Wei Cheng Jin, Steven H. Low Sanjay Hegde, "FAST TCP: Motivation, Architecture, Algorithms, Performance," IEEE/ACM Transactions on Networking, 14(6):1246-1259, Dec 2006.
- [7] Lori A. Dalton, Ciji Isen, "A Study on High Speed TCP Protocols," IEEE Communications Societ, Globecom 2004.
- [8] Liansheng Tan, Cao Yuan, Moshe Zukerman, "FAST TCP: Fairness and Queuing Issues," IEEE COMMUNICATIONS LETTERS, VOL. 9, NO. 8, AUGUST 2005.
- [9] Tomoya Hatano, Hiroshi Shigeno and Ken-ichi Okada, "TCP-friendly Congestion Control for High Speed Network," Proceedings of the 2007 International Symposium on Applications and the Internet (SAINT'07), 0-7695-2756-6/07 \$20.00 © 2007 IEEE.
- [10] Tony Cui, Lachlan L. H. Andrew, Moshe Zukerman, Liansheng Tan, "Improving the Fairness of FAST TCP to new Flows," IEEE COMMUNICATIONS LETTERS, VOL. 10, NO. 5, MAY 2006..
- [11] Sandor Molnar, Sandor Kardos, and Tuan Anh Trinh, "Parameter Setting Games in TCP Vegas and FAST TCP," High Speed Networks Laboratory, Department of Telecommunications and Media Informatics, Budapest University of Technology and Economics, H-1117, Budapest, Hungary.
- [12] Joon-Young Choi, Kyungmo Koo, Jin S. Lee, Steven H. Low, "Global Stability of FAST TCP in Single-Link Single-Source Network," in Proceedings of the 44th Conference on Decision and Control, and the European Control Conference 2005, Seville, Spain, December 12-15, 2005.
- [13] T. V. Lakshman, Member, IEEE, and Upamanyu Madhow, Senior Member, IEEE, "The Performance of TCP/IP for Networks with High Bandwidth-

Delay Products and Random Loss,” IEEE/ACM TRANSACTIONS ON
NETWORKING, VOL. 5, NO. 3, JUNE 1997.

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Development of Maintenance Strategy to Improve Performance of Induce Draft Wet Cooling Tower

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Abstract- Throughout the years, the importance of the maintenance management system and their functions has grown rapidly. Cooling towers are used in many process applications in the various industries. Reliability of these towers is crucial. In many cases, redundant towers are installed to ensure a process will not have to be stopped due to a cooling tower failure. The most prevalent cause of cooling tower downtime is failure of bearings, improper water distribution by the nozzles, fan unbalance, failure of the gearbox or associated mechanical components, such as the driveshaft or disc couplings etc. Further, the elimination of these components reduces the losses in the drive system and offers the possibility for improved overall system efficiency. To succeed in the ever-growing competitive global marketplace, it is vital for modern industries to reduce costs related to asset maintenance, repair and replacement, which directly affects the cost of manufactured products. Unplanned downtime results in high maintenance costs. Consequently, improving maintenance efficiency provides substantial benefits to equipments. Cooling tower maintenance considering future uncertainties could improve the efficiencies of the heat transfer processes and as a result, improve the performance of the cooling tower. As a step towards incorporating uncertainties in the cooling tower consideration, this paper presents a cooling tower maintenance methodology including cooling tower trouble shooting with their causes and remedies, preventive maintenance schedule for cooling tower, optimization of cooling tower overhauling activity in maintenance and monitoring technologies. The methodology has been presented, allows the easy maintenance and monitoring of cooling tower with the use of new technology in drive assembly. In this present work we have prepare a preventive maintenance schedule on the basis of their failure and causes. This increases the utilization of the cooling tower and reduces the uneven breakdown maintenance.

Index Terms- cooling tower, maintenance, optimization

I. INTRODUCTION

A cooling tower extracts heat from water by evaporation. Small portion of the water being cooled is allowed to evaporate into a moving air stream in an evaporative cooling tower which provides significant cooling to the rest of that water stream. Evaporative cooling towers are relatively inexpensive and very dependable means of removing low grade heat from your process.

In various industries there is a use of cooling tower in which various cells are grouped together in serial lines. Well organized of these cooling tower maintenance structure will ensure the effectiveness of the entire production lines. In order to increase the effectiveness of the cooling tower in the production lines, we have studied some advance technologies which ensure the well maintenance and easy survival of cooling tower. Improved reliability of cooling tower is now possible due to advancements in technology. Maintenance of instruments and equipment is a continuous process: once the equipment has been inventoried, the program must continue. Continuous monitoring and maintenance of cooling tower must be done in order to get the better performance of the cooling tower. Cooling tower suffers the many problems in their operation. Proper identification and implementation of corrective action is possible by preparing the scheduled maintenance of cooling tower.

In a cooling tower, cool water is pumped away from the cooling tower and is circulated through hot equipment. The cool water absorbs heat from the equipment and becomes warmer. The warmed water is returns back to the cooling tower. In the cooling tower the warmed water is sprayed downward, and air is blown upward with a fan. As the warm water droplets contact the air, some of the water droplets evaporate, and the air absorbs the heat released from this evaporation and thus lowering the temperature of the remaining water. This cooling effect of the remaining water is called the latent heat of evaporation. During this process, some water is lost to the air from evaporation and some water is lost by the misting effect (called "drift") into the air.

The basic way to distinguish between cooling towers is how the air and water interact, open cooling towers or closed cooling towers. Open cooling towers are also known as direct cooling towers; allow the water to come into contact with outside air. If cooled water is returned from the cooling tower to be used again, some water must be added to replace the water that has been lost. Pollutants are able to enter into the water used in these processes and must be filtered out. Cooling technology, inc provides all open water cooling towers with sand and gravel filters to help combat this issue. Another method of combating the excess minerals and pollutants is some means of a dissolved solid control, such as a blow down. With this, you drain off a small percentage of the flow to aid in the removal of these contaminants. This is fairly effective, but not as efficient as filtration.

Closed loop cooling towers is also known as indirect cooling tower which does not allow the water to come into contact with

any outside substance, therefore keeping the water more pure due to the lack of foreign particles introduced.

II. OBJECTIVE

In this study we find out all aspect of cooling tower failure and their causes which degrades the efficiency of the heat transfer processes. In our study on the basis of past data recorded and by proper observation of cooling tower our aim is to prepare the maintenance schedule of the cooling tower. This maintenance schedule reduces the uneven failure of the cooling tower. Proper monitoring and use of advanced technologies in cooling tower operation also reduces the maintenance task associates with the cooling tower. By proper monitoring we can find out the fault at primary stage so that we can reduces the major breakdown.

The primary goal of maintenance is to avoid the consequences of failure of equipment. This may be by preventing the actually occurrence of the failure, which Planned Maintenance and Condition Based Maintenance help to achieve. It is designed to preserve and restore equipment reliability by replacing worn components before they actually fail. Preventive maintenance activities include partial or complete overhauls at specified periods, oil changes, lubrication and so on. In addition, workers can record equipment deterioration so they know to replace or repair worn parts before they cause system failure. The ideal preventive maintenance program would prevent all equipment failure before it occurs.

III. PROBLEM IDENTIFICATION

Breakdown based maintenance strategy is used in existing cooling tower with most of the parts (nozzles, fills, drift eliminator). The most critical failures occur in the drive assembly which is mostly responsible for the fan unbalance.

In absence of advancement of technologies, the cooling tower monitoring and maintenance becomes difficult. Treated water is not used in some cooling tower. Proper maintenance department not included with the cooling tower.

I. Causes of Poor Performance:

The performance of a cooling tower degrades when the efficiency of the heat transfer process declines. Some of the common causes of this degradation include: Scale Deposits, Clogged Spray Nozzles, Poor Air Flow, Poor Pump Performance.

A. Scale Deposition

When water evaporates from the cooling tower, it leaves scale deposits on the surface of the fill from the minerals that were dissolved in the water. Scale build-up acts as a barrier to heat transfer from the water to the air. Excessive scale build-up is a sign of water treatment problems.

B. Clogged Spray Nozzles

Algae and sediment that collect in the water basin as well as excessive solids get into the cooling water and can clog the spray nozzles. This causes uneven water distribution over the fill, result in uneven air flow through the fill and reduced heat transfer surface area. This problem is a sign of water treatment problems and clogged strainers.

C. Poor Air Flow

Poor air flow through the tower reduces the amount of heat transfer from the water to the air. Poor air flow can be caused by debris at the inlets or outlets of the tower or in the fill. Other

causes of poor air flow are loose fan and motor mountings, poor motor and fan alignment, poor gear box maintenance, improper fan pitch, damage to fan blades, or excessive vibration. Reduced air flow due to poor fan performance can ultimately lead to motor or fan failure.

D. Poor pump performance

An indirect cooling tower uses a cooling tower pump. Proper water flow is important to achieve optimum heat transfer. Loose connections, failing bearings, cavitations, clogged strainers, excessive vibration, and non-design operating conditions result in reduced water flow, reduced efficiency, and premature equipment failure.

IV. DESCRIPTION OF PROBLEM

In operation of cooling tower various types of problems offered, which affects the performance of cooling tower. The problems occur in cooling towers are of many types and various causes are responsible for the same failure.

A. Cooling Tower Trouble Shooting

Cooling Towers are categorized under critical equipment in our plant. A catastrophic failure of a cooling tower has the potential to partially shut a major portion of the site down, costing thousands of dollars in lost production. It is very important that we know the mechanical condition of our cooling towers at all times.

B. Cooling tower trouble shooting description

Gearbox overheating: At one station, over half the gearboxes experienced failures of the output shaft bottom bearing. One of the root causes of failure was oxidation of the oil at the elevated temperatures at which the gearbox was running. The gearbox did not have a cooling fan mounted on the input shaft and the result was a "dead space" in the airflow around the gearbox. Oil analysis detected the oxidation and the grade of oil was changed.

Shaft bearing failure: A number of different failure mechanisms are responsible for output shaft bearing failures. Possible causes of bearing failure are solid or water ingress via a shaft seal, poor lubrication or contamination of oil. Some designs of gearbox are prone to oil starvation of the top output shaft bearing when the fan rotates in reverse. This has been addressed by the fitting of anti-reverse rotation devices. If the fans are left stationary false brinnelling damage can take place. Over long periods (>3 weeks) the thickness of the oil film reduces to the point where fretting corrosion can occur if water ingress occurs via the shaft seal. Such damage can occur during commissioning, when some fans run but others are left stationary for long periods.

Gear teeth failures: Some gearboxes experienced single teeth failures on the intermediate shaft bevel gear. Metallurgical analysis of the damaged teeth suggested a manufacturing defect or a transient overload on the gear, possibly when the motor was started. The defect was detected using Enveloped Signal Processing of the signal from the accelerometer mounted at the output shaft.

Fan unbalance: Water logging of fan blades can cause fan unbalance. Porous GRP material delaminates and small pieces break off inside the hollow fan blade, lodging at the end of the blades and blocking the water drain holes.

The most common Cooling Tower Fan failure involves the gearbox or fan blades and are catastrophic in nature. Cooling

Tower Fans have applications in many industries, and in most of these cooling is a reasonably critical process and warrants monitoring. The mechanical components of a Cooling Tower Fan are made up of, Motor, Jackshaft (Optional), Gearbox, and Fan Blades.

Make-up water system: Cooling tower is supplied with a mechanical ball & float valve in the basin for automatic addition of system makeup water. The valves are field adjusted during start-up. By piping directly to each basin on multiple tower installations, the rate of makeup is maximized. Make-up water supply pressure should be according to the design level to prevent valve failure. If supply pressure exceeds, the owner should supply a pressure-regulating valve.

Balancing water flow: On single inlet towers, there is no need to balance the flow. The system pressure drops insure uniform flow to each of the spray nozzles. On multiple inlet towers, if the piping to the tower is symmetrical, there will not be a need to balance flow between cells. On non-symmetrical inlet piping, you may need to balance the water flow between cells. The easiest way to accomplish this is to remove the drift eliminators (with fans off) and to observe the water distribution pattern over the fill on each cell. The water to individual cells can be adjusted by throttling the valve on the riser feeding each cell until the nozzle spray patterns are consistent and the resulting flow patterns over the fill on each cell are similar. This balancing should be performed at the anticipated/design flow to the tower.

Impact of air and water distribution on performance: Uniform air and water distribution in the cooling tower is needed to optimize interaction of air and water within the fill material. When either the air or water distribution becomes less than optimum, the tower thermal performance drops off. Significant variations in the water flow rate to your tower can reduce the spray pattern achieved by your nozzle spray header. Consequently, flow is concentrated within the fill and may locally exceed the liquid loading rate (m^3/hr) capacity of the fill. Excess loading will reduce heat transfer performance. In addition, such concentration of flow resulting from poor nozzle distribution leaves un-wetted pathways through the fill. Airflow intended for cooling the water moves to these dry, less obstructed pathways, effectively bypassing the hot water.

C. Problem caused by Improper Water Treatment

Corrosion: Corrosion of condenser system components such as circulating pumps, condenser tube sheets and cooling towers can be very costly in terms of service disruption, loss of production, increased maintenance and capital equipment replacement. Implementing a properly designed chemical water treatment program is the simplest method of preventing these corrosion problems.

Scale: Formation of scale deposits will result in a loss of cooling transfer efficiency, translating directly into increased cooling costs. Raw water contains varying amounts of mineral salts such as calcium, magnesium, iron and silica. When these minerals exceed their solubility point due to increased cycles of concentration, the minerals precipitate out of solution and produce scale forming salts. It is essential to maintain a proper bleed-off schedule to prevent excessive over cycling.

Fouling: Air contains particles of dust and dirt of various kinds, (depending upon the local environment), causing recirculating water to become contaminated with a variety of materials. This creates fouling on the inside surfaces of condenser systems

which can lead to under-deposit corrosion and loss of cooling transfer efficiency.

D. Safe Level of Water Constituent in Cooling Water

Tower water must also be evaluated for solids and mineral content. Minerals can form deposits or scale on the tower materials. As with biological growth, sedimentation and scaling of tower surfaces reduce the overall heat transfer coefficient and the cooling capability of the tower.

As material (biological, mineral, or particulate) is deposited within the fill, the overall tower effectiveness is lowered, and the weight of the fill increases substantially. This added loading can lead to structural failure of the fill and its support system. Clearly, the need for proper treatment, and its value, cannot be overstated.

The most obvious indicator that the fill is becoming contaminated is the loss of performance from the tower. This may be seen as an increase in the Cold Water Temperature (CWT) or an increase in fan power. Periodic visual inspection of the fill media is the most practical way to monitor water treatment effectiveness.

E. Optimization of Cooling Tower Overhauling Activity

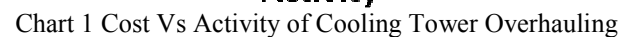
Dismantling of cooling tower is very complex and time consuming. This problem is occurs when proper sequencing procedure is not used in overhauling. This overhauling of cooling tower is occurs when we required the breakdown maintenance of cooling tower or when we needs the scheduled maintenance. When we use the proper sequence of overhauling activity then we can reduce the complexity in overhauling activity and achieves the less time with minimum labour. When this overhauling activity is unplanned then it increases the overhauling cost of a cooling tower in terms of labour cost and time consumption.

Overhauling Chart for Cooling Tower in Industry:

Table 1 Cooling tower overhauling activity Chart

Activity	Day	Labour Required	Labour Cost	Types of Labour
1	2	5	2000	skilled
2	2	5	2000	Skilled
3	3	6	3600	Skilled
4	4	4	2400	Semi Skilled
5	4	5	3000	Semi Skilled
6	8	4	6400	Skilled
7	5	6	6000	Skilled
8	2	4	1200	Semi Skilled
9	2	4	1200	Semi Skilled
10	2	4	1200	Semi Skilled
11	2	4	1200	Semi Skilled
12	5	4	3000	Semi Skilled
13	1	3	450	Semi Skilled
14	1	2	300	Semi skilled

This overhauling activity charts represents the cost and activity of a cooling tower overhauling. Chart shows the how much cost is associated with a particular activity involve in overhauling of a cooling tower used in the industry.



Optimization of cooling tower activity can be achieved by starting those activities together whose assembling or disassembling does not affect the one another. When we start these activities together then it saves the time in terms of lost in production and cost in terms of labour. This table shows the reduced time of overhauling activity thus saves the time and labour cost.

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Table 3 Optimization of Cooling Tower Overhauling Activity Chart

Sr No..	ACTIVITY	DAYS																							
		1	2	3	5	6	9	10	13	14	18	19	20	21	22	23	24								
1	Dismantling of driving assembly and chimney	█	█																						
2	Dismantling of deck and louvers	█	█																						
3	Dismantling of wooden structure			█	█																				
4	Cleaning of ROC basin					█	█																		
5	Civil repairing							█	█																
6	Preparation of wooden structure and fitting					█	█	█	█																
7	Assembly of wooden									█	█														
8	Deck fitting											█	█												
9	Louvers supports and louver fitting													█	█										
10	Draft elevator and fitting													█	█										
11	Joining with adjacent cells													█	█										
12	Driving assembly fitting											█	█	█	█										
13	Water circulation															█									
14	Mechanical trial and commissioning																█								

Table 4 Optimum Cost and Labour Involve in Cooling Tower Overhauling

Activity	Day	Labour Required	Labour Cost	Types of Labour
1 – 2	2	6	2400	Skilled
3	3	6	3600	Skilled
4 -6	8	7	11200	Skilled
7	5	6	6000	Skilled
8 – 12	4	7	5600	Skilled
13	1	3	450	Semi Skilled
14	1	2	300	Semi skilled

This chart represents the cost and activity of a optimize overhauling of cooling tower. The activity 1 -2 shows in the bar represents that these activity is started simultaneously. Simultaneous starting of this activity overcomes the time to complete the overhauling and save the cost in terms of labour and time.

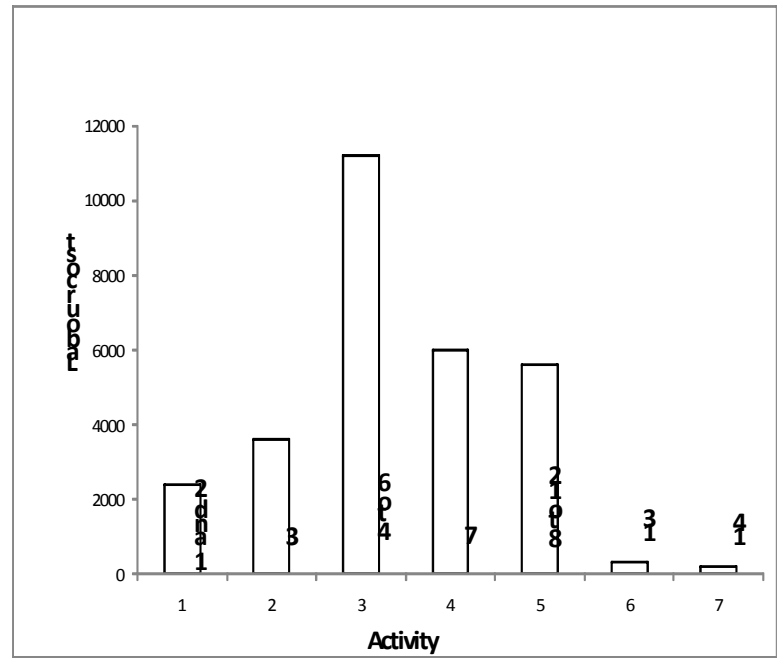


Chart 2 Cost Vs Activity, Optimization of Cooling Tower Overhauling

Cooling tower overhauling Cost Saving: This chart shows the save in cost of cooling tower overhauling activity. The previous cost of overhauling of cooling tower is 33150 and optimum cost is 29300.

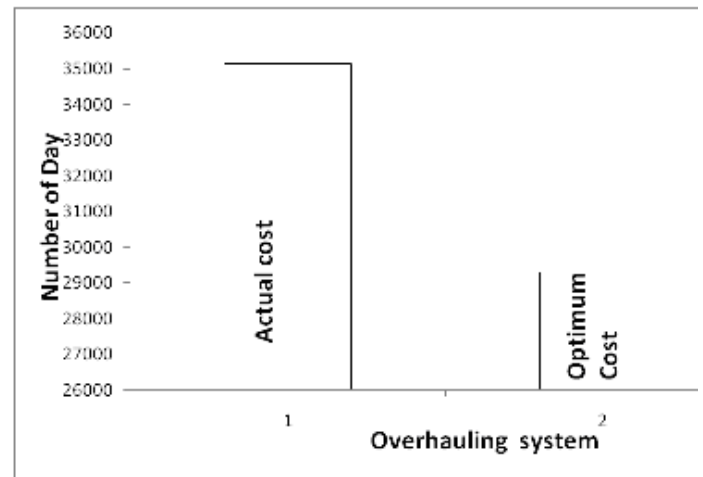


Chart 3 Cooling tower overhauling Cost Saving

$$\text{Cost Saving} = (\text{Actual Cost} - \text{Optimum Cost}) * 100 / \text{Actual Cost}$$

$$= (33150 - 29300) * 100 / 33150$$

$$= 11.62 \%$$

Hence we can save the cost up to 3850 i.e. 11.62 %.

Cooling tower overhauling Time Saving: This chart shows the save in time of cooling tower overhauling activity. The previous time of overhauling of cooling tower is 35 days and optimum cost is 24 days.

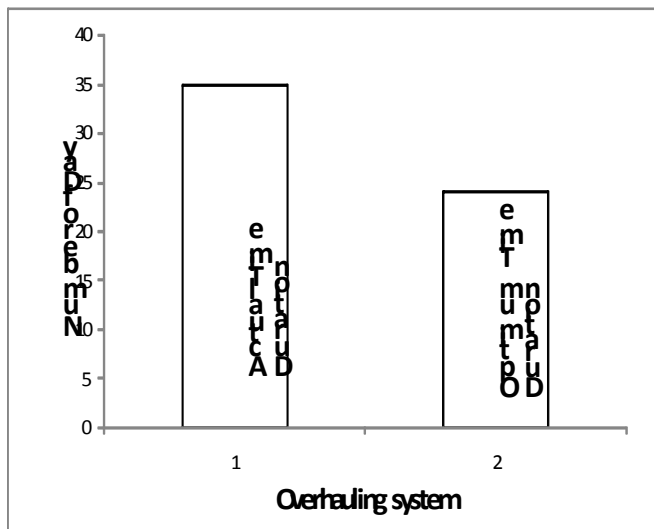


Chart 4 Cooling tower overhauling Time Saving

Time Saving = (Actual Time - Optimum Time) * 100 / Actual Time

$$= (35 - 24) * 100 / 35$$

$$= 31.43 \%$$

Hence we save the 11 days thus save in time up to 31.43 %.

V. CONCLUSION

1. The most important part of the cooling tower is the mechanical equipment, to which the operator must devote the most attention in order to maintain optimum cooling tower production. Downtime and associated losses can be prevented by proper operation and maintenance. Preparation of preventive maintenance schedule makes the proper inspection of cooling tower. This preventive maintenance schedule reduces the instant failure of the cooling tower thus enhances the life of cooling tower components. Proper water treatment of cooling tower as per scheduled maintenance also reduces the uneven biological growth, scaling and corrosion.

2. A well planned sequencing of cooling tower overhauling activity reduces the cost in terms of labour saving and time in terms of lost in production. This overhauling can be achieved by starting that activity together which does not affect the one another and also addition of some labour. This saves the cooling tower overhauling cost up to 11.62% and time (days) up to 31.43 %.

3. Failures of the gearbox, driveshaft, or disc couplings have been the biggest reliability issue facing tower manufacturers and end users. Many of the problems associated with cooling tower maintenance and reliability are solved with a direct drive, low speed, pm motor. The relatively high speed induction motor has been eliminated. The motor itself has not historically been a problem, but the associated resonances and potential vibration concerns have been an issue. The driveshaft and associated disc couplings have been removed, thus eliminating problems associated with misalignment, improper lubrication, natural frequencies, or delaminating of the driveshaft itself. Eliminating the troublesome gearbox maintenance issues with a simplified direct-drive motor is just the beginning. The permanent magnet motor and drive package provides high system efficiency. The variable speed control allows the tower to operate at optimum

performance, which results in a considerable amount of energy being saved. When gearboxes run at these high speeds they generate a lot of heat and that's energy being lost.

4. Continuous monitoring of the processes in the operating machinery has always been considered as one of the most efficient methods for machine condition assessment. Recently, a major step forward in the development of microprocessor and signal analysis technology has occurred that allows the development of powerful, efficient, and, at the same time relatively in-expensive systems for continuous condition monitoring of different machine parameters.

REFERENCES

- [1] Li Lei, Qian YanLing, Du Kai and Yang Y ongMin" A Fast Development Framework for Condition-Based Maintenance Systems" In proc. 2nd International Conference on Mechanical and Electronics Engineering in 2010, vol-2,inc. ICMEE 2010
- [2] Zhang Changxing and Hu Songtao" Simulation of Thermal Exchange Process in Countflow Cooling Tower" vol 1 2010 2nd International Conference, IEEE international conference, inc.2010
- [3] Hasson David, Sidorenko Georgiy and Semiat Raphael" Calcium carbonate hardness removal by a novel electrochemical seeds system" inc.2010
- [4] McElveen Robbie, Lyles Keith, Martin Bill, Wasserman Wayne"A new more reliable solution for coling tower drives," in proc. IEEE paper no.PCIC-AN97, inc.2010
- [5] S. Kleinmann, J.M. Koscielnny, A. Koller-Hodac, A. Paczynski, R. Stetter "Concept of an advanced monitoring control and diagnosis system for positive displacement umps" IEEE conference on control and fault-tolerant system, 2010
- [6] T. Young, M. Fehskens, P. Pujara, M. Burger, G. Edwards, "Utilizing data mining to influence maintenance actions" IEEE conference,2010
- [7] Liao Wenzhu, Pan Ershun and Xi Lifeng" Preventive maintenance scheduling for repairable system with deterioration," In proc. Springer Science+Business Media, LLC 2009, Published online: 4 April 2009
- [8] Lawrence Roger"The identification of opportunities to improve pump system maintenance and reduce system energy losses," IEEE paper, inc.2009
- [9] Zhang Changxing, Hu Songtao. "Thermal performance coefficient identification for counterflow cooling towers". Journal of HV&AC (Chinese), Vol. 39, February, 2009, pp. 23-26.
- [10] Nelson D.A."The influence of cooling requirements chassis resistance, and fan selection on noise emission", SEMI-THERM. 25th Annual IEEE, 2009
- [11] Zhao Xiangyu "A method of gear fault detection based on wavelet transform" IEEE Conferences on business intelligence and financial engineering, 2009
- [12] T. Ahonen, J. Tamminen, J. Ahola, J. Kestila "Sensorless pump operation estimation" IEEE conferences on power electronics and application, 2009
- [13] Pariazar M., Shahrabi J., Zaeri M.S.,andParhizi Sh" A combine approach for maintenance selection," journal of Applied Science 8 (23) 4321-4329, inc. 2008
- [14] Grabner C."Design impacts to the acoustic noise emission of a converter driven squirrel cage induction motor", IEEE international conference, 2008, Page(s): 711 – 716
- [15] Afanasenko V. G., Khafizov F. Sh., Khafizov N. F. Ivanov S. P. and Boev E. V."Development of designs for polymeric water traps in cooling towerusing centrifugal separation forces," journal of Chemical and Petroleum Engineering, Vol. 43, Nos. 11–12, inc. 2007
- [16] Boev E.V., Ivanov S.P.,Bove A.V."Design development of a polymeric atmospheric film type sparyer for cooling tower," Springer Science Business Media, Chemical and Petroleum Engineering, Vol. 43, Nos. 9–10, inc.2007
- [17] Kalatuzov V. A."A Procedure for constructing the normative characteristics of chimney-type evaporative cooling towers from the results of Field measurements," ISSN 0040-6015, Thermal Engineering, Vol. 54, No. 11, pp. 901–905, inc. 2007

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Impact of Beam Divergence on the Performance of Free Space Optical System

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Abstract- Free space optical communication system (FSO) is a potential solution for increasing bandwidth demands. The FSO has a capability to provide high speed data communication, economic and quick deployable. With recent advances and interest in Free Space Optics (FSO) for commercial deployments, a proper understanding of optical signal propagation in different atmospheric conditions has become essential. Although FSO has several advantages, but at the same time FSO faces a major challenge from scintillation introduced by atmospheric turbulence but improvement in performance of FSO Link has been observed with the use of small beam divergence angles. In this paper, the simulation performance investigation of varying beam divergence angle for FSO system is carried out. The performances are analyzed in terms of bit error rate (BER), Quality factor (Q) and eye diagrams.

Index Terms- Divergence, FSO, RZ, Turbulence, Scintillation

I. INTRODUCTION

Free space optics (FSO), also known as wireless optics, is a cost-effective and high bandwidth access technique [1] and has received growing attention with recent commercialization success. With the potential high data-rate capacity, low cost, convenient re-configurability and scalability, high-security and particularly wide bandwidth on unregulated spectrum (as opposed to the limited bandwidth radio frequency (RF) counterpart), FSO systems [1-4] have emerged as an attractive means for deep-space and inter-satellite communication and other applications, e.g., search and rescue operations in remote areas. As the demand for high data rate connectivity continuously increases, and the cost of deploying Fiber-to-home remains prohibitive due to the associated high initial infrastructure costs, wireless technologies remain the most attractive approaches. Free-space optics communications offer an enormous unregulated bandwidth with a high reuse factor, making it a suitable candidate for future wireless broadband access. In examining FSO performance, it is important to take several system parameters into consideration. In general, these parameters can be divided into two different categories: internal parameters and external parameters. Internal parameters are related to the design of a FSO system and include optical power, wavelength, transmission bandwidth, divergence angle, and optical loss on the transmit side and receiver sensitivity, bit-error

rate (BER), receive lens diameter, and receiver field of view (FOV) on the receive side. External parameters, or non-system-specific parameters, are related to the environment in which the system must operate and include visibility and atmospheric attenuation, scintillation, deployment distance. In our work the impact of Internal design parameter like divergence angle on the performance of the link will be studied. The RF channel model is based on an integrated set of four link attenuation models that estimates margin losses due to rain, fog [6] [9], and atmospheric (water vapor and oxygen) attenuation [6] and multipath effects. Due to the fact that the FSO link wavelength used in our simulation is 1550nm, gaseous attenuation can be neglected [8]. The rest of the paper is organized as follows: Sections 2 discusses channel model, Sections 3 Briefs about the performance metrics used for evaluation of the FSO link and section 4 gives system description used for simulation, section 5 discuss results and Section 6 concludes the paper.

II. FREE SPACE CHANNEL MODEL [1],[2],[4]

Observing power at the receiver and calculating the link margin, one can determine factors that affect quality of the link. Link Margin (LM), [4] usually expressed in decibels, is a ratio of the received power P_R and receiver threshold (s), or amount of power received above minimum detectable power:

$$LM = 10 \log \frac{P_R}{S} \quad (1)$$

In order for signal to be recovered at the receiver's side, its power must be higher than receiver sensibility or receiver threshold. Receiver threshold is usually given by manufacturer and it ranges from -20 to -40 dBm. Power at the receiver [1] [2] [4] can be expressed as:

$$P_R = P_T * \frac{A_{RX}}{(\theta L)^2} * e^{-\alpha L} \quad (2)$$

where: P_R and P_T are power at the receiver and transmitter respectively, A_{RX} is receiver aperture area, θ divergence angle, α atmospheric attenuation and L distance between transmitter and receiver. As shown in the equation (2), [4] power at the receiver is directly proportional to the transmit power and receiver

aperture area, but inversely proportional to the link range and divergence angle. Exponential part of the equation is related to atmospheric attenuation and it has the strongest influence on the link quality. Another factor that adds to attenuation of the signal is beam divergence. The received power can be increased by increasing the transmitter power, the receiver area, or by reducing the beam divergence of the transmitter beam, which is diffraction limited. In our simulation work we investigated that as divergence angle is decreased the performance is improved considerably and the reliability of the link increases.

III. PERFORMANCE METRICS

The robustness of the design of any optical communication system can be effectively verified by critically applying performance checks on the system. The evaluation criteria should provide a precise determination and separation of dominant system limitations, making them crucial for the suppression of propagation disturbances and performance improvement. In our system we have applied simple and accurate methods viz BER, Q factor, and eye opening to estimate the behavior of the system. The Bit Error Rate (BER) of an optical link is the most important measure of the faithfulness of the link in transporting the binary data from transmitter to receiver. The BER quantifies the rate of errors and is defined as the probability of an error occurring per transported bit. The bit error rate takes the simple form

$$BER = \frac{1}{2} \operatorname{erfc} \left(\frac{Q}{\sqrt{2}} \right). \quad (3)$$

Where Q is quality factor and ‘erfc’ denotes the complementary error function.

IV. SYSTEM DESCRIPTION

The block diagram of FSO link used for simulation is shown in the figure 1.

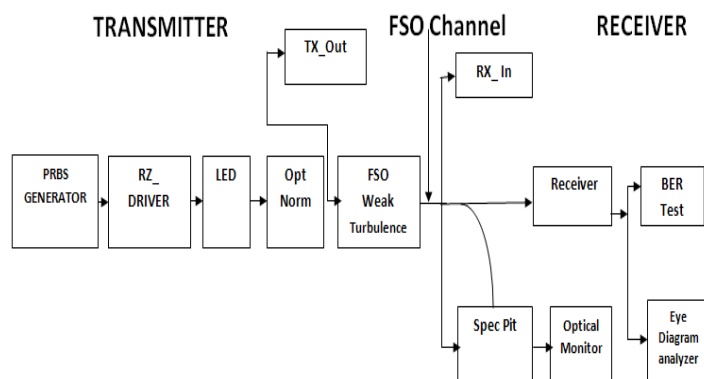


Figure 1: FSO link

The simulation study has been carried out using commercial simulation package OptSim. The FSO link wavelength used in our simulation is 1550nm. The transmitter consists of a PRBS generator and RZ Driver, and a directly modulated LED at 1550nm. Optical power out of the transmitter is 5 dBm. The FSO link has Data rate of 2.5 Gbps and length of link is 1000 meter.

The receiver is a PIN diode and is followed by a BER Tester. There are also an Optical Power Meter, Spectrum, Eye Diagram, and Optical Waveform Analyzers. Q factor and BER and eye diagram are studied for the different divergence angles from 0.1mrad to 3mrad.

V. RESULTS AND DISCUSSIONS

The simulation is performed for several divergence angles from the range 0.1mrad to 3mrad. The simulation system performance is monitored using eye diagram analyzer, BER tester and Q factor. We examined the eye diagrams taken at divergence angle of 3mrad, 2mrad, 1mrad and 0.6mrad and observed that decreasing the beam divergence from 3mrad to 0.1mrad has significant effect on the improvement of the performance of the FSO link. The table 1 shows the BER and Q factor for the different values of divergence angle ranging from 0.1 mrad to 3mrad. The measurements are being taken at attenuation value of -8.48dB. It is observed from the table that low divergence angles can increase the link performance. It is clear from the table 1 that for the smallest possible value of 0.1mrad divergence angle the BER is 10^{-85} and Q factor is 25.8dB. Here we have used term Additional Attenuation in our various figures which refers to the attenuation caused by various atmospheric and weather conditions like fog, rain, haze.

Table 1: BER and Q factor for RZ Modulation Schemes at different divergence angles at attenuation of -8.48 dB

Divergence Angle (mrad)	BER	Q ² (dB)
1.0000e-004	6.1433e-085	2.5798e+001
2.0000e-004	4.1512e-083	2.5701e+001
3.0000e-004	4.5896e-080	2.5534e+001
4.0000e-004	1.7500e-075	2.5271e+001
5.0000e-004	1.0479e-069	2.4915e+001
6.0000e-004	2.5524e-063	2.4483e+001
7.0000e-004	1.2312e-056	2.3981e+001
8.0000e-004	2.3939e-049	2.3358e+001
9.0000e-004	2.5917e-042	2.2659e+001
1.0000e-003	7.5273e-036	2.1899e+001
1.1000e-003	4.8887e-030	2.1081e+001
1.2000e-003	5.6964e-025	2.0218e+001
1.3000e-003	9.1768e-021	1.9343e+001
1.4000e-003	2.6802e-017	1.8463e+001
1.5000e-003	1.7592e-014	1.7591e+001
1.6000e-003	3.3396e-012	1.6732e+001
1.7000e-003	2.3100e-010	1.5892e+001
1.8000e-003	7.0968e-009	1.5073e+001
1.9000e-003	1.1407e-007	1.4278e+001
2.0000e-003	1.0950e-006	1.3506e+001
2.1000e-003	6.9739e-006	1.2759e+001
2.2000e-003	3.2020e-005	1.2036e+001
2.3000e-003	1.1314e-004	1.1335e+001
2.4000e-003	3.0506e-004	1.0698e+001
2.5000e-003	7.3691e-004	1.0048e+001
2.6000e-003	1.5784e-003	9.4025e+000

2.7000e-003	2.9515e-003	8.7965e+000
2.8000e-003	5.4414e-003	8.1187e+000
2.9000e-003	8.5246e-003	7.5521e+000
3.0000e-003	1.2577e-002	7.0012e+000

Figure 2 gives the graph between Q factor and divergence angle at attenuation value of -8.48dB. Figure 3 shows graph between BER and divergence angle at attenuation value of -8.48dB. It is assumed that the minimum values of Q factor required to achieve satisfactory link performance is 17dB. It is observed from figure 2 that for divergence angle of 3mrad the Q factor is only 7dB and for divergence of 2 mrad the Q factor is 13.5dB and for divergence angle of 1 mrad the Q factor is near to 22 dB which is above the minimum desired Q value of 17dB, which shows that for optimum link performance the small angles of divergence gives satisfactory link performance. Figure 4 shows the graph of BER vs. additional attenuation for divergence angle of 3 mrad and Figure 5 shows the graph between Q factor and additional attenuation for divergence angle of 3 mrad.

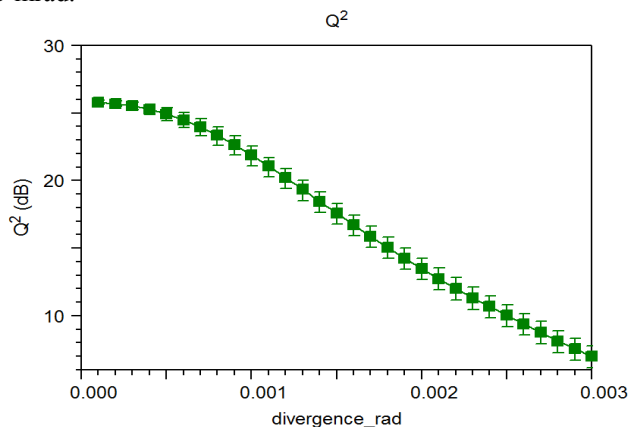


Figure 2: Q-factor vs. Divergence angle (milli radians) at attenuation value of -8.48dB

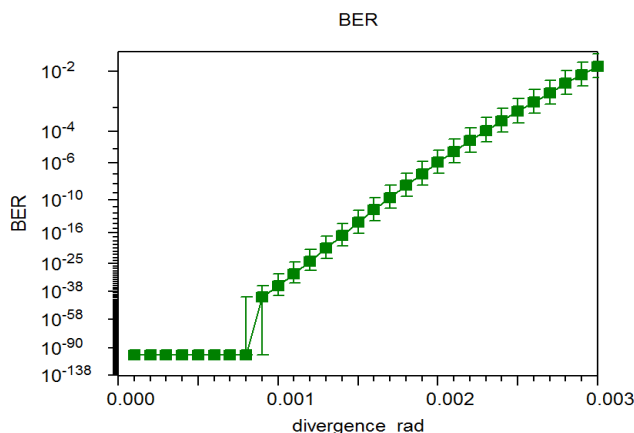


Figure 3: BER vs. Divergence angle (milli radians) at attenuation value of -8.48dB

Figure 4 shows the graph of BER vs. additional attenuation for divergence angle of 3 mrad and Figure 5 shows the graph between Q factor and additional attenuation for divergence angle of 3 mrad. Assuming That BER required for satisfactory link performance is less than or equal to 10^{-12} , it is observed from figure 4 that the link can tolerate maximum attenuation value of

less than -3dB and the value of Q factor achieved from figure 5 is approximately 16.5dB. Figure 6 shows Eye Diagram for divergence angle of 3 mrad at attenuation value of -3dB.

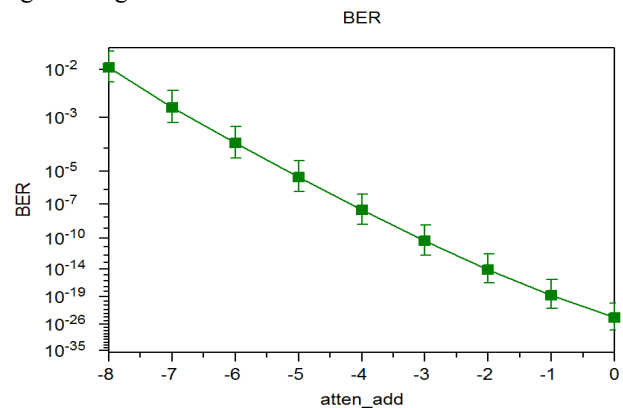


Figure 4: BER vs. additional attenuation [in dB] for divergence angle of 3 mrad

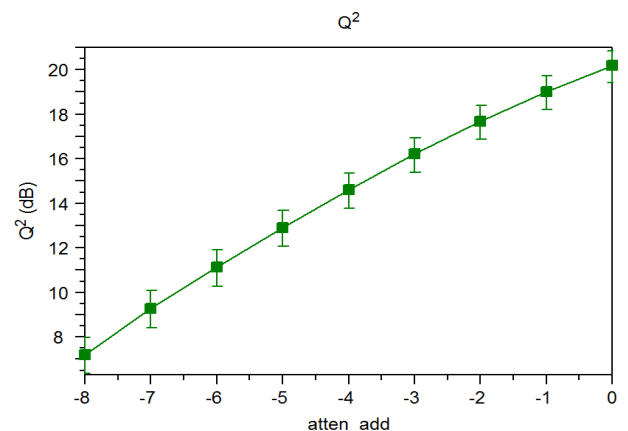


Figure 5: Q factor vs. additional attenuation [in dB] for divergence angle of 3 mrad

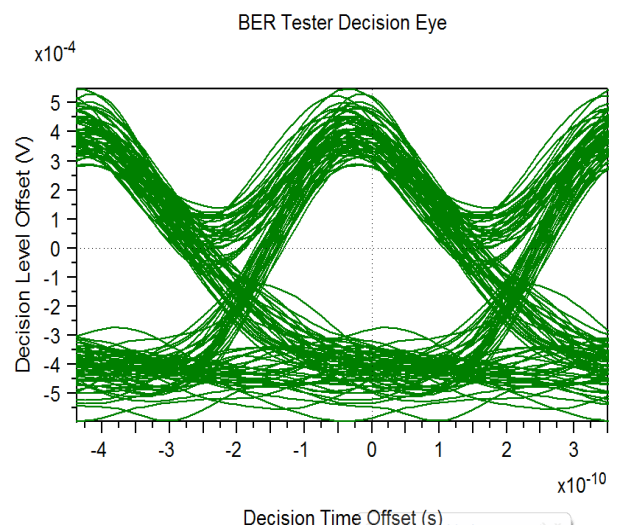


Figure 6: Eye Diagram for divergence angle of 3 mrad at attenuation value of -3dB

Figure 7 shows the graph of BER vs. additional attenuation for divergence angle of 2 mrad and Figure 8 shows the graph between Q factor and additional attenuation for divergence angle of 2 mrad. Assuming That BER required for satisfactory link

performance is less than or equal to 10^{-12} , it is observed from figure 7 that the link can tolerate maximum attenuation of upto -6dB and the value of Q factor achieved from figure 8 is approximately 17dB. Figure 9 shows Eye Diagram for divergence angle of 2 mrad at attenuation value of -3dB. This shows that divergence angle of 2 mrad provide better performance as compared to 3mrad divergence angle.

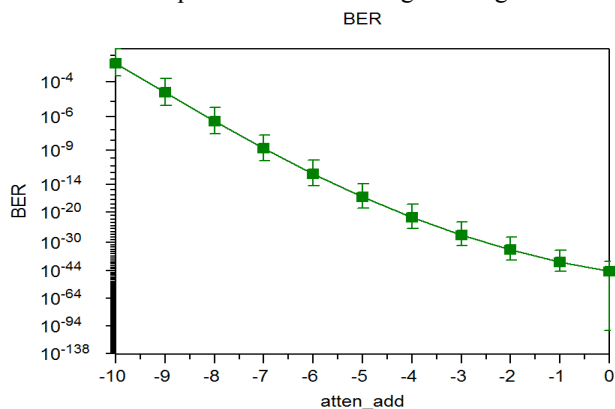


Figure 7: BER vs. additional attenuation [in dB] for divergence angle of 2 mrad

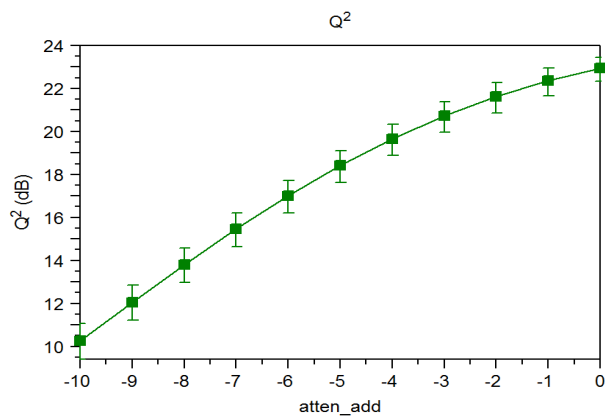


Figure 8: Q factor vs. additional attenuation [in dB] for divergence angle of 2 mrad

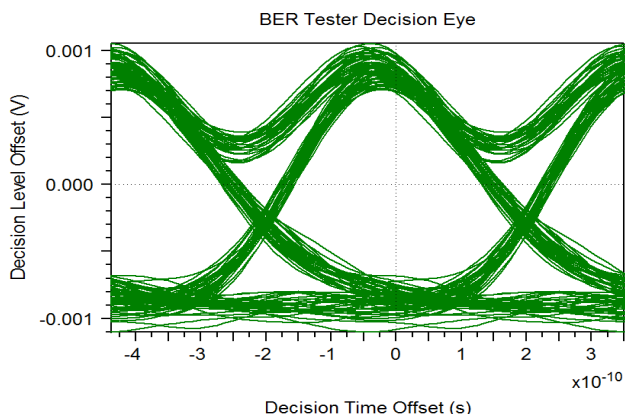


Figure 9: Eye Diagram for divergence angle of 2 mrad at attenuation value of -3dB

Figure 10 shows the graph of BER vs. additional attenuation for divergence angle of 1 mrad and Figure 11 shows the graph between Q factor and additional attenuation for divergence angle of 1 mrad. Assuming That BER required for satisfactory link performance is less than or equal to 10^{-12} , it is observed from

figure 10 that the link can tolerate maximum attenuation of upto -12dB and the value of Q factor achieved from figure 8 is approximately 17dB. Figure 12 shows Eye Diagram for divergence angle of 1 mrad at attenuation value of -3dB. This shows that divergence angle of 1 mrad can further improve the link performance as compared to 2mrad divergence angle.

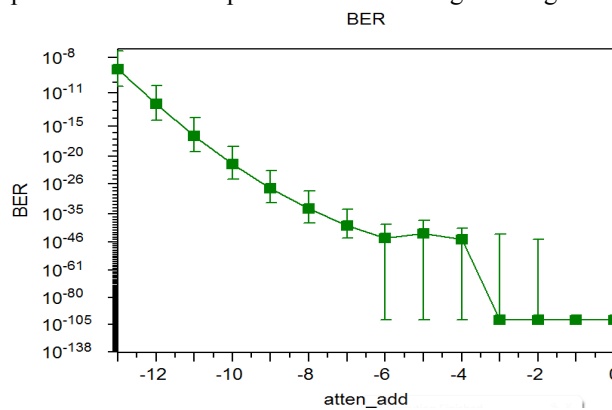


Figure 10: BER vs. additional attenuation [in dB] for divergence angle of 1 mrad

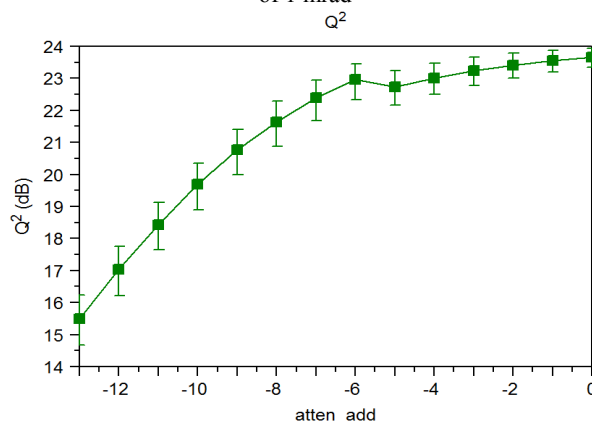


Figure 11: Q factor vs. additional attenuation [in dB] for divergence angle of 1 mrad

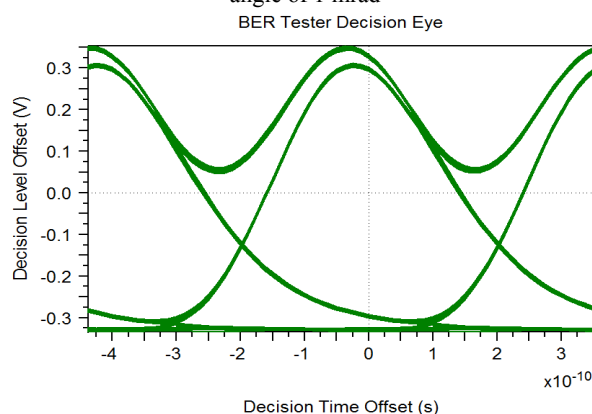


Figure 12: Eye Diagram for divergence angle of 1 mrad at attenuation value of -3dB

Figure 13 shows the Eye Diagram for divergence angle of 0.6 mrad at attenuation value of -3dB. Figure 13 demonstrates that considerable improvement in the link can further be achieved by decreasing the divergence angle to 0.6mrad from 3 mrad

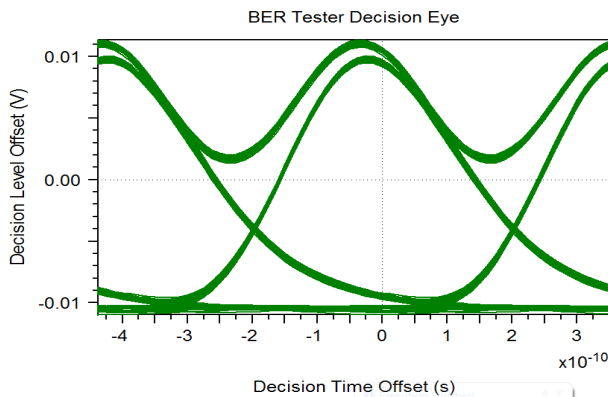


Figure 13: Eye Diagram for divergence angle of 0.6 mrad at attenuation value of -3dB

VI. CONCLUSION

The performance of varying divergence angle under controlled turbulence environment has been studied for FSO communication link. The Simulation results have shown that divergence 0.6mrad offer significantly performance improvement for the FSO link compared to 3mrad divergence. It is also concluded that the link can tolerate more attenuation by decreasing the divergence angle.

REFERENCES

- [1] Heinz Willebrand, and Baksheesh S. Ghuman, "Fiber Optics without Fiber," IEEE, 2001.
- [2] Scott Bloom, "Physics of free space optics," 2002.

- [3] Bloom, Eric Korevaar, John Schuster, Heinz Willebrand, "Understanding the performance of free-space optics," *Journal of Optical Networking*, 2003.
- [4] S. Sheikh Muhammad, P. Köhldorfer, E. Leitgeb, "Channel Modeling for Terrestrial Free Space Optical Links", IEEE, 2005.
- [5] Husagic Alma, Wajdi Al-Khateeb, "Effect of Weather Conditions on Quality of Free Space Optics Links," *Proceedings of the International Conference on Computer and Communication Engineering*, 2008.
- [6] M. Saleem Awan, E. Leitgeb, S. Sheikh Muhammad, Marzuki, F. Nadeem, M. Saeed Khan, C. Capsoni, "Distribution Function For Continental and Maritime Fog Environments For Optical Wireless Communication", *IEEE Proceedings*, 2008.
- [7] Ales Prokes, Vladislav Skorpil, "Estimation of Free Space Optics Systems Availability Based on Meteorological Visibility," *IEEE* 2009.
- [8] Thomas Plank, Erich Leitgeb, Markus Loeschnigg, "Recent Developments on Free Space Optical Links and Wavelength Analysis", *International conference on Space Optics and applications*, 2011.
- [9] S. Rajbhandari, Z. Ghassemlooy, J. Perez, H. Le Minh, M. Ijaz, E. Leitgeb, G. Kandus and V. Kvicera, "On The Study of the FSO Link Performance under Controlled Turbulence and Fog Atmospheric Conditions ", *International conference on Telecommunications*, 2011.

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Estimation of an L-G Fault Distance of an Underground Cable Using WNN

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Abstract- In this paper we have developed a three layer Wavelet Neural Network (WNN) for L-G fault location of an underground cable. Back Propagation (BP) algorithm is used for training of the network. Simulation result and graphs shows the effectiveness of WNN as a fault locator network.

Index Terms- Wavelet neural network, back propagation algorithm, underground cable system, L-G fault location

I. INTRODUCTION

Electrical energy transmission system is demanding safer and more reliable energy services. Underground cable is one of the best choices for safer and reliable power transmission. Although underground cables provide higher reliability than overhead system, in case of insulation failure it is very difficult to locate faults. To minimize such difficulties in underground system, different fault identification schemes are being evolved to locate the fault for proper remedial measures [1].

Wavelet Neural Network (WNN) is an alternative to feed forward neural network for approximating arbitrary non-linear functions. The WNN makes the best use of the good localization properties of wavelet transformation [2] and combine with the self-learning ability of neural networks [3]-[4]. Therefore WNN has better approximation and error correction abilities.

In this present work, a three layer WNN has been developed to estimate the cable fault (L-G) distance. A case study of fault currents was carried out for an underground cable for various fault location. The fault current and fault distance was chosen as input and output parameter respectively. The network was trained using back-propagation algorithm [5]. After the training has been done, the network has been tested with the tested data. Experimental graphs show that WNN can predict the fault location accurately.

II. WAVELET NEURAL NETWORK

The structure of a three-layer Wavelet neural network [2], [6]-[7] with multiple inputs and multiple outputs is shown in Fig 1

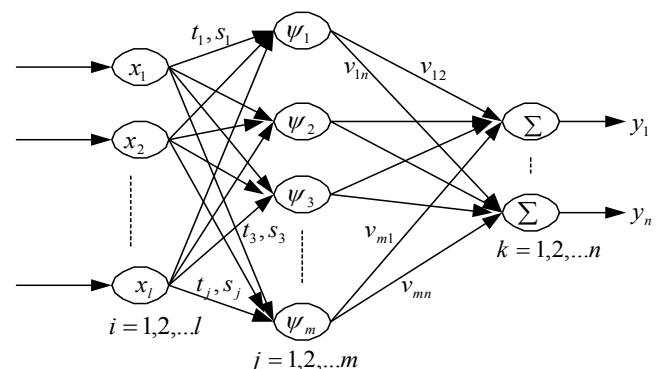


Figure 1: Wavelet Neural network

As illustrated in Fig 1 the entire network consists of three layers. First layer is called input layer which accepts the input data. The number of input nodes depends on the number of input parameters. The second layer is called hidden layer where a mother wavelet function is selected as an activation function which is Morlet wavelet for this work. Morlet wavelet function is expressed as follows [7]:

$$\psi(x) = \cos(1.75x)e^{-(1/2)x^2} \quad (1)$$

Output of the WNN is calculated from the equation (2)

$$y_k(x) = \left[\sum_{j=1}^m v_{jk} * \left(\sum_{i=1}^l \psi\left(\frac{x_i - t_j}{s_j}\right) \right) \right] \quad (2)$$

Where t_j, s_j denotes translation and dilation parameter respectively. v_{jk} is the weight parameters between hidden and output neurons. The weight parameters between input and hidden nodes are assumed to be unity. y_k, x_i represent k^{th} and i^{th} output and input vector respectively.

During the training session of the network, the input pattern causes output responses in each layer and hence y_k at the output layer is obtained. The difference between estimated and desired output yields an error. This error is to be minimized by feeding information forward and feeding error backward. The error function is called sum square error [7] which is described in the equation (3).

$$E = \frac{1}{2} \sum_{p=1}^{ts} \sum_{k=1}^n [d_k^p(x) - y_k^p(x)]^2 \quad (3)$$

where, $d_k^p(x), y_k^p(x)$ are the desired and real output of the k^{th} output node for the p^{th} training data respectively and $ts (p=1,2,...,ts)$ is the total number of training sets. The equation (3) is the objective function which is minimized using back propagation algorithm. On doing so a learning technique is adopted to reduce the learning time. According to this technique modification of different network parameters viz. v_{jk}, t_j, s_j are done using the following equations (4), (5), (6) respectively.

$$v_{jk}(c+1) = v_{jk}(c) + [-\eta \cdot \frac{\partial E_k}{\partial v_{jk}} + \mu \cdot \Delta v_{jk}(c)] \quad (4)$$

$$t_j(c+1) = t_j(c) + [-\eta \cdot \frac{\partial E_k}{\partial t_j} + \mu \cdot \Delta t_j(c)] \quad (5)$$

$$s_j(c+1) = s_j(c) + [-\eta \cdot \frac{\partial E_k}{\partial s_j} + \mu \cdot \Delta s_j(c)] \quad (6)$$

where, η, μ are the learning rate and momentum factor respectively.

III. UNDERGROUND CABLE MODEL

The schematic diagram of an L-G fault of an underground cable in the distribution substation using a 1 km long underground HT buried cable to distribute power through an 11 kV / 415 V distribution transformers is shown in Fig 2 [8].

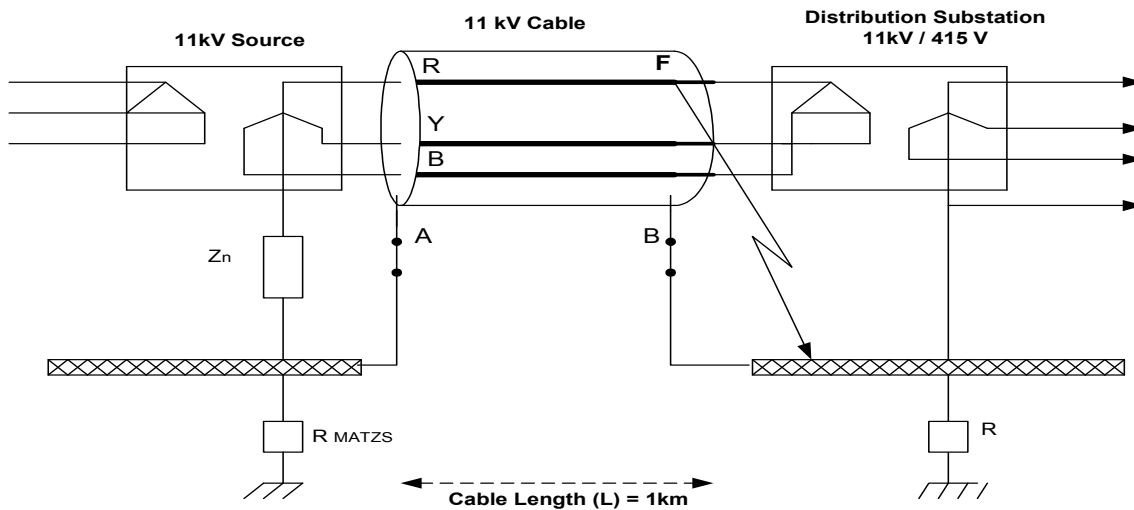


Figure 2: Schematic diagram of LG fault of an underground cable

Fault current in R-phase [9] can be found out by equation (7)

$$\therefore I_R = 3 I_{R1} = \frac{3 E_R}{Z_1 + Z_2 + Z_0} \quad (7)$$

where, E_R, I_{R1} is the pre-fault voltage and positive sequence component of fault current respectively and Z_1, Z_2, Z_0 is the positive, negative and zero sequence impedance respectively.

IV. 11 kV SYSTEM DATA

The 11kV system as shown in Fig 2 has three units, viz. source, 11 kV distribution cable and neutral and earthing system. The corresponding data [8] of each unit are given in Table I, II, and III respectively.

Table I: Source voltage (Volts) & impedance (Ω)

Serial Number	Parameters	Value
1	Line voltage V	11 kV
2	Single phase source voltage V_{ph-n}	6350 V
3	Single phase fault level S	200 MVA
4	Positive sequence source impedance (Ω)	$Z_{s1} = j \cdot \frac{V^2}{S} = j \cdot \frac{11^2}{200} = j0.605$
5	Negative sequence source impedance (Ω)	$Z_{s1} = Z_{s2} = j0.605$
6	Zero sequence source impedance (Ω)	$Z_{s1} = Z_{s0} = j0.605$

Table II: 11 kV distribution cable impedance (Ω / km)

Serial Number	Parameters	Value
1	Cable size & type	150 sqmm Aluminium belted PILCPS [8]
2	Length L	1 km
3	Positive sequence cable impedance (Ω / km)	$Z_{c1} = 0.2078 + j0.0773$
4	Negative sequence cable impedance (Ω / km)	$Z_{c2} = 0.2078 + j0.0773$
5	Zero sequence cable impedance (Ω / km)	$Z_{cond\ 0} = 0.2062 + j0.1142$
6	Zero sequence sheath resistance (Ω / km)	$R_{sh0} = 2.6612$
7	Effective zero sequence impedance of the general mass of the earth (Ω / km)	$Z_{g0} = 0.148 + j2.08$
8	Fault impedance (Ω)	$Z_f = 0.0$

Table III: 11 kV neutral & earthing impedance (Ω)

Serial number	Parameters	Value
1	Neutral impedance (Ω)	$Z_n = 0.0$
2	Zone substation earthing system resistance (Ω) [8]	$R_{MATZS} = 0.01$
3	MEN impedance of typical urban extensive MEN system (Ω) [8] (MEN is equivalent to men)	$Z_{MEN} = 0.103 + j0.076$
4	Surface soil resistivity ($\Omega \cdot \text{m}$)	$\rho = 10$
5	Transformer earthing system resistance (Ω)	$R_e = 0.1346 \times \rho = 1.346$
6	Equivalent MEN plus R_e impedance (Ω)	$Z_{eq} = \left(\frac{1}{Z_{MEN}} + \frac{1}{R_e} \right)^{-1}$ $\Rightarrow Z_{eq} = 0.1 + j0.07$

Three sequence impedances can be found out by the following equations [8]:

$$Z_1 = Z_{s1} + (Z_{cond\ 1} \times L) \quad (8)$$

$$Z_2 = Z_{s2} + (Z_{cond\ 2} \times L) \quad (9)$$

$$Z_0 = Z_{s0} + (Z_{cond0} \times L) + \left(\frac{1}{R_{sh0} \times L} + \frac{1}{(Z_{g0} \times L) + 3.(Z_{eq} + R_{MATZS})} \right)^{-1} \quad (10)$$

V. RESULT

The fault current (Phase R) is taken as input vector to the wavelet neural network. The fault distance is taken as the output vector of the network. Hence the WNN has one input and one output dimension. The network has been trained with different

values of learning rate (η) momentum factor (μ), number of hidden nodes and total number of iterations. An Error versus Iteration curve is shown in Fig 3 which clearly shows that error decreases with the iteration. This proves the good converging property of wavelet neural network.

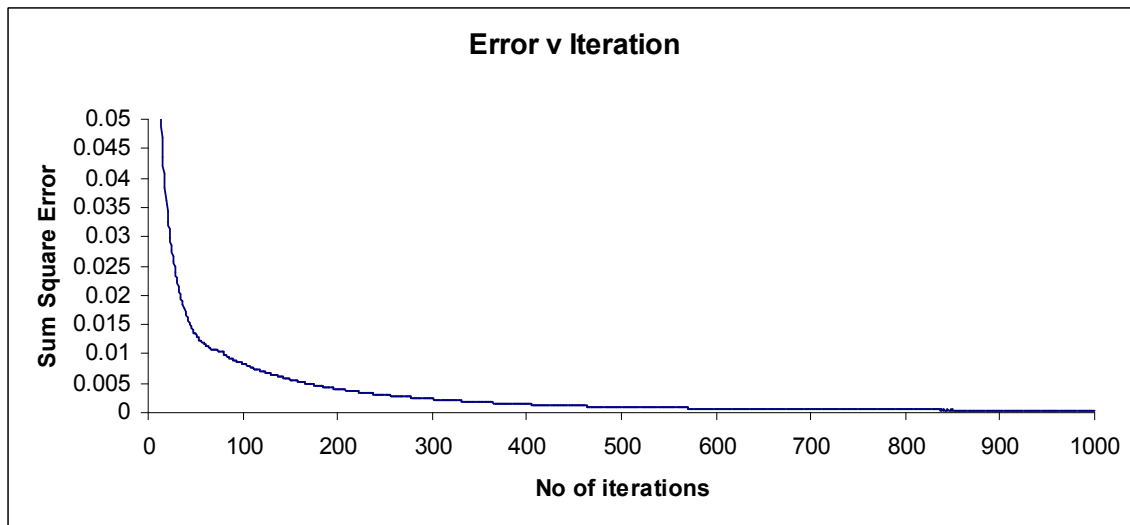


Figure 3: Sum Square Error value for different numbers of iteration

The best values of above four parameters are obtained during training process is shown in Table IV.

Table IV: Best Obtained Parameters

Learning rate	Momentum factor	No of Hidden Nodes	No of Iteration
0.09	0.09	31	3000

Using these best values of different parameters, an attempt has been made to show the accuracy of prediction between analytical and estimated output. Seventy six testing data were used for this purpose. The fault currents for different cable location are calculated for test cases. Fig 4 shows the graphical representation of analytically calculated and estimated values.

This shows that analytical and estimated values represented in solid and dotted lines respectively. As both are close enough, which intern shows the capability of the wavelet neural network for fault location.

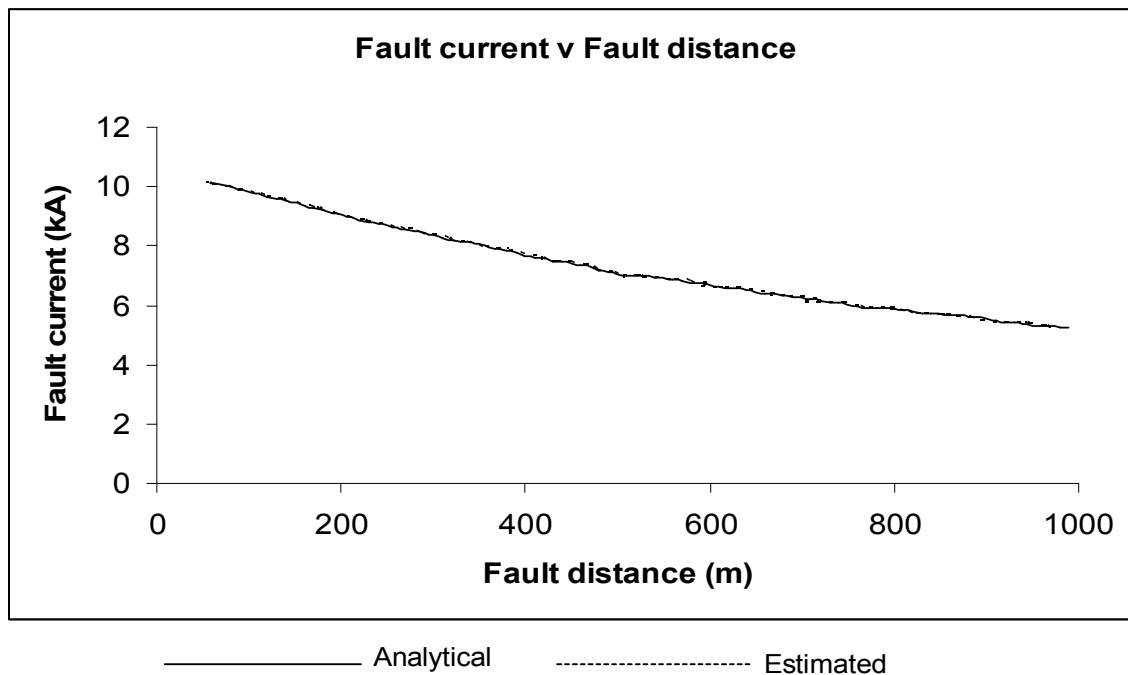


Fig 4 Analytical and estimated values of fault distance

VI. CONCLUSION

In this paper we designed back propagation algorithm based wavelet neural network to estimate cable fault (L-G) distance. Detailed studies have been made to determine the effects of various network parameters, viz. learning rate (η), momentum factor (μ), number of wavelons, and number of iterations on convergence of the training process which was implemented by BP algorithm. It has been observed that the WNN has given an accurate prediction of fault distance by using these optimum values of network parameters.

REFERENCES

- [1] H.K. Zadeh, "An Accurate Fault Locator for Cable Transmission Using ANN", Electrotechnical Conference of 12th IEEE Mediterranean, Melecon, Vol. 3, pp. 901-904, 2004.
- [2] Z. Kun, and C. W. Kai, "On-Line Fuzzy Adaptive Controller with Wavelet Neural Network", IEEE Proceedings, ICII 2001- Beijing, China, Vol. 4, pp. 394-399, 2001.
- [3] A. K. Pradhan, A. Routray, and A. Behera, "Power Quality Disturbance Employing Modular Wavlet Network", IEEE Conference on Power Engineering Society, Malaysia, 2006.

- [4] K. Karthikeyan, "A Comparative Study on the Performance of ANN, WNN, and PSO Aided WNN for Estimation of Complex Functions in High Voltage System", MEE Thesis, Jadavpur University, India, June 2007.
- [5] Charu Gupta, "Implementation of Back Propagation Algorithm (of neural networks) in VHDL", Master of Engineering Thesis, Thapar Institute of Engineering & Technology (Deemed University), Patiala, India, June 2006.
- [6] B.B. Mishra, P.K. Das, and G. Panda, "Pattern Classification Using Local Linear Wavelet Neural Network", IEEE Proceedings of International Conference on Information and Communication Technology, Dhaka, Bangladesh, pp. 92-95, 2007.
- [7] Z.Y. Luo, and Z.K. Shi, "Wavelet Neural Network for Fault Diagnosis of Push-Pull Circuits", IEEE Proceedings of International Conference on Machine Learning and Cybernetics, Guangzhou, China, Vol. 6, pp. 3327-3332, August 2005.
- [8] "Extensive Urban MEN System Supplied by a HV Buried Cable" by [http://www.nzccpts.co.nz/.../Mathead%20%20HB%20219%20Worked%20Example%203.7.1.%20\(NZ\).pdf](http://www.nzccpts.co.nz/.../Mathead%20%20HB%20219%20Worked%20Example%203.7.1.%20(NZ).pdf).
- [9] J.B. Gupta, "A Course in Power Systems", by S.K. Kataria & Sons.

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Financial Performance Evaluation of Depositories in India (A Comparative study of NSDL and CDSL)

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Abstract- Depository is an institution or a kind of organization which holds securities with it, in which trading is done among shares, debentures, mutual funds, derivatives, F&O and commodities. The intermediaries perform their actions in variety of securities at Depository on the behalf of their clients. These intermediaries are known as Depositories Participants. Fundamentally, there are two sorts of depositories in India. One is the National Securities Depository Limited (NSDL) and the other is the Central Depository Service (India) Limited (CDSL). The investor who is known as beneficial owner (BO) has to open a demat account through any DP for dematerialisation of his holdings and transferring securities. Depositories were setup with the objective of providing convenient, dependable and secure depository services at affordable cost to all market participants. All leading stock exchanges like the National Stock Exchange, Bombay Stock Exchange, Calcutta Stock Exchange, Delhi Stock Exchange, The Stock Exchange of Ahmedabad, etc have established connectivity with CDSL or NSDL. The paper entitled **“Financial Performance Evaluation of Depositories in India” (A Comparative study of NSDL and CDSL)** focuses on financial performance of both the depositories i.e. CDSL and NSDL of India. This study is purely based on secondary data and the period of the study is April – 2006 to March – 2011 i.e. five consecutive financial years. Main objectives of the study are (i) To comment on Financial soundness of the depositories during the period under study, (ii) To check Total Expenses to Total Income ratio of both the depositories, (iii) To check Operational Income to Total Income ratio of both CDSL and NSDL during the study period and (iv) To analyze Return on Investment of depositories during the period under review. The scope of the study is limited to Depositories and its profitability during the study period. To check the significance of Hypothesis, one – Way ANOVA has been used as a statistical tool apart from using Mean, Standard Deviation and Co-efficient of Variance.

Index Terms- Financial Performance, Depositories, Profitability, BO, DP, CDSL and NSDL

I. INTRODUCTION OF EPOSITORIES IN INDIA

Although India had a vibrant capital market which is more than a century old, the paper-based settlement of trades caused substantial problems like bad delivery and delayed transfer of title till recently. In the depository system, securities are held in depository accounts, which is more or less similar to holding funds in bank accounts. Transfer of ownership of securities is done through simple account transfers. This method

does away with all the risks and hassles normally associated with paperwork. Consequently, the cost of transacting in a depository environment is considerably lower as compared to transacting in certificates. A Depository facilitates holding of securities in the electronic form and enables securities transactions to be processed by book entry by a Depository Participant (DP)¹, who as an agent of the depository, offers depository services to investors. According to SEBI guidelines, financial institutions, banks, custodians, stockbrokers, etc. are eligible to act as DPs.

The enactment of Depositories Act in August 1996² paved the way for establishment of NSDL, the first depository in India. This depository promoted by institutions of national stature responsible for economic development of the country has since established a national infrastructure of international standards that handles most of the securities held and settled in dematerialised form in the Indian capital market. Using innovative and flexible technology systems, NSDL works to support the investors and brokers in the capital market of the country. NSDL aims at ensuring the safety and soundness of Indian marketplaces by developing settlement solutions that increase efficiency, minimise risk and reduce costs. NSDL play a quiet but central role in developing products and services that will continue to nurture the growing needs of the financial services industry.

As at the end of Nov. 2011, over 10,500 companies³ have admitted their securities (equities, bonds, debentures, and commercial papers), units of mutual funds, certificate of deposits etc. into the CDSL system. The NSDL had 13,767 DP service centers⁴ thorough out the country till Nov. 2011. The balances in the investors account recorded and maintained with CDSL can be obtained through the DP. The DP is required to provide the investor, at regular intervals, a statement of account which gives the details of the securities holdings and transactions. The depository system has effectively eliminated paper-based certificates which were prone to be fake, forged, counterfeit resulting in bad deliveries. CDSL offers an efficient and instantaneous transfer of securities. CDSL was promoted by Bombay Stock Exchange Limited (BSE) jointly with leading banks such as State Bank of India, Bank of India, Bank of Baroda, HDFC Bank, Standard Chartered Bank, Union Bank of India and Centurion Bank.

¹ www.stockholding.com

² www.sebi.gov.in

³ www.cdslindia.com

⁴ www.nsdl.co.in

II. REVIEW OF LITERATURE

This section covers the review of literature of some of the important studies, research papers and articles on the various aspects of depository system.

Shah (1996)⁵ highlighted that resolution of the single vs. multiple depositories, immobilization vs. dematerialization and role of capital adequacy norms for the custodians which is helpful in quick implementation of depository system in India.

Aggarwal and Dixit (1996)⁶ expressed their views about the legal framework for depository system in India. They also explained the benefits of the paperless trading, responsibilities of depository or participants and eligibility criteria, etc.

Sarkar (1996)⁷ analyzed the implications of the scrip less trading and share transfer based on book entry merely due to the existence of the depository ordinance 1995.

George (1996)⁸ explained the role of the NSDL in revolutionizing the paperless stock settlement system of the country. He also examined the steps taken by the depository to ensure that the scrip less trading system is a success and stressed on the importance of the role of the regulator in making the depository system successful.

Gurusamy (1996)⁹ explained that the introduction of depository system would help in transfer of securities in the capital market by a mere book entry. He also pointed out the advantages of depository system such as delay in transfer, registration, fake certificates, soaring cost of transactions, more paper work, non availability of depositories in when the transfer of securities take place by physical delivery.

Hurkat and Ved (1999)¹⁰ discussed the role of depository system in many advanced countries in the stock and capital

markets the world over. They also analyzed the services offered by NSDL, dematerialization, re-materialization, trading and fee or charges, comparison of a bank and a depository for the benefits of the depository.

Ravi Shah (2002)¹¹ highlighted that NSDL and CDSL have changed the face of the Indian capital market. The move from an account period settlement in paper form only to a T+3 settlement in pure electronic form has been achieved in a record span of few years, whereas it took anywhere between 10-20 years in most of the developed countries.

Schmiedel et. al. (2006)¹² analyzed the existence and extent of economies of scale in depository and settlement systems. The study indicated the existence of significant economies of scale but degree of such economies differs by settlement, institution and region.

Kanan (2008)¹³ highlighted that dematerialization has certainly brought about lot of improvement in the investment habits in our country and is bane for the companies and has created havoc in maintaining the members register and in conducting the members meeting.

Sultan Sing (2011)¹⁴ tried to study the factors affecting the decision making of the investors in depository system. Most of the investors are of the view that shorter settlement period, safety of securities with the depositories, attitude of the staff available with the DPs, timely services provided by the DPs to the investors, reduction in transaction cost, repatriation of sales proceeds of shares/debentures by NRIs are some of the factors which affects the decision making of the investors in depository system.

The earlier studies covered the depository system and environment, which mainly pertain to depository legislation, how a viable alternative of depository, implications of depositories ordinance, internal audit of depository participants, an overview of the Depositories Act, responsibilities of auditing profession, role of depository in stock and capital market, SEBI guidelines in the depository system, services provided by different depositories or accessibility of depositories to retail investors. But it is very

⁵ Shah, Mahesh (1996), "A Care for Depositories in India", *The Management Accountant*, April, pp. 259-261.

⁶ Aggarwal, V. K. and Dixit, S. K. (1996), "The Depositories Legislation: A Critical Evaluation," *Chartered Secretary*, April, pp. 367-376.

⁷ Sarkar, A. K. (1996), "Implications of Depositories Ordinance, 1995," *The Management Accountant*, June-July, pp. 473-477.

⁸ George, Philip (1996), "Towards a Paperless Settlement System", *Business World*, October, pp. 134-135.

⁹ Gurusamy, S. (1996), "Depository System-How a Viable Alternative", *The Management Accountant*, July, pp. 478-482.

¹⁰ Hurkat, Manoj and Ved, Umesh (1999), "Depository-An Inevitable Institution", *Chartered Secretary*, September, pp. 991-993.

¹¹ Ravi, Shah (2002), "Understanding Dematerialization", *The Management Accountant*, pp. 434.

¹² Schmiedel, HeiKo, Malkamaki, Markku and Tarkka, Juha (2006), "Economies of Scale and Technological Development Securities Depositories and Settlement System", *Journal of Banking and Finance*, Vol. 30, Issue-6, pp.1783-1806

¹³ S. Kanan (2008), "Market Comparable Approach", *Journal of Financial Services Research*, Vol. 24, No.2-3, pp. 121-148.

¹⁴ Prof. Sultan Sing and Sakshi Goyal (July 2011), "Analysis Factor Affecting the decision making of the investors in Depository system", *Journal of Banking, Financial Services and Insurance Research*, Vol. 1, pp. 13-38

important to study the financial performance of depositories itself. Therefore, the present study is an attempt to fill this gap.

III. RESEARCH METHODOLOGY

1. Rationale for the Study:

This research is based on the performance evaluation of Depositories in India. The research emphasizes on the comparative study of NSDL and CDSL. Here, eight Companies are taken for the study. This research, basically, is helpful to the Depositories to enhance their profitability and use the tools which raise their Income and reduce the expenses. Here, to check their financial performance during the study period i.e. from year 2006-2007 to the year 2010-11. Moreover, the results of the research will give the broad perspective in the field of Investment in the Equity market.

Here, on the bases of the research the selected Depositories can be effectively compared with each other. This comparison can be very helpful to both the Depositories in the efforts to increase the financial performance.

2. Statement of Problem:

A depository can be compared to a bank. A depository holds securities (like shares, debentures, bonds, Government Securities, units etc.) of investors in electronic form. Besides holding securities, a depository also provides services related to transactions in securities. NSDL and CDSL has a wide network of DPs, operating from over 6000 sites, across the country, offering convenience for an investor to select a DP based on his location. The equity shares of almost all A, B1 & B2 group companies are available for dematerialisation on Depositories, consisting of Public (listed & unlisted) Limited and Private Limited companies. These securities include equities, bonds, units of mutual funds, Govt. securities, Commercial papers, Certificate of deposits; etc. Thus, an investor can hold almost all his securities in one account with CDSL or NSDL. Considering current importance of Depositories it is very necessary to assess the Financial soundness of the depositories in India. So, the statement of the problem would be **“Financial Performance Evaluation of Depositories in India” (A Comparative study of NSDL and CDSL)**

3. Objectives of the Study:

Primary Objective:

The primary objective of the study is to check the financial stability and profitability of the selected Depositories in India.

Secondary Objectives:

1. To study the Financial Stabilization of NSDL and CDSL
2. To evaluate the Operating Income of selected Depositories
3. To check the expense pattern of the selected Depositories
4. To compare Overall profitability of NSDL and CDSL
5. To assess the soundness of the selected Depositories
6. To check the ROI of selected Depositories

4. Data Collection and Period of the Study:

The researcher will try to analyze the Performance and Financial Stability of NSDL and CDSL during the study period. The main source of data used for the study is secondary, derived from the published Annual Reports of selected units. Present study covers the financial analysis of selected Depositories for five consecutive financial years. The period of the study will start from 1st April, 2006 to 31st March, 2011. Researcher has selected the base year 2005- 06. This year is normal for the purpose of analysis and evaluation.

5. Hypothesis of the Study:

- i. There would be no significant difference in Operating Income of selected units.
- ii. There is no significant difference in Expenses Ratios in Selected units.
- iii. There is no significant difference in Financial Stability Ratios in Selected units.
- iv. There would be no significant difference in ROI in Selected units.

6. Tools and Techniques of Analysis:

- (A) Accounting Ratios: Various accounting ratios for five financial years have been calculated for the purpose of analysis and evaluation.
- (B) Statistical Tools and Techniques: Some of the statistical techniques such as Mean, Standard Deviation, Coefficient of Variation and One Way ANOVA has been used.

7. Limitations of the Study:

1. Present study is based on secondary data and secondary data has its own limitations which might affect the study.
2. Present study is done considering Accounting Ratio analysis only and there are certain ratios which won't be calculated so it will be one of the major limitations of the study.
3. Statistical tools have its own limitations and it will affect to present study.
4. The economic condition varies at different point of time and that will affect the findings of the present study.

IV. FINANCIAL ANALYSIS OF DEPOSITORIES

1. Operating Income to Total Income Ratio:

This ratio shows the Operating Income to Total Income Ratio of selected depositories during the study period. This ratio helps to assess the operational efficiency of the unit compare to total income of the depositories. The higher the ratio the better will be the profitability and affects positively to operational efficiency of the organization. The formula of the ratio is as under.

$$\text{Operating Income to Total Income Ratio} = \frac{\text{Operating Income}}{\text{Total Income}} \times 100$$

Table – 1
Operating Income to Total Income Ratio
(Figures in %)

Year	CDSL	NSDL
2006-07	77.89256	92.74984
2007-08	82.90816	91.90141
2008-09	77.68924	92.24299
2009-10	80.15795	91.65091
2010-11	82.45098	92.78713
Average	80.21978	92.26646
Standard Deviation	2.450971	0.504347
Co-efficient of Variance	3.055321	0.54662

Source: calculated from the Published Annual Reports of the Depositories during study period.

The above table shows Operating Income to Total Income ratio of CDSL and NSDL during the period under review. This ratio shows the operational efficiency of the depositories. It reveals from the above table that CDSL ratio represents increasing trend except financial year 2008-09 during the study period. It has reached at its highest level in the financial year 2007-08. The average ratio was 80.22%. The NSDL registered fluctuating trend during the study period however the Operating Income to Total Income ratio was greater than 90% during the period under review. Comparing the CV of CDSL and NSDL, the CDSL has registered with higher CV than NSDL which shows high fluctuations in the ratio whereas NSDL has low ratio which affects positively to its stability.

Ho: There is no significance difference in the Operating Income to Total Income ratio of Depositories during the period under review.

Table – 2
One way ANOVA of Operating Income to Total Income Ratio

Source of Variation	SS	Df	MS	F Cal	F crit
Between Depositories	362.806	1	362.806	115.882	5.31766
Within Depositories	25.0465	8	3.13081		
Total	387.853	9			

(at 5% Significance Level)

The above table shows one way analysis of Operating Income to Total Income ratio. Here, the hypothesis is tested at 5% significance level. Here, calculated value is much higher than tabulated value so, the null hypothesis get rejected and alternative hypothesis get accepted. So, it can be concluded that there is significance difference in NSDL's and CDSL's Operating Income to Total Income ratio during the study period.

2. Other Income to Total Income Ratio:

This ratio shows the Other Income to Total Income Ratio of selected depositories during the study period. This ratio helps to assess depositories' way of working. The higher the ratio the better will be the profitability but it can be said that the depository is unable to work operationally well. The Other Income here includes Misc. Income, Interest or Dividend Income, profit on sale of assets, etc. The formula of the ratio is as under.

$$\text{Operating Income to Total Income Ratio} = \frac{\text{Other Income}}{\text{Total Income}} \times 100$$

Table – 3
Other Income to Total Income Ratio
(Figures in %)

Year	CDSL	NSDL
2006-07	21.90083	7.250163
2007-08	16.96429	8.098592
2008-09	22.17795	7.757009
2009-10	19.84205	8.349086
2010-11	17.54902	7.212868
Average	19.68683	7.733544
Standard Deviation	2.403854	0.504347
Co-efficient of Variance	12.21047	6.521551

Source: calculated from the Published Annual Reports of the Depositories during study period.

The table - 3 shows Other Income to Total Income ratio of CDSL and NSDL during the period under review. This ratio shows income earned by depositories other than Operational one. Other Income includes Misc. Income, Interest or Dividend Income, profit on sale of assets, etc. It reveals from the above table that CDSL ratio represents decreasing trend except financial year 2008-09 during the study period. It has reached at its highest level in the financial year 2008-09. The average ratio was 19.68%. The NSDL registered fluctuating trend during the study period however the Other Income to Total Income ratio

was lower than 9% during the period under review which affects positively to company's operational efficiency. Comparing the CV of CDSL and NSDL, the CDSL has registered with higher CV than NSDL which shows high fluctuations in the ratio whereas NSDL has low ratio which shows stability in company's earning.

Ho: There is no significance difference in the Other Income to Total Income ratio of Depositories during the period under review.

Table – 4

One way ANOVA of Operating Income to Total Income Ratio

Source of Variation	SS	Df	MS	F Cal	F crit
Between Depositories	357.2025	1	357.2025	118.4186	5.31766
Within Depositories	24.13152	8	3.01644		
Total	381.334	9			

(at 5% Significance Level)

The above table reflects one way analysis of Other Income to Total Income ratio. Here, the hypothesis is tested at 5% significance level. Here, calculated value is higher than tabulated value so, the null hypothesis get rejected and alternative hypothesis get accepted. So, it can be concluded that there is significance difference in NSDL's and CDSL's Other Income to Total Income ratio during the study period.

3. Total Expenses to Total Income ratio:

This ratio shows the Total Expenses to Total Income Ratio of selected depositories during the study period. This ratio helps to assess depositories' Profitability from the view point of expenses. Higher ratio affects negatively to the profitability of depositories' income earning capacity. Total expenses include administration, and other expenses of the organization. The formula of the ratio is as under.

Total Expenses to Total Income Ratio =

$$\frac{\text{Total Expenses}}{\text{Total Income}} \times 100$$

Table – 5

Total Expenses to Total Income Ratio

(Figures in %)

Year	CDSL	NSDL
2006-07	45.45455	73.1548
2007-08	33.80102	60.96579
2008-09	38.11421	80.51402
2009-10	33.46496	66.35161
2010-11	32.84314	71.07313

Average	36.73557	70.41187
Standard Deviation	5.300489	7.343848
Co-efficient of Variance	0.144288	10.42984

Source: calculated from the Published Annual Reports of the Depositories during study period.

The table - 5 shows Total Expenses to Total Income ratio of CDSL and NSDL during the period under review. This ratio shows expenses accrued by depositories during study period. Total expenses include administration, and other expenses of the organization. It reveals from the above table that CDSL ratio represents fluctuating trend during the study period which shows that its profitability was not stable. It has reached at its highest level in the financial year 2006-07. The average ratio was 36.735%. The NSDL registered continuous decreasing trend except financial year 2008-09 and 2010-11 during the study period which affects positively to its profitability. The Total expenses to Total Income ratio was lower than 73% during the period under review which affects positively to company's operational efficiency. Comparing the CV of CDSL and NSDL, the CDSL has registered with lower CV than NSDL which shows that NSDL has less stability in term of Total Expenses to Total Income ratio during the study period.

Ho: There is no significance difference in the Total Expenses to Total Income ratio of Depositories during the period under review.

Table – 6

One way ANOVA of Total Expense to Total Income Ratio

Source of Variation	SS	Df	MS	F Cal	F crit
Between Depositories	2835.232	1	2835.232	69.12901	5.317655
Within Depositories	328.1091	8	41.01364		
Total	3163.342	9			

(at 5% Significance Level)

The above table reflects one way analysis of Total Expenses to Total Income ratio. Here, the hypothesis is tested at 5% significance level. Here, calculated value is considerably higher than tabulated value so, the null hypothesis get rejected and alternative hypothesis get accepted. So, it can be concluded that there is significance difference in NSDL's and CDSL's Total Expenses to Total Income ratio during the study period.

4. Return on Investment ratio:

This ratio shows the percentage return received by depositories on their total share holder's fund during the study period. This ratio helps to assess depositories' Profitability from the view point of share holder's fund. Higher ratio affects positively to the

profitability of depositories' income earning capacity. Total share holder fund includes share capital and reserve and surplus during one financial year. The formula of the ratio is as under.

$$ROI = \frac{\text{Profit After Tax}}{\text{Total Share Holder's Fund}} \times 100$$

Table 7
Return on Investment Ratio

Year	CDSL	NSDL
2006-07	12.31979	12.86232
2007-08	20.8286	2036474
2008-09	17.17172	9.544313
2009-10	20.58059	22.00900
2010-11	18.16118	19.50713
Average	17.81238	16.85750
Standard Deviation	3.444606	5.368971
Co-efficient of Variance	0.193383	31.84915

Source: calculated from the Published Annual Reports of the Depositories during study period.

The table - 7 shows Return on Investment ratio of CDSL and NSDL during the period under review. This ratio shows Profit earned by depositories during study period. The profit which is taken as post tax. It reveals from the above table that CDSL ratio represents fluctuating trend during the study period which shows that its profitability was not stable. It has reached at its highest level in the financial year 2007-08. The average ratio was 17.81%. The NSDL also registered fluctuating trend during the study period which also affects negatively to its profitability. The Return on Investment ratio recorded 9.54% which was the lowest during the period under review which affects negatively to company's operational efficiency. Comparing the CV of CDSL and NSDL, the CDSL has registered with lower CV than NSDL which shows that NSDL has less stability in term of Return on Investment ratio during the study period.

Ho: There is no significance difference in the Return on Investment ratio of Depositories during the period under review.

Table – 8
One way ANOVA of Return on Investment Ratio

Source of Variation	SS	Df	MS	F Cal	F crit
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Between Depositories	133.7747	4	33.44368	5.3476	5.1921
Within Depositories	31.26937	5	6.25387		
Total	165.0441	9			

(at 5% Significance Level)

The above table reflects one way analysis of Return on Investment ratio. Here, the hypothesis is tested at 5% significance level. Here, calculated value is marginally higher than tabulated value so, the null hypothesis get rejected and alternative hypothesis get accepted. So, it can be concluded that there is significance difference in NSDL's and CDSL's Return on Investment ratio during the study period.

V. FINDINGS OF THE STUDY

- Average Operating Income to Total Income ratio of NSDL was much higher than CDSL, which shows that NSDL earning higher operational income compare to CDSL.
- NSDL's Operating Income was almost 90%, so NSDL focuses on its operational income rather than other income.
- CDSL's other income was around 20% of its total income which reveals the operationally CDSL try to change its focus from other income to operational income.
- NSDL's income has almost 1.5 times higher than that of CDSL
- Total Expenses to Total Income ratio of NSDL was higher than CDSL
- It was found that there was a significant difference between Operating Income to Total Income ratio of both the depositories during study period.
- CDSL was promoted by Bombay Stock Exchange whereas NSDL was promoted by National Stock Exchange.
- The study reveals that there was significant difference between Other Income to Total Income ratio of CDSL and NSDL during the period under review.
- The financial performance of NSDL was quite better than CDSL during the study period.
- The study proves that there was a considerable difference in ROI of both the depositories during the study period.

VI. CONCLUSION

The trend of automation especially, Dematerialization, has enabled the Indian Capital Market to take the world's center stage and scale unprecedented heights. Securities market in India has grown exponentially as measured in terms of amount raised from the market, number of stock exchanges and intermediaries, the number of listed stocks, market capitalization, trading volumes, turnover on stock exchanges and investors population. The services offered by the Depositories like Pledge and Hypothecation, Account Transfer, Stock Lending and Borrowing, Nomination, Tax Information Network (TIN), Speed-E, Internet – based Demat Account Statement (Ideas), Securities Trading Information Easy Access and Delivery

(STEADY), etc bear testimony to the fact that it is perpetually progressing by leaps and bounds, thereby elevating its status to internationally acceptable standards. The analysis of the progress of National Securities Depository Limited (NSDL) and Central Depository Services (India) Limited (CDSL) in economic terms clearly reveals that both the depositories have shown a remarkable progress in terms of Demat Accounts, Demat value and quantity, Settlement value and quantity and the number of Depository Participants. In spite of its late emergence, the growth at CDSL is almost at par with that of NSDL. The exponential spurt in demat Accounts, both at NSDL and CDSL reaffirms the increased reliance of the investors on the depository System. This study reveals that both the depositories have been working financially smoothly over a period of last six financial years.

REFERENCES

- [1] www.stockholding.com
- [2] www.cdslindia.com
- [3] www.nsdl.co.in
- [4] Shah, Mahesh (1996), "A Care for Depositories in India", The Management Accountant, April, pp. 259-261.
- [5] Aggarwal, V. K. and Dixit, S. K. (1996), "The Depositories Legislation: A Critical Evaluation," Chartered Secretary, April, pp. 367-376.
- [6] Sarkar, A. K. (1996), "Implications of Depositories Ordinance, 1995," The Management Accountant, June-July, pp. 473-477.
- [7] George, Philip (1996), "Towards a Paperless Settlement System", Business World, October, pp. 134-135.
- [8] Gurusamy, S. (1996), "Depository System-How a Viable Alternative", The Management Accountant, July, pp. 478-482.
- [9] Hurkat, Manoj and Ved, Umesh (1999), "Depository-An Inevitable Institution", Chartered Secretary, September, pp. 991-993.
- [10] Ravi, Shah (2002), "Understanding Dematerialization", The Management Accountant, pp. 434.
- [11] Schmiedel, HeiKo, Malkamaki, Markku and Tarkka, Juha (2006), "Economies of Scale and Technological Development Securities Depositories and Settlement System", Journal of Banking and Finance, Vol. 30, Issue-6, pp.1783-1806.
- [12] S. Kanan (2008), "Market Comparable Approach", Journal of Financial Services Research, Vol. 24, No.2-3, pp. 121-148.
- [13] Prof. Sultan Sing and Sakshi Goyal (July 2011), "Analysis Factor Affecting the decision making of the investors in Depository system", Journal of Banking, Financial Services and Insurance Research, Vol. 1, pp. 13-38
- [14] Galagadera, Don U.A. and P. Edirisuriya, 2004, "Performance of Indian commercial banks (1995-2002): An application of data envelopment analysis and Malmquist productivity index", Working Paper, Monash University.
- [15] Ghate, Prabhu, 2006, "Microfinance in India, A State of the Sector Report", Ford Foundation and Care.
- [16] Ghosh, A., 2006, "Determination of Executive Compensation in An Emerging Economy: Evidence from India", Emerging Markets Finance and Trade, Vol. 42, No. 3, 66-90.
- [17] Ghosh Saibal, 2006, "Do Board Characteristics Affect Firm Performance? Firm level evidence from India", Applied Economic Letters, 2006, vol. 13, issue 7, pages 435-443
- [18] Gordon, James and Poonam Gupta, 2003: 'Portfolio Flows into India: Do Domestic Fundamentals Matter?', IMF working paper No 03/20.
- [19] Kumbhakar, S.C. and Sarkar, S., 2003, "Deregulation, Ownership, and Productivity Growth in the Banking Industry: Evidence from India", Journal of Money, Credit, and Banking, 35, 403-424.
- [20] La Porta, Rafael, Florencio Lopez-de-Silanes, and Andrei Shleifer, 2006. "What Works in Securities Laws?" Journal of Finance 61 (1), 1-32.
- [21] La Porta, Rafael, Florencio Lopez-de-Silanes, Andrei Shleifer, and Robert Vishny, 1998, "Law and Finance," Journal of Political Economy, 106, 1113-55.
- [22] Leuz, C., Nanda, D., and Wysocki, P. 2003. "Earnings Management and Investor Protection: An International Comparison". Journal of Financial Economics, 69: 505-527.
- [23] CBSE – Introduction to Financial Market – II

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Management Training Needs For Micro Women Entrepreneurs

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Abstract- Entrepreneurship amongst women has been a recent development. The entrepreneur is a person who has enterprising quality, takes initiative and establishes an economic activity or enterprise. Starting and operating an enterprise involves considerable risk and effort on the part of the entrepreneurs, particularly in the light of high failure rate. The enterprises started by women are so greatly influenced by the decisions and desires of the members of the family, women entrepreneurs who receive support from family, relatives and other support systems could manage their own enterprises successfully. Entrepreneurial talents and capabilities are latent in all communities but their translation to innovative action depends on appropriate stimuli and environment and these stimuli can be generated through training. Training women for entrepreneurial and managerial capabilities should be conceived as one of the most important factors for accelerating growth. Efforts are being made along these lines, however they are limited only to bring changes quantitatively but not qualitatively. Hence appropriate training and interventions are needed to bring qualitative changes in the situation. An attempt was made in this study to examine the quality of micro-enterprise management by women in socio-cultural milieu and to project the management training needs of women entrepreneurs.

Index Terms- women entrepreneurs micro-enterprise, management styles, need for training.

I. INTRODUCTION

Entrepreneurship is a more suitable profession for women than regular employment in public and private sectors since they have to fulfill dual roles. Women have been taking increasing interest in recent years in income generating activities, self employment and entrepreneurship. This is seen in respect of all kinds of women both in urban and rural areas. Women are taking up both traditional activities (knitting, pickle making, toy making, jam and jelly) and also nontraditional activities (like computer training, catering services, beauty parlor, gym etc.). It is clear that more and more women are coming forward to set up enterprises. Generally, women who initiate a micro-enterprise do it because of the factors which limit their capacity to start large ventures-low levels of self-confidence, little access to technical information, poor local market conditions, regulatory barriers and no access to capital. On the other hand, for some microenterprises offers a meaningful source of income and satisfaction. Women who try to enter an industry, either in managerial or in entrepreneurial role are generally exposed to various environmental constraints. Starting

and operating business involves considerable risk and effort on the part of the entrepreneur, particularly in the light of highest failure rate. Perhaps, this rate is even higher in the case of women entrepreneurs who have to face not only the usual business problems but also their family problems. This not only limits the scope of their contribution to the industrialization process, but also undermines the productive utilization of an available human resource, that is most needed in our country. Development as entrepreneurs is a recently discovered phenomenon for women for which they need motivation, training and family support. Realizing the need for training, government started introducing several programmes. Critical evaluation of the existing governmental and nongovernmental efforts indicate that training and technical assistance offered are not geared to suit the individual needs. The studies conducted by Kale (1990); Kirve and Kanitkar (1993), revealed that training approach is an important one for helping women in non-traditional high skill, male dominated activities and also to build confidence among women to meet the specific needs. Intensified effort has to be taken to assess the social attitude, mentality, needs and abilities of the women and to impart training. Flexible training programme and interest based skill training can push the women towards entrepreneurial activities. Training to develop good managerial skills is useful and essential to women (Padmavati, 2002 and Sathyasundaram, 2004).

II. OBJECTIVES OF THE STUDY

1. To study the reasons for being in business by women entrepreneurs
2. To study the Socio-demographic, economic, managerial and entrepreneurial profiles of women entrepreneurs
3. To study the efficacy of microenterprise women in Management training needs

III. METHODS

A sample of 100 women entrepreneurs was selected for the present study from Tamil nadu district of Chennai region to analyze the process and styles of management. For in-depth analysis, 50 women entrepreneurs from this 100 sample were taken. The sample was selected using non-random opportunity sampling technique as the list of women entrepreneurs available with the business development organizations did not tally to a great extent with the existing women entrepreneurs. In this research, interview and case study techniques were employed and the data was collected using the following tools. Interview schedule: to collect socioeconomic, demographic profiles of

women entrepreneurs. Interview schedule: for in-depth analysis of women entrepreneurs.

IV. RESULTS AND DISCUSSION

An in-depth analysis of socio-economic demographic, entrepreneurial personality and management profiles of women entrepreneurs was made to project the significant management training needs of the sample. This is made keeping in view of the perceptions of women entrepreneurs themselves on training needs and experienced trainers concerned with women entrepreneurship development. Socio-economic and demography profile of women entrepreneurs was prepared to project their characteristics and presented in Table1. Most of the women entrepreneurs (54%) belonged to the age group of 36 and above followed by the age groups of 26-35 (28%) and 16-25 (18%) in that order. Hisrich and Brush(1986) described the typical women entrepreneur to be about 35 years of age when she starts her first business venture. It appears women think of business idea in their thirties due to economic pressure/demand and more leisure time as their children are growing. Half (51%) of the women interviewed, belonged to the low income level. Thirty eight and 11 per cent belonged to the middle and high income strata respectively. The data indicate that economic need is the essential triggering factor for the women to enter into entrepreneurship. On the other hand women with small families enter into entrepreneurship compared to those with large families who are generally depending on wage employment. Immediate gratification is the driving force for the women with large families to decide on the strategy for economic development. Fifty per cent of women entrepreneurs had education less than S.S.C., 12 per cent were illiterates, 13 per cent had education up to SSC

Table 1” Socio-demographic –economic profile

Socio-demographic characteristics	Respondents (n)	%
	100 n	
Age		
16-25 yrs	18	18
26-35yrs	28	28
36 and above yrs	54	54
Education		
Illiterates	12	12
Less than SSC	50	50
SSC	13	13
Intermediate	7	7
Degree and more	18	18
Marital Status		
unmarried	6	6
Married	76	76
Widow	10	10
Divorcee / Separated	8	8
No. of Children		
1	18	18
2	37	37
3	20	20
4	7	7

5 & above	6	6
None	12	12
Income		
Rs.5000-2500	51	51
Rs.2501-5000	38	38
Rs.5001-7000	11	11

and the remaining 25 per cent had college education. The data indicates that majority of the women entering into business are with low or no education. Educational status does not influence women in seeking entrepreneurship (Rani, 1992). This trend may leads to less realization of the need for appropriate pre-entrepreneurial interventions. Majority (76%) of the women entrepreneurs were married and only low percent of them were unmarried (6%), widows (10%) and divorces/separated (8%). Married were experiencing freedom and receiving support directly and/or indirectly to start and manage their enterprises. Further parents were expressing that economic independence through entrepreneurship is barrier in fixing their marriage alliances. Single women households experiencing several problems like low/no support from both family as well as financial agencies.

Majority (60%) of the respondents had fewer than two children, which included 12percent had no children 18percent were single parent, and 37percent of the women entrepreneurs had two children. Only 40percent of women entrepreneurs had more than two children .It is clear from the data that more women with small families enter entrepreneurship compared to those with large families. Chandralekha (1994) also expressed that fewer number of children means less responsibility and more free time which must be a facilitating factor for women to take up entrepreneurship.

Entrepreneurial personality of the women entrepreneurs was assessed using simple questionnaire. The questions on entrepreneurial personality characteristics include initiation, risk taking, sociability, leadership independence etc. The data collected reveals that entrepreneurial personality traits range from low average to high average and thus concluding that women entrepreneurs possessed only average personality profile. Several factors like socio, economic demographic and cultural might be responsible for the existing average entrepreneurial personality profile.

Management styles of women entrepreneurs was also analyzed using another questionnaire contained questions on four entrepreneurial management skills i.e., producer, administrator, integrator and entrepreneur. It was observed that they have average production skills and average entrepreneurial skills. This entrepreneurial skills include preoccupied by external system, by change, by creativity and by new demands. Administration skills are found to be low. Integration skills are found to be very good, that is personnel skills, communication skills, negotiation skills, co-ordination skills etc. Integration skills are identified as one's concern to establish, maintain and sustain effective relationships with others. This is found to be important for those whose aim in life requires sacrifices and an avoidance of inter-personal conflicts in order to succeed.

In-depth analysis of 50 cases revealed that out of 50 cases, 15 cases were effectively managing (EME) their micro-enterprises in terms of profit, personal satisfaction etc., and the remaining

are merely surviving in their enterprises. Different management styles were exhibited by these two groups of entrepreneurs. The mere Surviving Entrepreneurs (SE) have average production skills, low administration skills, high average integration skills and average entrepreneur skills. When compared with effectively managing entrepreneurs (EME), both have equal production/service skills, EME have low average administration skills i.e. in setting up internal system, to be able to control, analyze the results, to plan for strategies, to set up norms and expectations, which is low in SE. SE have good integration skills, i.e. people skills, communication skills, negotiation skills, coordination skills compared to EME. But both have average entrepreneurial skills. Appropriate education training in entrepreneurship skills are necessary for women.

Management process of 50 women entrepreneurs was studied in respect of their planning, execution and controlling the activities of enterprise using their case study profiles. Most of the women entrepreneurs (56 per cent) belonged to service sector, twenty and twenty-four per cent of women entrepreneurs belonged to production and business sectors respectively. This supports the argument that women would tend to initiate business in sectors which are generally accepted as being "appropriate" for women. Twenty six per cent of female entrepreneurs received skill oriented business training; the remaining seventy four per cent didn't receive any business training. Only eighteen per cent of women entrepreneurs have business experience and the remaining eighty two per cent of them stated that they did not have any business experience before embarking on the business. It appears that most women gain their first management experience in their own business. From among the eighteen per cent of women entrepreneurs only eight per cent had formal experience compared to 10 per cent who received informal experience by assisting/participating/observing parents/siblings working for the enterprise.

As shown in table 2 fifty two per cent of women entrepreneurs invested only below Rs.1000/- for their enterprises while 30 per cent invested Rs.1000/- to Rs.5000/- and only 18 percent invested more than Rs.5000/-. This supports the fact that limited access to finance is the factor that works against the economic progress of women. Legally the property that is to be converted for the business is not often either inherited or belonged to the wife. So the freedom that is enjoyed in converting such assets into cash is naturally very limited. One factor found among women was that they would not go for large investment (Job, 1996).

Table 2: Investment invested by women entrepreneurs

Investment	Respondents (n) 50	
	n	%
Rs.101-1000	26	52
Rs.1001-5000	15	30
Rs.>5000	9	18

Most of the women entrepreneurs (66%) are aware of the support systems helping women entrepreneurs mostly the banks, and

thirty four percent of entrepreneurs are not aware of the support systems helping women entrepreneurs.

This need emphasis for orienting them with various incentives and assistance provided by the government and financial institutions and ways of accessing them. Twenty six per cent of women entrepreneurs are utilizing the services of support systems such as banks, governmental schemes and women groups and seventy four per cent of women entrepreneurs are constrained to use them. The procedures of bank loans, the delay and the running about involved discourages many a women from borrowing from banks. As the assistance from some government services and women groups is meager, they are borrowing from the relatives and moneylenders at high rate of interest.

Sixty eight per cent of women entrepreneurs took only below one month time for planning the business and thirty two per cent of women entrepreneurs took more than one month time for planning the business. Skill in planning is influenced by factors like entrepreneurial personality traits, formal managerial training etc., In the absence of formal training, the quality of planning will be affected.

Number of hours devoted for business is one of the important factor in business, (Table 3). Fourteen per cent of women entrepreneurs are devoting only 1-3 hours per day for business whereas fifty six per cent and thirty per cent of women entrepreneurs are devoting 4-6 hours and more than 6 hours per day respectively. When taken the number of hours devoted for family by these entrepreneurs, thirty six per cent of women entrepreneurs are devoting 1-3 hours per day for household work in the family and this group is mostly the married women who have grown up children, and getting help from the children in household chores. Sixty four per cent of women are spending more than 4 hours per day for household work. It is evident that women are devoting more or less as much as time for both family and business. Women differ from men with respect to the conflicting demands of business and family. Married women Entrepreneurs typically find that their husbands expect them to continue with their household duties despite the demands of their businesses and they rarely assist in running of houses.

Table 3: Number of hours devoted for business.

No. of hours	Respondents (n) 50	
	n	%
1 - 3 hrs	7	14
4 - 6 hrs	28	56
7 - 9 hrs.	11	22
9 hrs.	4	8

Only 12% of women entrepreneurs employed the workers and 88% didn't hire any employees.

Since they are micro-enterprises, they didn't feel the need for hiring the employees. Most of the women entrepreneurs (94%) didn't want to extend their business to other towns and cities. The reasons were that it may affect their families, that with their small business it is almost impossible to expand, few expressed, that they are satisfied with what they are and some entrepreneurs didn't think about it at all. And it is also partly because the markets for the types of products and services these business offer tend to be primarily local in scope and partly

because women entrepreneurs lack the vision and the strategic and operating abilities needed for expanding into large sized enterprises. The female entrepreneurs are seen as having limited vision and as thinking in terms of the short run.

The problems expressed by the women entrepreneurs in utilizing the existing training inputs of support systems.

- Men are the participants in most of the training programmers.
- In mixed groups, women hesitate to ask questions and tend to defer to the men who end up dominating discussions. This is not conducive to learning.
- Issues pertaining to women cannot be addressed in mixed group situations.
- Women traditionally think they need verification from others; they are not brought up to look at business start up as an option.
- Women face socio-cultural economic constraints to participate in the relevant trainings.
- Experienced trainers of Entrepreneurship Development Programme choose to share the following insights.
- With entrepreneurs no generic training plan can work. The design of set training format had to be individualized each time.
- You cannot separate the business and the person.
- Pay attention to the individual.
- Up front evaluation upon intake can be a key to success.
- Flexible programme delivery created more effective results.

Keeping in view the findings of the study, perceptions of women entrepreneurs and insights of experienced trainers, the following management training needs are projected :

- Confidence building : belief in one's own abilities and capacity to succeed.
- Competence : having the skill to do the job well.
- Connections : building very business contacts, networking with support systems and co-entrepreneurs.
- Capital : access to finance.

In order to meet the above said entrepreneurial management training needs, the following points need to be kept in mind while designing the entrepreneurship management training programme.1. Gender specific training is more essential to suit socio-economic-demographic conditions.2. Holistic approach is needed to look at the whole individual in a business perspective in the socio-cultural milieu.3. The product must fit the need through bottom-up approach.4. Some women need tremendous amount of on-technical support also.5. Some women need pre-entrepreneurial training.6. Total personal support and

awareness is needed - counseling, stress coping skills, public speaking skills.

V. CONCLUSION

It can be said that today we are in a better position where in women participation in the field of entrepreneurship is increasing at a considerable rate. Efforts are being taken at the economy as brought promise of equality of opportunity in all spheres to the Indian women and laws guaranteed equal rights of participation in political process and equal opportunities and rights in education and employment were enacted. But unfortunately the government sponsored development activities have benefited only a small section of women i.e. the urban middle class women. Women sector occupies nearly 45% of the Indian population. At the juncture, effective steps are needed to provide entrepreneurial awareness, orientation and skill development programs to women. The role of women entrepreneur in economic development is also being recognized and steps are being taken to promote women entrepreneurship. What women need for enterprise management is little training, finance, co-operation and encouragement in the sphere of activities, at all levels - home, the society and the government.

REFERENCES

- [1] Chandralekha, K.: Entrepreneurship and small business training for Indian women. *Paper presented at seminar on Appropriate Food Technologies* SPMVV, Tirupati, A.P. (1994)
- [2] Hisrich, R.D. and Brush, C.G.: *The Women Entrepreneur: Characteristics, Skills, Problems and Prescriptions for Success*. The Art and Science of Entrepreneurship, Cambridge, Mass, Ballinger (1986).
- [3] Job, K.T.: *Women Entrepreneurship Development Alternative for Gender Empowerment*. Centre for Management Development, Thycand, Trivandrum (1996).
- [4] Kale, J.D.: Women Entrepreneurship in Gujarat - Role of Centre for Entrepreneurship Development. *Journal of Indian Management* **29(7-12)**: 99-101 (1990).
- [5] Kirve, Harsha and Kanitkar, Azit: Entrepreneurship at the Grass Roots: Developing the Income Generating Capabilities of Rural Women. *Journal of Entrepreneurship*, **2(2)**: 177-197 (1993).
- [6] Lavoie, D.: Research Model and Tool for Collection of Data for Psycho-Socio-Economic Demographic Profile of Women Entrepreneurs. Presented at seminar on Appropriate Food Technologies, SPMVV, Tirupati, A.P. (1994).
- [7] Rani, C.: Potential Women Entrepreneurs. 78-99 In: *Women in Enterprise and Profession*. C. Kalbagh (Ed.). Discovery Publishing House, New Delhi (1992).

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Employee Performance Appraisal System and Use of Iris Biometric System in Human Resource Management Software

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Abstract- Human Resource is the backbone of any organization. Human resource management (HRM) is the only responsible factor ensuring that the right people at the right place and at the right time to execute corporate plans. Computerized Systems are being used to this effect in a big way. In this paper proposed a system for calculate performance appraisal of employee by a mathematical model and describe an eye's Iris-based biometric attendance system. We propose a performance appraisal system using multi aspect evaluation of employee in a software company. These aspects are Skills, Knowledge, Regularity, Effectiveness, Coordination and administration. Further these aspects are sub divided into sub aspects to ensure employee performance appraisal truthful.

The proposed software store employee details and Iris image in database. Every day when employee comes, camera detect Iris image and match with stored template in database. Employee id gets from database and makes employee today attendance and stored in database permanently. At the end of month, salary also calculated with help of attendance and also maintains leave status.

Index Terms- Human resource management, Iris Biometric system, performance appraisal system

I. INTRODUCTION

1.1 Human Resource Management System

A Human Resource Management System refers to the systems and processes in which the intersection between human resource management (HRM) and information technology. It merges HRM as a discipline and processes with the information technology field, whereas the programming of data processing systems does in enterprise resource planning (ERP) software.

These ERP systems have their origin on software that integrates information from different applications into one universal database. Human resource management system is the availability of professionally qualified HR managers and staff in effectively supported HRH units with capacity to carry out critical HR functions like recruitment, deployment, implement retention schemes, use workforce data to plan/manage staff, assist with budgeting [14].

The HR maintains a complete employee database including contact information, salary details, attendance, performance evaluation and promotion of all employees. To reduce the manual workload of these administrative activities, organizations began to electronically automate many of these processes by introducing specialized Human Resource Management Software.

1.2 Employees' Performance Appraisal

Employees' performance appraisal process is a crucial task undertaken by the HR department in each organization [15]. It involves various steps, ranging from preparing a questionnaire, conducting a face-to-face interview between the team supervisors or the HR manager and the employees, taking the help of outside appraisers, preparing reports, database and so on. No doubt, the whole process is quite troublesome and time-consuming. But thanks to new-age Appraisal System, this task can be done quite professionally with precision. This automated tool helps to keep track of each associated step with minimum headache.

Through Performance Appraisal System there is hardly any fear of mistake as the whole module is automated. Some of its key offerings include a 360° appraisal process, managing Appraisal Managers and database, keeping track of the relevant functions of the external appraisers, customizing appraisal templates etc. Modern versions of HRMS (Human Resource Management Software) offer this comprehensive module to ease up the tasks of the HR departments across the industries. The tool's easy-to-use and user-friendly characteristics have contributed in a big way behind popularizing this automated system.

Performance Appraisal Software has given freedom from dreadful paperwork. This robust software has initiated a silent but powerful revolution in the HR department by helping a smooth transition from a total manual job to fully automated process. A standard Employee Appraisal System enables the organizations to seamlessly align their corporate outlooks with that of the employees[15]. Now, equipped with this tool, the HR manager can fill the appraisal forms, prepare the questionnaire via online medium and forward them to the selected employees and receive them in the same way.

Automated appraisal systems help to maximize ROTI (Return on Talent Investment) in the organizations. Performance Management Module is a key accessory of this system that enables monitoring each employee's performance, picking up the flaws and finding the areas for which the concerned employees need to be trained. The whole system automates the task of chalking out, implementing, tracking, and evaluating a robust appraisal process in systematic and confidential way for ensuring best results.

The yardstick to scale employees' performance varies from organization to organization. Employee Performance Appraisal System is flexible enough to enable companies define the fields and parameters associated with the process. It ensures flawless mapping of employee-wise role KPI and KRA. HRMS has already become an inseparable accessory of the HR department

across the organizations and Appraisal System has contributed richly to its success.

Performance appraisal of candidates in relation to a particular position is a key task towards managing the human resources of an organization. Supervisors are concerned with performance appraisal judgments and evaluations that they have to make on their subordinates [1]. On the other hand, subordinates are increasingly realizing the importance of performance appraisal since it would very much affect their rewards and future career path. As the world began to shift towards knowledgebase capitalism, it reminds all organizations on the importance of maintaining their talented knowledge workers [1]. Therefore, discovering and promoting the most qualified candidates is essential because valuable human expertise is the main source of competitive advantage for the organizations. Thus, the creation of performance criteria is an important requirement towards performance appraisal [2].

In the organizational context, performance is usually defined as the extent to which an organizational member contributes to achieving the goals of the organization. Performance appraisal is defined as “the process of identifying, evaluating and developing the work performance of the employee in the organization, so that organizational goals and objectives are effectively achieved while, at the same time, benefiting employees in terms of recognition, receiving feedback, and offering career guidance [4].

Performance appraisal is usually conducted periodically within an organization to examine and discuss the work performance of subordinate so as to identify the strengths and weaknesses as well as opportunities for improvement among employees. Following this, most of the employers use the performance appraisal result to determine if a particular staff should be terminated or reinforced; as an employee development and coaching tool; to give a practical evaluation of an employee's readiness for promotion; and to serve as the foundation for giving merit bonus.

1.3 IRIS Biometric System

Biometric authentication has grown in popularity as a way to provide personal identification [6]. Biometrics is a Method to identifying individuals based on a physical or behavioral characteristic. Examples of physical characteristics include fingerprints, face recognition, and iris recognition [8].

Behavioral characteristics are individuality that are learned or acquired. Dynamic signature verification, Voice verification are examples of behavioral characteristics.

Biometric authentication requires comparing an enrolled biometric sample against a newly captured biometric sample. Iris recognition is treated as the most reliable biometrics and has been widely applied in public and personal areas for security and Human management [9]. Iris recognition related with the eye. The iris is the colored section between the pupil and the white region of the eye. Its primary function is to control the size of the pupil. The unique features of the iris include the trabecular meshwork (the tissue that gives the iris its 'radial' impression) as well as other physiological properties such as freckles, furrows, rings, and the corona.



Fig. 1 Flow diagram of Iris Recognition

II. PROPOSED EMPLOYEE PERFORMANCE APPRAISAL SYSTEM

2.1 Performance Appraisal Process

Performance appraisal is used by an organization to reward and develop the human resource of the organization to ensure that the organization runs smoothly and grow. Every year, staffs are required to fill up Yearly Work Plan to report on the progress of the tasks assigned as agreed early of the year. This is done at the beginning and at the middle of the year. At year end, the Yearly Work Plan is used to evaluate the performance of the staff throughout the whole year. The process of performance appraisal is shown in Fig. 2 below.



Fig. 2 Performance Appraisal Process

2.2. Proposed Performance Appraisal System

Six aspects will be taken into consideration when evaluating employee performance of a software company. Further these aspects will be divided into three sub-aspects, as follows:

Aspect-1(Skills): This aspect evaluates various types of skills of employee. Sub aspects are (1) Communication skills (2) Delegation Skills and (3) IT Skills.

Aspect -2 (Knowledge): This aspect evaluates the staff's knowledge in various fields. Sub aspects are (1) Job Knowledge (2) Technical Knowledge and (3) problem solving and decision making knowledge.

Aspect- 3 (Regularity): This aspect evaluates the staff's regular performance in various places. Sub aspects are (1) Time management (2) planning, budgeting and forecasting (3) energy, determination and work-rate.

Aspect- 4 (Effectiveness): This aspect evaluates the staff's efficiency in various areas. Sub aspects are (1) Steadiness under pressure (2) Creativity (3) Quality of work.

Aspect- 5 (Coordination): This aspect evaluates the staff's headship quality in various areas. Sub aspects are (1) Team-working and developing others (2) Leadership and integrity (3) Adaptability, flexibility and mobility.

Aspect- 6 (Administration): This aspect evaluates the staff's administrative quality in various areas. Sub aspects are (1) Reporting and Administration (2) Commercial judgment (3) Corporate responsibilities and ethics.

To evaluate these aspects, proposed software use following screen, here in screen aspect-3 (Regularity) is shown.

Fig. 3 Performance evaluation aspects

When evaluating staff's performance, appraiser will use a scale of 1 to 10 to rate each sub-aspects. The grade for the scale is shown in following Table-1.

GRADES	SCALE
Excellent (E)	9-10
Good (G)	6-8
Satisfactory(S)	4-5
Poor(P)	1-3
Not applicable(NA)	Nil

Table-1 Grades and scale

In proposed system we have 3 multiple choice questions in each aspect. According to selection parameter we find an Average of first aspect like this:

$$\text{AVG (Aspect-1)} = \frac{Q1+Q2+Q3}{30}$$

Here we have following point to remember:

- Each question has 10 marks.
- According to select option, final getting marks of particular question calculated using above table grades and scale.
- If any select option not applicable, then question remove from aspect and total (30 marks) reduce by 10.

For example $\text{AVG (Aspect-1)} = \frac{Q1 + Q3}{20}$
(If 2nd question is N/A)

In same way we calculate all six aspects.

Now we design a matrix of Average value of each aspect in following form.

	Average value of aspect
Aspect-1	9
Aspect-2	8

Aspect-3	10
Aspect-4	5
Aspect-5	7
Aspect-6	4

The above matrix is made between aspects and Average value and it is called matrix-A.

Now we assume 100 marks for all 6 aspects. Now assign value to each aspect according to employee type from value 100. Every aspect has its role according to employee type.

For example, Aspect-1 has 15, Aspect-2 has 15, Aspect-3 has 15, Aspect-4 has 20, Aspect-5 has 20 and Aspect-6 has 15 for Employee type Team Leader.

Now we get a matrix $B = [15 \ 15 \ 15 \ 20 \ 20 \ 15]$ using aspects value. Now we calculate BXA

$$BXA = [15 \ 15 \ 15 \ 20 \ 20 \ 15] \times \begin{bmatrix} 9 \\ 8 \\ 10 \\ 5 \\ 7 \\ 4 \end{bmatrix}$$

$$BXA = 15 \times 9 + 15 \times 8 + 15 \times 10 + 20 \times 5 + 20 \times 7 + 15 \times 4$$

$$BXA = 135 + 120 + 150 + 100 + 140 + 60$$

$$BXA = 705$$

To calculate Overall Performance Ratings (OPR) of employee we divide BXA by 10.

$$\text{Now } OPR = 705/10$$

$$OPR = 70.5$$

Final Report of employee performance calculated from following parameter:

Overall Performance Ratings	Group	Remarks
Above 80	High Performer	<ul style="list-style-type: none"> • Entitled for "Best Service Award". • A certificate of appreciation.
Less than 80 but more than 50	Average Performer	<ul style="list-style-type: none"> • Advised to improve their Performance in the coming year.
Less than 50	Low Performer	<ul style="list-style-type: none"> • Disciplinary action might be taken Towards the staff. • Should constantly report his / her Work progress to his / her assessors in a stated period.

Table-2 Overall performance rating

III. USE IRIS BIOMETRIC IN HUMAN RESOURCE

Management Software

When new employee join organization, capture employee's either left and right eye's Iris image with help of Iris camera or other cameras. With his/her detail Iris image also taken, make template for future use and stored in database. Now with help of

proposed software images of Iris are stored in database with all employee details.

Fig. 4 Input screens for both eyes Iris

Every day when employee comes in organization, camera detect Iris image and match with stored template in database. When successfully matched, employee id gets from database and makes his/her today attendance and stored in database permanently with help of proposed software.



Fig. 5 Screen for manipulation attendance

When both image are comes to proposed system from Iris Scanner, the system perform matching these image template with already stored image temple. When matching performs successfully employee attendance adds in screen's table with emp_id, emp_name, emp_designation, arrival time. when these same image are detect next time, it means this time is employee's departure time and entry will made in screen's table and record

update for today's attendance. When match not successful, the system reset and wait for another input from Iris Scanner.

The proposed software screen also shows the status of coming employees in order to the entered in organization and total no of employee entered in the organization. At the end of month, salary also calculated with help of attendance and also maintains leave status.

IV. CONCLUSION

Employees' performance appraisal process is a crucial task in HR department. In this study, we have developed a performance appraisal system using various aspects related to employee performance. Further these aspects are sub divided into sub aspects to ensure employee performance appraisal truthful. Here we also develop Software to store employee details and Iris image in database. Every day when employee comes, camera detect Iris image and match with stored template in database. Employee id gets from database and makes employee today attendance and stored in database permanently. At the end of month, salary also calculated with help of attendance and also maintains leave status.

REFERENCES

- [1] C. C. Yee, and Y.Y.Chen, "Performance Appraisal System using Multifactorial Evaluation Model ", in World Academy of Science, Engineering and Technology 53 2009
- [2] Mostafa Jafari, Atieh Bourouni, "A New Framework for Selection of the Best Performance Appraisal Method", in European Journal of Social Sciences – Volume 7, Number 3 (2009)
- [3] Steven W. Pool , "The learning organization: motivating employees by integrating TQM philosophy in a supportive organizational culture" ,in Leadership & Organization Development Journal 21/8 [2000] 373-378 MCB University Press [ISSN 0143-7739]
- [4] Rafikul Islama and Shuib bin Mohd Rasad,"Employee Performance Evaluation by the AHP: A Case Study", in Asia Pacific Management Review (2006) 11(3), 163-176
- [5] Michael Paik, Navkar Samdaria, Aakar Gupta , Julie Weber, " A Biometric Attendance Terminal and its Application to Health Programs in India" in NSDR'10 June 15, 2010.
- [6] Debnath Bhattacharyya, Rahul Ranjan, Farkhod Alisherov A., and Minkyu Choi, "Biometric Authentication: A Review" in International Journal of u- and e- Service, Science and Technology Vol. 2, No. 3, September, 2009
- [7] K. Saraswathi, Dr. R. Balasubramanian and B. Jayaram, "Iris Biometrics Based Authentication and Key Exchange System " in IACSIT International Journal of Engineering and Technology, Vol.3, No.1, February 2011 ISSN: 1793-8236
- [8] K. Saraswathi, Dr. R. Balasubramanian and B. Jayaram," Retinal Biometrics based Authentication and Key Exchange System" in International Journal of Computer Applications (0975 – 8887) Volume 19– No.1, April 2011
- [9] Mohinder Pal Joshi, R.S. Uppal, Livjeet Kaur," Development of Vision Based Iris Recognition System " in (IAEST) INTERNATIONAL JOURNAL OF ADVANCED ENGINEERING SCIENCES AND TECHNOLOGIES Vol No. 6, Issue No. 2, 277 – 281
- [10] John Daugman , "How Iris Recognition Works" in IEEE TRANSACTIONS ON CIRCUITS AND SYSTEMS FOR VIDEO TECHNOLOGY, VOL. 14, NO. 1, JANUARY 2004
- [11] RICHARD P. WILDES, " Iris Recognition: An Emerging Biometric Technology ", PROCEEDINGS OF THE IEEE, VOL. 85, NO. 9, SEPTEMBER 1997
- [12] Kevin W. Bowyer, Karen Hollingsworth, and Patrick J. Flynn, " ImageUnderstanding for Iris Biometrics: A Survey" in Computer Vision and Image Understanding 110 (2), 281-307, May 2008.

- [13] Vanaja roselin.E.Chirchi, Dr.L.M.Waghmare , E.R.Chirchi, “ Enhancement of Person Identification using Iris Pattern” in International Journal of Scientific & Engineering Research Volume 2, Issue 4, April-2011 ISSN 2229-5518
- [14] http://www.who.int/hrh/migration/hmr_core_expert_mccaffery.pdf (Accessed on 2-9-2011) <http://www.articlesbase.com/software-articles/appraisal-system-module-has-automated-employee-performance-analysis-4908928.html> (Accessed on 15-4-2011)

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In-Vitro Antioxidant and Free Radical Scavenging Activity of *Bauhinia Variegata* Linn

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Abstract- In this present study our aim was to evaluate *In vitro* antioxidant and free radical scavenging potential of methanolic extracts of *Bauhinia variegata* Linn. Different parts of *Bauhinia variegata* like leaves, bark and flowers have free radical scavenging activity by hydroxyl radical scavenging method. All extracts have different level of antioxidant activity. Methanol extracts was found to be good solvent for extraction and having good antioxidant activity. IC₅₀ value of *Bauhinia variegata* leaf, stem bark and floral buds are 17.9, 19.5 and 17.2 ug/ml. The Reducing power of extracts was carried out with ascorbic acid as a standard reducing agent. All the analysis was made with the use of UV-Visible Spectrophotometer (UV -1601 SHIMADZU). In this plant (*Bauhinia variegata*) leaf, stem bark, floral buds extracts there was a remarkable concentration dependent free radical scavenging and reducing power was exhibited. These findings demonstrated that *Bauhinia variegata* possess free radical and hydroxyl radical scavenging activity as well as antioxidant activity *in vitro*. In conclusion the present study indicates that *Bauhinia variegata* may be a potential source of natural antioxidant.

Index Terms- Antioxidant activity, Hydroxyl radical, ascorbic acid, *Bauhinia variegata*, TBARS

I. INTRODUCTION

Bauhinia variegata is a medium sized deciduous tree found on the rocky hills of Circars, Deccan, and Carnatic regions of South India (Farnsworth, *et. al.*, 1985). An infusion from its bark is used as an astringent, tonic and useful in scrofula, skin diseases, and ulcers. The decoction of the roots is used in dyspepsia and as an antidote to snake poison (Gupta, *et. al.*, 1979). Previous phytochemical studies on the stems (Gupta, *et. al.*, 1980; Gupta and Chauhan, 1984; Gordon and David, 2001) flowers (Hirano, 1989; Jose, *et. al.*, 2007) and seeds (Ontbriand, 2000b) of this species have led to the isolation of several flavonoids. There are various types of the fatty acid compound found in *Bauhinia variegata* such as linolinic acid, oleic, steric, palmitic and myristic acid (Preston, *et. al.*, 1987) A new lectin from seeds of the *Bauhinia variegata* was purified and biochemically characterized (Raj Kapoor, *et. al.*, 2006). The Anti-inflammatory and antibacterial activity of all the extracts of *Bauhinia variegata* was reported (Raj Kapoor, *et. al.*, 2004; 2003). There are few reports on the antitumour activity of *Bauhinia variegata* ethanolic extract against Dalton's ascetic lymphoma (DAL) in *Swiss albino* mice (Raj Kapoor, *et. al.*, 2003). The increasing awareness among consumers about the relation

between diet and health is a sign for food producers to pay more attention to the possibilities of health protecting properties in new product development. Product characteristics such as sensory properties (taste, color and texture), microbiological safety, nutritive value, and keep ability have always been regarded as the only important quality attributes in food product development. Nowadays interest is growing for compounds that have been considered as nonnutritive, but which may play a physiological role in the human body. These compounds might be important in maintaining human health and are referred to as "bioactive compounds". Examples are flavonoids, glucosinolates, carotenoids, organosulfides, sterols, and peptides (Steinmetz and Potter, 1996). Since ancient times, many official herbs have provoked interest as sources of natural products. They have been screened for their potential uses as alternative remedies for the treatment of many infections and preservation of foods from the toxic effects of oxidants. A distinction must be made between water-soluble and fat-soluble antioxidants (Hirasa and Takemasa, 1998). Examples of water-soluble antioxidants are ascorbic acid (vitamin C) and B vitamins (e.g., thiamin and riboflavin), while tocopherols (such as vitamin E) and carotenoids (e.g., *beta*-carotene and Lycopene) are fat-soluble antioxidants. Antioxidants in the polyphenol and flavonoids groups vary in their hydrophilic-lipophilic properties (Steinmetz and Potter, 1996).

The preservative effect of many plant species and herbs suggests the presence of antioxidative and antimicrobial constituents (Hirasa and Takemasa, 1998). A number of phenolic compounds with strong antioxidant activity have been identified in these plant extracts (Nakatani, 1997). The antioxidative effect is mainly due to phenolic components, such as flavonoids (Pietta, 1998), phenolic acids, and phenolic diterpenes (Shahidi, *et. al.*, 1992), which can play an important role in absorbing and neutralizing free radicals, quenching singlet and triplet oxygen, or decomposing peroxides (Osawa, 1994). Many of these phytochemicals possess significant antioxidant capacity that may be associated with lower incidence and lower mortality rates of cancer in several human populations (Velioglu, *et. al.*, 1998). The purpose of this study was to evaluate *Bauhinia variegata* (kachnar) Linn as new potential sources of natural antioxidants. The antioxidant activities were determined by *in vitro* assays: inhibition of hydroxyl radicals by TBRAS system.

II. MATERIALS AND METHODS

Plant material – Aerial parts of *Bauhinia variegata* (Kachnar) like leaves, stem bark and floral bud were collected in the early

stages of vegetation from the Bhopal, and District Mandla (M.P.) ,India during the October month of 2006. The identification of the plant *Bauhinia variegata* L. (Kachnar) (family: *Leguminose*) was done by botanist Dr. S.S. Khan (Voucher Specimen No: SP/101/LGOB/2006), Department of Botany, Safia Science College, Bhopal, Madhya Pradesh (India).

Reagent and authentic samples – The reagents used were of highest purity (>99.95%) and were purchased from Sigma Chemical Co. (Germany). Sample absorbances were read using a Lambda 532 nm, UV - 1601 Spectrometer Shimadzu (Japan).

Preparation of *B. variegata* extract - Dried powdered plant material such as leaves, stem bark and floral buds (10 g) were extracted by continuous mixing in 100 ml 50% methanol, and stem bark in 95% methanol, 24 h at room temperature. After filtration, methanol was evaporated until only water remained through evaporation on water bath at 60-70 °c temperature. The dried powder were kept in air tied box.

Deoxyribose assay to assess OH⁻ radical scavenging activity

The OH⁻ radical scavenging activity of *Bauhinia variegata* leaves, stem bark, floral buds extract (10–100 ug/ml) were determined according to the deoxyribose method of Halliwell, *et. al.*, (1987) in the presence of 100 IM EDTA, FeCl₃, H₂O and ascorbic acid were prepared in degassed H₂O prior to use. The reaction tube contained (final concentrations) 3.6 mM deoxyribose, 100 IM EDTA, 1 mM H₂O₂, 100 IM L- ascorbic acid, 100 IM FeCl₃, H₂O in 25 mM phosphate buffer, pH 7.4 in 1.0 ml total volume. Follow in incubation at 38° C, 1 hrs, 1.0 ml 1.0% TBA in 0.05 M NaOH and 1.0 ml 10% TCA were added to the reaction mixture which was then heated in a boiling water bath for 15 min. Once samples were cooled, the absorbances were read at 532 nm. The IC₅₀ value of the crude extract was compared with that of ascorbic acid, which was used as the standard. Lower absorbance of the reaction mixture indicates higher free radical scavenging activity. The percent inhibition of hydroxyl radical was calculated as follows:

$$\% \text{Inhibition} = \frac{\text{Abs: 532 nm Control Abs.} - \text{532 nm sample Abs.}}{\text{Abs: 532 nm Control Abs.}} \times 100$$

532 nm Control Abs

Antioxidant capacity of test compounds was expressed as IC₅₀, the concentration necessary for 50% inhibition concentration of TBARS.

III. RESULT AND DISCUSSION

The effect of *Bauhinia variegata* extracts on inhibition of hydroxyl radical production was assessed by the iron (II)–dependent deoxyribose damage assay. The Fenton reaction generates hydroxyl radicals (OH⁻) that degrade deoxyribose using Fe⁺⁺ salts as an important catalytic component (11). Oxygen radicals may attack the sugar, which leads to sugar fragmentation. Addition of transition metal ions such as iron at low concentrations to deoxyribose causes degradation of the sugar into malondialdehyde and other related compounds which form a chromogen with thiobarbituric acid (TBA). Antioxidant activity of the extracts was compared with the standard drug ascorbic acid (Table 1) .The results of the effects of the examined *Bauhinia variegata* leaf, stem bark and floral buds, extracts as well as control solutions on OH⁻ radical production. They show that all extracts of *Bauhinia variegata* and control solutions inhibited the production of OH⁻ radicals. The % of free racial scavenging activity of methanolic extract of *Bauhinia variegata* leaf, stem bark and floral bud presented in Table 1. have reducing power, the free radial OH⁻ scavenging activity of the extract increases with increasing the concentration.

The IC₅₀ value of *Bauhinia variegata* leaf, stem bark and floral buds were shown the highest inhibitory activity with IC₅₀ of 17.9, 19.5 and 17.2 ug/ml, respectively. When compared to the reference substances, the all aerial parts of *Bauhinia variegata* extracts were found to be less efficient in radical scavenging. The scavenging effects of the examined extracts could be due to the flavonoids, but could also be a result of the activity of other secondary bimolecular present in the extracts. This indicates that the concentration of flavonoids is not the only factor related to the antioxidant activity. The possible synergism of flavonoids with other components present in the extracts may be responsible for this observation. Plant extract exhibited antioxidative potential and increased concentration of plant extract has shown increased antioxidative potential.

Table 1: Antioxidant activity of methanolic extracts of *B. variegata*

Concentration (µg/ml)	% of inhibition (TBARS)			
	Ascorbic acid	<i>B. variegata</i> leaf extract	<i>B. variegata</i> stem bark extract	<i>B. variegata</i> floral buds extract
10	25.89 ± 2.36	20.86 ± 1.94	19.42 ± 2.31	21.58 ± 1.92
20	60.43 ± 2.59	55.39 ± 1.73	51.43 ± 1.46	56.83 ± 1.93
30	70.50 ± 3.20	62.58 ± 2.53	60.07 ± 2..58	65.46 ± 1.87

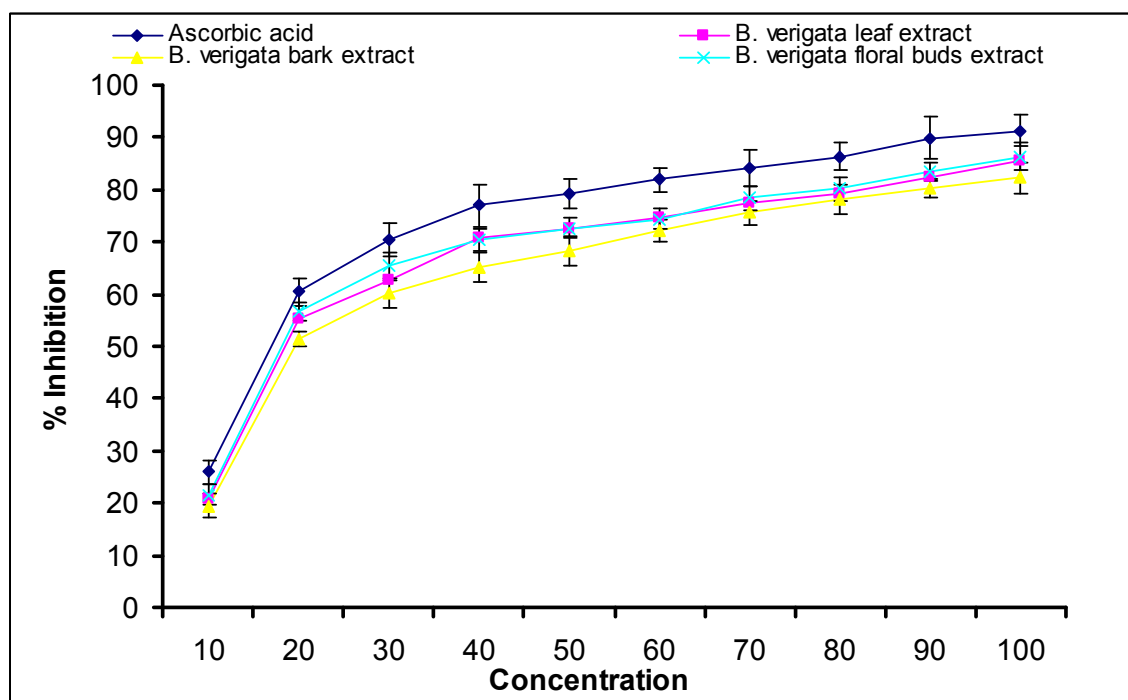
40	76.97 ± 4.03	70.86 ± 2.19	65.10 ± 2.80	70.50 ± 3.10
50	79.13 ± 2.85	72.66 ± 1.84	68.34 ± 2.79	72.66 ± 2.34
60	82.01 ± 2.31	74.82 ± 1.80	72.30 ± 2.10	74.46 ± 1.97
70	84.17 ± 3.44	77.33 ± 2.30	75.53 ± 2.34	78.41 ± 2.04
80	86.33 ± 2.90	79.13 ± 2.34	78.05 ± 2.81	80.21 ± 2.07
90	89.92 ± 4.16	82.37 ± 1.67	80.21 ± 1.81	83.45 ± 1.78
100	91.36 ± 2.87	85.61 ± 2.68	82.37 ± 2.98	86.33 ± 1.92
Control OD at 532 nm – 0.280				

IC₅₀ values:

S. No.	Group	IC ₅₀ Values
1.	Ascorbic acid	16 µg/ml
2.	<i>B. variegata</i> leaf extract	17.9 µg/ml
3.	<i>B. variegata</i> leaf extract	19.5 µg/ml
4.	<i>B. variegata floral</i> buds extract	17.2 µg/ml

a absorbance at 532 nm, **b** Scavenging effect (%) = [(Abs. Blank – Abs. sample)/ Abs. Blank] × 100

Group 1: Calibration curve for the total TBARS content of the *B. variegata* Leaf, stem bark and floral buds extracts.



IV. DISCUSSIONS

In these experiments antioxidant activity was determined by measuring the inhibition of TBARS by a range of ten different concentrations of a certain antioxidant. For each concentration the percent inhibition was measured after 60 min of incubation. The concentrations were chosen in such a way that the lowest concentration provided minimum inhibition of TBARS and the highest concentration gave maximum inhibition of TBARS. The reproducibility of this method is good, the variation in IC_{50} values that are obtained when standard antioxidant compounds are applied is 10-100ug/ml. Methanolic extracts of *Bauhinia variegata* species possess significant free radical scavenging, hydroxyl radical scavenging and antioxidant activity *in vitro*, which offer the possibility of using these extracts as natural antioxidants. In conclusion the results of this study demonstrated that using *in vitro* model *Bauhinia variegata* was found to have antioxidant activity. This activity was found due to presence of polar phenolic compounds flavonoid, tannin etc. Overall *Bauhinia variegata* can be considered as a model herbal drug for experimental studies including free radical induced disorders like cancer, diabetes, atherosclerosis etc. Further studies are required to establish its *in vivo* antioxidant activity using different animal models.

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REFERENCES

[1] Farnsworth, N.R., O. Akerele, A.S. Bingel, D.D. Soejarto, and Z. Guo. Medicinal plants in therapy. Bul. World Health Org. 1985, 63, 965-981.

[2] Gordon M.C., David J.N., Natural Product Drug Discovery in the next millennium, Pharm Biol. 2001, 39, 8-17.
[3] Gupta, A.K., Chauhan, J.S., Constituents from the stem of *Bauhinia variegata*. National Academy of Science Letters. 1984, 7, 15-16.
[4] Gupta, A.K., Vidyapati, T.J., Chauhan, J.S., 5,7-Dihydroxyflavanone-40-O- β -rhamnopyranosyl- β -d-glucopyranoside from *Bauhinia variegata*. Indian Journal of Chemistry. 1979, 18 (B), 85-86.
[5] Gupta, A.K., Vidyapati, T.J., Chauhan, J.S., Chemical examination of the stem of *Bauhinia variegata*. Planta Medica. 1980, 38, 174-176.
[6] Halliwell B., Gutteridge JMC, & Aruoma OI. The deoxyribose method: A simple "test-tube" assay for determination of rate constants for reactions of hydroxyl radicals. Analytical Biochemistry, 1987, 165, 215-219.
[7] Hirano, T., Oka, K., Akiba, M., Antiproliferative effect of synthetic and naturally occurring flavonoids on tumour cells of human carcinoma cells lines. Research Communication in Chemistry, Pathology and Pharmacology: 1989, 64, 69-78.
[8] Hirasa K and Takemasa M, *Spice Science and Technology*, Marcel Dekker, New York. 1998, 2, 87-89.
[9] Jose A. Silva, Daniela C., S. Damico, Paulo A. Baldasso, Marcelo A. Mattioli, Flavia V. WinckLeonardo F. Fraceto, Jose C. Novello and Sergio Marangoni, Isolation and Biochemical characterization of a galactoside Binding lectin from *Bauhinia Variegata* candida (Bvcl) seeds The Protein Journal, 2007, 26 (3), 193-201.
[10] Nakatani N, Antioxidants from Spices and Herbs, in Natural Antioxidants: Chemistry, Health Effects, and Applications (Ed. F. Shahidi), AOCS Press, Champaign, 1997, 64-75.
[11] Ontbriand, M. J. Senior and health-professionals' mismatched perceptions and communication about prescription and non-prescription medication. Canadian Journal on Aging, 2000b, 19, 35-56.
[12] Osawa T, Novel Natural Antioxidants for Utilization in Food and Biological Systems, in Postharvest Biochemistry of Plant Food-materials in the Tropics (Eds. I. Uritani, Garcia VV and Mendoza EM), Japan Scientific Societies Press, Tokyo, 1994, 241-251.
[13] Pietta PG, *Flavonoids in Medicinal Plants*, in *Flavonoids in Health and Diseases* (Eds. C. A. Rice-Evans and L. Packer), Marcel Dekker, New York, 1998, 61-110.
[14] Preston R.J., Dean B.J., Galloway A.F., Mcfee, Sheldy, Mammalian *in vivo* cytogenetic assay- analysis of chromosomal aberration in bone marrow cells Mutat. Res, 1987, 189, 157 - 165.

- [15] Raj Kapoor B., Jayakar B. and Murgesh N., Antitumor activity of *Bauhinia variegata* on Dalton's ascetic lymphoma. *Journal of Ethnopharmacology*, 2003, 89,107-109.
- [16] Raj Kapoor B., Jayakar B. and Murgesh N., Sub chronic toxicity of plant extract *Bauhinia variegata* on rats. *Journal of Ecotoxicology and Environmental Monitoring*, 2004, 14(1), 71-74.
- [17] Raj Kapoor B., Jayakar B., Murgeshand N.D., Akthisekaran. Chemoprevention and cytotoxic effect of *Bauhinia variegata* against Nnitrosodiethylamine induced liver tumors and human cancer cell lines. *Journal of Ethnopharmacology*, 2006, 104,407-409.
- [18] Shahidi F, Janitha PK and Wanasundara PD, Phenolic antioxidants, *Crit. Rev. Food Sci. Nutr.* 1992, 31, 67–103.
- [19] Steinmetz K A., Potter JD. Vegetables, fruit, and cancer prevention: a review. *J. Am. Diet. Assoc.* 1996, 96 (10): 1027-39.
- [20] Velioğlu Y.S., Mazza G., Gao L and Oomah BD, Antioxidant activity and total phenolics in selected fruits, vegetables and grain products, *J. Agric. Food Chem.* 1998, 46, 4113–4117.

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Study of a most meaningful Block Decodable Line Code for High Speed Optical Communication

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Abstract- In this paper a coding scheme is presented that allows the use of high-rate error control codes with a simple line code that gives tight run-length bounds. This implementation offers a small decrease in the overall code rate and is of particular interest in high speed optical communication systems. This code provides a most feasible mechanism for fruitful operation of an Optical Fiber Communication System.

Index Terms- Coding Scheme, Code Rate, Feasible, High Rate Error, Mechanism

I. INTRODUCTION

There is evidence that the error performance of long-haul high speed optical communication systems, employing optical amplifiers, can be improved if maximum run-length limited sequences are transmitted. In an experimental system, the bit error rate of a link was found to be markedly higher when a long m-sequence (with runs of the order of 30 bits) was used to generate the input data, compared with the results obtained using a short m-sequence (with runs of the order of 7 bits). This indicates that there is potential benefit in using run length limited coding. Since systematic error control, typically based on Reed-Solomon (RS) codes, is now employed for such systems, it is appropriate to devise arrangements that enable run-length limiting to be incorporated. In this particular context it is important to note that the data rates are very high (1 Gb/s and greater) so that any proposed codes must be of relatively low complexity if it is to be practically realizable.

II. A BLOCK DECODABLE LINE CODE

When RS coded data are used with a block decodable line code, the input size of the line code word can be selected to match the symbol size of the error control code. This avoids error extension due to the line code since it is restricted in only one n bit symbol of the RS code. The disadvantage of this approach is that the maximum rate of the line code that can be used is $n/(n+1)$. If a higher-rate line code is used, the error extension of the line code will affect more symbols, and in order to achieve the same residual bit error rate the use of either a more powerful RS code or interleaving is required. Here we present a new procedure which allows higher rate block decodable line codes to be used. Conventional techniques utilize an inner line code and an outer error control code. This has the disadvantages mentioned above. Our technique also utilizes two cascaded codes. However, the line code encapsulates the error control

code. The decoder is similar to that used in Error Correcting Line Codes 241. The received code word is initially error control decoded (before line decoding takes place) therefore error extension is virtually eliminated. Furthermore a line code with an arbitrary symbol length can be used.

The later only codes the information symbols, leaving the error control symbols uncoded, and so without run-length limitations. To combat this, the error control symbols are distributed as single bits between the lines coded symbols. By correctly designing the line code it is possible in most cases to incorporate this added bit in the maximum run-length of the code. To further increase the code rates, some of the information bits can be distributed uncoded between the line code words.

III. IMPLEMENTATION EXAMPLE

As an example consider an RS (255,245) five error correcting line code. For each code word 2040 bits are transmitted. With our procedure, 238 of the input symbols can be encoded using a 13B14B line code giving 136 line codewords, and leaving 136 bits uncoded (10 error control symbols and 7 information symbols) Those bits can be distributed one after each line code word, giving a sequence with a maximum run of 6 identical symbols.

This procedure can be viewed as using a line code with one 'systematic' bit. Such a code has the property that the non-systematic part is decoded independently of the value of that bit. This allows the transmission of the uncoded control symbols with a small increase in the complexity of the code.

IV. CONCLUSION

A coding scheme has been described that allows the use of high rate error control codes with a simple line code that gives tight run-length bounds with a small decrease in the overall code rate. This scheme is of particular interest in high speed optical communication systems.

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REFERENCES

- [1] Matrakidis and J.J. O'Reilly, "A Block Decodable Line Code for High Speed Optical Communication" IEEE Letters, 1997, pp 221-222.
- [2] R.W. Tkach, R.M. Derosier, F. Forghieri, A.H. Gnauck, A.M. Vengsarkar, D.W. Peckham, J.L. Zysking J.W. Sulhoff A.R. Chraplyvy, "Transmission of Eight 20-Gb/s Channels Over 232km of Conventional Single-Mode Fiber", *IEEE Photon. Technol. Lett.*, vol. 7, no. 11, pp. 1369-1371, Nov. 1995.
- [3] W. Krzymien: "Transmission Performance Analysis of a new Class of Line Codes for Optical Fiber Systems", *IEEE Trans. Commsn.*, vol. 37, no. 4, pp. 402-404, Apr. 1989.
- [4] J.P.J. Heemskerk, K.A. Schouhamer Immink, "Compact Disc: System Aspects and Modulation", *Philips tech. Rev.*, vol. 40, no. 6, pp. 157-164, 1982.
- [5] O'Reilly, A. Popplewell, "Class of Disparity Reducing Transmission Codes with Embedded Error Protection", *IEE PTOCI*, vol. 137, no. 2, pp. 73-77, Apr. 1990.

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Epigallocatechin-3-gallate (EGCG), a green tea polyphenol suppresses bacilli-induced augmented expression of *Mycobacterium tuberculosis* 85B and proinflammatory TNF- α in human monocytes

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Abstract- Reactive oxygen species (ROS) and tumor necrosis factor (TNF- α), the hallmarks of tuberculosis, are directly induced in human monocytes by *Mycobacterium tuberculosis* (*MTB*). We have previously shown that the expression of 85B in *MTB* infected monocytes correlates positively with both the amount of secreted TNF- α and subsequent mycobacterial growth. In this study, we show the augmented expression of 85B in *MTB* and TNF- α at both the gene and protein levels in *MTB*-infected monocytes were suppressed by EGCG, a green tea polyphenol, in dose-dependent manner. Of notable importance, the anti-inflammatory mechanism of EGCG was mediated by inhibition of NF- κ B pathway. Moreover, EGCG enhances the antioxidant potential of monocytes by ameliorating the intramonocyte sIFN- γ levels, glutathione levels and glutathione peroxidase activity, which correlates with the down regulation of TNF- α in *MTB*-infected monocytes. Taken together, this study provides the first novel insight into the possible anti-inflammatory and antioxidant role of EGCG that can be exploited in tuberculosis management.

Index Terms- Epigallocatechin-3-gallate (EGCG), glutathione peroxidase, IFN- γ , ROS, TNF- α

I. INTRODUCTION

Tuberculosis (TB), which claims between 2-3 million lives per year [1], is spiraling out of control at an alarming rate due to prevalence of multidrug-resistant (MDR) strains, emergence of AIDS-related TB [2, 3] and variation in the efficacy of Bacillus Calmette-Guerin (BCG) vaccine with respect to geographic latitude [4]. Moreover, despite of antibiotics helping in complete recovery from TB in non-MDR patients, reports are available where development of antibiotics-induced side effects is evident in host cells. Therefore, research interest has now been shifted in probing compounds from natural sources that have antioxidant, anti-inflammatory and antimycobacterial activity. Thus, after boosting host immunologic responsiveness, these compounds may be particularly useful in the treatment of both TB and MDR-TB.

We have already reported that the bacilli infection in host mononuclear phagocytes results in the induction of reactive oxygen species (ROS) leading to activation and upregulation of host TNF- α [5, 6]. TNF- α in turn, activates and upregulate *M.*

tuberculosis 85B which further elevates the host TNF- α levels forming a positive feedback loop [5, 7]. Therefore, the interaction of *MTB* 85B and host TNF- α creates a vicious circle in which each maintains the production of the other. The expression of 85B in *MTB*-infected monocytes correlates positively with both the amount of secreted TNF- α and subsequent intracellular mycobacterial growth [4]. Earlier reports by our group [5, 6] have already established the role of TNF- α as a significant mediator of macrophage activation which enables intracellular killing of *MTB*. However, both beneficial and deleterious effects of TNF- α in host contributing to the pathophysiology of tuberculosis have been reported [8].

EGCG (epigallocatechin-3-gallate), a green tea polyphenol, plays an important role in the prevention of cancer and cardiovascular diseases [9], acts as reversal agent of multidrug resistance (MDR) [10], and show anti-inflammatory property [11]. In this study, we for the first time experimentally demonstrated the incorporation of EGCG as an effective antioxidant and chemopreventive natural adjunct for the TB treatment. We show that EGCG exerts its potent antioxidant and anti-inflammatory effects on host mononuclear cells infected with *MTB* by suppressing the augmented expression of *MTB* 85B and proinflammatory TNF- α in human monocytes.

II. MATERIALS AND METHOD

2.1 Materials

Epigallocatechin-3-gallate (EGCG), SN50, its analogue SN50/M and Trypan blue were obtained from Sigma-Aldrich (St. Louis, MO, USA). Ficoll-Paque was obtained from Pharmacia (LKB Biotechnology Piscataway, NJ). All other chemicals used were of the highest purity grade available. Blood was obtained from healthy, non-smoking volunteers between 20–40 years of age.

2.2 Strain and media

M. tuberculosis (H₃₇Rv) was grown in Middlebrook 7H9 broth supplemented with Middlebrook ADC and characterized as described earlier [4].

2.3 PBMC preparation, infection and cell culture

PBMC (peripheral blood mononuclear cells) (>95% purity) were isolated from buffy coats of blood obtained from healthy donors.

Cells were adhered onto 12-well tissue culture plates (Costar Corp., Cambridge, MA) at $1-2 \times 10^6$ cells/well and resuspended in complete RPMI 1640 medium followed by incubation at 37°C , 5% CO_2 for 1–2 h adherence. Adhered monocytes were infected with *MTB* at 1:1 (bacteria/cell) as reported by us previously [5]. Control cultures received RPMI-1640 medium with 2% autologous serum while experimental cultures received varying doses of EGCG (0–25 $\mu\text{g/ml}$) immediately after infection. To assess the role of NF- κB , some cultures were pre-treated for 3 min with SN50 and its control analogue SN50/M (100 $\mu\text{g/ml}$). Then, cultures were harvested after 24 h and cells were lysed in 0.5 ml of TRIZOL Reagent (Invitrogen Inc., Carlsbad, CA). Culture supernatants were stored at -70°C until use.

2.4 Cell Viability Assay

Cell viability was determined using the MTT Cell Viability Assay kit (R & D Systems) according to the instructions provided in the kit to assess the effect of EGCG (0–25 $\mu\text{g/ml}$). Control cells were treated exactly the same except that no EGCG was added to the wells. The percentage of viable cells in these experiments was calculated by the formula [(Absorbance value of control/Absorbance value of treated) $\times 100$] and the results were expressed as “Viable cells (% of control).” Cell viability was also probed by Trypan blue exclusion assay as described earlier [13].

2.5 Isolation of total RNA and reverse transcription

Total RNA from uninfected as well as infected monocytes was isolated according to the instructions provided in the Qiagen kit (Valencia, CA). Reverse transcription reaction was carried out as described by us earlier [5]. The products obtained were analyzed by electrophoresis on ethidium bromide-stained 2% agarose gels.

2.6 Quantitative real-time RT-PCR

Quantitative real-time RT-PCR was employed to quantify host TNF- α gene transcription as described previously [4–7]. This technique affords a sensitive and specific quantification of individual RNA transcripts [14]. Human R18 housekeeping gene was employed to normalize gene expression. TaqMan PCR primers and probes as well as target-specific RT primer for each assay were designed as described elsewhere [5, 6]. All other conditions were exactly same as reported by us earlier [5]. In each sample, host 18S ribosomal RNA was used as internal control. Expression of TNF- α mRNA was normalized with internal control (host 18S rRNA) in the same sample and was expressed as copies of TNF- α in 10^{10} copies of R18 (equivalent to 1×10^6 monocytes).

2.7 Assay for glutathione peroxidase (GPx) activity and intramonocyte glutathione (GSH) levels in EGCG-treated infected monocytes.

Glutathione peroxidase (GPx) activity was measured as described elsewhere [15]. Briefly, *MTB*-infected monocytes were co-cultured for 24 h with or without 5 $\mu\text{g/ml}$ EGCG, 100 $\mu\text{g/ml}$ SN50 and 100 $\mu\text{g/ml}$ SN50/M. Cells were then scrapped, sonicated and centrifuged as described earlier [15]. The supernatants were subjected to GPx activity quantification in 100 μl /sample, with continuous photometric monitoring of oxidized glutathione (GSSG) at 37°C . The conversion of NADPH to

NADP was evaluated using UV absorbance at 340 nm [16]. GPx activity was calculated after subtraction of the blank value and expressed as μmol of NADPH oxidized/min/mg protein (U/mg protein).

Glutathione (GSH) levels were assayed spectrophotometrically by employing GSH kit (Calbiochem) in treated or control monocytes. Monocytes were mixed with equal volume of ice cold 5% metaphosphoric acid and centrifuged at 3000 rpm for 15 min. Supernatants were used for GSH assay, according to the instructions provided in the kit and described previously [7].

2.8 Measurement of secreted TNF- α , *MTB* 85B antigen and IFN- γ by ELISA.

The amount of soluble, secreted TNF- α , *MTB* 85B and sIFN- γ in various culture supernatants was determined using commercial ELISA Kits (R&D systems), according to the instructions provided with the kits.

2.9 Statistical analysis

All experiments were repeated twice to ensure for reproducibility. All assays and quantitative measurements were performed in triplicate. The data was analyzed for statistical significance by paired t test and expressed as mean \pm S.E. of three independent experiments. $P < 0.05$ was considered statistically significant.

III. RESULTS

3.1 Effect of EGCG on monocyte viability and housekeeping gene expression

EGCG (0–20 $\mu\text{g/ml}$; $P < 0.001$) failed to show any adverse effect on the viability of monocytes as revealed by MTT assay (Fig. 1A) and Trypan blue exclusion assay (data not shown). Cell viability is expressed as percent mean (\pm S.E.) viable cells compared to untreated cells (taken as 100% viable).

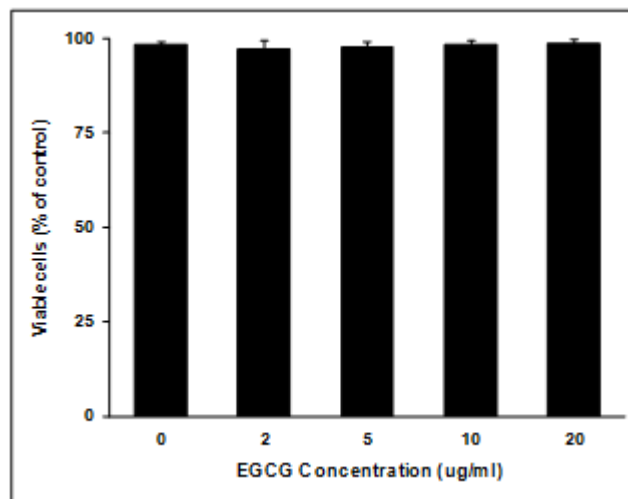


Fig. 1 (A) MTT cell viability assay for dose-effect of EGCG (0–20 $\mu\text{g/ml}$) on *MTB*-infected monocytes. Data represents the analysis of three independent experiments in duplicates, which are expressed as mean viable cells (\pm S. E.) percentage of controls.

Similarly, no effect of EGCG (0-25 $\mu\text{g/ml}$) was observed on housekeeping genes like R18 gene (18S rRNA) as depicted by quantitative real time RT-PCR (Fig. 1B). This indicates that EGCG does not affect human housekeeping gene transcription non-specifically.

3.2 EGCG downregulates expression of TNF- α and MTB 85B

It has been reported [4, 6] that the expression of *MTB* 85B mRNA increases early during infection of monocytes and

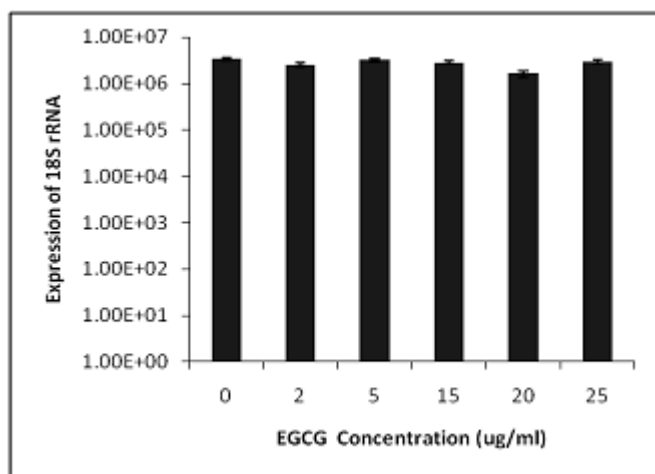


Fig. 1 (B) 'Real-time' quantitative RT-PCR for human housekeeping R18 gene (18S rRNA) in presence of EGCG (0-25 $\mu\text{g/ml}$), where data are mean (\pm S.E.) of three experiments

correlates positively with both the amount of secreted TNF- α and subsequent intracellular mycobacterial growth in *MTB*-infected monocytes. An attempt was made to probe the dose-response effect of EGCG on TNF- α and *MTB* 85B gene expression in *MTB*-infected monocytes. Infected/uninfected cultures devoid of EGCG served as controls. The effect of EGCG (0-20 $\mu\text{g/ml}$) on amplification of TNF- α and *MTB* 85B was found to be dose-dependent. The expression of 85B mRNA was normalized with mycobacterial 16S rRNA and expressed as 85B:16S. As revealed by 'real time' RT-PCR, in comparison to the control, a linear downregulation of TNF- α and *MTB* 85B mRNA copy numbers were recorded with 2, 5, 10 and 20 $\mu\text{g/ml}$ of EGCG, respectively (Fig. 2A and B). Computation of IC_{50} of EGCG (Figs. 2A and B) was found to be $\sim 5 \mu\text{g/ml}$.

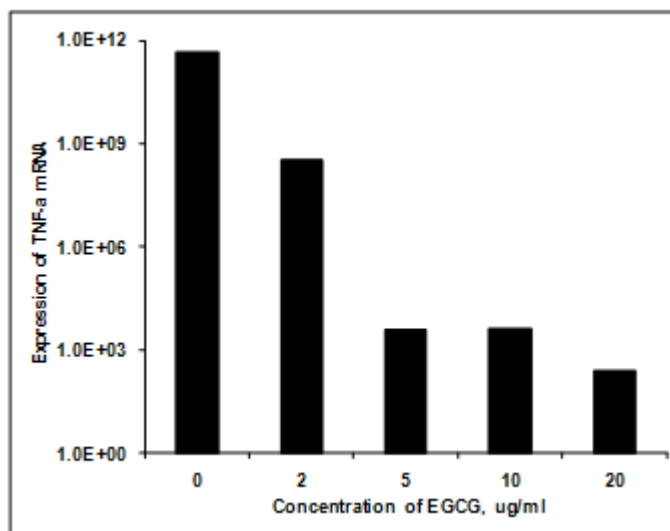


Fig. 2 (A) Dose response effects of EGCG (0-20 $\mu\text{g/ml}$) on expression of TNF- α by 'real time' RT-PCR in *MTB*-infected monocytes. Expression of TNF- α mRNA was normalized with host 18S rRNA and expressed as TNF- α in 10^{10} copies of R18 (equivalent to 1×10^6 monocytes.)

Similar dose dependent suppressive effects were recorded for the secreted TNF- α and *MTB* 85B proteins upon supplementation with EGCG (0-25 $\mu\text{g/ml}$) (Fig. 2C and D; $P < 0.001$). Thus, EGCG potentially inhibits the pro-inflammatory cytokine TNF- α and *MTB* 85B antigen.

3.3 EGCG modulates TNF- α level through inhibition of NF- κB

Induction of TNF- α by cellular activation is known to be mediated via NF- κB [17-19]. It has been well documented that TNF- α induced nuclear translocation of NF- κB is inhibited in SN50 peptide-treated human monocytic cell lines [20].

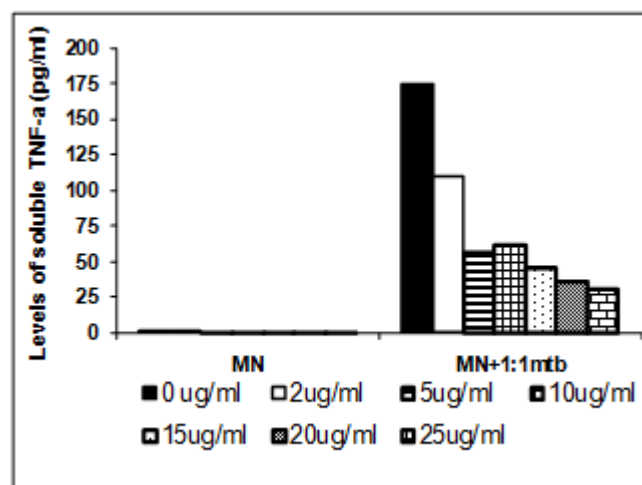


Fig. 2 (B) Dose response effect of EGCG (0-25 $\mu\text{g/ml}$) on expression of secreted TNF- α protein (pg/ml) in 24 h culture supernatant in *MTB*-infected monocytes. Data are mean (\pm S.E.) of three experiments.

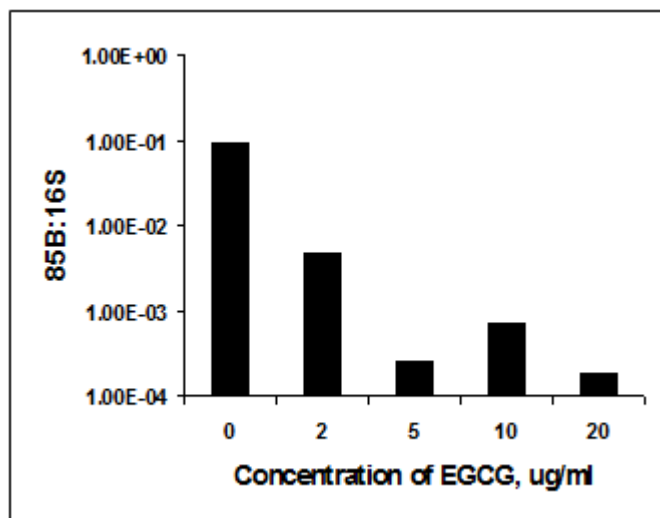


Fig. 2 (C) Dose response effect of EGCG (0-20 µg/ml) on 85B expression in 24 h culture of monocytes infected with MTB assessed by 'real time' RT-PCR. Expression of 85B was normalized with mycobacterial 16S rRNA and represented as 85B:16S ratio. Data are means (\pm SE) of three experiments.

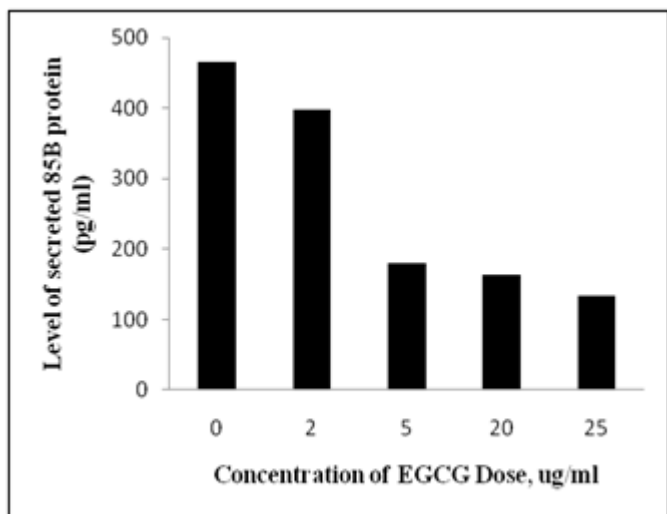


Fig. 2(D) Dose response effect of EGCG (0-25 µg/ml) on the secreted Antigen 85B protein in pg/ml. Antigen 85 complex were determined in culture supernatants at 24 h. Data are means (\pm SE) of three experiments.

Thus, we employed SN50, an inhibitor of NF- κ B, to assess the role of NF- κ B in EGCG mediated downregulation of TNF- α and MTB-85B expression in MTB-infected monocytes. SN50 (100 µg/ml) was added to monocytes 3 minutes prior to *M. tuberculosis* infection. At 24 hours, SN50 suppressed endogenous TNF- α mRNA expression in MTB-infected monocytes by around 6.2 logs ($P < 0.001$) in comparison to control cultures devoid of SN50 pre-treatment (Fig. 3A).

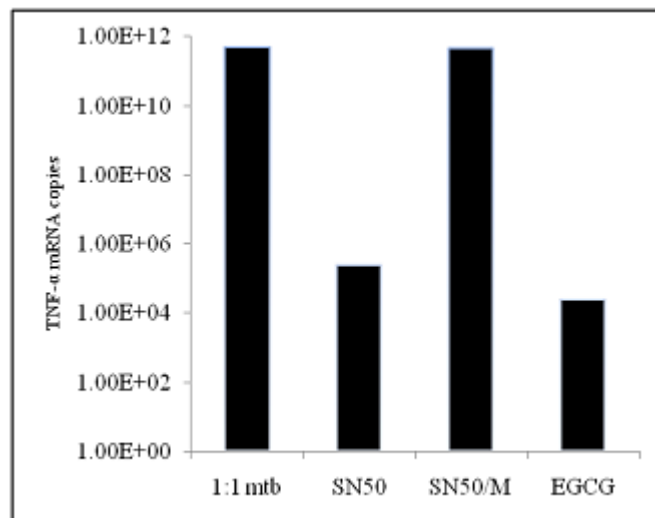


Fig. 3 (A) Effect of inhibition of NF- κ B on expression of TNF- α mRNA. Human monocytes were infected with MTB H37Rv (1:1 bacteria/cell) in the presence of 100 µg/ml of SN50 and SN50/M. Total RNA was extracted at 24 h and was assessed for expression of TNF- α mRNA. Data are mean (\pm S.E.) of three experiments.

Comparable results were observed when EGCG was employed. To ensure that cellular inhibition was specific, we compared the effect of SN50 with its inactive analogue, SN50/M. As expected, SN50/M failed to show any effect on TNF- α mRNA expression ($P > 0.05$) (Fig. 3A). Similarly, SN50 treatment led to decrease in the ratio of 85B:16S in MTB-infected monocytes (Fig. 3B). Therefore, it can be concluded that the increased expression of TNF- α and 85B mRNA in MTB-infected monocytes is mediated mainly via NF- κ B inhibition.

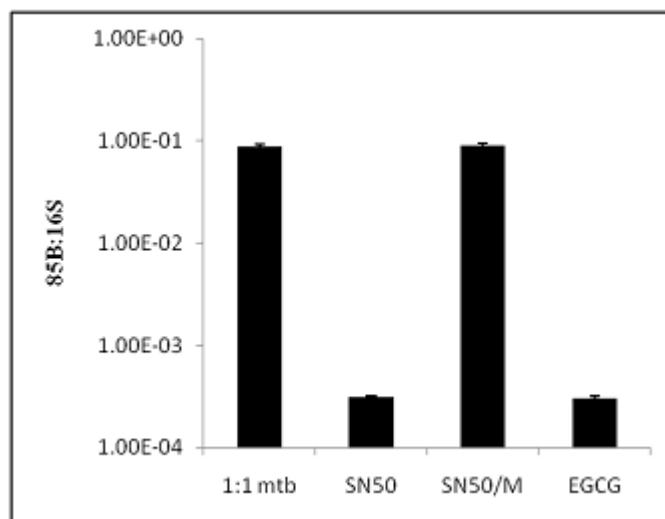


Fig. 3(B) Effect of SN50 (100 µg/ml) and SN50/M (100 µg/ml) on the expression of intramonocyte MTB 85B:16S ratio in *M. tuberculosis*-infected monocytes after 24 h of infection by 'real time' RT-PCR. MTB-infected monocytes (-) that were devoid of any supplement served as control. The results are mean (\pm SE) of three experiments.

3.4 EGCG enhances the anti-inflammatory and antioxidant potential of MTB infected monocytes

To probe the anti-inflammatory and antioxidant role of EGCG, we first measured the sIFN- γ levels in MTB-infected monocytes. Uninfected and untreated control monocytes in/of 24 hr cultures exhibited sIFN- γ levels of 262 pg/ml ($P>0.001$) (Fig. 4A). On the contrary, infected monocytes that were devoid of any EGCG, the sIFN- γ levels were found to be 81 pg/ml ($P>0.001$) (Fig. 4A). However, addition of EGCG in MTB-infected monocytes exhibited an augmentation in sIFN- γ levels to 233 pg/ml ($P>0.001$) (Fig. 4A). Thus, it appears that down-regulation of sIFN- γ levels in culture supernatant of MTB-infected monocytes is reversed by EGCG.

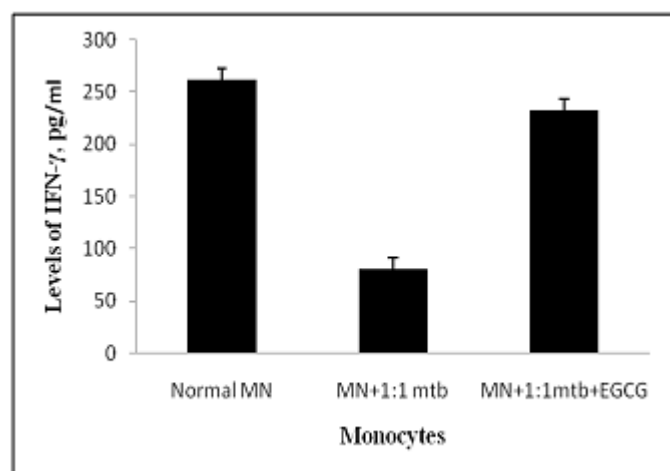


Fig. 4 (A) Assay of sIFN- γ by ELISA in monocytes that were uninfected and infected with MTB H37Rv (1:1 bacteria/cell) and supplemented with EGCG (5 μ g/ml). The concentration of sIFN- γ was determined in culture supernatant and expressed in pg/ml.

Data are mean (\pm S.E.) of three experiments.

Next, the glutathione (GSH) level was investigated in MTB-infected monocytes co-cultured for 24h with and without EGCG. Uninfected monocytes showed 269 pg/ml ($P>0.001$) GSH level, which was suppressed to 159 pg/ml ($P>0.001$) in MTB-infected monocytes. An elevation in GSH levels to 210pg/ml ($P>0.001$) was exhibited upon EGCG treatment (Fig. 4B).

IV. DISCUSSION

Widespread and prolonged usage of antibiotics in treating infection caused by *MTB* has led to the emergence of Multidrug resistance (MDR). Although, mechanisms of MDR and major factors which contribute to it are fairly established, there are evidences to suggest that MDR is a multi-factorial phenomenon which may be contributed by yet unknown mechanisms. EGCG being a potent reversal agent of MDR [21], was selected in the present study. That enhancement of TNF- α and ROS being a significant parameter for *MTB* proliferation in host cells [5-7], this study probed the EGCG-induced regulation of ROS and TNF- α activation in *MTB*-infected human monocytes. TNF- α is implicated in both the pathophysiology and protective host response to *MTB* [22]. Since elevated level of TNF- α are present at the site of *MTB* infection, monocytes isolated from TB

patients produce more TNF- α in vitro than those from uninfected donors [23]. Moreover, ROS are also involved in promotion of TB as free radicals generated in *MTB*-infected cells stimulate TNF- α causing *MTB* proliferation. Our findings show that EGCG induce dose dependent suppression of augmented TNF- α and *MTB* 85B at both gene and protein levels in *MTB*-infected monocytes. Also, EGCG ameliorated the sIFN- γ and intramonocyte glutathione levels, which correlate inversely with the down regulation of ROS and TNF- α in *MTB*-infected monocytes. Thus, EGCG exerts potent anti-inflammatory effects on host mononuclear cells infected with *MTB*. EGCG does not affect the human housekeeping gene R18, thereby demonstrating that EGCG did not mediate cellular death, but induce specific inhibition of expression and secretion of pro-inflammatory molecules. The results indicate an appreciable EGCG-induced suppression in endogenous TNF- α mRNA expression in *MTB*-infected monocytes. Elevated expression of TNF- α mRNA and activation of a relevant transcription factor, NF- κ B has been reported in monocytes cells treated with *MTB*. Our results are in accordance to our previous findings [5] where induction of TNF- α expression due to *MTB* infection was mediated through activation of NF- κ B, as evident by the suppression of TNF- α mRNA in presence of SN50, an inhibitor of NF- κ B. It has been previously shown that in electrophoretic mobility shift assay (EMSA), TNF- α induced nuclear translocation of NF- κ B was inhibited by SN50 peptide [20]. The NF- κ B heterodimer is retained in the cytoplasm in an inactive form through association with one of the I κ Ba inhibitory proteins. The degradation of I κ B releases active NF- κ B, which translocates to the nucleus and regulates gene expression by binding to κ B binding sites or by interacting with other transcriptional factors [24]. Our data suggests that EGCG-induced effect involves inhibition of the NF- κ B pathway probably by inhibiting the degradation of I κ Ba, however this remains to be experimentally validated. Since a number of genes involved in inflammatory responses are regulated by NF- κ B pathway, thus high magnitude down regulation of the NF- κ B pathway by EGCG would predictably reduce the elaboration of NF- κ B mediated TNF- α mRNA expression. Based on IC₅₀ values, EGCG exerted an appreciable degree of neutralization effects on TNF- α induced action in *MTB* infected human monocytes.

Alteration of redox status upon inflammation is associated with activation of phagocytes and increased formation of reactive oxygen and nitrogen intermediates [25]. Up regulation of sIFN- γ in culture supernatant coupled with simultaneous down regulation of TNF- α at both the gene and protein levels is indicative for anti-inflammatory and protective immune response properties of EGCG. GSH, a known antioxidant, helps in neutralizing ROS generated inside the cell. Similarly GPx, which catalyzes the removal of peroxide ions, as well contribute towards the antioxidant mechanisms. We observed a decline in GSH levels in *MTB*-infected monocytes, thereby correlating with earlier reports that substantial amount of ROS are generated in cells infected with *MTB* due to cellular activation [8, 16]. Intriguingly, augmentation in both GSH levels and GPx activity were observed on treatment with EGCG, thus indicating EGCG to be an effective natural antioxidant combating ROS that was generated as a consequence of cellular activation in *MTB*-infected mononuclear phagocytes.

V. CONCLUSION

In conclusion, our study demonstrates that ameliorated GSH and sTNF- γ levels correlate inversely with the downregulation of TNF- α mRNA expression and ROS in monocytes infected with *MTB*. Therefore EGCG, could help in arresting the vicious circle created as a consequence of interaction between *MTB* 85B and host TNF- α , where each maintains the production of the other. The data generated in the present study involving infected human monocytes, strongly indicate EGCG to be a potential adjunct in the treatment of TB. Hence, EGCG may prove to be safe, economic and natural anti-oxidant whose therapeutic potential could be exploited in future for TB management.

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REFERENCES

- [1] Z. Toossi, M. Wu, N. Islam, L. Teixeira-Johnson, R. Hejal and H. Aung, *Transactivation of human immunodeficiency virus-1 in T-cells by Mycobacterium tuberculosis-infected mononuclear phagocytes*, J. Lab. Clin. Med. 2004; 144(2):108-15.
- [2] Z. Toossi, *Virological and immunological impact of tuberculosis on human immunodeficiency virus type 1 disease*, J. Infect. Dis. 2003; 188:1146-1155.
- [3] L. B. Reichman, *Tuberculosis drug resistance comes full circle*, Lancet. 2008; 371(9618):1052-3.
- [4] R. J. Wilkinson, L. E. Desjardins, N. Islam, et al, *An increase in expression of a Mycobacterium tuberculosis mycolyl transferase gene (fbpB) occurs early after infection of human monocytes*, Mol Microbiol. 2001; 39:813-821.
- [5] N. Hasan, N. Yusuf, Z. Toossi and N. Islam, *Suppression of Mycobacterium tuberculosis induced reactive oxygen species (ROS) and TNF- α mRNA expression in human monocytes by allicin*, FEBS Letters. 2006; 580:2517-2522.
- [6] N. Islam, R.A. Kanost, L. Teixeira-Johnson, R. Hejal, H. Aung, R.J. Wilkinson, et al, *The role of cellular activation and tumor necrosis factor alpha (TNF- α) in the early expression of M. tuberculosis 85B mRNA in human alveolar macrophages*, J Infect Dis. 2004;190: 341-351.
- [7] N. Hasan, M.U. Siddiqui, Z. Toossi, S. Khan, J. Iqbal N. Islam, *Allicin induced suppression of Mycobacterium tuberculosis 85B mRNA in human monocytes*, Biochem Biophys Res Comm. 2007;355(2):471-476.
- [8] L. G. Bekker, A.L. Moreira, A. Bergtold, S. Freeman, B. Ryffel and K. Gilla *Immunopathologic effects of tumor necrosis factor alpha in murine mycobacterial infection are dose dependent*, Infect Immun. 2000;68(12):6954-6961.
- [9] D. Chen, V. Milacic, M.S. Chen, et al, *Tea Polyphenols their biological effects and potential molecular targets*, Histol Histopathols. 2008;23(4):487-96.
- [10] R. S. Feldberg, S.C. Chang, A.N. Kotik, M. Nadler, Z. Neuwirth, Sundstrom et al. *In vitro mechanism of inhibition of bacterial cell growth by allicin*, Antimicrob. Agents Chemotherapy. 1988; 32:1763-1768.
- [11] J.C. Shanahan and St W. Clair, *Tumor necrosis factor alpha blockade: a novel therapy for rheumatic disease*, Clin Immunol. 2002; 103:231-42.
- [12] Y. Z. Lin, S.Y. Yao, R.A. Veach, T.R. Torgerson and J. Hawiger, *Inhibition of nuclear translocation of transcription factor NF- κ B by a synthetic peptide containing a cell membrane permeable motif and nuclear localization sequence*, J. Biol. Chem. 1995;270:14255-14258.
- [13] L. Pool-Zobele, C. Guigas, R.G. Kien, C.H. Neudecker, H.W. Renner, P. Schmezer, *Assessment of genotoxic effects by lindane*, Food Chem Toxicols. 1993;31:271-283.

- [14] C. Hartel, G. Bein, H. Kirchner and H. Kluter, *A human whole blood assay for analysis of T-cell function by quantification of cytokine mRNA*, Scand. J. Immunol. 1999; 49:649-654.
- [15] J. Mohandas, J.J. Marshall, G.G. Duggin, J.S. Horvath and D.J. Tiller, *Low activities of glutathione-related enzymes as factors in the genesis of urinary bladder cancer*, Cancer Research. 1984;44:5086-5091.
- [16] J. M. Mates, J. M. Segura, C. Perez-Gomez, R. Rosado, L. Olalla, M. Blanca and F. M. Sanchez-Jimenez, *Antioxidant enzymatic activities in human blood cells after an allergic reaction to pollen or house dust mite*, Blood Cells, Molecules and Diseases 1999; 25(7):103-109.
- [17] Z. Toossi, B.D. Hamilton, M.H. Phillips, L.E. Averill, J.J. Ellner and A. Salvekar, *Regulation of nuclear factor- κ B and its inhibitor I κ B- α /MAD-3 in monocytes by Mycobacterium tuberculosis and during human tuberculosis*, J. Immunol. 1997; 159:4109-4116.
- [18] J. Fan, R.S. Frey, A. Rahman and A.B. Malik, *Role of neutrophil NADPH oxidase in the mechanism of TNF α -induced NF- κ B activation and intracellular adhesion molecule-1 expression in endothelial cells*, J. Biol. Chem. 2002;277:3404-3411.
- [19] N. Hasan, N. Yusuf, Z. Toossi and N. Islam, *Suppression of Mycobacterium tuberculosis induced reactive oxygen species (ROS) and TNF- α mRNA expression in human monocytes by allicin*, FEBS Letters. 2006; 580:2517-2522.
- [20] Y.Z. Lin, S.Y. Yao, R.A. Veach, T.R. Torgerson and J. Hawiger, *Inhibition of nuclear translocation of transcription factor NF- κ B by a synthetic peptide containing a cell membrane permeable motif and nuclear localization sequence*, J. Biol. Chem. 1995;270:14255-14258.
- [21] W. Dongzhi, M. Yuying, L. Jianwen, *Quantification of doxorubicin and validation of reversal effect of tea polyphenols on multidrug resistance in human carcinoma cells*, Biotech Letters. 2003;25(4):291-294.
- [22] J.L. Flynn, M.M. Goldstein, J. Chan, et al, *Tumor necrosis factor- α is required in the protective immune response against Mycobacterium tuberculosis in mice*, Immunity. 1995; 2:561-572.
- [23] P.F. Barnes, S. -J. Fong, P.J. Brennan, P.E. Twomey, A. Mazumder, R.L. Modlin, *Local production of tumor necrosis factor and IFN- γ in tuberculous pleuritis*, J. Immunol. 1990;145:149-154.
- [24] K. Brown, S. Gerstberger, L. Carlson, G. Franzoso and U. Siebenlist, *Control of I kappa B- α proteolysis by site-specific, signal-induced phosphorylation*, Science. 1995; 267:1485-1488.
- [25] S.R. Thomas, H. Salahifar, R. Mashima, N.H. Hunt, D.R. Richardson, and R. Stocker, *Antioxidants inhibit Indoleamine 2,3-Dioxygenase in IFN- γ -activated human macrophages: Posttranslational regulation by Pyrrolidine Dithiocarbamate*, J. Immunol. 2001; 166:6332-6340

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The effects of climatic change on the diversity & composition of phytoplankton community in Tungabhadra Reservoir

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Abstract- The autotrophic plankton comprising the major position in reservoirs acts as a basic food material in the aquatic food-chain. Plankton acts as biomarkers for the water quality assessment which facilitates fish production. 21 hydrological parameters with meteorological factors were studied in Tungabhadra reservoir (TBR) at 15° 12' 18" N and 76° 13' 30" E from Jan 2009 to Dec 2010 covering summer, monsoon & transition periods chiefly to understand the plankton productivity. Qualitative analysis varied significantly during the study period. Maximum diversity was recorded in the months of Dec-Mar. A total of 53 species of phytoplankton representing four classes were recorded in the up-streams. Among the Bacillariophyceae, melosira was significantly dominant. Abundance of desmids was the indication of relatively unpolluted condition in the up-streams of Tungabhadra Reservoir. Yet it is experiencing drastic climatological changes.

Index Terms- Tungabhadra reservoir, phytoplankton, climatic change and hydrology

I. INTRODUCTION

Both phytoplankton and zooplankton play a significant role in the aquatic food chain. Phytoplankton form primary producers of food on which zooplankton feed upon. Some genera of phytoplankton act as biological indicators of water quality (Patrick, 1971). Zooplankton ecology is closely related to fishery limnology.

The sustainability of fish diversity and its abundance is based on the quality of water existing in that locality. All the hydrological parameters as well as plankton diversity influences the production of fish species. The plankton diversity is solely dependent upon the hydrological parameters. The present investigation is aimed at studying hydro-biological status of Tungabhadra Reservoir (TBR) with special reference to plankton.

II. METHODOLOGY

STUDY AREA:

Tungabhadra reservoir is geographically located at 76° 21' 10" E latitude and 15° 15' 19" N longitude, near Mallapur village about 5 kilometers away from Hospet. Sampling was done at

15° 12' 18" N and 76° 13' 30" E from Jan 2009 to Dec 2010 for the period of 24 calendar months.

SAMPLING STATION:

The sampling station is highly prone to change characteristics. Satellite imagery of the reservoir is depicted in the plates 1-3.

ANALYTICAL METHOD

SAMPLING PROGRAM AND LABORATORY PROCEDURES:

Water samples were collected in the one liter plastic bottles and transported to the laboratory for analysis. Air and water temperature were measured at the sampling site itself at 8 a.m. and recorded. pH of water body was also recorded at the sites using pH meter. Further analysis of water parameters such as free CO₂, Dissolved Oxygen (DO), Total alkalinity (TA), Total Dissolved Solids (TDS), Total Suspended Solids (TSS), phosphates, sulphates, nitrates, total hardness, electrical conductivity, fluoride, chloride, turbidity, iron, magnesium, calcium including BOD & COD were carried out as per the standard methods (APHA, 1992) and presented in the table-1&2. Phytoplankton samples were collected monthly for the same period. Phytoplankton was collected by filtering 100 liters of water through the nylon bolting cloth (mesh 25nm). Plankton samples fixed at 100ml were kept for about 24hr to settle & stored in small vials. The samples were used for further investigation. For microscopic investigation one ml. sample was taken on "Sedgewick Rafter cell". Averages of 5 to 10 counts were made for each sample and the results are expressed as number of organisms per liter of sample. The identification of phytoplankton was done with the help of standard books and monographs (Smith, 1950; Ward and Whipple 1959; Desikachary, 1959; Prescott, 1962; and Turner, 1982). The total number of phytoplankton present in a liter of water sample was calculated using the formula:

$$N = \frac{n \times v}{V} \times 1000$$

Where N: total number of phytoplankton cells per liter of water filtered,

n: average number of phytoplankton cells in 1 ml of plankton sample,

v: volume of plankton concentrate (ml),

V: volume of total water filtered (lit).

III. RESULTS & DISCUSSION



Plate 1: Satellite pictograph of Indian sub-continent



Plate 2: Tungabhadra Reservoir elevation at 50 miles



Plate 3: Tungabhadra Reservoir elevation at 15 miles

The results on various physico-chemical parameters data on water quality parameters having a direct bearing upon the distribution and ecology of various phytoplankton communities in the reservoir were collected. Monthly fluctuations of different phytoplankton groups are also presented.

Phytoplankton ('phyto' = plant; 'planktos' = made to wander) are single celled algae, some of which are capable of movement through the use of appendages while the others drift with currents. In the present study phytoplankton community during 2009 is represented by the members of Cyanophyceae, Bacillariophyceae, Chlorophyceae, Dinophyceae and

Euglenophyceae. The phytoplankton members comprised of 53 species of which 09 belonging to Cyanophyceae, 24 to Chlorophyceae, 16 to Bacillariophyceae, 01 to Dinophyceae and 3 to Euglenophyceae. Among the total phytoplankton, Chlorophyceae contributed 45.28% of the total population during the study period. The next dominant group was the Bacillariophyceae which comprised of 30.19% followed by Cyanophyceae that were 16.98% and Euglenophyceae 5.66% during Dec 2009 - Jan 2010 study period. (Fig.1)

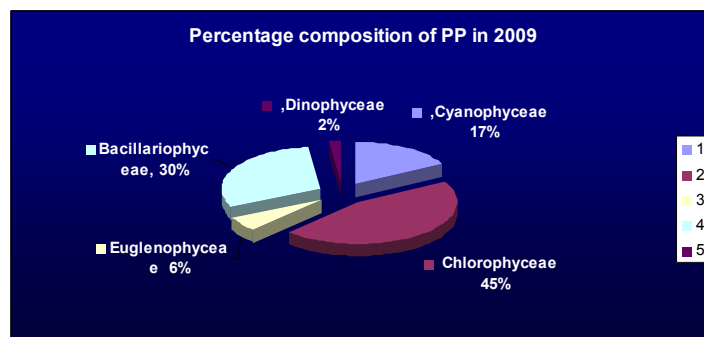


Fig 1: Percentage composition of phytoplankton community in TBR

Similarly percentage composition of phytoplankton community during 2010 is represented by the members of Bacillariophyceae, Chlorophyceae, Cyanophyceae, Euglenophyceae and Dinophyceae respectively (Fig.2).

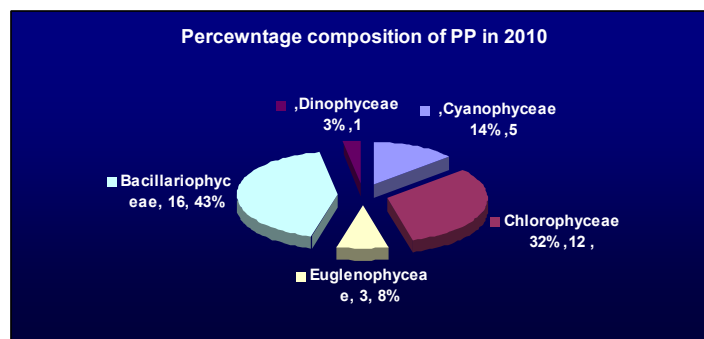


Fig 2: Percentage composition of phytoplankton community in TBR

Srinivasan (1964) and Jepachandramohan et al., (2009) observed similar results in Amaravathi reservoir and in Pechiparai reservoir in the earlier studies. In the present study the maximum diversity was recorded in the post monsoon period that is in the months of Dec - Mar. This could be due to the prolonged availability of light in the post monsoon period and significantly high inflow of nutrients during the monsoon. Based on the studies it is concluded that there exists a strong correlation between the population, diversity and the productivity of the phytoplankton. Naik et al., (2005) stated that maximum value of pH and nitrate supports the growth of Cyanophyceae. The inland freshwater ecosystems are being increasingly subjected to greater stress from various human activities.

	2009	JAN'09	FEB'09	MAR'09	APR'09	MAY'09	JUN'09	JUL'09	AUG'09	SEP'09	OCT'09	NOV'09	DEC'09	Unit
1	Air temp	30.50	31.50	31.50	30.50	31.00	31.00	30.00	29.00	29.80	30.50	30.00	31.00	°C
2	Water temp	28.00	30.00	30.00	28.50	30.00	29.50	28.90	27.00	28.00	29.00	29.00	29.50	°C
3	Turbidity	15.00	12.00	18.00	15.00	16.00	16.00	10.00	15.00	20.00	18.00	10.00	12.00	NTU
4	TDS	110.00	180.00	300.00	260.00	250.00	200.00	190.00	260.00	210.00	180.00	220.00	150.00	mg/L
5	TSS	50.00	20.00	70.00	70.00	90.00	60.00	30.00	120.00	140.00	50.00	80.00	20.00	mg/L
6	E Cond	210.00	200.00	350.00	290.00	260.00	290.00	280.00	390.00	410.00	200.00	260.00	250.00	µS/cm
7	Total alkalinity	145.00	90.00	80.00	75.00	95.00	40.00	30.00	90.00	100.00	90.00	70.00	70.00	mg/L
8	COD	40.00	100.00	110.00	110.00	90.00	80.00	40.00	100.00	130.00	510.00	400.00	340.00	mg/L
9	BOD	2.00	3.00	3.00	4.00	3.00	2.00	2.00	3.00	4.00	3.00	3.00	4.00	mg/L
10	D O	6.00	6.20	5.00	5.50	6.00	4.50	5.20	6.00	4.00	6.50	5.00	6.20	mg/L
11	Sulphate	30.00	20.00	40.00	60.00	50.00	20.00	30.00	60.00	60.00	50.00	40.00	30.00	mg/L
12	Nitrate	2.00	2.00	2.50	2.60	1.80	2.50	2.20	2.10	2.60	2.00	3.00	2.90	mg/L
13	Phosphate	2.00	1.00	1.00	2.00	1.00	1.00	3.00	4.00	2.00	2.00	2.00	2.00	mg/L
14	Ca	27.00	20.00	35.00	40.00	32.00	25.00	23.00	35.00	40.00	30.00	32.00	20.00	mg/L
15	Mg	3.00	11.50	8.60	13.00	12.00	7.50	3.80	15.00	14.00	8.00	8.50	9.00	mg/L
16	Fe	1.50	2.00	1.50	2.00	2.00	2.50	3.00	3.50	4.00	3.00	2.50	1.50	mg/L
17	Flouride	0.90	0.50	0.40	0.50	0.40	1.00	0.50	0.50	0.40	0.50	0.50	0.40	mg/L
18	CO2	1.20	1.70	1.60	1.60	1.70	1.20	1.80	2.00	1.50	1.60	1.50	1.40	mg/L
19	pH	8.50	8.30	8.30	8.40	8.50	8.10	8.00	7.90	8.30	8.30	8.40	8.00	-- --
20	Cl	29.00	22.00	29.00	40.00	42.00	38.00	40.00	40.00	36.00	32.00	30.00	30.00	mg/L
21	Hardness	85.00	70.00	90.00	95.00	110.00	50.00	45.00	130.00	120.00	70.00	80.00	65.00	mg/L

Table 1. Hydrological data from January2009 to December 2009 from Tungabhadra reservoir.

	2010	JAN'10	FEB'10	MAR'10	APR'10	MAY'10	JUN'10	JUL'10	AUG'10	SEP'10	OCT'10	NOV'10	DEC'10	Unit
1	Air temp	29.0	30.0	30.5	29.0	29.5	30.0	30.5	29.0	29.5	30.0	30.0	30.0	°C
2	Water temp	26.0	28.0	29.0	27.0	29.0	29.0	28.0	26.0	27.0	29.0	28.0	29.0	°C
3	Turbidity	14.0	12.0	18.0	16.0	12.0	14.0	12.0	18.0	20.0	16.0	14.0	12.0	NTU
4	TDS	98.0	156.0	289.0	260.0	240.0	200.0	220.0	280.0	260.0	198.0	200.0	160.0	mg/L
5	TSS	40.0	16.0	80.0	66.0	88.0	60.0	40.0	140.0	120.0	40.0	80.0	20.0	mg/L
6	E Cond	214.0	198.0	356.0	340.0	360.0	285.0	272.0	410.0	400.0	240.0	280.0	260.0	µS/cm
7	Total alkalinity	134.0	80.0	78.0	84.0	96.0	30.0	30.0	80.0	98.0	86.0	68.0	72.0	mg/L
8	COD	40.0	60.0	160.0	120.0	80.0	60.0	40.0	120.0	160.0	540.0	340.0	320.0	mg/L
9	BOD	3.0	2.0	3.0	4.0	3.0	2.0	2.0	3.0	4.0	3.0	4.0	3.0	mg/L
10	D O	6.0	6.0	5.0	6.0	6.0	4.0	5.0	6.0	4.0	6.0	4.0	6.0	mg/L
11	Sulphate	30.0	20.0	40.0	40.0	60.0	20.0	20.0	40.0	60.0	40.0	36.0	30.0	mg/L
12	Nitrate	2.6	2.0	2.5	1.5	2.0	2.0	2.0	2.0	3.0	2.0	3.0	1.6	mg/L
13	Phosphate	2.0	1.0	1.0	2.0	2.0	1.0	1.0	3.0	4.0	2.0	4.0	2.0	mg/L
14	Ca	28.0	24.0	48.0	32.0	38.0	20.0	22.0	40.0	46.0	28.0	32.0	22.0	mg/L
15	Mg	2.6	11.7	8.3	13.6	13.1	7.8	4.4	17.5	14.0	7.8	8.6	9.7	mg/L
16	Fe	2.0	2.0	1.5	2.0	2.0	3.0	4.0	4.0	3.0	3.0	2.0	2.0	mg/L
17	Flouride	0.6	0.4	0.4	0.5	0.5	1.0	0.5	0.5	0.5	0.6	0.5	0.2	mg/L
18	CO2	1.5	1.7	1.6	1.7	1.8	1.6	1.4	2.0	1.8	1.6	1.4	1.6	mg/L
19	pH	8.3	8.5	8.4	8.3	8.4	8.3	8.2	8.3	8.4	8.2	8.4	8.0	-- --
20	Cl	30.0	20.0	28.0	42.0	40.0	32.0	32.0	40.0	38.0	34.0	28.0	24.0	mg/L
21	Hardness	94.0	72.0	82.0	88.0	92.0	52.0	46.0	112.0	128.0	60.0	64.0	62.0	mg/L

Table 2. Hydrological data from January2010 to December 2010 from Tungabhadra reservoir.

IV. CONCLUSION

The present study revealed that the distribution and population density of phytoplankton species depend upon the physico-chemical parameters of the environment. It is clear from the results that the reservoir is mesotrophic and aging towards eutrophication especially in the upstreams. Hence measures should be taken to minimize the pollution by preventing entry of debris from the anthropocentric activities, controlled disposition from the neighboring farm lands. To monitor the continuous potential fish yield from the reservoir, annual documentation is necessary. Any fluctuation in the plankton biomass and diversity will reflect upon the zooplankton community thereby affecting fish production as certain plankton are the indicators of water quality. In addition the data generated is essential so that this information may be used in taking decision for conservation and effective utilization of water bodies. In the climate-warming scenario, it is expected that low flows in rivers would be more severe along with a general water stress. Water demand in coming years by municipal and industrial sectors would increase; substantial increases in withdrawals for irrigation are expected; a growing human population will increase water demand more. The adaptive capacity under such situation will depend on the abilities to implement integrated water resource management approaches for the sustenance of reservoir productivity.

REFERENCES

- [1] Patrick, R. 1971. Algae as indicator of pollution. In Robt A Taft (ed). Biological problems in water pollution. Sanitary Engg. Center, Cincinnati, Ohio, 223-231.
- [2] David, A., P. Ray, V. B. Govind, K. V. Rajagopal and R. K. Banerjee, 1969a. Limnology and fisheries of the Tungabhadra reservoir, *Bulletin 13, Central Inland Fisheries Research Institute*, Barrackpore, pp 188.
- [3] Naik, U.G., Bhosale, S.H., Rathod, J.L., and Bhat, V.G. (2005). Diversity of phytoplanktonic groups in the river kali, west coast of India. Proceeding of Senior, Lecture University Grants Commission Haveri, pp. 192-196
- [4] APHA (1998). Standard method for the examination of water and waste water, (19th Ed). New York: American Public Health Association, Inc.
- [5] Ward, H.B. and Whipple, G.C. (1959). Fresh water biology . 2nd edition (Ed W/T. Edmondson L. John) Wiley and sons, New York.
- [6] Desikachary, T.V (1959). Cyanophyta. ICAR. Monograph, ICAR, New Delhi. Prescott, G.W (1962). Algae of the Western Great lakes area Wm. C Brown CO. Dubuque Iowa.

- [7] Munawar, M. (1970). Limnological studies on fresh. Water ponds of Hyderabad India II. The biocoenose distribution of Cellular and colonial phytoplankton in polluted and unpolluted environments. *Hydrobiologia*, 36/05428
- [8] Philipose, M.T. (1959). Chlorococcales, New Delhi ICAR. Sankala, S.K., Jain, S.L., Dhakar, M.L., and Vyas L.N (1981). Phytoplankton Periodicity in three lakes around Udaipur. *Acta Limnology India*, 1, 11-16.
- [9] Tripathy, A.K., and Pandey S.N. (1990). Water Pollution. Ashish Publishing House, 1, 326. Velecha, V., and Bhatnagar, G.P. (1988). Seasonal changes of phytoplankton in relation to some physico-chemical factors in lower lake Bhopal. *Geobios*, 15, 170-173.
- [10] Gonzalves, E.A., and Joshi, D.B. (1964). The seasonal succession of the algae in tank of Bandra. *Journal of Bombay Natural History Society*, 46, 1544, 154-176.
- [11] Goldman, C.R., and Horne, A.J. (1983). Limnology p. 1464. Japan: Mc Graw Hill Inc. Jana, B.B. (1973). Seasonal periodicity of plankton in fresh water in west Bengal, India. *International Review Ges. Hydrobiologia*, 58, 127-143.
- [12] Chitra, P. and Meera, S. (2004). Flora of temporary water bodies along with the semi coastal line chackai to Shagusham in Thiruvananthapuram. *India Hydrobiology*. 7(1&2): 47-51.
- [13] Hosmani, S.P. (1988). Seasonal changes in phytoplankton communities in a fresh water pond at Dharwad, Karnataka state, India. *Phykos*. 27: 82-87.
- [14] Jose, L. and patel, R.J. (1991). An ecological study of algae in the central waste water treatment plant of India petrochemical corporation Ltd., Baroda. *Geobios*. 18 (2-3): 87-91. Smith, G.M. (1950). The fresh water Algae of the united states, MC. Graw Hill Book Company-Inc, Newyork Toronto London. 719 pp.
- [15] Dutta, N., Malhotra, J.C. and Bose, B.B. (1954). Hydrobiology and Seasonal fluctuations of the phytoplankton in the Hooghly estuary in IPFC. *Proc*. 35-47.
- [16] Turner, W.B. (1982). The Fresh Water Algae of East India. K. Svenska Vetensk. Akad. H and Le, 25(5): pg 187.
- [17] Hosetti. B.B. & Aravind kumar. 2001. A textbook of Applied aquatic biology, Daya publishing house, New Delhi

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Mobile Banking as Technology Adoption and Challenges: A Case of M-Banking in India

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Abstract- If technological revolution is at its peak, one of the notable sectors of the economy where technology is at its helm of affairs with respect to customer service is BANKING. Over the years, banking has transcended from a traditional brick-and-mortar model of customers queuing for services in the banks to modern day banking where banks can be reached at any point for their services. In today's business, technology has been on the predominant indicators of growth and competitiveness. The banking industry today is in the industry of its revolution. Information technology has basically been used under two different avenues in banking. One is communication and connectivity and other is business process. Today, banks have welcomed wireless and mobile technology into their boardroom to offer their customers the freedom to pay bills, planning payments while stuck in traffic jams, to receive updates on the various marketing efforts while present at a party to provide more personal and intimate relationships. This paper examines consumer adoption of a new electronic payment service as mobile banking and the factors influencing the adoption of mobile banking in India.

Index Terms- MPSP, mobile banking, mobile payments

I. OBJECTIVE OF THE STUDY

This study plans to 'plug' gap of research in the acceptance of mobile banking among the consumers. The primary objective of this study are to :

- focus on the adoption of mobile banking services by consumers
- Identify factors influencing the adoption and usage of mobile banking in India.

The personal characteristics of mobile banking users were found to be important determinants of their adoption decisions. This finding provides the financial services industry with a better understanding of customer perceptions of mobile banking services and helps them plan their marketing strategies and promotion approaches for mobile banking services in the future.

II. RESEARCH METHODOLOGY

For the present research, the paper is based on Exploratory Research. The major emphasis of Exploratory Research is on the discovery of ideas. Through Exploration, the researcher develops concepts more clearly, establish priorities, develop operational definitions, and improve the final research design. This research is both quantitative and qualitative. This research is based on the data collected through "Questionnaire" with Mobile banking User and Non-user.

III. RESEARCH DESIGN

The data have been grouped into two main categories - primary and secondary data. The secondary data have been compiled from newspaper, journals, magazines, and web links and also research papers. The primary data have been collected through an exploratory research – Questionnaire with user and non user of mobile banking basically Businessmen, servicemen, professionals, students etc.

IV. LITERATURE REVIEW

Adoption of tele-banking [1] as well as Internet banking [2] has received research attention in recent years. Much of the existing research in electronic banking services has adopted an organizational perspective [3] or a distribution channel perspective [4]. Consumers using these services have been focus in a large body of current research, nevertheless customer behavior in mobile banking context have remained rather uncharted territory. This paper aims at filling that gap by shedding light on the general usage of mobile services and in particular on influence of demographic characteristics on usage. The survey was conducted among Ghaziabad bank customers. The paradigm shift, from traditional branch banking to electronic banking; the newly emerged channels; rapidly increasing penetration rates of mobile phones are among other the motivators of this study. The approach employed is practical and provides insights drawn from the quantitative empirical survey.

The newly emerged mobile banking services represent an innovation where both intangible service and an innovative medium of service delivery employing high technology are present. Thus, concepts of innovation and diffusion of innovation are even more intricate as technology and service aspects have an effect on the characteristics of mobile banking services[5]. Traditionally research relating to the customer adoption of innovation has tended to concentrate on socio-demographic and psychographic attributes of potential adopters. Even though these kind of personal characteristics of a consumer have found to be predictors of adoption [1], an increasing body of research has demonstrated that it is the perceived attributes of innovation itself rather than the personal characteristics that are the stronger predictors of the adoption decision [6]. In the search to understand consumers' adoption of innovation, and where research has focused on the consumer perspective, Rogers' diffusion model, which originally dates back to 1962, has often been employed[8]. Within financial services innovation research [7], [9,10], have applied Rogers' model to Internet banking.

According to Rogers (1995)[11] the perceived innovation characteristics are supposed to provide the framework how potential adopters perceive an innovation. Research that has investigated the product characteristics of innovation has

generally endorsed evaluating the innovation along the product characteristics that involve five constructs; relative advantage, compatibility, complexity, trialability and observability[12]. Concept of perceived risk is often included as augmented by Bauer (1960)[13]. Particularly in banking services the perceived risk associated with the financial product itself as well as with electronic delivery channel is higher than in basic consumer goods, and hence increasing the importance of this attribute of innovation[14]. Ensuring security and confidentiality are the fundamental prerequisites before any banking activity involving sensitive information can take place[15]. Relative advantage, compatibility, trialability and observability are positively related to adoption of an innovation and the remaining two, complexity and perceived risk, negatively related[11]. These innovation attributes and their influence on adoption of mobile banking services are detailed under empirical implications.

V. INTRODUCTION OF MOBILE BANKING

The mobile banking is defined as “the provision of banking services to customers on their mobile devices”: specifically the operation of bank current and deposit or savings accounts. According to recent research findings and forecasts in business, media and academia, mobile phones and handheld devices should have been firmly established as an alternative form of payment in most technologically advanced societies [16]. Despite ongoing efforts by key players such as banks, mobile network operators and mobile payment service providers (MPSP) in promoting and offering mobile payment options, absence of widespread customer acceptance of this innovation have resulted in a lag in the adoption of mobile payments as an alternative form of payment mechanism [17]. While each of these players approach the market with different expectations, several studies have shown that merchant/consumer adoption is key to the success of mobile payments [16, 17]. ‘Mobile payments are defined as the use of a mobile device to conduct a payment transaction in which money or funds are transferred from a payer to a receiver via an intermediary or directly without an intermediary’ [18]. Due to the all-encompassing nature of this definition, it should be made clear that a distinction exists between mobile payments and mobile banking. The latter refers to mobile payment transactions that are exclusive to their respective customers whilst the former is a mode of payment that is widely available to all parties in a retail environment [18]. Mobile payments have been suggested as a solution to facilitate micropayments in electronic and mobile commerce transactions and to encourage reduced use of cash at point-of-sales terminals [18, 19]. If efforts in promoting the use of mobile payments succeed, it will boost both ecommerce and m-commerce adoption and may be the killer service in 2.5G, 3G and beyond [17]. The early development of mobile payment was largely triggered by the high penetration rate of mobile phones and handheld devices in most markets. Mobile phones today clearly outnumber every other mobile device. With a mobile phone subscriber base of 500 million, which is expected to reach 700 million by 2012 according to the Department of Telecommunications (DoT), the India can easily expect mobile commerce or m-commerce to take off faster than online or e-commerce.

VI. MOBILE BANKING ADOPTION IN INDIA

In India, the situation of the banks is quite different from the banks overseas particularly in developed markets. Indian banks are not facing huge write downs or losses and are still quite well capitalized. In India, however, this could be an opportune moment for banks to focus on the internal processes and consolidate their IT platforms across functionalities to use technology as an effective strategic tool. The use of technology in India has undergone rapid transformation. The last two decades have witnessed a sea change in the nature of services offered by not only banks but also the financial sector and even the Government - all of which have had a positive impact on the customers of these organizations and the general public at large.

Financial Services are generally complex and need a lot of trust for the consumer to use technology. Banks have changed from paper-based banking solutions provider to the latest of the technologies like online-banking, mobile-banking, etc. It is surprising to know as to why most of the Indian customers have not welcomed this up gradation. Customers across the world, even technologically optimists, have refrained from using technology aided solutions. There are many reasons why technology has not been able to ride the acceptance wave and cross the hurdle and become an acceptable feature in banking. As today's banking has redefined itself as customer centric, it becomes more important that the customer is happy with the services being provided. Unfortunately, the acceptance and adoption rates are very low even in the case of educated customers. The paper looks at various factors which explain why consumers are not using mobile banking and other technologies in banking. It would also try to suggest why people are not currently using mobile banking and try to suggest how to overcome this problem and increase the acceptance levels.

Data has been collected from various sources; there is a combination of both primary and secondary data that has been used in this research.

A. Primary Data

The data for the research is extracted from a survey conducted in Ghaziabad in U.P., India. A total of 100 respondents participated in the research of Mobile banking. The demographic profile of respondents in each research is shown in Table and chart. The data collected through this method was adequate enough to make projections in the research.

B. Secondary Data

Articles have been sourced from magazines and journals dealing with current issues in mobile banking adoption. Internet & Text books related to Mobile Banking & Research Methodology have been a major secondary source for the extraction of the expert's opinion.

1. Factors that affect Mobile Banking Adoption

In order to identify the top and least five perceived items in affecting the adoption intention of Mobile banking; the percentage score of the respondents was computed? Table provides the result.

Table 1 : Demographic Profile of Respondents

Characteristics	Frequency	%age
Gender		
Male	65	65
Female	35	35
Age		
<20	1	1
20-29	68	68
30-39	21	21
40-49	5	5
>50	5	5
Income (Monthly)		
<Rs. 5,000	65	65
>=Rs.15,000	23	23
Missing	12	12

Table 2 : Most and Least Perceived Factors in Mobile Banking Adoption

Items	Percentage of Using Mobile Banking Population (%)
1. I would use Mobile banking if I could use it on a trial basis first to see what it can offer	81
2. I would use Mobile banking if I could see a trial demo first?	76
3. I would use Mobile banking if I could test Mobile banking first?	75
4. I would use or be more likely to use Mobile banking if Mobile banking was compatible with my lifestyle?	45
5. I would use or be more likely to use Mobile banking if using my Mobile to conduct banking transactions fits	35

into my working style?	
6. Mobile banking is a risky mode of banking to use?	54
7. Mobile banking would allow me to manage my finances more efficiently?	44
8. Mobile banking would be complex to use?	60
9. I would use Mobile banking if Mobile banking increased my status?	71
10. Mobile banking would require a lot of mental effort?	63

The findings in table indicate that adoption of Mobile Banking appears to be influenced by its trialability and compatibility. Regarding the least perceived items that affect mobile banking adoption, these seem to be related to complexity, relative advantage and perceived risk of Mobile Banking are perceived as factors least affecting its adoption.

Table 3 shows the intention to adopt the mobile banking and the factors to adopt that affect such intention.

Compactibility	46%
Trial Ability	59%
Risk	64%
Complexity	49%
Adoption Intent	40%

Factor 1: Access Problems

It is the most important factor, Accessing Problem statements such as 'Possibility of error is higher than Internet Banking', Using key code list with mobile phone is complicated and Mobile phone is an unpractical device for banking emerge with good positive correlations. The great influence on the adopters not to have mobile banking services.

Factor 2: Dissatisfaction

Four variables load on to this factor. 'Dissatisfaction' is the second significant factor, which accounts of the variations. The statements 'Data transmission is very slow', Mobile banking services are risky and not secure, Mobile banking services are not enough versatile and Its use has been a disappointment by others signify that the non-adopters have seen the dissatisfaction among the users of mobile banking services.

Factor 3: Inability to Provide Knowledge

This is another crucial factor, which is reflection of variations. The statements of insufficient guidance is there for using mobile banking and its use is complicated which reflects that consumer behavior tends to be based on how a given problem is to be solved. In this research, the non-adopters of mobile banking are afraid of being the usage of new technology due to the complications in the systems and, moreover, no proper guidance is provided to them.

VII. DISCUSSIONS AND RECOMMENDATIONS

The banks providing mobile banking services to their customers, wishing to increase their customer share by removing all the above-discussed hurdles in the way of adoption of mobile banking services, may find relevant information from the findings. The factors appear to be defined by a mix of items that are reflections of problems in supplier side of the services and functionality of a mobile phone as delivery medium for banking services from the customer side. As the Internet banking is still in its growing stage, mobile banking has emerged as the next advance way of doing banking. Since the pace of technology advancement is not matching with the adoption rate, problems will arise if this widened gap is not going to be filled up with suitable measures. This negative effect of accelerating pace of development is manifested in services that are launched at an early stage of development process due to competitiveness and cost pressures. As a consequence, competence of service quality, does not reach an adequate level; consumers feel that service-providers are not responding to their needs. An example of that is the support for the item services are not enough versatile. In addition, emphasizing technology in service offering may result in ignoring certain fundamental prerequisites required for acceptance. Technology is an enabler a way to build up a new delivery channel, but communicating only technological features other elements of services such as service content. Technology-based electronic delivery medium does not constitute service offering and creates value alone, but service content has to function properly and the way of usage has to be known. Another main impediment seems to be functionality of a mobile phone as delivery medium for banking services. Mobile phone, obviously is not designed for this type of services: For instance, key board is relatively small, which makes it more prone for correcting errors in keeping the figures. Results indicate that consumers get disheartened by the complicated functions while accessing the mobile banking services which lead them to the dissatisfaction level as no proper guidance is to be provided to them. The fact is that the factor risk and security are the most considerable significant factors for banking service adoption, and particularly in relation to 'new' electronic environment. The result of perceived risk on the adoption of mobile banking services appears to indicate that consumers are serious about the risk of conducting banking via a wireless channel, measured in terms of overall security and trustworthiness of the services offered. On the basis of the findings, it is suggested that service providers be aware of the problems of their customer base using mobile services. This kind of data has its value when designing new services and products or implementing market communications. In addition, information gained from experience with Internet banking and other modes of electronic banking cannot be

straightforward implemented to mobile banking service customers. Given the increased competition and pressures to cut expenses, financial institutions have to be able to make informed decisions on resource allocation. Thus, research of this kind is of critical importance.

VIII. CONCLUSION

It is well recognized that mobile phones have immense potential of conducting financial transactions thus leading the financial growth with lot of convenience and much reduced cost. For inclusive growth, the benefits of mobile banking should reach to the common man at the remotest locations in the country. For this all stakeholders like Regulators, Govt, telecom service providers and mobile device manufactures need to make efforts so that penetration of mobile banking reaches from high-end to low-end users and from metros to the middle towns and rural areas. Inclusion of non-banking population in financial main stream will benefit all. There is also need to generate awareness about the mobile banking so that more and more people use it for their benefit.

REFERENCES

- [1] Al-Ashban, A. A. & Burney, M. A. 2001. Customer adoption of tele-banking Technology: the case of Saudi Arabia. *International Journal of Bank Marketing*. Vol. 19 (5), pp. 191-200.
- [2] Bradley, L. & Steward, K. 2002. A Delphi study of the drivers and inhibitors of Internet banking. *International Journal of Bank Marketing*. Vol. 20 (6), pp. 250-260.
- [3] Daniel, E. 1999. Provision of electronic banking in the UK and the Republic of Ireland. *International Journal of Bank Marketing*. Vol. 17 (2), pp. 72-82.
- [4] Black, N. J. & Lockett, A. & Ennew, C. & Winklhofer, H. & McKechnie, S. 2002. Modelling consumer choice of distribution channels: an illustration from financial services. *International Journal of Bank Marketing*. Vol. 20 (4), pp. 161-173.
- [5] Thornton, Jennifer and White, Lesley (2001), "Customer Orientations and Usage of Financial Distribution Channels," *Journal of Services Marketing*. Vol. 15 (3), 168-185.
- [6] Mohr, J. 2001. *Marketing of high-technology products and innovations*. Upper Saddle River: Prentice Hall.
- [7] Black, N. J. & Lockett, A. & Winklhofer, H. & Ennew, C. 2001. The adoption of Internet financial services: a qualitative study. *International Journal of Retail and Distribution Management*. Vol. 29 (8), pp. 390-398.
- [8] Howcroft, B. & Hamilton, R. & Hewer, P. 2002. Consumer attitude and the usage and adoption of home-banking in the United Kingdom. *International Journal of Bank Marketing*. Vol. 20 (3), pp. 111-121.
- [9] Polatoglu, V. N. & Ekin, S. 2001. An empirical investigation of the Turkish consumers' acceptance of Internet banking services. *International Journal of Bank Marketing*. Vol. 19(4), pp. 156-165.
- [10] Tan, M. & Teo, T. S. H. 2000. Factors influencing the adoption of Internet banking. *Journal of the Association for Information Systems*. Vol. 1 (5), pp. 1-42.
- [11] Rogers, E. M. 1995. *Diffusion of innovations*. 4th edition. New York: Free Press.
- [12] Moore, G. C. & Benbasat, I. 1991. Development of an instrument to measure the perceptions of adopting an information technology innovation. *Information Systems Research*. Vol. 2 (3), pp. 192-222.
- [13] Bauer, R.A. 1960. Consumer behaviour as risk taking. *Proceedings of the Educators Conference, American Marketing Association*, pp. 389-398.
- [14] Harrison, T. 2000. *Financial services marketing*. Wiltshire: Prentice Hall.
- [15] Jayawardhena, C. & Foley, P. 2000. Changes in the banking sector - the case of Internet banking in the UK. *Internet Research: Electronic Networking Applications and Policy*. Vol. 10 (1), 19-30.

- [16] K. Taga and J. Karlsson, Arthur D. Little Global M-Payment Report. Austria, Vienna, 2004.
- [17] S.Karnouskos, "Mobile Payment: A journey through existing procedures & standardization initiatives " IEEE Communications Surveys & Tutorials, pp. 44-66, 2004.
- [18] N. Mallat, "Exploring consumer adoption of mobile payments - A qualitative study," Journal of Strategic Information Systems, vol. 16, pp. 413-432, 2007.
- [19] D. B. Begonha, A. Hoffman, and P. Melin, "M-payments; hang up, try again," Credit Card Management, vol. 15, pp. 40-44, 2002.

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Configuring an EIGRP based Routing Model

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Abstract- The term *routing* is used for taking a packet from one device and sending it through the network to another device on a different network. Routers don't really care about hosts—they only care about networks and the best path to each network. Due to the major role that routing protocol play in computer network infrastructures, special cares have been given to routing protocols with built –in security constraints. In this paper we have shown how we can do routing with an EIGRP based routing protocol. A network model of Cisco routers has been employed in a network simulation software 'packet tracer'. Eventually an EIGRP routing protocol has been configured and run on a network model. Among all the routing protocols available EIGRP protocol has been mostly used for routing a complex network.

Index Terms- cisco, configuring, EIGRP, network, packet tracer, routing, routing protocol, simulation

I. INTRODUCTION

Enhanced IGRP (EIGRP) is a classless, enhanced distance-vector protocol that gives us a real edge over another Cisco proprietary protocol, Interior Gateway Routing Protocol (IGRP). That's basically why it's called Enhanced IGRP. Like IGRP, EIGRP uses the concept of an autonomous system.

EIGRP is sometimes referred to as a hybrid routing protocol because it has characteristics of both distance-vector and link-state protocols. For example, EIGRP doesn't send link-state packets as OSPF does; instead, it sends traditional distance-vector updates containing information about networks plus the cost of reaching them from the perspective of the advertising router. And EIGRP has link-state characteristics as well—it synchronizes routing tables between neighbors at startup and then sends specific updates only when topology changes occur. This makes EIGRP suitable for very large networks. EIGRP has a maximum hop count of 255 (the default is set to 100).

There are a number of powerful features that make EIGRP a real standout from IGRP and other protocols. The main ones are listed here:

- 1) Support for IP and IPv6 (and some other useless routed protocols) via protocol dependent modules.
- 2) Considered classless (same as RIPv2 and OSPF).
- 3) Support for VLSM/CIDR.
- 4) Support for summaries and discontinuous networks.
- 5) Efficient neighbor discovery.
- 6) Communication via Reliable Transport Protocol (RTP).
- 7) Best path selection via Diffusing Update Algorithm (DUAL).

B. Neighbour Discovery

Before EIGRP routers are willing to exchange routes with each other, they must become neighbors. There are three conditions that must be met for neighbourhood establishment:

- 1) Hello or ACK received
- 2) AS numbers match
- 3) Identical metrics (K values)

Link-state protocols tend to use Hello messages to establish neighborhood (also called adjacencies) because they normally do not send out periodic route updates and there has to be some mechanism to help neighbours realize when a new peer has moved in or an old one has left or gone down. To maintain the neighbourhood relationship, EIGRP routers must also continue receiving Hellos from their neighbors.

Let's define some terms before we move on:

C. Feasible distance

This is the route that you will find in the routing table because it is considered the best path. The metric of a feasible distance is the metric reported by the neighbor (called reported or advertised distance) plus the metric to the neighbor reporting the route.

D. Advertised distance

This is the metric of a remote network, as reported by a neighbor. It is also the routing table metric of the neighbor and is the same as the second number in parentheses as displayed in the topology table, the first number being the feasible distance.

E. Neighbor table

Each router always keeps state information about adjacent neighbors. When a newly discovered neighbor is learned, the address and interface of the neighbor are recorded, and this information is held in the neighbor table, stored in RAM. There is one neighbor table for each protocol-dependent module.

F. Topology table

The topology table is populated by the protocol-dependent modules and acted upon by the Diffusing Update Algorithm (DUAL). It contains all destinations advertised by neighboring routers, holding each destination address and a list of neighbors that have advertised the destination.

G. Feasible successor

A feasible successor is a path whose reported distance is less than the feasible distance, and it is considered a backup route. EIGRP will keep up to six feasible successors in the topology table. Only the one with the best metric (the successor) is copied and placed in the routing table.

H. Successor

A successor route (think successful!) is the best route to a remote network. A successor route is used by EIGRP to forward traffic to a destination and is stored in the routing table. It is backed up by a feasible successor route that is stored in the topology table—if one is available. By using the feasible distance, and

having feasible successors in the topology table as backup links, the network can converge instantly, and updates to any neighbor make up the only traffic sent from EIGRP.

II. EIGRP METRICS

Another thing about EIGRP is that unlike many other protocols that use a single factor to compare routes and select the best possible path, EIGRP can use a combination of four:

- 1) Bandwidth
- 2) Delay
- 3) Load
- 4) Reliability

Like IGRP, EIGRP uses only bandwidth and delay of the line to determine the best path to a remote network by default.

And it's worth noting that there's a fifth element, maximum transmission unit (MTU) size. This element has never been used in EIGRP calculations, but it's a required parameter in some EIGRP related commands, especially those involving redistribution. The value of the MTU element represents the smallest MTU value encountered along the path to the destination network.

III. VIRTUAL NETWORK SIMULATION MODEL

We have developed a virtual networking model comprising of CISCO routers by using Virtual networking simulation software named packet tracer as shown in fig 1. We have used many components such as routers, switches and make physical connection by connection cables to serial and fast Ethernet ports.

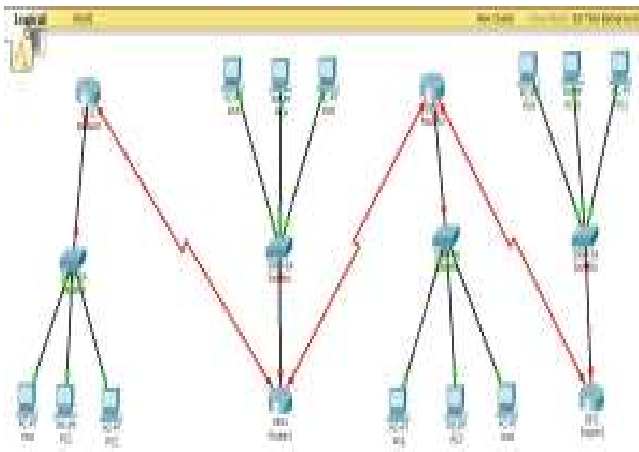


Figure 1: virtual network model on packet tracer

IV. CONFIGURING NETWORK WITH EIGRP

A. Configuring CISCO Routers

After implementing the physical model we need to do configuring of network with EIGRP routing protocol. There are two modes from which EIGRP commands are entered: router configuration mode and interface configuration mode. Router configuration mode enables the protocol, determines which networks will run EIGRP, and sets global characteristics. Interface configuration mode allows customization of summaries, metrics, timers, and bandwidth.

To start an EIGRP session on a router, use the router eigrp command followed by the autonomous system number of your network. You then enter the network numbers connected to the router using the network command followed by the network number as shown in the following commands.

```
Router(config)# router eigrp 200
Router(config-router)# network 172.16.0.0
Router(config-router)# network 10.0.0.0
```

A.1: Router 0 Configuration

--- System Configuration Dialog ---

Continue with configuration dialog? [yes/no]: n

Press RETURN to get started!

Router>enable

Router# configure terminal

Enter configuration commands, one per line. End with CNTL/Z.

Router(config)# interface fastEthernet 0/0

Router(config-if)#ip address 192.168.10.1 255.255.255.0

Router(config-if)#no shutdown

%LINK-5-CHANGED: Interface FastEthernet0/0, changed state to up

Router(config-if)#exit

Router(config)#interface serial 0/2/0

Router(config-if)#ip address 10.0.0.1 255.0.0.0

Router(config-if)#no shutdown

%LINK-5-CHANGED: Interface Serial0/2/0, changed state to down

Router(config-if)#clock rate 9600

Router(config-if)#bandwidth 64000

Router(config-if)#exit

Router(config)#exit

%SYS-5-CONFIG_I: Configured from console by console

Router#configure terminal

Enter configuration commands, one per line. End with CNTL/Z.

Router(config)#router eigrp ?

<1-65535> Autonomous system number

Router(config)#router eigrp

Router(config-router)#network 192.168.10.0 255.255.255.0

Router(config-router)#network 10.0.0.0 255.0.0.0

Router(config-router)#exit

Router(config)#exit

A.2: Running Configuration Output

Router#show running-config

Building configuration...

Current configuration : 580 bytes

interface FastEthernet0/0

ip address 192.168.10.1 255.255.255.0

duplex auto

speed auto

interface FastEthernet0/1

no ip address

duplex auto

speed auto

shutdown

interface Serial0/2/0

```
bandwidth 64000
ip address 10.0.0.1 255.0.0.0
clock rate 9600
interface Serial0/3/0
no ip address
shutdown
interface Vlan1
no ip address
shutdown
router eigrp 3
network 192.168.10.0
network 10.0.0.0
auto-summary
ip classless
line con 0
line vty 0 4
login
end
```

After this we need to apply the same configuration commands to another routers in the network with their own serial and fast Ethernet port IP. After that we need to configure each pc in network model. But here we are showing connectivity between only pc '1' and pc '3'.

B. Configuring PC

After configuring our Cisco routers we need to configure our personal computers pc '1' and pc '3'. But for this we don't need to use any command we can do this manually by just filling address of IP, Subnet Mask, and Default Gateway as shown in below figures.



Figure 2: Pc 1 Configuration

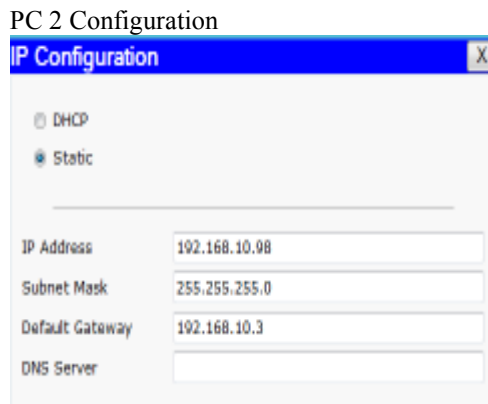


Figure 3: Pc3 configuration

V. VERIFYING NETWORK MODEL

We can easily check or verify our routing model by going in command- line window application of packet tracer. After typing cmd command a black screen comes where we can write ping command to check connectivity between different local and wide area networks. After this command it shows the reply from connected networks as shown below.

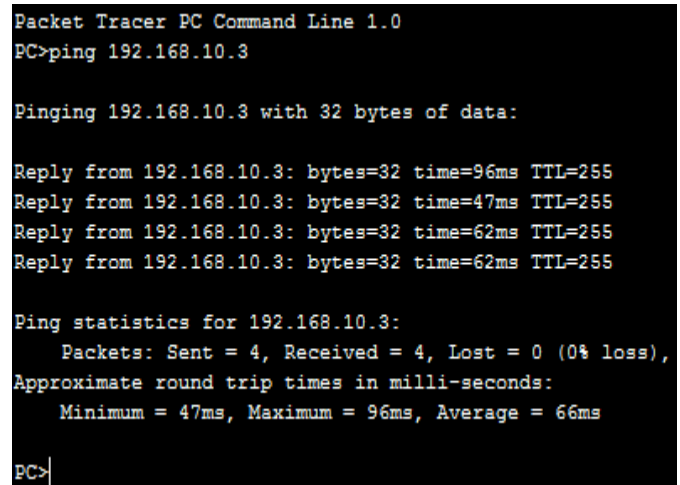


Figure 4: running window showing connectivity

VI. CONCLUSION

Routing protocols are used basically for routing of data. In this paper we have developed a virtual network model based on EIGRP routing protocol. It has shown that EIGRP choose best routing path on the basis of four metrics bandwidth, delay, load, reliability. EIGRP is the first internet routing protocol that provides loop freedom at every instant and convergence times comparable to those obtained with standard link state protocols. Furthermore, EIGRP provides multiple paths to every destination that may have different weights.

As of this writing, EIGRP is mostly deployed in part of cisco system's engineering network. It has shown that how we can easily configured and run an EIGRP networking model in laboratory environment. Similarly we can also implement this model in the real world internetwork.

REFERENCES

- [1] D.Bertsekas and R.Gallager, Data Network, Second Edition, Prentice-Hall, 1992.
- [2] L.Bosak, "Method and Apparatus For Routing Communications among Computerv Networks," U.S. Patent assigned to Cisco Systems, Inc., Menlo Park, California, February 1992.
- [3] Albrightson, B., Garcia-Luna-Aceves, J., Jand Boyle, J. (1994) "EIGRP- A fast Routing Protocol Based on Distance Vectors", Proceedings of Network/Interop94, Las Vegas, Nevada, May 1994.
- [4] Cisco (2005a) "Enhanced Interior Gateway Routing Protocol", Document ID: 16406, http://www.cisco.com/en/US/tech/tk365/technologies/white_paper09186a0080094cb7.shtml (Accessed 5 September 2005)
- [5] A.S.Tanenbaum. Computer Networks. Prentice-Hall, 2002.
- [6] J.J.Garcia-Lunes-Aceves. Loop-free routing using diffusing computations. *IEEE/ACM Transactions on Networking*, 1(1):130-141, 1993.
- [7] A.Riesco and A.Verdejo. The EIGRP protocol In Maude. Technical Report SIC307, Depto. Sistemas Informaticos y Computacion, Universidad Complutense de Madrid, April 2007. <http://maude.sip.ucm.es/eigrp>.

- [8] GertDe L.and Gert S. ,*Network Security Fundamentals*, Publisher Cisco Press,2004.
- [9] E.M.Rover,C.K.ToH,"A review of current routing protocols for ad hoc networks",IEEE Communications,vol6,1999,pp46-55.
- [10] F.Bertocchi,P.Bergamo,G.Mazzin,"Performance Comparison of Routing Protocols for AdHoc Networks", IEEEGLOBECOM2003.
- [11] Merike.k., *Designing Network Security*, Cisco Press,2003.

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An Effective Approach for Prevention of Phishing Attack

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Abstract- An effective approach for phishing Web page detection is proposed, which uses Earth Mover's Distance (EMD) to measure Web page visual similarity, and gives digital water marking approach for more authentication purpose. First convert the involved Web pages into low resolution images and then use color and coordinate features to represent the image signatures. This paper proposes to use EMD to calculate the signature distances of the images of the Web pages. To train an EMD threshold vector for classifying a Web page as a phishing or a normal one. Digital watermarking approach is used to protect the original Web pages.

Index Terms- phishing, anti-phishing, visual assessment, earth mover's distance

I. INTRODUCTION

Phishing Web pages are forged Web pages that are created by malicious people to mimic Web pages of real Web sites. Most of these kinds of Web pages have high visual similarities to scam their victims. Some of these kinds of Web pages look exactly like the real ones. Unwary Internet users may be easily deceived by this kind of scam. Victims of phishing Web pages may expose their bank account, password, Credit card number or other important information to the phishing web page owners.

Phishing is a relatively new Internet crime in comparison with other forms, e.g., virus and hacking. More and more phishing Web pages have been found in recent years in an accelerative way. A report from the Anti-Phishing Working Group [10] shows that the number of phishing Web pages is increasing each month by 50 percent and usually 5 percent of the phishing e-mail receivers will respond to the scams. Also, there were 15,050 phishing cases reported simply in one month in June 2005 [10]. This problem has drawn high attention from both Industry and the academic research domain since it is a severe security and privacy problem and has caused huge negative impacts on the Internet World. It is threatening people's confidence to use the Web to conduct online finance-related activities.

In this paper, we propose an effective approach for detecting phishing Web pages, which employs the Earth Mover's Distance (EMD) [6] to calculate the visual similarity of Web pages. The most important reason that Internet users could become phishing victims is that phishing Web pages always have high visual similarity with the real Web pages, such as visually similar block layouts, dominant colors, images, and fonts, etc.

We follow the antiphishing strategy to detect phishing and providing more security to the original web pages.



Figure 1: Phished Report from APWG [10]

II. BACKGROUND

In [2] M.Wu described about Web Wallet which was a browser sidebar. In this, users have to submit their sensitive information online. It detects phishing attacks. It suggests an alternative safe path. It asks security questions to user's workflow so it cannot be ignored by the user.

In [4] R. Dhamija described about interaction between user and browser. Here personal image is selected by user. Information is maintained only by browser. Abstract image is generated by server. Visual hash is generated between browser and server. Browser has to verify and authenticate it. In [3] W. Liu described about the basic methodology of visual similarity assessment. It deals with only visual calculations.

In [5] Y. Chen proposed about resized images. Mobile devices have already been widely used to access the Web. However, because most available web pages are designed for desktop PC in mind, it is inconvenient to browse these large web pages on a mobile device with a small screen. In this paper, they propose a new browsing convention to facilitate navigation and reading on a small-form-factor device. In [6] Grauman proposed EMD which deals matching between two shapes and their features which reveals how similar the shapes are.

III. PROPOSED SYSTEM

It works well on visual similarities. Digital watermark approach which is embedded in an image of a Web site which is used to protect against phishing attacks. The hidden watermark

could be used to identify a legitimate Web site, distinguishing it from a bogus phishing site used for stealing credentials.

In this proposed system first retrieve the suspected Web pages and protected Web pages from the Web and generate their signatures. The task of our Web page preprocessing approach contains three procedures: 1) obtain the image of a Web page from its URL, 2) perform normalization, and 3) represent the Web page image into a Web page visual signature (consists of color and coordinate features), which is used to evaluate the visual similarity of a pair of Web pages. The process of displaying a Web page in a Web browser on the screen from HTML and accessory files (including pictures, Flash movies, ActiveX plug-ins, Java Applets, etc.) is the Web page rendering process. We use GDI (graphic device interface) API provided by the Microsoft IE browser to get Web page images (in jpeg format). The images of the original sizes are processed into images with normalized size (e.g., 100 * 100). The Lanczos algorithm [10] is used to calculate the resized image because the Lanczos algorithm has very strong antialiasing properties in Fourier domain, and it is also easy to be computed in spatial domain. Moreover, sharp images can be generated with the Lanczos algorithm as intuitively, the sharp images could provide better signature for identification from the others. www.bbb.org is an example of a square-like image, www.banktechnews.com is an example of a longer image, and www.bankofcyprus.com is an example of a wider image.

IV. METHODOLOGY

A. EMD (Earth Mover's Distance) Method

The minimum cost of matching features from one shape to the features of another often reveals how similar the two shapes are. The cost of matching two features may be defined as how dissimilar they are in spatial location, appearance, curvature, or orientation; the minimal weight matching is the correspondence field between the two sets of features that requires the least summed cost. The proposed system present a contour matching algorithm that quickly computes the minimum weight matching between sets of descriptive local features using a recently introduced low-distortion embedding of the Earth Mover's Distance (EMD)[6] into a normed space. Our method EMD is to calculate the similarity of two Web pages based on their signatures as follows:

Step 1: The distance matrix

$$D = [d_{ij}] \quad (1 \leq i \leq m, 1 \leq j \leq n)$$

First calculate the normalized Euclidian distance of the degraded ARGB colors, and then calculate the normalized Euclidian distance of centroids. The two distances are added up with weights p and q, respectively, to form the feature distance, where $p + q = 1$.

Step 2: The color distance

Feature $\phi_i = \langle d_{ci}, C_{dci} \rangle$, where $d_{ci} = \langle$

$dA_i, dR_i, dG_i, dB_i \rangle$.

Feature $\phi_j = \langle d_{cj}, C_{dcj} \rangle$, where $d_{cj} = \langle$

$dR_j, dG_j, dB_j \rangle$.

Step 3: The maximum color distance

$$MD_{color} = \| \langle MaxA - 0, MaxR - 0,$$

$$MaxG - 0, MaxB - 0 \rangle \|$$

Where MaxA, MaxR, MaxG, MaxB are the maximum numbers of the four components of ARGB.

Step 4: Normalized color distance

NDcolor is defined as

$$ND_{color}(dc_i, dc_j) = \sqrt{(dci - dcj) \times (dci - dcj)^T} / MD_{color}$$

is article guides a stepwise walkthrough by Experts for writing a successful journal or a research paper starting from i

V. DESIGN OF THE PROPOSED SYSTEM

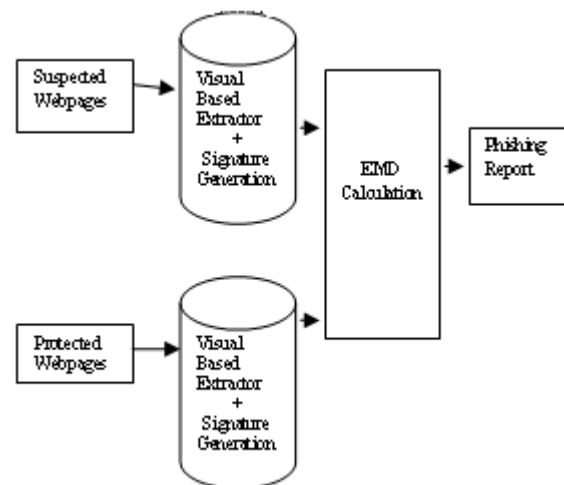


Figure 2: Design Diagram

1. Store the original web ages and perform web page preprocessing.
2. Using Digital water marking which gives more security to original web pages and their database.
3. Store the phished web pages and perform web page preprocessing.
4. Generate the signatures for both web pages.
5. Using EMD method Calculate visual similarity between the pages.
6. The difference value is finally compared with threshold value.
7. If the value is greater than threshold then report the page is phished one.

A. Similarity assessment

The Visual Similarity Assessment Module measures the visual similarity between two web pages in three aspects: block level similarity, layout similarity, and overall style similarity. All these three aspects are defined based on web page segmentation. Next, our method defines three similarity metrics in the following three subsections respectively.

B. Block Level Similarity

The block level similarity [3] measures the visual similarity of two pages at the level of individual blocks. It is defined as the weighted average of the visual similarities of all matched block pairs between two pages. Basically, the content of a block can be categorized as either text or image. We use different features to represent text blocks and image blocks. The features for text blocks include colors, border style and alignment, etc., and the features for image blocks include alternative text, dominant color, and image size, etc. We first calculate their similarity in terms of each feature in the feature set and then use a weighted sum of the individual feature similarities as the total similarity of

the two blocks. The weight of each feature means its importance to the total similarity and can be assigned empirically. In our implementation, we focus more on color related features. Two blocks are considered as matched if their similarity is higher than a threshold. After this method obtain the similarity values of all pairs of possible matching blocks, our method finds a matching scheme between the two web pages blocks. This is actually a bipartite graph matching problem and a globally optimal solution can be obtained.

C. Layout Similarity

Usually, it takes many efforts to make a brand new web page mimicking a true web page. A convenient way is to copy the source file of the true one and modify it a little bit for this purpose. In this case, the main web page structure is kept. Hence, our method defines the layout similarity as the ratio of the weighted number of matched blocks to the total number of blocks in the true web page. We employ the method in [3] for layout matching. Two blocks are considered matched if they both exhibit high visual similarity and satisfy the same constraints with corresponding matched blocks. We then define the layout similarity of two web pages as the ratio of the weighted number of matched blocks to the total number of blocks in the true web page, and the weight of each block is assigned differently according to its importance to the whole web page.

D. Overall Style Similarity

In addition to the web page content, the style consistency is another important feature which can easily cheat the victims' eyes. Generally, all web pages owned by one company would keep the style consistent. The overall style similarity focuses on the visual style of a web page, which can be represented by several format definitions, e.g., the font family, background color, text alignment, and line spacing. We first obtain the histogram of the style feature values for each web page.

VI. IMPLEMENTATION OUTLINE

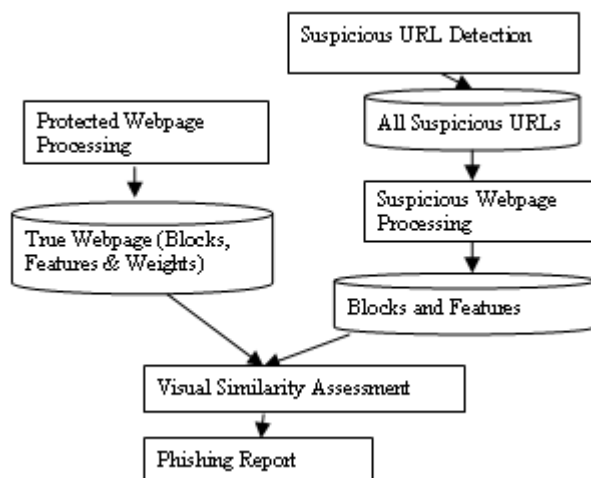


Figure 3 Implementation Diagram

The proposed system has been implemented in Java Swing. Here Web capture is used for capturing the online web pages. Image Magick is used for compressing the web page images. The first module is focusing on preprocessing process. In the second module is for EMD calculation and the protection of original web

pages. In the last module which will be focusing on efficiency of the method and digital water marking approach.

VII. CONCLUSION

Phishing has becoming a serious network security problem, causing finical lose of billions of dollars to both consumers and e-commerce companies. Our proposed method of EMD to calculate visual similarity between phished and original web pages. The implementation of the proposed system is in progress and it is expected that the implementation results will detect phished web pages and gives more security to the original web pages using digital watermarking approach.

REFERENCES

- [1] M. Wu, R.C. Miller, and G. Little, "Web Wallet: Preventing Phishing Attacks by Revealing User Intentions," Proc. Symp. Usable Privacy and Security, 2006.
- [2] W. Liu, X. Deng, G. Huang, and A.Y. Fu, "An Anti-Phishing Strategy Based on Visual Similarity Assessment," IEEE Internet Computing, vol. 10, no. 2, pp. 58-65, 2006.
- [3] R. Dhamija and J.D. Tygar, "The Battle against Phishing: Dynamic Security Skins," Proc. Symp. Usable Privacy and Security, 2005.
- [4] W. Liu, G. Huang, X. Liu, M. Zhang, and X. Deng, "Phishing Web Page Detection," Proc. Eighth Int'l Conf. Documents Analysis and Recognition, pp. 560-564, 2005.
- [5] K. Grauman and T. Darrell, "Fast Contour Matching Using Approximate Earth Mover's Distance," Proc. 2004 IEEE CS Conf. Computer Vision and Pattern Recognition, vol. 1, pp. 220-227, 2004.
- [6] A.Y. Fu, X. Deng, and W. Liu, "A Potential IRI Based Phishing Strategy," Proc. Sixth Int'l Conf. Web Information Systems Eng. (WISE '05), pp. 618-619, Nov. 2005.
- [7] Y. Chen, W.Y. Ma, and H.J. Zhang, "Detecting Web Page Structure for Adaptive Viewing on Small Form Factor Devices," Proc. 12th Int'l Conf. World Wide Web, pp. 225-233, 2003.



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Study on the efficacy of supplementation of functional beverage on the blood profile of Sportswomen

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Abstract- Sports drinks are much relevant to the Indian sports scenario because of the fact that many of the Indian sports persons are undernourished and anaemic. Functional beverage was prepared by using whey water, pearl millet [*Pennisetum typhoideum*], cauliflower [*Brassica oleracea* var. *botrytis*] leaf powder, banana and jaggery at three different levels i.e. S₁, S₂ and S₃. The developed functional beverage was organoleptically evaluated by a panel of judges and students by using nine-point hedonic scale. Both the panels gave the highest overall acceptability scores to the S₁ level which was prepared by using 2.5 g cauliflower leaf powder, 5 g pearl millet, 10 g jaggery, 20 g banana and 63 ml whey water per 100 ml. The most acceptable level was chemically analyzed. Thirty sportswomen in the age group of 16 to 18 years were selected from Punjab Agricultural University, Ludhiana. The study was divided into two periods i.e. control and experimental. During control period the subjects were observed without supplementation for a month while during experimental period the subjects were supplemented with 200 ml of developed functional beverage for 3 months. The haematological profile, blood glucose and serum retinol level of the subjects were analyzed. Significant ($p \leq 0.01$) improvement was seen in haemoglobin, packed cell volume and mean corpuscular volume after the experimental period i.e. 9.42, 3.35 and 2.08 %, respectively. Seventy seven percent subjects were anaemic before the study which was reduced to fifty percent after 3 months. Significant ($p \leq 0.01$) improvement was also observed in blood glucose and serum retinol level i.e. 12.7 and 5.46 % in the subjects after the experimental period. Hence, it can be inferred from the results that supplementation of functional beverage before the sports training improved the blood profile of the sportswomen.

Index Terms- functional beverage, haematological profile, organoleptically, cauliflower [*Brassica oleracea* var. *botrytis*] leaf powder, whey water.

I. INTRODUCTION

In today's world of neck and neck competition, a sportsperson cannot afford to take chance in any area, as minute action can deprive him of fame and fortune. The ability to recover from all of these stresses can be the difference between a champion and a loser. The prerequisite for optimum levels in sports performance is not just good training but also a carefully maintained health.

Sports drinks are much relevant to the Indian sports scenario because of the fact that many of the Indian sports persons are undernourished and anaemic. Being a tropical country, Indian athletes tend to get exhausted quickly particularly during summer and this affects their performance. A direct relationship has been

found between haemoglobin and serum retinol concentration. Dietary deficiency of vitamin A and iron frequently coexist in developing countries and vitamin A deficiency appears to affect iron transport and RBC production (Lynch, 1997).

Some of the underutilized foods like whey water, cauliflower leaves, pearl millet, banana and jaggery can be utilized for the improvement of the nutritional status of sportswomen.

Whey is a nutritious by-product from cheese, *chhana* and *paneer* containing valuable nutrients like lactose, proteins, minerals and vitamins etc., which have indispensable value as human food (Parekh, 2006). In India, it is estimated that about 100 million kg of whey is annually derived as a by-product which may cause substantial loss of about 70,000 tonnes of nutritious whey solids. In addition, it is adding Biological Oxygen Demand (BOD) load to effluent (approx 35,000 to 45,000 mg / L) (Parekh, 2006).

In India, the consumption of green leafy vegetables is very low and is much below the recommended dietary allowances. Therefore, majority of Indians don't meet sufficient vitamins and minerals present in leafy vegetables. Cauliflower [*Brassica oleracea* var. *botrytis*] bears extensive leaves which are removed and discarded prior to cooking. The proportion of cauliflower and leaves arriving in the market is 2:1 of which the discarded leaves contribute to approximately 50 per cent of total production of cauliflower and dehydrated greens are considered concentrated sources of nutrients, addition of small amounts of these foods in various dietary preparations could be of immense value to combat the global prevalence of micronutrient malnutrition (Kowsalaya and Vidhaya, 2004).

In India, Pearl millet [*Pennisetum typhoideum*] is the fourth most important staple food crop after rice, wheat, and sorghum. The grain of pearl millet is particularly rich in iron and zinc and has high levels of fat and considered to have one of the best protein quality or amino acid score as compared to other cereals. Nutritional quality of pearl millet is improved by traditional processing practices viz. soaking, dehulling, fermentation, germination and malting. Thus, the pigments and anti-nutritional factors present in pearl millet could be reduced by using these simple home level processing methods (Archana et al 2000).

Bananas [*Musa paradisiaca*] are power house of nutrients. They originally come from Malaysia. Bananas and nutrition go hand in hand. They are great sources of an array of nutrients, with B-complex vitamins, vitamin C, potassium, manganese and magnesium. They are also important source of vitamin B (Cheamsawat, 2003) especially thiamine, which has an effect on fatigue reduction.

Jaggery [*Saccherum officinarum*] is a traditional unrefined non-centrifugal whole cane sugar consumed in Asia, Africa, Latin

America, and the Caribbean. It is a concentrated product of cane juice without separation of the molasses and crystals.

Keeping in view the beneficial effect of underutilized foods the present study was planned to study the impact of supplementation of functional beverage on the haematological profile, blood glucose and serum retinol level of sportswomen.

II. MATERIALS AND METHODS

A. Development and sensory evaluation of functional beverage

Functional beverage was developed at three different levels i.e. S₁, S₂ and S₃ using whey water, pearl millet, cauliflower leaf powder, banana and jaggery. The organoleptic evaluation of developed functional beverage was done by the panel of judges using the Hedonic rating scale.

B. Chemical analysis of developed functional beverage

Most acceptable level of the developed functional beverage was chemically analyzed for proximate composition (AOAC, 1990), total soluble sugars (Dubois et al 1956), reducing sugars (Nelson, 1944), non reducing sugars (by calculation), iron (AOAC, 2000), calcium (AOAC, 1980), ascorbic acid (AOVC, 1996) and beta-carotene (Rao, 1967).

C. Selection and feeding of the subjects

Thirty sportswomen in the age group of 16 to 18 years were selected from Punjab Agricultural University, Ludhiana. General and sports information pertaining to age, religion, residential status, family size, menstruation, duration of menstruation was recorded for all the subjects through questionnaire schedule. The whole study was divided into two periods i.e. control period and experimental period. All the observations were recorded before the study, after one month of control period and after three months of experimental period. During control period the subjects were observed without the supplementation for a month while during experimental period the subjects were supplemented with 200 ml of developed functional beverage for a period of three months. The beverage was given half an hour before their sports activity.

D. Blood analysis of the selected subjects

Blood analysis was done for glucose (Glucometer), Haemoglobin (Dacie and Lewis, 1975), Packed Cell Volume (Raghuramula et al 2003), Mean Corpuscular Haemoglobin Concentration (MCHC) (Raghuramula et al 2003), Mean Corpuscular Volume (MCV) (Dacie and Lewis, 1975), Total Iron Binding Capacity (Teitz, 1976) and Serum Retinol Level (Raghuramulu et al 2003).

E. Statistical analysis

The data on all the blood parameters was analyzed statistically. The mean standard error, percentages, paired t- test and their statistical significance was ascertained using a computer programme package (Cheema and Singh, 1990).

III. RESULTS AND DISCUSSIONS

The study was conducted on 30 sportswomen between the age group of 16 to 18 years studying in Punjab Agricultural University. Majority of subjects 67 percent were Sikh and rest 33 percent were Hindu. Most of the subjects were hostellers (73 percent) while 27 percent were day scholars. Majority of subjects belong to medium family with family size of 4-6 members. The

menstrual flow was normal in 77 percent of the subjects and rest 23 percent was having heavy flow (Table 1).

Table 1: General Information of the subjects

Characteristics	Total (N=30)
Age (years):	
16 -18	30 (100)
Religion:	
Hindu	10 (33)
Sikh	20 (67)
Residential status:	
Hostellers	22 (73)
Day Scholars	8 (27)
Family size:	
Small (< 4)	1 (3)
Medium (4– 6)	28 (93)
Large (>6)	1 (3)
Menstruation:	
Normal	23(77)
Heavy	7(23)
Duration, Days:	
2-3	8 (27)
4-5	18 (60)
>5	4 (13)

Figures in parenthesis are percentages

The developed functional beverage was organoleptically evaluated by a panel of judges from the department of food and nutrition, Punjab Agricultural University, Ludhiana and students by using nine-point hedonic scale to judge the acceptability of the product and the scores given by the trained panel for color, appearance, flavor, texture, taste as well as overall acceptability of the developed functional beverage varied from 7.18 to 7.7, 6.7 to 7.70, 6.4 to 7.5, 6.2 to 7.4, 6 to 7.8 and 6.3 to 7.8, respectively. The corresponding scores given by the student's panel varied from 7.5 to 7.7, 6.8 to 7.3, 6.3 to 7.5, 5.8 to 7.4, 6.5 to 7.7 and 6.2 to 7.8, respectively. According to the both panels the most acceptable level of beverage was having 2.5 g cauliflower leaf powder, 5 g pearl millet, 10 g jaggery, 20 g banana and 63 ml whey. It had the overall acceptability score of 7.8 ± 0.78 (Table 2).

Hundred grams of developed functional was analyzed for proximate composition showed that it had 81 g of moisture, 2.8 g of crude protein, 0.4 g of crude fat, 0.9 g of crude fibre, 0.85 g of ash, 14.05 g of carbohydrates and provided 71 Kcal of energy. Developed functional beverage had 11.8 g total soluble sugars, 4.55 g of reducing sugars, 7.25 g of non-reducing sugars and 4.6 g of starch. The concentration of minerals iron and calcium in

Table 2: Organoleptic evaluation of developed functional beverage

S. No	Colour	Apperance	Flavour	Texture	Taste	Overall acceptability
Trained Panel						
S 1	7.7±0.58	7.70±0.66	7.5±0.79	7.4±0.78	7.8±0.43	7.8±0.78
S 2	7.63±0.48	7.6±0.48	7.3±0.46	7.1±0.33	7.1±0.48	7.3±0.43
S 3	7.18±0.63	6.7±0.43	6.4±0.69	6.2±0.63	6±0.5	6.3±0.43
F-Ratio	3.4*	17.9*	12.4*	16.8*	58.5*	23.1*
C.D. at 5%	0.42	0.38	0.49	0.45	0.34	0.43
Students Panel						
S 1	7.5±0.47	7.3±0.47	7.5±0.5	7.4±0.5	7.7±0.47	7.8±0.37
S 2	7.7±0.47	7.3±0.47	7±0	7±0	7.2±0.37	7.2±0.37
S 3	7.5±0.5	6.8±0.37	6.3±0.74	5.8±0.37	6.5±0.5	6.2±0.37
F-ratio	0.20 ^{NS}	2.14 ^{NS}	6.4*	23.2*	8.41*	25.3*
C.D. at 5%			0.69	0.49	0.61	0.5

S 1= functional beverage with 2.5 g cauliflower leaf powder, 5 g pearl millet, 10 g jaggery, 20 g banana and rest whey water to raise the volume to 100ml

S 2 =functional beverage with 3 g cauliflower leaf powder and rest ingredients same as in S1

S 3 =functional beverage with 3.5 g cauliflower leaf powder and rest ingredients same as in S1

Values are Mean ± S. E *: Significant at 5% level.

functional beverage was 5.51 mg and 103 mg, respectively. The concentration of vitamins, ascorbic acid and β -carotene was 2.7 mg and 1185 μ g, respectively.

At the end of three months with supplementation of functional beverage a significant ($p \leq 0.01$) increase was observed in the haemoglobin level (Hb), packed cell volume (PCV), mean corpuscular volume (MCV), blood glucose and serum retinol level of the subjects (Table 3 and 4).

The mean heamoglobin (Hb) of the subjects before and after the control period was 10.73 and 10.77 g/dl and after the three months of experimental period the corresponding value was 11.89 g/dl. The Hb of the subjects was less than the reference Hb value of 12 g/dl (WHO, 2001). The poor iron status of the sportswomen indicated by their low haemoglobin levels could be associated with iron losses from gastrointestinal bleeding, consumption of pain relievers, blood loss in urine from damaged muscles, excessive sweat and excessive exercise. Eichner (1992) and Kim et al (2002) reported that sportswomen are especially susceptible to poor iron status because of the blood loss experienced during menstruation but the primary cause is the inadequate iron in their diet. However, Portal et al (2003) reported that the most common cause of the decrease in athlete's heamoglobin is pseudo-anaemia which resulted from an increase in plasma volume during a sporting performance.

The value of mean packed cell volume (PCV) of the subjects before the study was 31.1%. The corresponding values after control and after experimental period were 31.16 and 32.24%. The reference PCV range is 37-44% (Dacie and Lewis, 1975). The corresponding value of PCV obtained was below the normal range indicating anaemic condition of the subjects. However, the statistical analysis revealed a significant ($p \leq 0.01$) increase in PCV after the supplementation period. Kaur (2002) reported the PCV range of the sportswomen to be 24.2 to 42.6%. Malkit (1987) reported a range of 33.9 to 35.0% of PCV of the girls, whereas the PCV of Hockey and Handball players as observed

by Kaur (1988) was 36.9% and 44.8% before and after the exercise response, respectively.

The initial mean corpuscular volume (MCV) value of the sportswomen was 90.04 fl. The corresponding values before and after the three month experimental period were 90.1 and 92.01 fl, respectively. The normal MCV range is 77-95 fl (Dacie and Lewis, 1975). The corresponding value of MCV before and after the study was in-between the normal range. A significant ($p \leq 0.01$) increase was seen in the MCV value of the subjects after the supplementation period.

The initial mean corpuscular haemoglobin concentration (MCHC) value of the subjects was 32.63% and the corresponding values before and after the experimental period were 32.44 and 33.01%, respectively. The normal MCHC range is 30-33% (Dacie and Lewis, 1975). The corresponding value of MCHC after the supplementation was slightly high than the normal range but there was a non-significant ($p \leq 0.01$) difference seen in the MCHC value of the subjects after the supplementation period. Kaur (1988) reported a range of 17.1 to 48.9% with a mean value of 26.8 ± 0.1 and $29.1 \pm 1.6\%$ before and after the exercise in hockey and handball players. Kaur (2002) reported the MCHC range of the sportswomen which varied from 25.4-46.6%.

The initial mean total iron binding capacity (TIBC) value of the subjects was 236.3 μ g/dl. The TIBC of the subjects before and after the supplementation period was 237.5 and 235.8 μ g/dl, respectively. A non significant ($p \leq 0.01$) change was seen in the TIBC of the subjects after the supplementation period. It was observed that the TIBC value was lower than the normal range. The normal TIBC range is 250-416 μ g/dl (Goodhart and Shills, 1990). Bains (1995) reported that the mean value of TIBC for young girls was 429 μ g/dl. Onno et al (1998) revealed that TIBC, which is a measure of both unsaturated and saturated transferrin, is already affected before the iron supply fails: TIBC rises as storage iron decreases. Santolo et al (2008) evaluated the effects

Table 3: Hematological profile of the subjects before and after supplementation of functional beverage by the subjects

Blood parameters	Control period		Experimental period	% Change		Normal values	t-value		
	0 month	After 1 month	After 3 months						
	a	b	C	(a vs b) (b vs c)			a vs b	b vs c	c vs a
Haemoglobin, g/dl	10.73±1.07	10.77 ± 1.04	11.89 ± 0.82	0.37	9.42	> 12a	1.42 ^{NS}	7.9**	7.47**
PCV, %	31.14 ± 6.61	31.16 ± 6.61	32.24 ± 2.56	-	3.35	37 – 44b	0.11 ^{NS}	6.86**	7.74**
MCV, fl	90.04 ± 0.43	90.1 ± 0.33	92.01 ± 1.51	0.07	2.08	77 – 95b	1.45 ^{NS}	3.86**	4.11**
MCHC, %	32.63 ± 1.8	32.44 ± 2.02	33.01 ± 1.36	-	1.73	30 – 33b	1.18 ^{NS}	1.2 ^{NS}	0.86 ^{NS}
TIBC, µg/dl	236.3±32.9	237.5±32.9	235.8±20.59	0.5	0.7	250 – 416c	1.25 ^{NS}	1.31 ^{NS}	1.23 ^{NS}

** : Significant at 1 % level NS : Non-Significant

a : WHO (2001), b: Dacie and Lewis (1975), c : Goodhart and Shills (1990)

of regular physical exercise on anemia and iron status as it reduces serum iron and transferrin saturation, and elevates soluble transferrin receptors young non-professional female athletes. They observed that physical exercise has an impact on iron. Nearly one fifth of recreational athletes have anemia and a third have iron deficit, these conditions can decrease their physical performance.

The mean glucose level of the subjects before the study was 120.6 mg/dl. The corresponding values before and after the supplementation period were 121.4 and 139 mg/dl, respectively (Table 4). The obtained value was in-between the normal range given by Raghuram et al (2007). There was a significant ($p \leq 0.01$) increase in the blood glucose level after the supplementation period. Kanabur and Devi (2005) also reported that a sports drink

has a positive effect on the blood glucose level as compared to placebo.

The mean serum retinol level of the subjects before and after the control period was 24.67 and 24.93 µg/dl, respectively. After the three months supplementation period the corresponding value was 26.37 µg/dl. The normal value for serum retinol level is 25 µg/dl (Table 4). The increase could be due to the consumption of cauliflower leaf powder in the form of developed functional beverage. There was a significant ($p \leq 0.01$) increase in the serum retinol level after the supplementation period. A study conducted by Jood et al (2001) revealed that after the supplementation of 100 g cauliflower leaf powder per day to the school children the serum retinol level increased by 33.33%.

Table 4: Glucose and Serum retinol level of the subjects before and after the supplementation of functional beverage

Blood parameters	Control period		Experimental period	% Change		Normal values	t-value		
	0 month	After 1 month	After 3 months						
	a	b		(a vs b) (b vs c)			a vs b	b vs c	c vs a
Glucose, (mg/dl)	120.6 ± 10.21	121.4 ± 9.85	139.0 ± 8.80	-	12.7	<200 [#]	1.63 ^{NS}	16.43**	12.56**
Serum retinol, (µg/dl)	24.67 ± 1.69	24.93 ± 1.70	26.37 ± 1.84	1.04	5.46	25 µg/dl [^]	1.43 ^{NS}	6.9**	7.1**

* : Significant at 5% level ** : Significant at 1% level

NS: Non-significant, #: Raghuram et al (2007), ^ : WHO (1998)

IV. CONCLUSION

The investigation of present study revealed that supplementation of 200 ml developed functional beverage prepared by using 5 g cauliflower leaf powder, 10 g pearl millet, 20 g jaggery, 40 g banana and 126 ml whey helped in improving the hematological profile, serum retinol level and blood glucose level of the subjects. This was reflected by significant ($p \leq 0.01$) increase in haemoglobin (9.42%), mean corpuscular volume (2.08 %), packed cell volume (3.35 %), mean corpuscular haemoglobin concentration (1.73%), blood glucose level (12.7 %) and serum retinol level (5.46 %) respectively. Hence it can be inferred from the results that supplementation of developed functional beverage significantly improved the blood profile of the sportswomen.

REFERENCES

[1] AOAC (1980) Official Methods of Analysis 11th ed. Association of Official Analytical Chemists. Washington, DC.

[2] AOAC (1990) Official Methods of Analysis 14th ed. Association of Official Analytical Chemists. Washington, DC.
[3] AOAC (2000) Official Methods of Analysis 17th ed. Association of Official Analytical Chemists. Washington, DC.
[4] AOVC (1996) Methods of Vitamin assay. Association of Vitamin Chemists Inc. (Ed.) Interscience Publishers. pp. 306-312.
[5] Archana, Sehgal S and Kawatra A (2000) In vitro protein and starch digestibility of pearl millet as affected by processing techniques. Die Nahrung 45 (1):25-27.
[6] Bains K K (1995) Impact of energy and iron status on the physical fitness among college girls. Ph.D. Dissertation, Punjab Agricultural University, Ludhiana.
[7] Cheamsawat N (2003) Production process of syrup from banana and the by-products. Outstanding Researches 3:36.
[8] Cheema H S and Singh B (1990) CPCSII- A computer program package for the analysis of commonly used experimental designs. Punjab Agricultural University, Ludhiana, India.
[9] Dacie J V and Lewis S M (1975) Practical Haematology. 5th ed. English Language Book Society and Churchill Ltd., London, pp.32.

- [10] Dubois M, Gilles K A, Hamilton J K, Rebers P A and Smith F (1956) Colorimetric methods for determination of sugars and related substances. *Anal. Chem.*28: 350.
- [11] Eichner E R (1992) Sports anaemia, iron supplementation and blood doping. *Med. Sci. Sports Exerc.*24: 315-18.
- [12] Goodhart R S and Shills M E (1980) Modern nutrition in health and disease. 6th ed. Lea and Febiger, Philadelphia Co.,p. 334.
- [13] Jood S, Gupta M, Yadav S K and Khetarpaul N (2001) Effect of supplementation on haemoglobin and serum retinol levels and nutritional status of school children of northern India. *Nutr. Health* 15(2):97-111.
- [14] Kanabur V V and Devi K (2005) Development, nutritional analysis and evaluation of some sports drinks. *J. Fd. Sci. Technol.* 42: 415-18.
- [15] Kaur A (2002) Impact of haematinic supplementation to enhance the physical performance of sportswomen. M.Sc. Thesis. Punjab Agricultural University, Ludhiana, India.
- [16] Kaur N (1988) Assessment of nutritional status of girl athletes. Ph.D. Dissertation, Punjab Agricultural University, Ludhiana.
- [17] Kim S H, Kim H Y P, Kim W K and Park O J (2002) Nutritional status, iron-deficiency-related indices, and immunity of female athletes. *The Intr. J. of Applied and Basic sci. Nutritional Sci.* 18: 86-90.
- [18] Kowsalaya S and Vidhaya M R (2004) Nutritive value of selected dehydrated green leafy vegetables. *Ind J. Nutr. Dietet.* 41: 279-86.
- [19] Lynch S R (1997) Interaction of iron with other nutrients. *Nutr Rev* 55:102.
- [20] Malkit (1987) Assessment of nutritional status of young Punjabi women. Ph.D. Dissertation, Punjab Agricultural University, Ludhiana.
- [21] Nelson N (1944) A photometric adaptation of the Somogyi method for the determination of glucose. *J. Bio. Chem.* 153: 375-380.
- [22] Onno W V A, Basil T D, Virgil F F, Elaine W G and Daviel A N (1988) Determination of serum iron, total iron binding capacity and percent transferring saturation, approved standard. Clinical and laboratory standards institute. NCCL, Wayne, Pennsylvania.
- [23] Parekh J V (2006) Emerging new technologies in the dairy industry in India. (Cited from <http://www.fnbnews.com/article /detarchive .asp? articleid=19393&ionid=40>).
- [24] Portal, Epstein S M and Dubnov G (2003) Iron deficiency and anemia female athletes cause and risks. Centre of sports medicine science and research, Wingate Institute, Jerusalem, Israel, 149 (10): 698-03.
- [25] Raghuram T C, Pasricha S and Sharma R D (2007) Diet and diabetes. ICMR, Hyderabad.
- [26] Raghuramula N, Nair K M and Kalayanasundram S (2003) *A manual of Laboratory techniques*. National Institute of Nutrition, ICMR, Hyderabad, India. pp. 308-09.
- [27] Rao C N (1967) True vitamin A value of some vegetables. *Ind. J. Nutr. Dietet.*4:10-16.
- [28] Santolo M, Stel G, Banfi G, Gonano F and Cauci S (2008) Anemia and iron status in young fertile non-professional female athletes. *Eur J Appl Physiol*;102(6):703-9.
- [29] Teitz N W (1976) *Fundamentals of Clinical Chemistry*. W.B. Saunders and Co. p. 928.
- [30] WHO (1998) Immunization- linked vit A supplementation study group. Randomized trial to assess benefit and safety of vit A supplementation linked to immunization in early infancy. *Lancet* 352:1257-63.
- [31] WHO (2001) Iron deficiency anemia: Assessment, Prevention and Control. A guide for program manager. P-3. World Health Organization, Geneva.

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Dielectric relaxation behaviour and ac conductivity of acrylonitrile and Vinyl propionate (an-vp) copolymers

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Abstract- Acrylonitrile based copolymers have a variety of industrial applications and attracted the attention of material researchers with increasing interest in recent years to study their electrical properties with respect to their homopolymers. The dielectric relaxation studies as a function of temperature and frequency of the applied field reveals the information about the nature of segmental motion in polymer chain.

A systematic measurement of dielectric constant (ϵ) and dielectric loss ($\tan\delta$) on powder pressed pellets of AN-VP copolymer in composition 50/50 have been carried out in the frequency range 200Hz -100kHz and in the temperature range from room temperature to 180°C, covering through the glass transition temperature T_g . Two sets of relaxation peaks on slight above room temperature and the other slightly above T_g are noticed from $\tan\delta$ versus temperature curves for different frequencies. The peaks are attributed to β - and α - relaxations. Temperature coefficient of dielectric constant ($TC\epsilon$) is evaluated to understand the nature of the temperature dependence, AC conductivity is evaluated to understand the conduction process. Activation energy is calculated from loss ($\tan\delta$) versus temperature curves and $\log\omega_p$ versus reciprocal temperature plots. Activation energy is also calculated from Arrhenius plots.

Index Terms- dielectric constant, dielectric loss, ac conductivity, activation energy.

I. INTRODUCTION

Acrylonitrile based copolymers have become the materials of considerable interest in recent years owing to their technological importance. The study of the dielectric properties of these polymers helps in understanding the intra and intermolecular interaction in macromolecules¹⁻³. Hill, N.E⁴.and Elif Vargun, et al.⁵, reported the preparation and characterization of Acrylonitrile- Ethyl Methacrylate copolymers, Sridevi, et al⁶. reported cyclohexane carbonitrile initiated copolymerization of AN with EMA and dielectric properties at 20kHz and Rajani kumar,et al.⁷, reported reactivity ratio, thermal and dielectric properties cyclohexane carbonitrile initiated AN with Vinyl Propionate. No detailed dielectric properties have been reported on these materials. With this in view, the authors felt that it would be of the greater interest to study the dielectric properties of acrylonitrile and Vinyl propionate copolymers' both as a function of temperature and frequency. We discuss the dielectric relaxation behaviour in the light of experimental results.

II. EXPERIMENTAL

The copolymer sample of AN-VP in the powder form was used to prepare the pellets of the dimensions viz., 1-2 mm thickness and 1cm diameter. The dielectric constant and loss ($\tan\delta$) were measured on these pellets using GR-1620A Capacitance measuring assembly in conjunction with a laboratory build three terminal cell. The measurements were carried out in the frequency range 100Hz to 100 kHz and temperature range from room temperature to 180°C. The glass transition temperature T_g was determined by Differential Scanning Calorimetry (DSC) technique. (Mettler Toledo SR System). The overall accuracy in the measurement of dielectric constant and loss was 1% and 2% respectively.

III. RESULTS AND DISCUSSION

Figures 1(a) and 1(b) show the variation of dielectric constant (ϵ) and loss ($\tan\delta$) at room temperature as a function of frequency for AN-VP 50/50 composition. The dielectric constant varies from 4.5 at 200Hz to 3.6 at 100 kHz and ϵ decreases at a rapid rate up to 10 kHz and decreases at a slower rate beyond 10 kHz. The influence of space charge polarization is more at lower frequencies resulting in higher value of ϵ , where as this effect is negligible for the frequencies beyond 10 kHz⁸. Similarly the $\tan\delta$ value decreases from 0.12 at 200Hz to 0.04 at 100 kHz.

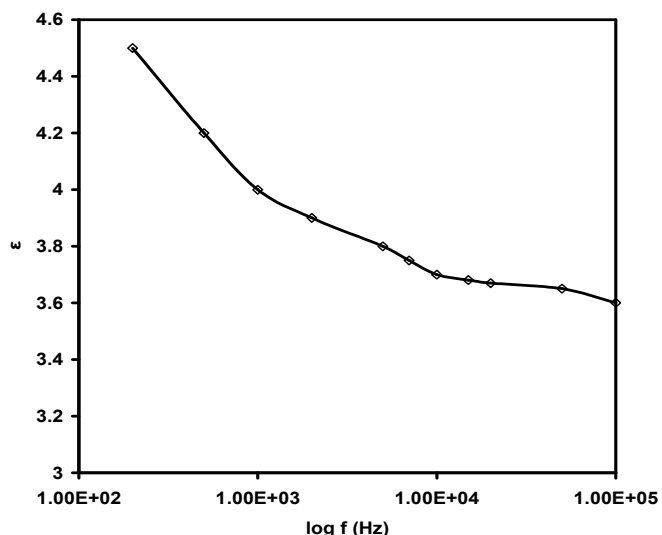


Fig.1(a)- Variation of ϵ with frequency for AN-VP(50/50) at room temperature

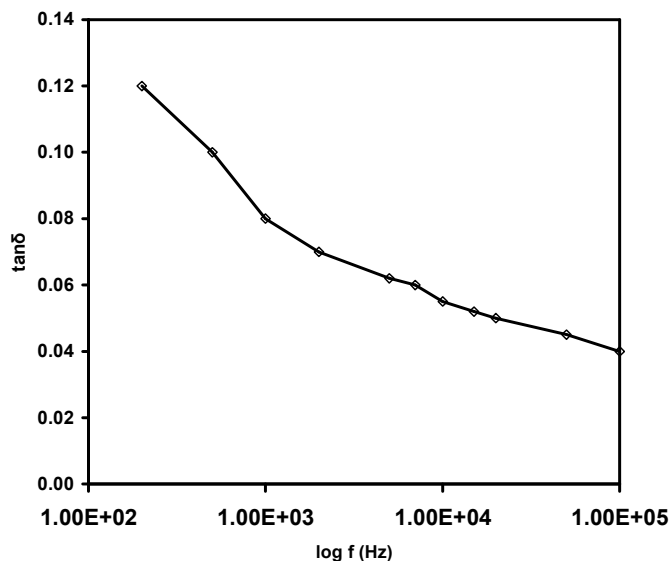


Fig.1b.Variation of $\tan\delta$ with frequency for AN - VP (50/50) at room temperature

Figure 2 shows the variation of ϵ with temperature for different frequencies. At room temperature the value of ϵ is both frequency dependent and temperature independent up to 90°C, beyond 90°C the increase of ϵ is at a rapid rate for lower frequencies and slower rate for higher frequencies, reaching maximum and giving rise a peak at 145° C for all frequencies.

It is further seen that, strong temperature dependence starts at lower temperature for lower frequencies and at higher temperature for higher frequencies. To understand the nature of temperature dependence, the temperature coefficient of dielectric constant (TC ϵ) is calculated for various intervals of temperature (Table 1) for 1 kHz. The temperature coefficient of dielectric constant (TC ϵ) has been determined from room temperature T_{rt} , up to glass transition temperature T_g , according to the relation $TC\epsilon = 1/\epsilon_{m.p.} \cdot d\epsilon/dt$. Where $d\epsilon$ is the difference between dielectric constants, $\epsilon_{m.p.}$ is the dielectric constant at the mid point of T_g and T_{rt} ^{9,10}.

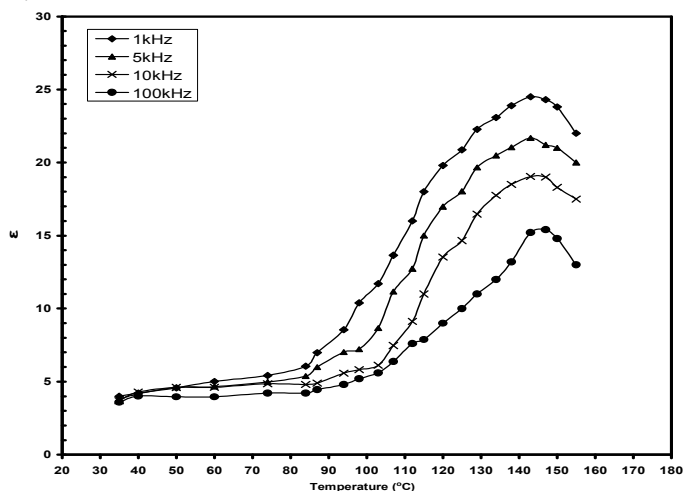


Fig. 2- Variation of ϵ with temperature for AN - VP(50/50)

Table 1: Variation of temperature coefficient of Dielectric constant (TC ϵ) for AN-VP at 1 kHz

temperature (°C)	TC ϵ (°C) ⁻¹
35-84	0.0092
84-112	0.0417
112-143	0.0123
143-155	-0.00875

The dielectric constant (ϵ) is unaffected by temperature from room temperature to 90°C, At lower temperature molecular chains are not only immobile but also tightly bound at some points because of dipole-dipole interaction.¹¹ Beyond 90°C the increase of ϵ is at a rapid rate is attributed to, more and more dipole groups are released and the mobility polymer segments increases, as the order of the orientation of dipoles increases with increase in temperature. The T_g determined from DSC is 115°C. Various polarizations contribution to total polarization is also effective up to few degrees above T_g resulting in a maximum value of ϵ for all frequencies. Further increase of temperature causes chaotic thermal oscillations of the molecule and the diminishing degree of order of orientation of dipoles, confirming the disordered phase of the polymer chain above T_g i.e. in the rubber like state^{10, 12}.

The Figure 3 shows the variation of $\tan\delta$ with temperature for different frequencies. The $\tan\delta$ is both frequency and temperature dependent and decreases giving rise a peak at 50°C for all frequencies. Beyond 60°C and up to 85°C $\tan\delta$ is temperature independent and frequency dependent.

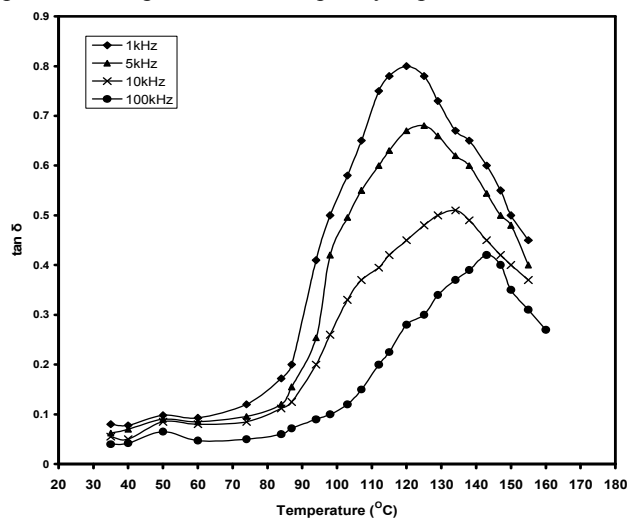


Fig. 3-Variation of $\tan\delta$ with temperature for AN-VP(50/50)

Beyond 90°C the increase of $\tan\delta$ is at a rapid rate up to 117°C. The relaxation peaks were found at 120°C, 125°C, 134°C and 143°C for 1 kHz, 5 kHz, 10 kHz and 100 kHz respectively.

It is evident that the variation in $\tan\delta$ was found to be higher for low frequencies and smaller for higher frequencies. Further the peaks shifted towards higher temperatures for higher frequencies, giving rise relaxation behaviour in the material. The peaks that appeared around 50°C to be β - relaxation peak and attributed to the micro-Brownian motion of the individual molecular groups¹³. It is to be noted that there is no shift in peak position with frequency. The peaks that appeared at high temperatures are believed to be α - relaxation peaks, are due to flexible motion of main chain segment^{13, 14, 15}.

The activation energies for relaxation are calculated and given in Table 4.2. It is seen from the table that the activation energies for the relaxation process in the low frequency region i.e., up to 10 kHz shows a decrease and then in the high frequency region i.e., beyond 20 kHz there is an increase. The activation energy was obtained from (Method I) the slope of $\log \omega_p$ versus $1/T$ plot (Fig 4) is 1.55 eV. Further the relaxation time (τ) for the process is found to be larger for low frequencies and smaller for

high frequencies. The average of activation energy evaluated from $\tan\delta_{\max}$ versus temperature (Method II) is 1.54 eV, which is found to be in good agreement with the value obtained from first method.

The plots of AC conductivity against reciprocal temperature for frequencies 1 kHz, 5 kHz, 10 kHz, and 100 kHz are shown in Figure 5. The plots show two regions. In the first region up to a temperature of 50°C, σ_{ac} increase at slower rate and in the second region i.e. 50°C-60°C, a decrease in conductivity with increase of temperature is observed for all frequencies. In the temperature range between 90°C and 145°C, σ_{ac} increases linearly with temperature and frequency independent. Above 145°C and up to 170°C the conductivity decreases at all frequencies due to similar variations in ϵ and $\tan\delta$. Further the conductivity values are larger for higher frequencies. The σ_{ac} values range from 10^{-10} to 10^{-7} ($\Omega\text{-cm}$)⁻¹.

Table 4.2: Values of activation energy and relaxation time for AN-VP (50/50) for 1 kHz

S.No	frequency (kHz)	Peak temperature(K)	$\tan\delta_{\max}$	activation energy (eV)	relaxation time (τ) sec.
1	$f_1=1$	393	0.8	1.88	1.272×10^{-4}
	$f_2=5$	398	0.68	
2	$f_2=5$	398	0.68	0.50	2.163×10^{-5}
	$f_3=10$	407	0.51	
3	$f_3=10$	407	0.51	1.51	8.113×10^{-6}
	$f_4=100$	416	0.42		6.681×10^{-7}

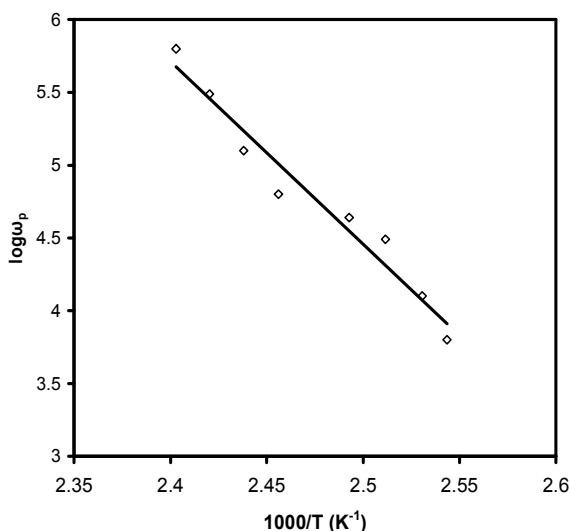


Fig.4- plot of $\log \omega_p$ verses reciprocal temperature for AN-VP(50/50)

A slow increase of ac conductivity from room temperature up to 50°C is attributed to low concentration of impurities and their mobility. A similar behavior that observed in $\tan\delta$ variation reflected in conductivity between 50°C and 60°C due to the

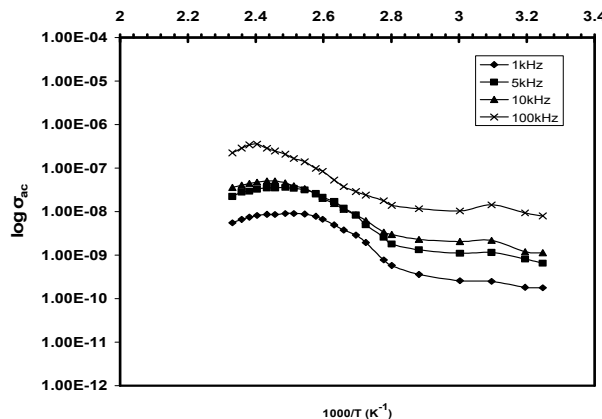


Fig. 5- Variation of ac conductivity with reciprocal temperature for AN-VP(50/50)

presence of pendant groups of the polymer chain. The linear increase in conductivity above 90°C and upto 145°C is due to high concentration of thermally generated charge carriers in the polymer chain. These carriers can move more easily into the volume of the sample resulting in large currents and hence an increase in conductivity. Thus at higher temperatures the increase in conductivity is mainly attributed to the increase in mobility of ions in the polymeric material¹⁶. Beyond 140°C the decrease in conductivity is attributed to disordered motion of the charge carriers. The activation energy for the conduction process for the linear portion of the graph in the temperature range 90°C – 140°C is estimated from the slope. The activation energy thus obtained is 1.61 eV.

IV. CONCLUSION

The dielectric property of the AN-VP has been studied and ac conductivity is also evaluated and studied the conduction process and molecular motions and relaxations in the polymer material. Nature of temperature dependence of ϵ has been studied. Relaxation time is found to be larger for low frequencies and smaller for high frequencies.

REFERENCES

- [1] The chemistry of acrylonitrile, 2nd ed., American Cyanamid co., New York (1959) P2 2
- [2] A.Y. Coran and R. Patel. Rubber Chem. 53, (1980), 781
- [3] Mc Crum, N.G.B.E. Read and G. Williams, Anelastic and Dielectric effects in Polymeric solids Wiley, New York (1967).

- [4] Hill, N.E., Vaughan, W.E., Price, A.H. and Davis, M., Dielectric properties and molecular behavior, Von Nostrand Reinhold Company (London). (1969)
- [5] Elif Vargun, Mehmet Sankir, Ali Usanmaz, Yasin Kanbur, Ufuk Abaci, H. Yukselguney J. App. Sci. 10, (2011), 1002.
- [6] S. Sridevi, K. Rajani Kumar, S.K. Feroz and P. Raghunath Rao. J. Chem. 2, (2009) 61.
- [7] K. Rajani Kumar, S.K. Feroz and P. Raghunath Rao. Kthermal, Asian J. Research Chem. 1, (2008), 58.
- [8] Rao, K.V. and Smakula, A., J. Appl. Phys. 37 (1966) 319.
- [9] Anju Tanwar, Gupta, K. K., Singh, P. J. and Vijay, Y. K., Bull. Mater. Sci. 29 (2006), 397.
- [10] Tareev, B., Physics of dielectric materials, MIR Publications, Moscow (1979).
- [11] Gupta AK, Singhal RP and Agarwal AK. Polymer. 22, (1981), 285.
- [12] Nada, A. M. A, Dany, M., Salama, A. H., J. Mater. Chem and Phys. 84 (2004) 205.
- [13] Abd El- Kader, A.M. SHEHAP, M.S. ABO Ellil. And K.H. Mahmoud 22, (2005), 349.
- [14] Rebek, J. F., Experimental methods in polymer chemistry, (1980).
- [15] Shasidhar, G.V.S., Satyanarayana, N., Sundaram, E.V., Sathaiah, G. and Sir Deshmukh, L., J. Macro. Mol. Sc (Chem.), A 27, (1990), 1069.
- [16] Fahmy, T and Ahmed, M. T., J. Polym. Mater. 20, (2003), 367.

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Area efficient 0.18um Cmos phase frequency detector for high speed PLL

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Abstract- Two phase frequency detectors (PFDs) are proposed in this paper that can overcome the speed and area limitations of conventional PFD. The AND gate based PFD uses 22 transistors. It consumes 161.41uW power when operating at 50MHz clock frequency with 1.8V supply voltage. The NOR gate based PFD uses 20 transistors and preserves the main characteristics of conventional PFD. It consumes 96.67uW power at 50MHz with 1.8V supply. The designs are implemented using 0.18um cmos process in Tanner 13.0v and can operate up to 1GHz frequency. These can be used in PLL for high speed applications.

Index Terms – phase frequency detector, phase locked loop, CMOS integrated circuits, tanner

I. INTRODUCTION

The phase-locked loop (PLL) plays the role of generating a clock signal that is usually a multiple of a reference clock and synchronized with the reference clock in phase. The PLL is widely used in many applications such as frequency synthesis, phase modulation, phase/frequency demodulation, and clock data recovery. In most cases, the charge pump PLL (CP-PLL) is used due to its high frequency range and simple structure. The basic block diagram of the PLL is shown in the Fig.1. In general a PLL consists of five main blocks:

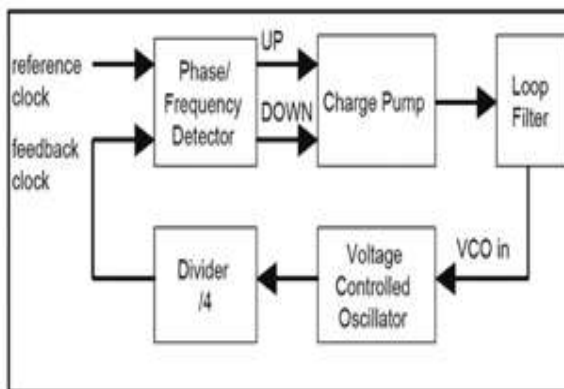


Fig.1 PLL Block Diagram

1. Phase Detector or Phase Frequency Detector (PD or PFD)
2. Charge Pump (CP)
3. Low Pass Filter (LPF)
4. Voltage Controlled Oscillator (VCO)
5. Divide by N Counter

In the PLL, the phase frequency detector (PFD) compares the rising edges of the reference clock and the voltage-controlled oscillator (VCO) clock, and generates a lead signal when the

reference phase is leading or a lag signal when the reference phase is lagging. The phase difference detected in the PFD passes through the loop filter to control the VCO. As the phase difference critically affects the overall characteristics of the PLL such as lock-in time and jitter performance, the PFD should be designed to work accurately for any phase difference.

II. CONVENTIONAL PFD

An ideal phase detector produces an output signal whose dc value is linearly proportional to the differences between the phases of two periodic inputs.

$$V = K_{pd} * \Delta\theta \quad (1)$$

Where K_{pd} is the gain of the phase detector and $\Delta\theta$ is the phase difference between the input signals. PFD generates an output pulse whose width is equal to the time difference between consecutive zero crossings of the input signals. The block diagram of the conventional PFD is shown in Fig.2 and Fig.3 shows the waveform for PFD.

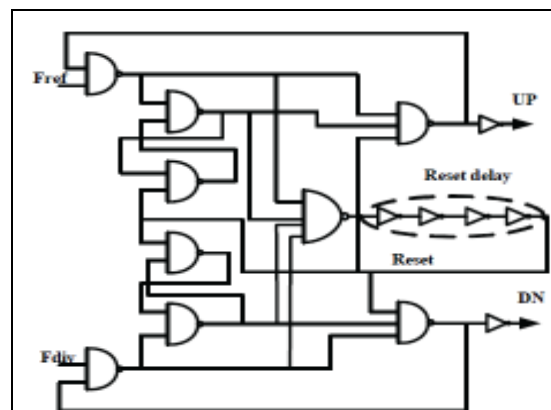


Fig.2 Conventional PFD

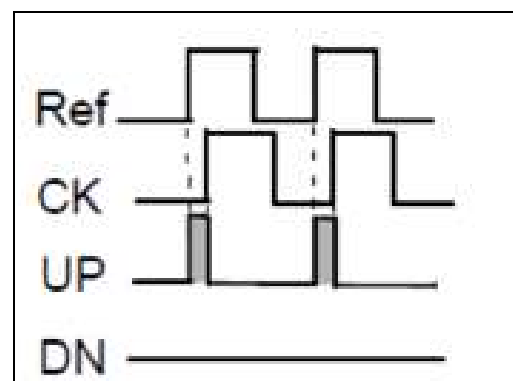


Fig.3 Waveform for conventional PFD

The con-PFD has large dead zone in phase characteristics at the steady state, which generates a large jitter in locked state in PLL. Also, a large amount of power consumption cannot be avoided in high frequency operations because internal nodes of the con-PFD are not completely pull up or pull down. Furthermore, the maximum speed of the con-PFD is limited and uses 48 transistors hence the area is also increased.

III. CIRCUIT DESCRIPTION

A. PFD using AND Gate

This paper presents two PFD architectures having low area and can work on higher frequencies. Fig.4 shows the phase frequency detector using AND gate. The circuit consists of two resettable, edge triggered

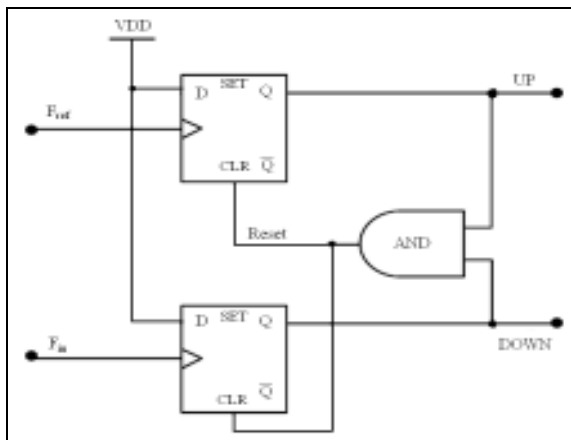


Fig.4 AND gate based PFD

D flip flops with their D inputs tied to logic 1. The Ref and Clk serve as clocks of the flipflops. Suppose the rising edge of REF leads that of CLK, then UP goes to logic high. UP keeps high until the rising edge of CLK makes DN on high level. Because UP and DN, are ANDed, so RESET goes to logic high and resets the PFD into the initial state. The schematic of AND gate based PFD circuit consisting of only 22 transistors is as given in Fig.5.

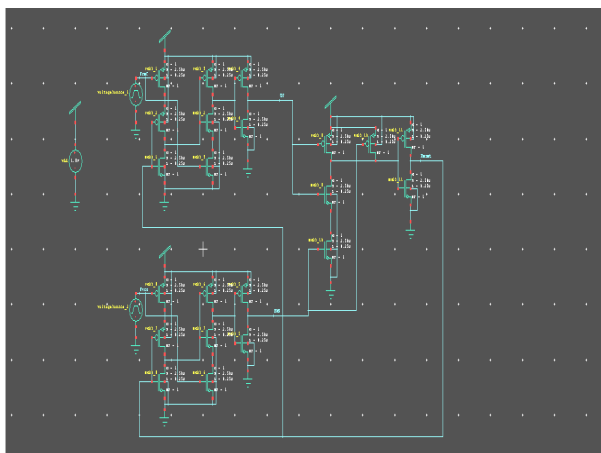


Fig.5 Schematic of AND gate based PFD

B. PFD using NOR Gate

Fig.6 shows the phase frequency detector using NOR gate. The circuit consists of two resettable, edge triggered D flip flops with their D inputs tied to logic 1. The Ref and Clk serve as clocks of the flip flops. The UPb and DNb signals are given as input to the NOR gate. Suppose the rising edge of REF leads that of CLK, then UPb goes to logic low i.e. UP keeps high until the rising edge of CLK makes DNb on low level. Because UPb and DNb, are NORed, so RESET goes to logic high and resets the PFD into the initial state.

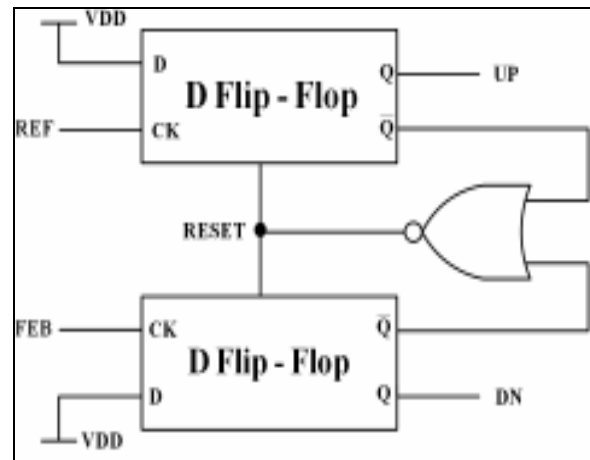


Fig.6 PFD using NOR gate

The circuit is implemented in Tanner 13.0v with only 20 transistors. The schematic of the NOR based PFD is as shown in Fig.7.

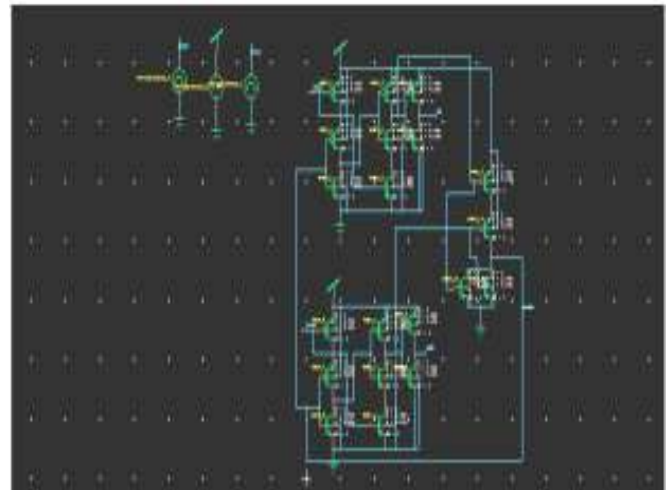


Fig.7 Schematic of NOR based PFD

IV. SIMULATION RESULTS

The AND gate based PFD circuit is simulated on Tanner 13.0 at 1.8V to obtain the results with the input frequency of 1GHz and the two inputs are 90° out of phase.

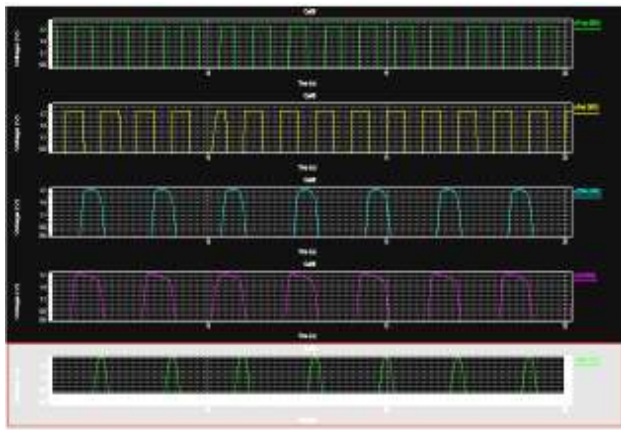


Fig.8 The waveforms of the AND gate based PFD when the input frequency is 1GHz and the two inputs are 90° out of phase.

The NOR gate based PFD circuit is simulated on Tanner at 1.8V to obtain the results with the input frequency of 1GHz and the two inputs are 90° out of phase.

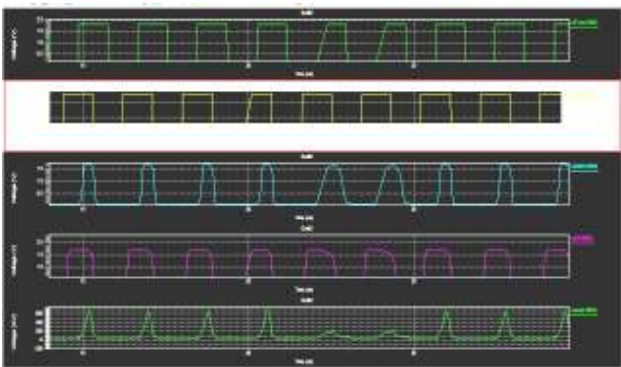


Fig.9 The waveforms of the NOR gate based PFD when the input frequency is 1GHz and the two inputs are 90° out of phase.

The two circuits can be simulated when Fref and Fvco have different frequencies. Fig.10 shows the waveform for NOR based PFD when Fref is greater than Fvco. The UP signal goes high at the rising edge of Fref and the DN signal goes high at the rising edge of Fvco. When both UP and DN signals become logic high the circuit is reset to initial state. The pulse width of UP and DN signal is proportional to the frequency difference between the two inputs.

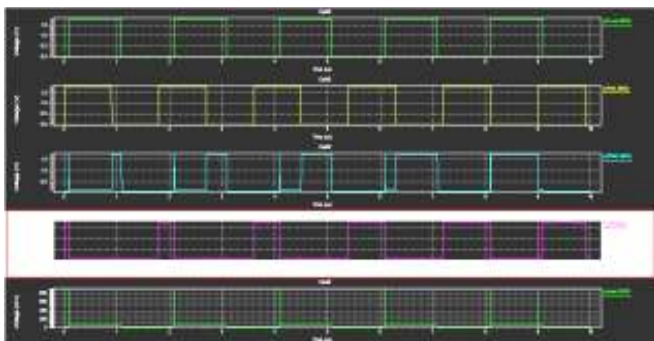


Fig.10 The waveforms of the NOR gate based PFD when the Fref is greater than Fvco

V. PERFORMANCE COMPARISON

TABLE 1

PFD TYPE	MAXIMUM OPERATING FREQUENCY	POWER CONSUMPTION AT 50MHZ	NO. OF TRANSISTORS	DEAD ZONE
Con-PFD	500MHz	335uW	48	-
AND gate based PFD	1GHz	161.4uW	22	50ps
NOR gate based PFD	1GHz	96.67uW	20	40ps

VI. CONCLUSION

This paper presents two PFD designs implemented in 0.18um CMOS process. The AND gate PFD consists of 22 transistors and the NOR gate PFD consists of only 20 transistors. Both the PFDs can operate upto 1GHz frequency and preserves the main functionality of conventional PFD with low power consumption. The performance of the two PFDs is compared against the conventional PFD in table 1.

REFERENCES

- [1] D. H. Kim, et al, "Clock and data recovery circuit with two exclusive OR phase frequency detector", in IEEE Electronics Letters, vol. 36, no. 16, Aug. 2000, pp 1347 – 1349.
- [2] W. Hu, et al, "Fast frequency acquisition phase frequency detector with zero blind zone in PLL", in IEEE Electronics Letters, vol. 43, no. 19, Sep. 2007.
- [3] H. O. Johansson, "A simple precharged CMOS phase frequency detector", in IEEE Journal of Solid State Circuits, vol. 33, no. 2, Feb. 1998, pp 295 - 299.
- [4] R. Y. Chen, et al, "A high speed fast acquisition CMOS phase frequency detector for MB-OFDM UWB", in IEEE Transaction on Consumer Electronics, vol. 53, no. 1, Feb. 2007, pp 23 - 26.
- [5] N. M. H. Ismail, et al, "CMOS phase frequency detector for high speed application", in 4th International Design and Test Workshop, Nov 2009.
- [6] K. Park, et al, "Fast frequency acquisition phase frequency detector with prediction based edge blocking", in IEEE International Symposium on Circuits and Systems, 2009, pp 1891 - 1894.
- [7] B. Razavi, "Design of Analog CMOS Integrated Circuits", Prentice Hall, 1998.
- [8] R.Jacob Baker, CMOS Circuit Design, Layout and Simulation.
- [9] Weste, CMOS VLSI Design

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An Approach towards Software Implementation of Interactive Color Transformation Algorithm

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Abstract- In this paper we present a recoloring technique called interactive color transfer which is similar to local color transfer which gives a user more control to define local areas & match the local areas in order to perform color transfer. This paper presents a fast and simple interactive algorithm based on local color statistical analysis which is used to impose one image's color characteristics on another. Here focus on orthogonal color space i.e. $l\alpha\beta$ color space without correlation between the axes is given. Target image's color influence mask is prepared. It is a mask that specifies what parts of target image will be affected according to selected color range. After that target image is recolored in $l\alpha\beta$ color space according to prepared color influence map. In the $l\alpha\beta$ color space luminance and chrominance information is separate so it allows making image recoloring optional. The basic color transformation uses stored color statistics of source and target image. Our paper presents an approach towards the software implementation of the proposed technique. The proposed algorithm is implemented in JAVA object oriented language.

Index Terms- color space, recoloring, color transfer, local color information, image segmentation.

I. INTRODUCTION

Images can convey information not only through the depicted objects but also through the particular mood, color scheme and composition of the scene. Artists can manipulate the color palette manually to change the appearance of an image and achieve specific effects but that can be a time-consuming process, requiring advanced image manipulation skills. To that end, several color transfer techniques have been proposed that uses the color palette of a second image as a target and achieve similar results with minimal user input and skill necessary. Often this means removing a dominant and undesirable color cast, such as the yellow in photos taken under incandescent illumination. Typically, there are two types of color transfer method: global color transfer and local color transfer. Most of existing methods are aimed to perform global color transfer. This usually means that the whole image is affected. Global color transfer does not have adequate spatial consideration, so it cannot avoid the following two problems. One is that if the source or target image contains different color regions, the global transfer cannot distinguish the different statistics and will mix regions up. The other problem is that if the color of the two images are very

different, in the $l\alpha\beta$ color space, the chromaticity channels are easily exaggerated which will cause unnatural and saturated result. Later to overcome problems associate with global color transfer local color transfer methods have been proposed for application to specific local regions within an image. In this case, the user can select a pair of corresponding regions in the source and target image for the color change.



Figure 1: (a) The effect of total image recoloring using the method of Reinhard et al [1].



Figure 1: (b) Partial image recoloring with an image fragment using proposed method.

Figure 1(a) shows the effect of global color transfer in which the whole image gets affected while figure 1(b) shows the partial image recoloring which is nothing but a local color transfer. Here the user just have to select a pair of corresponding regions in the source and target image for the color change. The data of the selected region is used to calculate its color statistics. We use them to estimate pixels of the target image belong, or rather are close enough, to the selected color range. Then color transformation is applied to the image, according to this estimation. In this paper a novel approach towards the software implementation of the local color transfer algorithm is proposed.

II. RELATED WORK

Most of the existing color transfer algorithm performs global color transfer. Reinhard et al presented a method for global color transfer. [1] shifts and scales the pixel values of the source image to match the mean and standard deviation from the target. This is done in the lab opponent color space, which is on averaged correlated [2]. This allows the transfer to take place independently in each channel, turning apotentially complex 3D

problem into three much simpler 1D problems. Although this technique can be successful for a large range of images, the quality of the results largely depend on the composition of the source and target images. While this algorithm is simple and efficient, it cannot distinguish the color statistics of local regions, which generate an unnatural or oversaturation in resulting image.

Some authors try to solve this problem using complex image spatial or color characteristics, but these methods have other limitations. Method based on Basic Color Categories [3] is limited in variations of color changing, because any color can be replaced only by a color from the same color category. For example, we can't turn blue into red. Another method, described in [4], uses complex image color and spatial characteristics to determine image palette associations. Image color segmentation using Expectation Maximization method is offered in [6] to solve the problem of local color transfer, but segmentation and region color decision is performed fully automatically, and again for the whole image, which is not always desirable. Cellular automata is used successfully in [7] to select an object of interest, but only a single color can be used as color source and recoloring is very uniform, even when some variability of color shade is desired according to initial look and feel of the object.

III. LOCAL COLOR TRANSFER

This method is developed to correct an object on a *target* image, selected by user. It is important, that user doesn't have to select the object by shape, for it is difficult to do precisely. The object is selected in terms of its color range and calculating its color statistics.

The source color can be defined as a single color or a region of another image, that we will call the *source* image. In this case source color statistics are calculated. After the information of the target color range is gathered, we prepare the target image's Color Influence Map (CIM). It is a mask that specifies what parts of the target image will be affected according to the selected color range.

The next step is recoloring itself, that is applied to the target image according to the prepared CIM. To recolor the target image we use a modified version of the Color Transfer algorithm, described in [1]. The basic algorithm uses transformation method, based on source and target color statistics in $l\alpha\beta$ color space [1],[4]. The limitations of this method are 1) only an image can be used as a source for recoloring; 2) only the whole image can be recolored. These limitations are removed in our algorithm.

A. Need to transfer of RGB color space to $l\alpha\beta$ color space:

When a typical three channel image is represented in any of the most well-known color spaces, there will be correlations between the different channels' values. For example, in RGB space, most pixels will have large values for the red and green channel if the blue channel is large. This implies that if we want to change the appearance of a pixel's color in a coherent way, we must modify all color channels in tandem. This complicates any color modification process. What we want is an orthogonal color space without correlations between the axes. When a typical three channel image is represented in any of the most well-known color spaces, there will be correlations between the different channels' values. For example, in RGB space, most pixels will have large values for the red and green channel if the blue

channel is large. This implies that if we want to change the appearance of a pixel's color in a coherent way, we must modify all color channels in tandem. This complicates any color modification process. What we want is an orthogonal color space without correlations between the axes which lets us apply different operations in different color channels with some confidence that undesirable cross channel artifacts won't occur. Additionally, this color space is logarithmic, which means to a first approximation that uniform changes in channel intensity tend to be equally detectable. Once the RGB color space is transformed to $l\alpha\beta$ color space then the object's color statistics is calculated.

B. Calculating object's color statistics

At first user has to select an object to correct at the target image. This can be done by loosely selecting a rectangular region of the object that needs correction. There's no need to select the region precisely close to the edges of the area, that user wants to correct, because we will use its color range without spatial characteristics. The only limitation is that the whole region must be inside this object.



Figure (2): The region is selected to correct the sky.

After the user has selected the region at the target image, we calculate color statistics (mean and variation) for this region, for each channel of the working color space separately:

$$\mu_c^R = \frac{1}{N_R} \sum_{i=i_1}^{i_2} \sum_{j=j_1}^{j_2} c(i, j), \quad (1)$$

$$\sigma_c^R = \sqrt{\frac{1}{N_R - 1} \sum_{i=i_1}^{i_2} \sum_{j=j_1}^{j_2} (c(i, j) - E^R c)^2}, \quad (2)$$

where $N_R = (i_2 - i_1 + 1)(j_2 - j_1 + 1)$ is the number of pixels in the selected region R , $1 \leq i_1 < i_2 \leq H$ and $1 \leq j_1 < j_2 \leq W$ define the rectangular region R and $c(i, j)$ is a processed color channel of pixel (i, j) .

If colors of another image must be used as color source, then this step is applied to the source image as well. Note that all these and further calculations can be made in any color space, but as it is discussed earlier in this paper & is shown in [4] that the most suitable color space for color transformations is Rudermann et al. $l\alpha\beta$.

C. Building the Color Influence Map

After color statistics of the target image are gathered, they are used to determine the mask for the target image recoloring.

CIM contains weights for color transformation for each pixel of the target image. Each pixel's weight is determined from its proximity to the color range, selected by user and stored in color statistics information. That is Mahalanobis distance between the pixel and the center of the color distribution, defined by the stored color statistics. Since $l\alpha\beta$ is a color space with

decorrelated axes (as stated in [1]) Mahalanobis distance turns to Euclidian:

$$\rho(x, \mu) = \|x - \mu^R\|_E \quad (3)$$

where x – is a color vector in working color space and $\mu^R = (\mu^R l, \mu^R a, \mu^R b)$, obtained from (1).

Weights f_{ij} in CIM are build using this formula:

$$f_{ij} = F(\rho(\mu^R, C(i,j))) \quad (4)$$

where $C(i,j)$ is a color vector, $\rho(\mu^R, C(i,j))$ is obtained from (3), $F(x)$ is defined at $[0, \infty)$ and $\lim_{x \rightarrow \infty} F(x) = 0$; $F(0) = 1$;

$F(x)$ is not strictly defined in (4), because there can be used various functions. Our experiments have shown that for photographs of good enough quality better results can be achieved using:

$$F(x) = e^{-3x^2} \quad (5)$$



Figure (3): CIM for the selected region from Fig. 2 using (5).

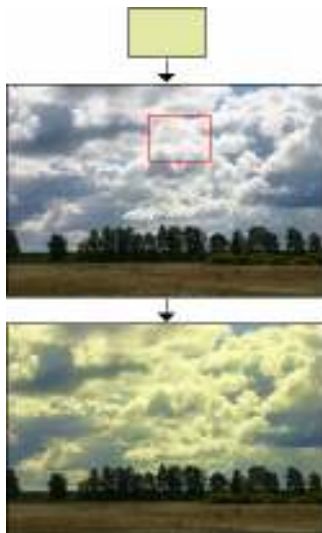


Figure (4): Partial image recoloring with a single color used as color source.

D. Color transfer

At this step the target image is recolored according to the prepared CIM. The basic color transformation uses the stored color statistics. The below original formula from [1] is applied to all the pixels of the target image, separately for each color channel. Here and further the source data are marked with index s and the target data are marked with index t .

$$c_t^{new}(i,j) = \mu_s + \frac{\sigma_s}{\sigma_t} (c_t(i,j) - \mu_t) \quad (6)$$

This transformation is modified to include the CIM information and to apply a single color as a source, if necessary. Thus, if the source color is taken from an image, then the stored source color statistics are used:

$$c_t^{new}(i,j) = c_t(i,j) + f_{ij} \cdot \left(\mu_c^R + \frac{\sigma_c^R}{\sigma_c^t} (c_t(i,j) - \mu_c^t) - c_t(i,j) \right) \quad (7)$$

$$i = \overline{1, H_t}, j = \overline{1, W_t},$$

Where $C_t^{new}(i,j)$, $C_t(i,j)$ are new and old values of a color channel of pixel (i,j) of the target image respectively; μ_c^R , μ_c^t are taken from (1); σ_c^R , σ_c^t are taken from (2), f_{ij} is taken from (4), H_t is target image height, W_t is target image width.

If the single color Col is used as the source for recoloring, then (7) turns to:

$$c_t^{new}(i,j) = c_t(i,j) + f_{ij} \cdot (Col - \mu_c^t), \quad (8)$$

$$i = \overline{1, H_t}, j = \overline{1, W_t},$$

Fig. 2 shows the result for the image and selection. We can see that only the sky was corrected, while the field and the trees were left unchanged. Moreover, the details of the recolored area are saved, so that it has quite natural look. Fig. 5 shows the example of using a single color as source color. Like in the previous example, only the sky was corrected while the field and trees weren't damaged. And both Figs.2 and 5 shows, that the whole area of the selected color range was affected by color transformation. Note that in the $l\alpha b$ color space luminance and chrominance information is separate, so it allows making image recoloring optional in this way easily.

IV. EXPERIMENTS

Here we try to implement the proposed algorithm in JAVA. In the first step of implementation a GUI is prepared which allows the user to load the source & target image of their interest. After that our algorithm calculates the histogram for both the source & target image and also it compares the histogram of source & target image. The source & target images are present in RGB color space. To perform the local color transfer it is required to convert the RGB color space into $l\alpha b$ color space. The next step of implementation will be the conversion of RGB color space into $l\alpha b$ color space. The source & target images which are shown in fig 1(a) are loaded and after that our algorithm calculates the red, green, blue histogram for both the images. After calculation of histograms for both images comparison is performed.

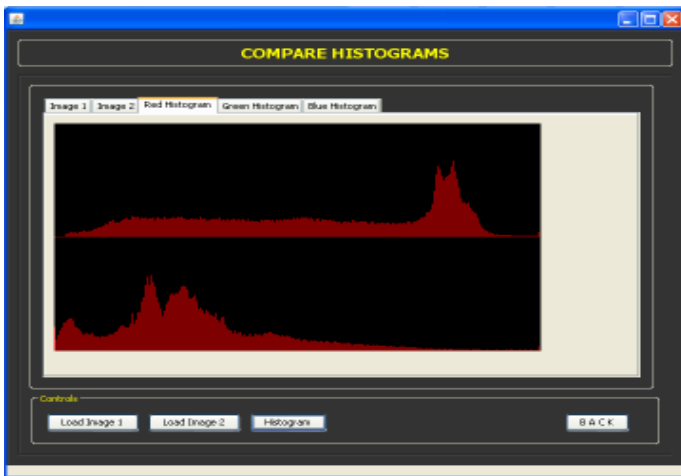


Figure (5): GUI for Histogram comparison

Figure(5) shows GUI through which user can load source & target images of their interest. It also shows the comparison of red histogram similarly our algorithm performs comparison for green as well as blue histogram.

V. CONCLUSION

In this paper a novel approach for the implementation of interactive local color transfer algorithm is proposed. Here the color transfer is performed by mapping dominant colors of source image to target image. This algorithm allows user to correct an object of interest at an image saving one from the trouble of selecting it precisely. The proposed method allows the user to recolor a part of the image in a simple and intuitive way, preserving other color intact and achieving natural look of the result for wide variety of input images. The proposed algorithm is fast, fully automatic and can depict all the dominant color styles of the target image in the output image.

REFERENCES

- [1] Eric Reinhard, Michael Ashikhmin, Bruce Gooch, Peter Shirley, "Color Transfer Between Images", Computer Graphics and Applications, 2001, Vol.21, Issue 5, pp. 34-41.
- [2] Ruderman D, Cronin T, Chiao C. Statistics of cone responses to natural images: implications for visual coding. Journal of the Optical Society of America A 1998;15(8):2036-45 .
- [3] Youngha Chang, Suguru Saito, Masayuki Nakajima, "Color transformation based on Basic Color Categories of a Painting", Proceedings of Computer Graphics International, 2003, pp. 176-181.
- [4] Donald H. House, Gary R. Greenfield, "Image Recoloring Induced by Palette Color Associations", Journal of WSCG, 2003, Vol.11, No.1, pp. 189-196.
- [5] Daniel L. Rudermann, Thomas W. Cronin, Chuan-Chin Chiao, "Statistics of cone responses to natural images: implications for visual coding", Journal of the Optical Society of America, 1998, Vol.15, Issue 8, pp. 2036-2045.
- [6] Jiaya Jia, Chi-Keung Tang, Yu-Wing Tai, "Local Color Transfer via Probabilistic Segmentation by Expectation- Maximization", IEEE Computer Society Conference on Computer Vision and Pattern Recognition, 2005, Vol.1, pp. 747-754.
- [7] V. Konushin, V. Vezhnevets, "Interactive Image Colorization and Recoloring Based on Coupled Map Lattices", Graphicon'2006 Conference Proceedings, 2006, pp.231-234.
- [8] Alla Maslennikova, Vladimir Vezhnevets" Interactive Color Transfer Between Images" Graphics and Media Lab., Department of Computational Mathematics and Cybernetics Lomonosov Moscow State University, Moscow, Russia

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The Overview of Change Management and Building Change Management Competency

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*"The greatest danger in times of turbulence is not the turbulence;
It is to act with yesterday's logic."*

— Peter Drucker

Abstract- Change Management as a hot topic in today's trend provides a typical process and creates tools to make understanding of people - side of change. An organization that faces stable demands to change and there of uses effective change management above and over with each one of the new inventions may know-how a fundamental change in its operations. Management competency is the existing of a business value that believes change and responds with the understanding, perceptions, tools and techniques to mark the change seamless and uncomplicated. It is that creating change as a part of the "business as usual." This leads to Change management competency.

The purpose of building the competency to cope change is to give people the perspective, authority and skills they need to support many changes they will face. The change management competency is that an organization-wide ability to apply the change management practices effectively and routinely.

This paper gives the overview of change management and Building change management competency for success of the organization.

Index Terms- change, organization, change management, competency.

I. INTRODUCTION

Change is the get by the process of moving from the present state of change to the desired state of change that individual, groups and organizations except in response to dynamic internal and external factors that alter current actualities. Fortune magazine first published the list of American's top 500 companies in 1956. Gloomily less than 30 companies from the top 100 on the original list leftovers today. Greatly the speed and complexity of change severely tests the competencies of managers and employees to adapt quickly and effectively. When the organizations fail to change, the cost of the failure may be higher.

II. THE SIGNIFICANCE OF CHANGE

Change will not disappear or disintegrate. The pace of change has increased intensity. The world may not be circling faster but humanity certainly. In many sectors of the economy, organizations must have the ability to adapt hastily to survive.

Business and executives are now faced with highly vigorous and ever more complex operating environments. This leads importance of change to executives and organizations.

III. FORCES THAT INVOLVES IN CHANGE

Any factor in the environment that interferes with the organization's ability to attract the human, financial and material resource it needs, or to produce and market its service or product becomes a force of change.

Internally, several forces operate in the organization that could ease or hinder its function, processes and actions. An organization thus subject to two sets of forces those of the external political, economic, social and competitive environment and those of internal individual/ group speculations, technological changes, system dynamic resource constraints, etc.,

IV. DIFFERENT TYPES OF CHANGE

Change is to move from the present state of the future, from the know state to a relatively unknown state. The organization can experience different types of changes ranging from Directional change, Operational change, Total change, Planned change, Happened change, Transformational change, Revolutionary change, and Recreation change.

V. PRINCIPLES OF CHANGE MANAGEMENT

1. Always involve and agree support from people within system (system = environment, processes, culture, relationships, behaviors, etc., whether personal or organizational).
2. Recognize where you/the organization is at the moment.
3. Realize where you need to be, when, why, and what the actions will be for having got there.
4. Plan development towards above principle in exact achievable measurable stages.
5. Communicate, involve, enable and ease participation from the people, as initial and willingly and as fully as possible.

VI. CHANGE MANAGEMENT AND CHANGE MANAGEMENT COMPETENCY ARE DISTINCT

Change management competency is as like that to change management, but to hand are several key distinctions.

- Change management is the practice of exact activities to cope the change of the people-side to understand fruitful results of a business change. It's an organization's ability to react and manage the change over and over. This change management competency is not an exact activity. It is an organization-wide know-how to apply

the change management practices positively and routinely.

- Despite the fact change management can be trained and learned that needs an ultimate shift in its values and culture. Change management must turn out to be part of routine operations and cannot be just demonstrated in training programs or instructional material.
- Change management competency should be obvious at all levels - mainly Executives, sponsors and front-line employees. Frequently, these areas in the organization lack the importance of accepting and skills required to be supporters of change. Although the centers of excellence or project teams can become skillful in change management, the whole organization need to experience a change in the way it strategies business as routine to build change competency.

VII. NECESSITY FOR CHANGE MANAGEMENT COMPETENCY

In an organization building the change management competency is not like giving orientation platform or carrying out a fresh policy. It requires a new approach and attitude. Persons in the change-competent organization state their work relative to change and worth the capability to change their core responsibilities. They know that change will happen, expect it and naturally perform through and also when there is a change.

Change management competency ruins the occurrence of a business environment that expects change and responds with the perspectives, understanding, techniques and tools to make changes effortless and seamless. It is that making changes as a part of "business as usual."

VIII. BUILDING THE CHANGE MANAGEMENT COMPETENCY

Change management as a sprouting and an important competency progressed up on the trends list from position five in 2007 to two in the 2009 study. Change management competency has straight conclusion results. Latest research shows that the organizations are more flourishing when they successfully manage the change.

A report by well-known McKinsey initiate that skills in the 12 key change management areas openly correlate to the return grasped on projects. In adding Prosci data analysis with 327 project teams indicated that teams which used outstanding change management were more probable to meet their goals and to finish their work on periodically.

Building the change management competency is attracting a strategic goal for all the prominent organizations in today's business environment. Peoples specified more demand for

training and knowledge around change management, and more widespread competency building programs. Change management competencies were becoming obvious in senior leadership levels as well as front-line management levels.

IX. CONCLUSION

This briefing has unfilled a common indication of some of the factors involved in Change Management. Yet, human behavior in groups and practice in organizations is too far and also complex for the magic 'change management formula'. Change is not predictable it should be accepted. Nearly by definition, it calls for a flexible rather than a fixed response. Planning for change increases the possibility that the change process will yield certain outcomes. But it does not guarantee them. 'Managing' change is not 'controlling' it. Change agents can more realistically. Building the change management competency is attracting a strategic goal in today's business scenario for all prominent organizations.

REFERENCES

- [1] Kavita singh, Organisation change & Development, Excel Publications, 2005.
- [2] Gareth R. Jones, Organisational Theory, Design & Change, Pearson Education., 2007.
- [3] (2011) Change management website. [Online]. <http://www.change-management.com/tutorial-competency>.
- [4] Wendell L. French and Cecil H. Bell., Organization Development, Prentice Hall of India, 2005.
- [5] (2011) Prosci web site. [Online]. <http://www.acmp.info/europe/hiatt.htm>
- [6] Jeff Hiatt, Best Practices in Change Management, Prosci's Edition, 2009.

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Application of Remote Sensing and GIS for groundwater recharge zone in and around Gola Block, Ramgarh district, Jharkhand, India

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Abstract- In the present scenario of our world's burgeoning population which is becoming increasingly difficult, it is must rather than a challenge for any country to meet the task of providing sufficient quantity of water to each and every person in the face of the changing consumption patterns, impacts of the climate change and degradation of the finite land and water resources. The study area comprises hard rock of Precambrian/Archean and some part of sedimentary deposits. The intersection zones of lineaments provide potential for ground water accumulation and ground water recharge. Occurrence of groundwater in such rocks is essentially confined to fractured and weathered zones. The present paper aims to establish basic information for site selection of rainwater harvesting /artificial recharge structures to the aquifer systems by preparing various thematic maps such as geology, geomorphology, drainage pattern, drainage density, lineaments, Landuse/ Landcover etc. which have been prepared on visual interpretation techniques using the remote sensing data with the help of GIS techniques and topographic information along with secondary information and limited field checks of the study area, that falls in and around Gola block, Ramgarh district, Jharkhand, India. It is an attempt to suggest for maintaining the proper balance between the groundwater quantity and its exploitation.

Index Terms- Artificial Recharge sites, GIS, Groundwater recharge structures, Remote Sensing, weightage overlay

I. INTRODUCTION

Groundwater is the most important natural resource of the Earth which is required for drinking, irrigation and industrialization. Its availability depends upon the presence of rock types and their physical properties such as porosity, permeability, transmissivity and storage capacity. Scarcity of groundwater depends upon the development activities of the area. Continuous failure of rain falls, increasing demand and overexploitation of groundwater cause to depletion of groundwater. These problems could be sorted out to certain extends by artificial recharge to the aquifers by construction of small water harvesting structures across streams/watersheds. When the natural recharge rate cannot be sufficient to maintain the demand for water, the balance is disturbed and hence require for artificial recharge on a country wise basis. The main objective of artificial recharge is to provide sustainability to ground water by restoring supplies to aquifers depleted due to excessive draft and to enhance recharge to the aquifers lacking adequate natural recharge both in space and time. In hard rock terrains, groundwater availability is of limited extent. Occurrence and movement of groundwater in such rocks is

confined in fractured zones and depth of weathered rocks. Extensive hydrogeological studies have been carried out by several workers in delineating groundwater potential zones in hard rock terrain (Agarwal *et al.*, 1992; Rao *et al.*, 2001). Remote sensing and GIS are playing a rapidly increasing role in the field of hydrogeology and water resources development. Remote sensing provides multi-spectral, multi-temporal and multi-sensor data of the earth's surface (Choudhury, 1999). Satellite data provides quick and useful baseline information on the parameters like geology, geomorphology, lineament, Landuse/Landcover etc. All thematic maps are integrated in the Geographic Information System (GIS) and a final composite map has been



Fig. 1 Location map of the study area

generated and checked with adequate field data, particularly well inventory and yield data. It is possible to identify the ranges depth, the yield, the success rate and the types of wells suited to different litho units under different hydrogeological units. Based on groundwater development, management and irrigated areas, artificial recharge structures such as percolation tanks, check dams, sub surface dykes, recharge-cure-discharge wells and rainwater harvesting structures can be recommended in upstream of groundwater irrigated areas to recharge the wells in the downstream areas so that it may possible to augment groundwater resources. The present study area is an attempt to identify such suitable zones for artificial recharge to the aquifer system in and around Gola block, Ramgarh district, Jharkhand, India using remote sensing and GIS techniques.

II. MATERIALS AND METHODS

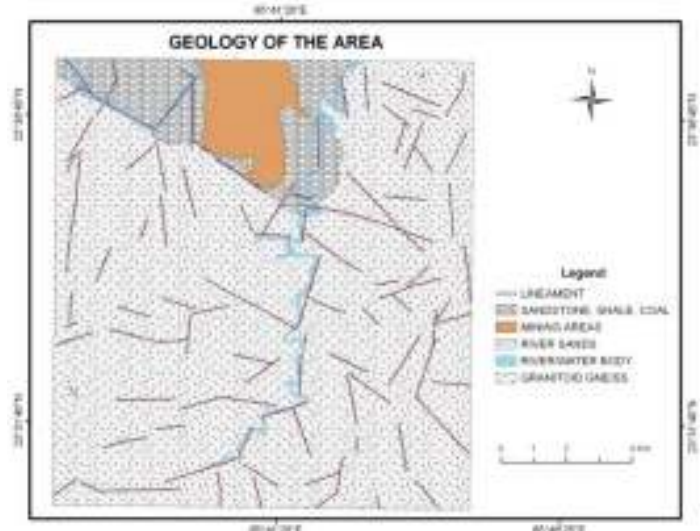
The study area lies in Survey of India toposheet No. 73E/10 falling between latitude 23°30'00"- 23°37'30"N and longitude 85°37'30" - 85°45'E in Gola block, Ramgarh district of Jharkhand state and is situated in NNE of Ranchi comprising about 70 kms by road from the city. Remote sensing data, topographic map of Survey of India (SOI) and other published maps and reports constitute the database for the interpretation and delineation of various thematic layers and information. Satellite data IRS-P6, LISS-III, in digital format were used in conjunction with secondary data. Basic technical guidelines are adopted by National (Natural) Resources Information System (NRIS, 2000), and Rajiv Gandhi National Drinking Water Mission (NRSC, 2007) for identifying the ground water recharge zones. The thematic maps of geology, geomorphology, landuse/landcover, drainage and lineaments were prepared using digitally enhanced satellite data. Arc Map version 9.0 software package was used for creation of digital database using on visual interpretation technique, data integration and analysis. Each thematic map assigned weights depending on its influence on groundwater recharge and storage. Knowledge based weight assignment was carried out for each feature and they were integrated and analyzed by using the weighted overlay method. The different units in each theme were assigned ranking from 0 to 4 on the basis of their significance for artificial recharge to aquifer system. The final score of a theme is equal to the product of the rank and weightage. From the composite layer, the delineation of site suitability analysis was made by grouping the polygons into different prospect zones i.e. good, moderate to good, poor or not suitable.

III. RESULTS AND DISCUSSION

A. Geological setup

The study area falls in the Chotanagpur Granite Gneissic Complex. The Hazaribag plateau, separated from the Ranchi plateau by the Gondwana belt, is predominantly made up of lower Ranchi surface (Mahadevan, 2002). The lower Ranchi surface is broadly in the elevation of the region ranges between of 450-600m amsl. The outliers of Gondwana sediments lie over the Precambrian gneisses and high grade schistose basement formations. Precambrian basement are exposed on the floor of Damodar River and the periphery of eastern part of the Gondwana basin. Main litho units are granite gneiss, mica-schist

with quartzite and amphibolites which are interbedded and have



been subjected to intense folding.

Fig. 2 Geological map with lineaments of study area

Barakar formation, the main lithounit sequences of coalfield, is deposited over Talchir. It is composed of coarse grained to pebbly sandstone, medium to fine grained sandstone, grey and carbonaceous shale along with coal seams. Among intrusive igneous rocks lamprophyres are found in south eastern region of the Rajrappa project, which has resulted in the formation of columnar joints within shale.

Table.1 Generalized geological succession of the area

Division	Description of beds	Age
Barakar	Coarse grained feldspathic sandstone	Lower Permian
Karharbari	<i>Fine grained sandstone, Medium to coarse grained, sand stone with interbedded coal seam</i>	Upper Carboniferous to Lower Permian
Talchir	Boulder Conglomerate/ Olive green shale	Upper Carboniferous
Archaean	Metamorphic rocks, Granite gneiss, Quartzite, mica schist schists.	Archaean

B. Lineaments/Structures

Lineaments are linear or curvilinear structures on the earth surface, it depicts the weaker zone of bed rocks and area is considered as secondary aquifer in hard rock regions. These lineaments are mapped with the help of satellite data and can be correlated with faults, fractures, joints, bedding planes and lithological contacts. The study area is found to have a number of criss-crossed lineaments. The intersection of lineaments is considered as good occurrence of groundwater potential zones. For analysis purposes lineament density have been prepared and categorized in four classes: low, medium, high and very high. Higher density of lineament is very good favorable zones for ground water recharge than lesser one therefore weightage are

assigned high for higher density and low for lower density (Fig 3).

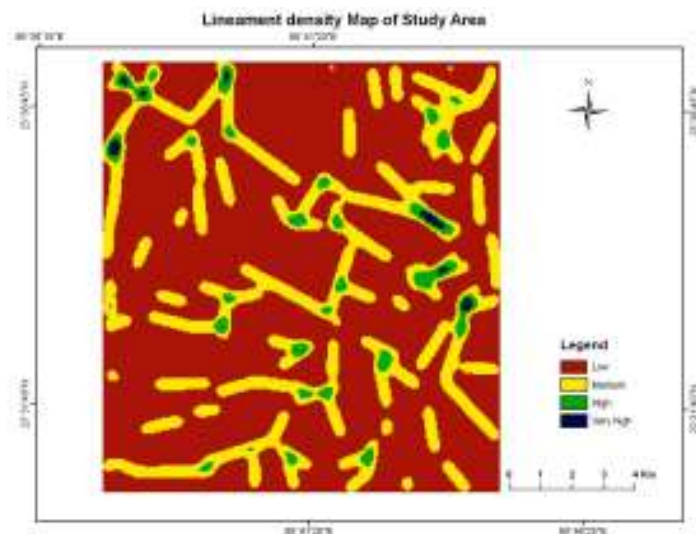


Fig.3 Lineament density map of the study area

C. Geomorphological setup

An integrated study of the geology and evolution of landforms is useful to understand the occurrence of porous and permeable zones (Karanth, K. R., 1999). The study area has complex geomorphic features, which are describe as follows.

1. *Cuesta* - Cuesta (from Spanish: “slope”) is a ridge formed by gently tilted sedimentary rock strata in a homoclinal structure (<http://www.Britannica.com/eb/topic-14944,cuesta>). Prospect of groundwater in cuesta is rated good. The cuesta is identified in the northern part of the study area.

2. *Inselberg* - These are isolated hills of massive rocks with steep side slope, which act as runoff zone. These features are found in the south-western part of study area.

3. *Pediment inselberg complex* - Pediments, small erosional surfaces, with individual units are not mappable. In Pediment Inselberg Complexes contributes limited to moderate recharge is reported.

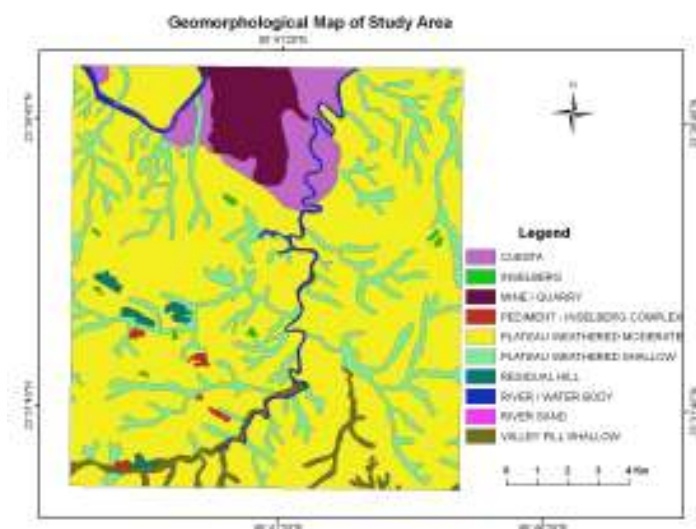


Fig. 4 Geomorphological map of the study area

4. *Residual hills* - These geomorphic features are isolated bodies seen in the south western part of the study area and in this area have very poor recharge and limited prospect of ground water.

5. *Plateau weathered* - Weathered rocks being porous and permeable possess very good storage and yield capacity of groundwater in hard rock terrain. Study area is observed to contain moderate to shallow weathered rocks. The study area is reported weathered zones are up to 20m depth.

6. *Valley fills* - The valley fill constitute unconsolidated materials deposited by the southern part of the study area in narrow nallas/rivers in narrow valleys and are found in patches. Depth of the valley area is reported less than 5m depth.

D. Drainage pattern and drainage density

Drainage pattern depict history of the evolution of the earth crust. The study area has been drawn drainage - pattern map with the help of Survey of India topographic map and updated from satellite data. The streams present in the study area have been ordered using Strahler's system of stream ordering (Strahler1957).

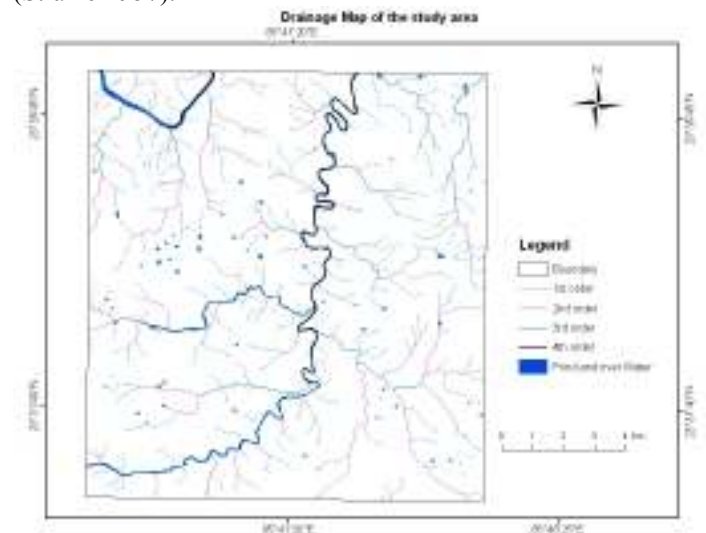


Fig. 5 Drainage map of the study area

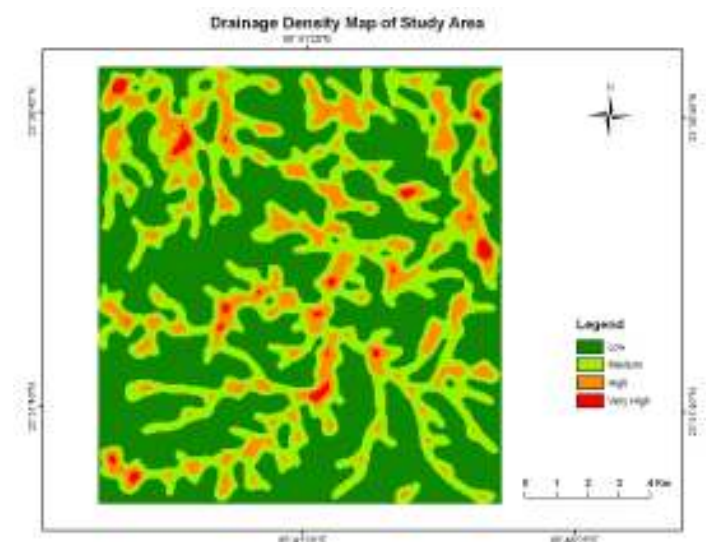


Fig. 6 Drainage density map of the study area

The smallest initial tributaries are designated as 1st order and when two first order channels join, the channel segment formed is 2nd order stream and so on. The highest order of stream found in the area is of 4th order developed in and around Gola block. The study area has dendritic drainage pattern which is typical character of granitic terrain. The drainage density map reveals density value ranging from 0 to 6 km/km². For analysis purposes they were regrouped into four category i.e. > 3 high, 3 – 2 medium, 2 – 1 low and 1 – 0 very low km/km². Considering from recharge point of view more weightage is assigned to very low drainage density regions where as low weightage assigned to very high drainage density (fig-5 and fig-6).

E. Landuse / Landcover

Remote sensing data and GIS techniques provide reliable basic information for landuse mapping and play very important role in determining land use pattern by visual interpretation. In the study area major landuse pattern includes cropland (Kharif and Rabi), fallow land, forest area, barren rocky area, land with scrubs and without scrubs, mine area etc. following the guidelines of IMSD and NRIS.

Cropland mainly Rabi and Kharif crops have been identified by the light medium red tone, fine/medium texture. Land with scrubs have been identified in uplands and plains with gentle to moderate slopes, uplands and plains with cultural lands it appears light yellow to greenish blue tones and irregular shapes. The forest gives light reddish and fine to medium texture with irregular shape and varying size. Forest area has good water recharge potential zone but it is categorized as poor, keeping in mind that these areas are generally restricted.

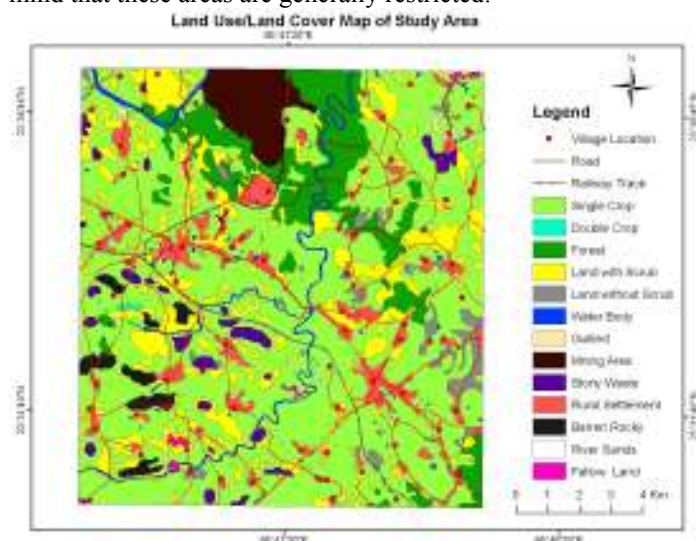


Fig. 7 Landuse/Landcover map of the study area

F. GIS Analysis

To delineate the ground water recharge zones in the study area all the thematic maps like Geology, geomorphology, Landuse/Landcover, Drainage density and lineament density are assigned knowledge based weightages to each thematic features after considering their importance with respect to groundwater recharge. All the thematic maps were integrated in GIS environment and the polygons have been regrouped into different classes.

G. Weight Assignment

All thematic layers such as geomorphology, geology, landuse, lineaments density and drainage density maps have been considered for site suitability analysis. Based on the available knowledge each parameter has been considered and assigned weightages of 24, 22, 20, 18 and 16 for geomorphology, geology, lineament density, drainage density and landuse respectively. Again each of these layers has been further classified into different classes. Each of the classes, is based on suitable of groundwater infiltration has been given ranks 4, 3, 2, 1&0. Finally, scores have been calculated as the product of the weightage and rank. Rank, weightage and scores for the various themes for site suitability modeling. Artificial recharge sites of the study area have been identified based on the number of parameters loaded such as 4, 3, 2, 1 & 0 parameters, again the study area is classified into priority I, II, III & IV (Poor, Poor to Moderate, good and Very good fig.8) suggested for artificial recharge sites based on the number of parameters loaded using GIS integration.

Table 2 Weightage assigned of the features

Geomorphic Unit Weightage - 24			Land use/Land cover Unit Weightage-16		
Geomorphic Unit	Rank	Score	Land use/Land cover	Rank	Score
Cuesta	2	48	Single Crop	4	64
Inselberg	1	24	Double Crop	4	64
Pediment	1	24	Forest	0	0
Inselberg Complex	1	24	Land with Scrub	2	32
Residual Hills	0	0	Land without Scrub	2	32
Plateau Weathered Moderate	3	72	Water	0	0
Plateau Weathered Shallow	2	48	Gullied	1	16
Mine/Quarry	0	0	Mining	0	0
River Sands	0	0	Stony Waste	1	16
River Water	0	0	Rural Settlement	0	0
Valley Fill	4	96	Barren Rocky	0	0
Geological Unit Weightage-22			River Sand	0	0

Mine/Quarry	0	0
Barakar Sand Stones	4	88
Chotanagpur Granitoid Gneiss	3	66
Drainage Density Unit Weightage-18		
Low	4	72
Moderate	3	54
High	2	36
Very High	1	18
Fallow Land	3	48
Lineament Density Unit Weightage- 20		
Low	1	20
Medium	2	40
High	3	60
Very High	4	80

Boulder bunds are low cost structures. They are made across 1st to 3rd order stream in upper reaches catchments area. It may be constructed in a series of height bunds. Its purpose is to stabilize the erosion of soil and improve the groundwater recharge by checking flow of rainwater. They are generally recommended at the foot of the upstream.

B. Check Dams

Check dams are Engineering structures constructed across the higher order greater than 3rd order stream has minimum average area 25 hectares. These are constructed checking the run-off of the stream and store the rainwater for use in lean period and it also recharge the groundwater reservoir systems.

C. Recharge Pit

Recharge pits are excavated pit or embankment across a water course or combination of both. These structures are recommended in single crop area for providing to irrigation to limited area in critical period.

D. Sub Surface dyke

These structures are generally proposed across water course to arrest the lateral Flow of groundwater through subsurface dykes that helps to recharge the groundwater aquifer systems. The structures should be below at least 2meters from ground surface to the bed rocks.

V. CONCLUSION

The groundwater conditions in hard rock terrain are multivariate due to the heterogeneous nature of the aquifer owing to the varying composition, compaction and density of weathering. The site suitability modeling for locating the artificial recharge structures to ground water aquifer system using GIS analysis has an added advantage over conventional survey. The multilayer integration viz., geomorphology, landuse, geology, lineament (density) and drainage (density) gives smaller suitability units as a composite layer structures site of the study area. The interlayer ranking and intralayer weightages further intensify the interpolation. These zones are then compared with the Landuse/Landcover map and ordering of drainage for the further adopting the suitable structures for rain water harvesting/artificial recharge to the aquifer system in the particular structures.

REFERENCES

- [1] Binay Kumar, Uday Kumar, Ground water recharge zonation mapping and modeling using Geomatics Techniques International Journal of Environmental Sciences Volume 1 No.7, 2011.
- [2] Jaiswal, R.K., Mukherjee, S., Krishnamuthy, J. and Saxena, R.(2003) Role of remote sensing and GIS techniques for generation of groundwater prospect zones towards rural development an approach. International Journal Remote Sensing, v.24 no.5, pp. 993-1008.
- [3] Jayakumar, R. and Ramasamy, SM. (1996). Groundwater Targeting in Hard rock Terrain through Geomorphic Mapping: A case study in part of South India. Asian Pacific Remote Sensing and GIS Journal, Vol.8, No.2, Jan.'96. pp.1723
- [4] Karanth, K. R., 1987, Ground water assessment, development and management, Tata McGraw-Hill publishing company Limited, New Delhi.
- [5] Mandevan, T.M., (2002), Geology of Bihar and Jharkhand, Geological Society of India, Bangalore pp.203.
- [6] National Remote Sensing Agency, (NRSA), 1985, Integrated Mission for Sustainable Development Technical Guidelines, National Remote Sensing Agency, Department of Space, Hyderabad.

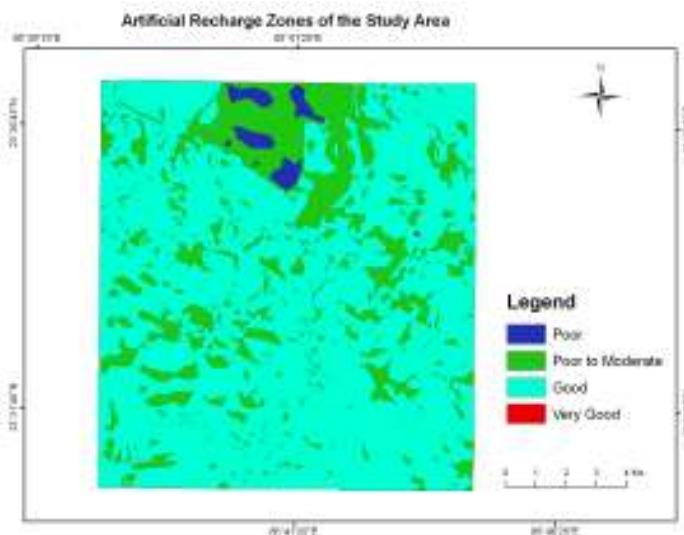


Fig. 8 Artificial recharge zones map of the study area

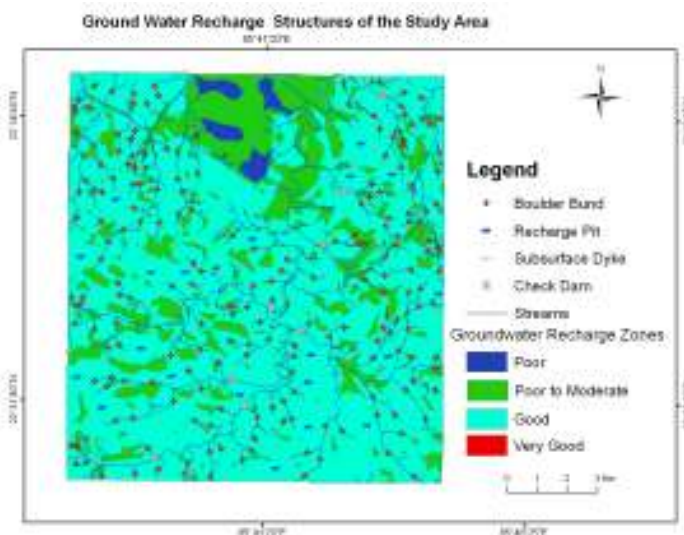


Fig. 9 Suggested artificial recharge structures map of the study area

IV. PROPOSED GROUNDWATER HARVESTING/ARTIFICIAL RECHARGE STRUCTURE (FIG. 9)

A. Boulder bunds

- [7] National Natural Resources Management System/ISRO HQ, 2000, National (Natural) Resources Information System (NRIS) Node Design and Standards, ISRO HQ, Bangalore.
- [8] National Remote Sensing Agency (NRSA), 2007, Manual for Ground Water Prospects Mapping using Remote Sensing techniques and Geographic Information System Rajiv Gandhi National Drinking Water Mission Project.
- [9] Rao S N, Chakradar GKJ and Srinivas V, 2001, Identification of groundwater potential zones using Remote Sensing Techniques in around Guntur Town, Andhra Pradesh, India, Journal of Indian Society of Remote Sensing, 29(12), pp 69 78.
- [10] Sankar K, 2002, Evaluation of groundwater potential zones using remote sensing data in Upper Vaigai river basin, Tamil Nadu, India. Journal of Indian Society of Remote Sensing, 30(30), pp 119–129.
- [11] Saraf A K and Choudhury PR, 1998, integrated remote sensing and GIS for ground water exploration and identification of artificial recharge sites,

International Journal of Remote Sensing, Volume 19, Issue 10, pp 1825–1841.

- [12] <http://www.britannica.com/eb/topic-14944/cuesta>

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Struggle for iron: a key attribute for combating Multi Drug Resistance in human pathogen *Candida albicans*

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Abstract- Continuous deployment of antifungals in treating infections caused by dimorphic opportunistic pathogen *Candida albicans* has led to the emergence of drug resistance resulting in cross-resistance to many unrelated drugs, a phenomenon termed as Multi-Drug Resistance (MDR). Although there is reasonable understanding of major factors which contribute to MDR mechanisms, it appears unavoidable to consider novel MDR mechanisms. The ability of pathogenic fungi, including opportunists like *Candida albicans*, to sense and become accustomed to changes in the host environment is essential for their survival and confers the basis of their success as dreadful pathogen. Recent findings suggest that in addition to the classical MDR mechanisms, existence of other novel mechanisms controlling MDR cannot be nullified. Improved knowledge of such mechanisms could facilitate the development of novel therapies to combat these intransigent infections. One such significant environmental factor that *C. albicans* must respond to is iron limitation since they encounter diverse such anatomical sites during the establishment of infection within the host. Considering the importance of *C. albicans* being the fourth most common cause of hospital acquired infectious disease, this review focuses on gaining insights of new regulatory mechanism controlling MDR in *C. albicans* as a response towards iron deprivation.

Index Terms- MDR, *Candida albicans*, iron, microbial infection

I. INTRODUCTION

In the last decades, the incidence of fungal infections has increased dramatically due to the rise in the number of immunocompromised patients. The most prevalent fungal pathogen of humans is *C. albicans*. This species ranks as the fourth most common cause of hospital acquired infectious disease and is the primary cause of systemic candidiasis, with mortality rates approaching 50% (Pfaffer & Diekema, 2007). The opportunistic pathogen, *C. albicans* is normally a commensal organism in humans, but in conditions such as AIDS, organ transplant, diabetes, or in cancer patients when the host is unable to mount an adequate immune response, it results in mucosal, cutaneous or invasive mycoses (Calderone *et al.*, 2002). Continuous usage of antifungal drugs in treating infections caused by *C. albicans* has led to the emergence of drug resistance. This acquired resistance in clinical isolates of *C. albicans* mostly results in cross-resistance to many unrelated

drugs, a phenomenon termed as Multi-Drug Resistance (MDR) (Franz *et al.*, 1998; Franz *et al.*, 1999; White *et al.*, 1998). The evolution of drug resistance in fungal pathogens have posed serious problems due to the limited number of clinically useful anti fungal drugs available (Anderson *et.al* 2005; Cowen *et. al* 2008). The various mechanisms of MDR to survive exposure to antifungal drugs includes an over expression or mutations in *ERG11*, encoding the target enzyme of azoles lanosterol 14 α -demethylase (Lamb *et al.*, 1997; Prasad, 2004; White *et al.*, 1998; White *et al.*, 2002), an over expression of the drug efflux pumps encoding genes such as *CaCDR1* and *CaCDR2* belonging to the ABC (ATP-Binding Cassette) (Albertson *et al.*, 1996; Kohli *et al.*, 2002 Sanglard *et al.*, 1997) and *CaMDR1* belonging to the MFS (Major Facilitator Super family) transporters (Gupta *et al.*, 1998 Pao *et al.*, 1998).

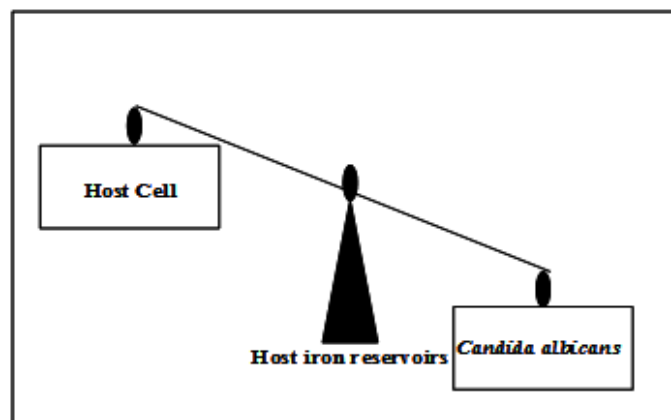
In the recent years emerging evidences has demonstrated that there do exists many novel mechanisms controlling MDR and improved knowledge of such molecular mechanisms controlling MDR in pathogenic fungi should facilitate the development of novel therapies to combat these intransigent infections. This review further defines the focus on the urgent need for the understanding of one such novel mechanism regulating MDR i.e. iron availability and attempts to highlight its significance when one considers drug susceptibilities in *C. albicans*.

II. IRON AVAILABILITY AS AN IMPORTANT BIOLOGICAL DETERMINANT GOVERNING MICROBIAL INFECTION

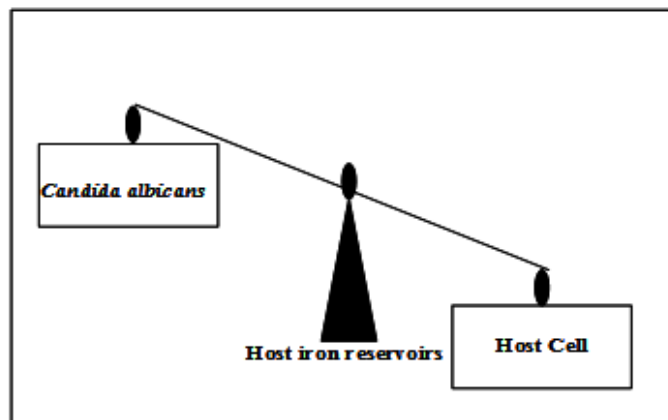
Intracellular pathogens colonize a variety of anatomical sites which are likely to be scarce in iron, especially under conditions of severe and chronic immunosuppression induced by HIV infection. Apart from exception like *Borrelia burgdorferi* (which does not require iron, Posey & Gherardini, 2000) almost every organisms require iron for growth. Iron is an indispensable critical micronutrient which is required both by the host as well as by the microbial community residing within the host especially as a cofactor in important metabolic functions (Almeida *et al.*, 2009, Bullen *et al.*, 2006; Fischbach *et al.*, 2006; Nyilassi *et al.*, 2005; Spacek *et al.*, 2005; Weinberg *et al.*, 1999). Iron being a transition metal and because of its ability to donate and accept electrons can participate in the formation of toxic free radicals; therefore, availability of iron in host macrophage cells is tightly regulated (Radisky & Kaplan, 1999). Since iron in macrophages is not freely available, therefore pathogenic organisms needs to exploit host iron reservoirs to make their own niches within it for their survival. In contrast, macrophages

sequester iron to avoid iron acquisition by invading organisms using different strategies (Nairaz *et al.*, 2007). They also need to protect iron from intracellular pathogens to maintain their own homeostasis, as iron is required as cofactors in many enzymes including those generating reactive oxygen or nitrogen species as immediate defense against invading organisms. Moreover, the macrophages play critical role in body iron homeostasis by recycling iron for erythropoiesis (Andrews and Schmidt, 2007). So, protecting iron from invading organisms is immensely important for macrophages. This competition between the pathogen and host macrophages for iron represents a critical virulence trait of many infectious diseases (Fig 1) and serves as a natural defense mechanism against infection (Emery, 1980; Kontoghiorghe & Weinberg, 1995; Schaible & Kaufmann, 2004; Weinberg, 1984). Many studies depicting correlations between host iron content and pathogenicity have been observed for the pathogenic fungi *Cryptococcus neoformans* (Barluzzi *et al.*, 2002) and *Aspergillus fumigatus* (Kontoyiannis *et al.*, 2007) and bacteria such as *Mycobacterium tuberculosis*, *Salmonella* species and *Yersinia* species (Schaible & Kaufmann, 2004; Doherty, 2007). Another study revealed the iron dependent role of *Leishmania MDR1* gene in mediating drug resistance (Wong *et al.*, 2006). A recent study shows that iron deprivation downregulates *MDR1/P-gp* function and expression in a leukemic cell line (Fang *et al.*, 2010).

Figure 1: Iron Balance: Struggle for limited iron reservoirs within the host cells forms the basis of establishment of infection by invading microorganism.



Survival of Intracellular pathogens



Survival of Host Cell

III. CHEMISTRY AND BIOLOGY OF IRON

The history of earth and evolution of life depicts the abundance, availability, and suitability of iron had been critical to living system. Iron is the fourth most abundant element in the earth crust and second most abundant metal. In the periodic table iron is positioned in the middle. It is a transition metal that exists in various oxidation states ranging however, in the living cell system biochemically, Fe(II) and Fe(III) are the most relevant oxidation states. Transfer of a single electron between these two states is readily accomplished with ascorbate or molecular oxygen. This variability in redox states contributes significantly to the role of iron as an essential biological metal. Although non-toxic in its ferric state, soluble ferrous can be toxic due to its participation in the generation of hydroxyl radicals via Fenton reaction (Halliwell & Gutteridge, 1984). Hydroxyl radicals can depolymerise polysaccharides, cause DNA strand breaks, inactivate enzymes and initiate lipid peroxidation (McCord, 1996).

IV. IRON ACQUISITION IN *C. ALBICANS*

Iron acquisition is a critical need for all microorganisms because iron in a human host is not freely available, but mostly linked to host proteins, therefore pathogens such as *C. albicans* must possess mechanisms to gain iron from these proteins. *C. albicans* possesses various type of iron acquisition system, as each system is specifically adopted for a given environmental niche. Here summary of the known and proposed strategies of how *C. albicans* exploits iron from host proteins is mentioned.

Haemoglobin Uptake: Most of the haem in mammalian host is bound to haemoglobin which serves as the largest reservoir of iron for the pathogenic microbes. *C. albicans*, exploit extracellular haemin as an iron source *in vivo* probably through the binding of erythrocyte (Santos *et al* 2003). The iron acquisition by *C. albicans* involves four steps.

- Binding of haemoglobin to extracellular glycosyl phosphatidylinositol-linked receptor, Rbt5.
- Endocytosis and probable dissociation of the heme from the globins in the acid environment of the endosome.
- Degradation of iron-protoporphyrin IX by heme oxygenase, CaHmx1, to alpha-biliveridin, free iron and CO and
- Uptake of the released iron by the vacuolar iron permease (Weissman *et al* 2008).

Siderophore Uptake: Siderophores are low molecular weight 1.5kda ferric iron chelators that are produced through short, well defined metabolic pathways by many bacteria and fungi under conditions of extreme iron stress (Howard, 1999). These molecules contain lateral chains and functional groups which confer a strong affinity for iron. Most of the fungal siderophores are hydroxamates in nature containing an N-δ-hydroxyornithine

moiety. The uptake of iron siderophore complex is followed by intracellular reduction of this siderophore bound iron by vacuolar enzymes. In addition to being a means of iron acquisition, specialised intracellular siderophore has also been reported to act as iron storage molecule in *A. fumigates* (Howard, 1999; Schrettl *et al* 2008). Although *C. albicans* have not been reported to synthesize and secrete siderophores, they do possess a well defined siderophore uptake system comprised of siderophore transporters such as Sit1p and Arn1-3 hydroxamate transporters (Lesuisse *et al* 1998; Heyman *et al* 2002) indicating that it probably extract iron from siderophores secreted by other organisms in the environment.

Reductive Iron Uptake:

This pathway relies on the extracellular ferric reductases (Fre) located in the plasma membrane that can reduce either free or complexed ferric (Fe^{3+}) ions into soluble ferrous (Fe^{2+}) ions. Since reduced ferrous iron generated by surface reductase activity can be toxic, due to the spontaneous generation of free radicals, Fe^{2+} ions are subsequently oxidized Fe^{3+} and transported into the cell by the protein complex consisting of a multicopper oxidase and iron permease. Therefore Fe^{2+} ions are then taken up by high affinity permeases (Ftr1p) along with the cell surface multicopper ferroxidase (Fet3p) after reoxidation (Askwith *et al* 1994, Stearman *et al* 1996).

An intracellular copper transporter Ccc2p is essential for function of the reductive pathway (Weissman *et al.*, 2002) as it delivers copper to Fet3p and is regulated by cellular iron levels. Multiple homologs of *S. cerevisiae* FRE and FTR genes have been reported in *C. albicans* (Kornitzer, 2009; Baek *et al.*, 2008). Two proteins with iron permease activity are encoded by two highly homologous genes, with different affinities for iron ions, and with different regulation. The high affinity iron permease gene *FTR1* is induced upon iron deprivation, and low affinity *FTR2* is induced when higher levels of iron are available. Moreover, from all components of the reductive pathway, only *Ftr1* has been shown to be crucial for *C. albicans* virulence in an experimental animal model of infection (Ramanan and Wang, 2000). This reductive iron acquisition system is utilized to scavenge iron from the environment and from high affinity host iron binding proteins such as transferrin and ferritin. It has been hypothesized that release of iron from ferritin occurs by acidification of the surrounding environment followed by uptake of iron through reductive high affinity mechanism. Likewise *C. albicans* has also been found to scavenge free iron from transferrin via reductive pathway consisting of ferric reductase, Fre10 and high affinity permease, Ftr1 (Knight *et al.*, 2005).

V. STARVING THE INVADERS TO COMBAT MDR

Iron plays a key role in providing natural resistance to infections in humans (as reviewed above). Iron, a ubiquitous redox-active element, serves as a co-factor for several essential enzymes and biochemical processes that includes cellular respiration and metabolism, oxygen transport, drug metabolism and DNA synthesis (Welch *et al.*, 2001). In pathogenic *C. albicans*, iron deprivation represents one of the crucial environmental stress conditions it encounters during infection process. Iron acquisition during infection is considered as

virulence attribute therefore, the susceptibility to *C. albicans* infections is influenced by iron content of the host. For example, pretreatment of endothelial cells with the iron chelator phenanthroline reduces damage by *C. albicans* due to reduced invasion (Fratti *et al.*, 1998). Similarly, loading the epithelial cells with iron increased damage by *C. albicans*, in contrast to the pretreatment of oral epithelial cells with the iron chelator (BPS) (Almeida *et al.*, 2008). In a mouse model of systemic candidiasis, an intravenous injection with colloidal iron (60mg per kg body weight) for 3 consecutive days before intravenous inoculation of *C. albicans* yeast cells (10^7 cells) significantly increased the mortality rate of mice: within 28 days of infection, 40% of mice without iron administration died, while 80% mortality was observed among iron-loaded animals (Abe *et al.*, 1985). Similarly, many other studies have already established roles for iron in epithelial invasions (Heyman *et al.*, 2002), infections in mouse model (Ramanan & Wang, 2000) suggesting iron to play a vital role in the virulence of *C. albicans*. Recently role of iron in recurrent vulvovaginal candidosis (RVVC) showed that iron is not only important for pathogenic yeast, but also for normal function of host immunity (Spacek *et al.*, 2005). Kuipers *et al.*, 1999, had shown that lactoferrin, an iron binding glycoprotein, is synergistic with antifungals against different *Candida* species. However, no report was demonstrated whether iron affects drug susceptibility of *Candida* cells experimentally until Prasad *et al.*, 2006, reported for the first time. In the study, they focused on whether availability of iron could have an impact on defense mechanisms of *Candida* against antifungal drugs. Interestingly, it was observed that iron deprivation enhanced drug susceptibility of *Candida* cells resulting in an increase in membrane fluidity, which in turn leads to enhanced passive diffusion of drugs. A link between changes in membrane fluidity to lowered ergosterol levels was established in iron deprived *Candida* cells probably due to down regulation of *ERG11*. Furthermore, Hameed *et al.*, 2011, provided the first novel insight into the intricate relationship between cellular iron, calcineurin signaling, membrane lipid homeostasis and drug susceptibility of *Candida* cells. Recently, Dhamgaye *et al.*, 2012, demonstrated that antifungal action of malachite green is mediated viz depletion of labile iron pools as one of its mechanisms. The combination of lactoferrin with fluconazole has been reported to synergistically enhance the antifungal activity of fluconazole against *Candida* spp. (Kobayashi *et al.*, 2011). A significant recent finding establishes that Cap2/Hap43 is essential for *C. albicans* growth under iron-deprivation conditions and for virulence in mouse (Singh *et al.*, 2011). One of the target based approach that has been taken in recent times is the usage of fungicidal monoclonal antibodies which interferes with iron acquisition in *C. albicans* (Brena *et al.*, 2011). Hsu *et al.*, 2011, provided the first evidence that Hap43 is essential for the growth of *C. albicans* under low-iron conditions and for *C. albicans* virulence in a mouse model of infection.

VI. IRON REGULATORY CIRCUIT LINKS WITH OTHER MDR MECHANISMS IN C. ALBICANS

Like iron deficiency, *C. albicans* also often encounter sites within the host during infection which has inadequate vascularization and irregular blood flow thus representing

hypoxic areas. Iron limitation appears to limit metabolism largely by similar mechanisms compared with hypoxia as iron proteins are involved in oxygen-dependent reactions. For instance, the activation of *HIF1* is also dependent on cellular iron status as it was shown that the incubation of mammalian cells with iron chelators also activate *HIF-1* (Buss *et al.*, 2004, Comerford *et al.*, 2002,) which in turn activate its target genes like *MDR1*. Interestingly, recent studies suggest that there could be a correlation between intracellular iron and MDR phenomenon in mammalian cells (Epsztejn *et al.*, 1999). Similarly, pH is another environmental condition which *C. albicans* has to cope up within the host. That environmental pH can have influence on the other MDR regulatory mechanisms is amplified by the fact that at alkaline or neutral pH most of the iron is in insoluble ferric form and thus represents a form of iron deficiency. This is also evident from the fact that transcriptome analysis under alkaline pH conditions reveals that a host of upregulated genes were responsible for iron acquisition indicating that *RIM101* pathway also governs expression of iron acquisition genes (Bensen *et al.*, 2004). Moreover, *RIM101* regulated Als3p known to be important for adhesion was recently shown to bind ferritin and mediates growth on ferritin as an iron source (Almeida *et al.*, 2008).

VII. CONCLUSION

That iron availability is an important aspect which represents a well regulated novel MDR mechanism, therefore, any iron depleting strategy having influence on changes in drug susceptibilities of pathogenic microorganisms including *Candida* either alone or in combination with various antimicrobial compounds certainly merits a closer look. The importance of studying these novel mechanisms in *C. albicans* will help to understand how they are adapted to the mammalian host and potentially identify new approaches for treating infections.

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REFERENCES

- [1] Abe F, Tateyama M, Shibuya H, Azumi N and Ommura Y (1985) *Experimental candidiasis in iron overload*. Mycopathologia 89: 59–63.
- [2] Albertson GD, Niimi M, Cannon RD, Jenkinson HF. (1996) Multiple efflux mechanisms are involved in *Candida albicans* fluconazole resistance. Antimicrob Agents Chemother 40: 2835-2841.
- [3] Almeida RS, Brunke S, Albrecht A, Thewes S, Laue M, Edwards JE, Filler SG and Hube B (2008) *The hyphal-associated adhesion and invasion Als3 of Candida albicans mediates iron acquisition from host ferritin*. PLoS Pathog 4: e1000217.
- [4] Almeida RS, Wilson D and Hube B (2009) *Candida albicans iron acquisition within the host*. FEMS Yeast Res 9 1000–1012.
- [5] Anderson JB. (2005) Evolution of antifungal-drug resistance: mechanisms and pathogen fitness. Nat. Rev. Microbiol. 3: 547–556.
- [6] Andrews NC and Schmidt PJ (2007) *Iron homeostasis*. Annu Rev Physiol 69: 69–85.
- [7] Askwith C, Eide D, Van Ho A, Bernard PS, Li L, Davis-Kaplan S, Sipe DM, Kaplan J. (1994) *The FET3 gene of S cerevisiae encodes a multicopperoxidase required for ferrous iron uptake*. Cell 76: 403-410.

- [8] Baek YU, Li M and Davis DA (2008) *Candida albicans* ferric reductases are differentially regulated in response to distinct forms of iron limitation by the Rim101 and CBF transcription factors. Eukaryot Cell 7: 1168–1179.
- [9] Barluzzi R, Saleppico S, Nocentini A, Boelaert JR, Neglia R, Bistoni F and Blasi E (2002) *Iron overload exacerbates experimental meningoencephalitis by Cryptococcus neoformans*. J Neuroimmunol 132: 140–146.
- [10] Bensen ES, Martin SJ, Berman J, Davis D. (2004) Transcriptional profiling in *Candida albicans* reveals new adaptive responses to extracellular pH and functions for Rim101p. Mol Microbiol; 54 (5): 1335–1351.
- [11] Brena S, Cabezas-Olcoz J, Moragues MD, Fernández de Larrinoa I, Domínguez A, Quindós G, Pontón J. (2011) [Fungicidal monoclonal antibody C7 interferes with iron acquisition in Candida albicans](#). Antimicrob Agents Chemother. 55(7):3156-3163.
- [12] Bullen JJ, Rogers HJ, Spalding PB and Ward CG (2006) *Natural resistance, iron and infection: challenge for clinical medicine*. J Med Microbiol 55: 251-258.
- [13] Buss JL, Greene BT, Turner J, Torti FM and Torti SV (2004) *Iron chelators in cancer chemotherapy*. Curr.Top.Med.Chem. 4:1623-1635.
- [14] Calderone RA (2002) *Candida and Candidiasis*. Washington DC: American Society for Microbiology Press.
- [15] Comerford KM, Wallace TJ, Karhausen J, Louis NA, Montalto MC and Colgan SP (2002) *Hypoxia-inducible factor-1-dependent regulation of the multidrug resistance (MDR1) gene*. Cancer Res. 62: 3387-3394.
- [16] Cowen LE.(2008) The evolution of fungal drug resistance: modulating the trajectory from genotype to phenotype. Nat. Rev. Microbiol. 6: 187–198.
- [17] Dhamgaye S, Devaux F, Manoharlal R, Vandeputte P, Shah AH, Singh A, Blugeon C, Sanglard D, Prasad R. (2012) [In Vitro Effect of Malachite Green on Candida albicans Involves Multiple Pathways and Transcriptional Regulators UPC2 and STP2](#). Antimicrob Agents Chemother. 56(1):495-506.
- [18] Doherty CP (2007) Host–pathogen interactions: the role of iron.J Nutr 137: 1341–1344.
- [19] Emery T (1980) Iron deprivation as biological defense mechanism. Nature 287: 776-777.
- [20] Epsztejn S, Glickstein H, Picard V, Slotki IN, Breuer W, Beaumont C and Cabantchik ZI (1999) H-ferritin subunit overexpression in erythroid cells reduces the oxidative stress response and induces multidrug resistance properties Blood 94: 3593–3603.
- [21] Fang D, Bao Y, Li X, Liu F, Cai K, Gao J and Liao Q (2010) *Effects of Iron Deprivation on Multidrug Resistance of Leukemic K562 Cells* Chemotherapy 56: 9–16.
- [22] Fischbach MA, Lin H, Liu DR & Walsh CT (2006) *How pathogenic bacteria evade mammalian sabotage in the battle for iron*. Nat Chem Biol 2: 132-138.
- [23] Franz R, Kelly SL, Lamb DC, Kelly DE, Ruhnke M, Morschhauser J. (1998) Multiple molecular mechanisms contribute to a stepwise development of fluconazole resistance in clinical *Candida albicans* strains. Antimicrob Agents Chemother 42: 3065-3072.
- [24] Franz R, Ruhnke M, Morschhauser J.(1999) Molecular aspects of fluconazole resistance development in *Candida albicans*. Mycoses 42: 453-458.
- [25] Fratti RA, Belanger PH, Ghannoum MA, Edwards JE Jr & Filler SG (1998) *Endothelial cell injury caused by Candida albicans is dependent on iron*. Infect Immun 66: 191-196.
- [26] Gupta V, Kohli AK, Krishnamurthy S, Puri N, Aalamgeer SA, Panwar SL, Prasad R. (1998) Identification of mutant alleles of CaMDR1, a major facilitator of *Candida albicans* which confers multidrug resistance and its in vitro transcriptional activation. Curr Genet 34: 192-199.
- [27] Halliwell B and Gutteridge JM (1984) *Free radicals, lipid peroxidation and cell damage*. Lancet 2 (8411): 1095
- [28] Hameed S, Dhamgaye S, Singh S, Goswami SK, Prasad R.(2011) Calcineurin Signaling and Membrane Lipid Homeostasis Regulates Iron Mediated MDR Mechanisms in *Candida albicans*. PLoS ONE. 6(4): e18684.
- [29] Heymann P, Gerads M, Schaller M, Dromer F, Winkelmann G and Ernst JF (2002) The siderophore iron transporter of *Candida albicans* (Sit1p/Arn1p) mediates uptake of ferrichrome-type siderophores and is required for epithelial invasion. Infect Immun 70: 5246-5255.

- [30] Howard DH (1999) Acquisition, transport and storage of iron by pathogenic fungi. Clin Microbiol Rev 12: 394-404.
- [31] Hsu PC, Yang CY, Lan CY. (2011) *Candida albicans Hap43 is a repressor induced under low-iron conditions and is essential for iron-responsive transcriptional regulation and virulence*. Eukaryot Cell. 10(2):207-225.
- [32] Knight SA, Vilaire G, Lesuisse E and Dancis A (2005) Iron acquisition from transferrin by *Candida albicans* depends on the reductive pathway. Infect Immun 73: 5482-5492.
- [33] Kobayashi T, Kakeya H, Miyazaki T, Izumikawa K, Yanagihara K, Ohno H, Yamamoto Y, Tashiro T, Kohno S. (2011) *Synergistic antifungal effect of lactoferrin with azole antifungals against Candida albicans and a proposal for a new treatment method for invasive candidiasis*. Jpn J Infect Dis.64(4):292-296.
- [34] Kohli AK, Smriti M, Mukhopadhyay K, Prasad R. (2002) In vitro low-level resistance to azoles in *Candida albicans* is associated with changes in membrane lipid fluidity and asymmetry. Antimicrob Agents Chemother 46: 1046-1052.
- [35] Kontoghiorghes GJ and Weinberg ED (1995) Iron: Mammalian defense systems, mechanisms of disease and chelation therapy approaches. Blood Rev 9: 33-45.
- [36] Kontoyiannis DP, Chamilos G, Lewis RE, Giralt S, Cortes J, Raad II, Manning JT and Han X (2007) Increased bone marrow iron stores is an independent risk factor for invasive aspergillosis in patients with high-risk hematologic malignancies and recipients of allogeneic hematopoietic stem cell transplantation. Cancer 110: 1303-1306.
- [37] Kornitzer D (2009) *Fungal mechanisms for host iron acquisition*. Curr Opin Microb 12: 377-383.
- [38] Kuipers ME, De Vries HG, Eikelboom MC, Meijer DK and Swart PJ (1999) Synergistic fungistatic effects of lactoferrin in combination with antifungal drugs against clinical *Candida* isolates. Antimicrob. Agents Chemother 43: 2635-2641.
- [39] Lamb DC, Kelly DE, Schunck W-H, Shyadehi AZ, Akhtar M, Lowe DJ, Baldwin BC, Kelly SL. (2007) The mutation T315A in *Candida albicans* sterol 14a-demethylase causes reduced enzyme activity and fluconazole resistance through reduced affinity. J Biol Chem 272: 5682-5688.
- [40] Lesuisse E, Knight SA, Camadro JM and Dancis A (2002) Siderophore uptake by *Candida albicans*: effect of serum treatment and comparison with *Saccharomyces cerevisiae*. Yeast 19: 329-340.
- [41] McCord JM (1996) Effects of positive iron status at a cellular level. Nut. Rev 54(3): 85-88.
- [42] Nairaz M, Theurl I, Ludwiczek S, Theurl M, Mair SM, Fritsche G and Weiss G (2007) The co-ordinated regulation of iron homeostasis in murine macrophages limits the availability of iron for intracellular *Salmonella typhimurium*. Cell Microbiol 9: 2126-2140.
- [43] Nyilassi I, Papp T, Tako M, Nagy E and Vagvolgyi C (2005) *Iron gathering of opportunistic pathogenic fungi. A mini review*. Acta Microbiol Immunol Hung 52: 185-197.
- [44] Pao SS, Paulsen IT, Saier MH Jr. (1998) *Major Facilitator Superfamily*. Microbiol Mol Biol Rev; 62: 1-34.
- [45] Pfaller MA, Diekema DJ. (2007) Epidemiology of invasive candidiasis: a persistent public health problem. Clin. Microbiol. Rev. 20: 133-163.
- [46] Posey JE and Gherardini FC (2000) *Lack of role of iron in Lyme disease pathogen*. Science 288 (54710): 1651- 1653.
- [47] Prasad R, Gupta N, Gaur M.(2004) *Molecular basis of antifungal resistance in pathogenic fungi*. p. 357-414. In G. San-Blas and R. A. Calderone (ed.), Pathogenic fungi –Host interactions and emerging strategies for control, Caister Academic Press, England.
- [48] Prasad T, Chandra A, Mukhopadhyay CK and Prasad R (2006) Unexpected link between iron and drug resistance of *Candida* spp.: iron depletion enhances membrane fluidity and drug diffusion, leading to drug-susceptible cells. Antimicrob Agents Chemother 50: 3597-3606.
- [49] Radisky D and Kaplan J (1999) Regulation of transition metal across the yeast plasma membrane. J Biol Chem 274: 4481-4484.
- [50] Ramanan N and Wang Y (2000) A high-affinity iron permease essential for *Candida albicans* virulence. Science 288: 1062-1064.
- [51] Sanglard D, Ischer F, Monod M, Bille J. (1997) Cloning of *Candida albicans* genes conferring resistance to azole antifungal agents: characterization of CDR2, a new multidrug ABC transporter gene. Microbiology; 143: 405-416.
- [52] Santos R, Buisson N, Knight S, Dancis A, Camadro JM and Lesuisse E (2003) *Haemin uptake and use as an iron source by Candida albicans: role of CaHMX1-encoded haem oxygenase*. Microbiology 149: 579-588.
- [53] Schaible UE and Kaufmann SHE (2004) *Iron and microbial infection*. Nat Rev Microbiol 2: 46-54.
- [54] Schrettl M, Kim HS, Eisendle M, Kragl c, Nierman WC, Heinekamp T, Werner ER, Jacobsen I, Illmer P, Yi H, Brakhage AA and Haas H (2008) *SreA-mediated iron regulation in Aspergillus fumigatus*. Mol Microbiol 70: 27-43.
- [55] Singh RP, Prasad HK, Sinha I, Agarwal N, Natarajan K. (2011) *Cap2-HAP complex is a critical transcriptional regulator that has dual but contrasting roles in regulation of iron homeostasis in Candida albicans*. J Biol Chem. 286(28):25154-70.
- [56] Spacek J, Jilek P, Buchta V, Forstl M, Hronek M and Holeckova M. (2005) The serum levels of calcium, magnesium, iron and zinc in patients with recurrent vulvovaginal candidosis during attack, remission and in healthy controls. Mycoses. 48: 391-395.
- [57] Stearns R (1996) A permease-oxidase complex involved in high-affinity iron uptake in yeast. Science 271: 1552-1557.
- [58] Weinberg ED (1984) Iron withholding: a defense against infection and neoplasia. Physiol Rev 64: 65-102.
- [59] Weinberg ED (1999) *Iron loading and disease surveillance*. Emerg Infect Dis 5: 346-352.
- [60] Weissman Z, Shemer R and Kornitzer D (2002) Deletion of the copper transporter CaCCC2 reveals two distinct pathways for iron acquisition in *Candida albicans*. Mol Microbiol 44: 1551-1560.
- [61] Weissman Z, Shemer R, Conibear E and Kornitzer D (2008) *An endocytic mechanism for haemoglobin-iron acquisition in Candida albicans*. Mol Microbiol. 61 (1): 201-217.
- [62] Welch KD, Van Eden ME and Aust SD (2001) *Modification of ferritin during iron loading*. Free Radical Biol Med 31: 999-1006.
- [63] White TC, Holleman S, Dy F, Mirels LF, Stevens DA (2002) Resistance mechanisms in clinical isolates of *Candida albicans*. Antimicrob Agents Chemother 46: 1704-1713.
- [64] White TC, Marr KA, Bowden RA. (2005) Clinical, cellular, and molecular factors that contribute to antifungal drug resistance. Clin Microbiol Rev 11: 382-402.
- [65] Wong IL and Chow LM (2006) The role of *Leishmania enriettii* multidrug resistance protein 1 (LeMDR1) in mediating drug resistance is iron dependent. Mol Biochem Parasitol. 150(2): 278-287.

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Serum Soluble Fas (sFas) levels might be a discriminator between precancerous and Cancerous Cervical lesion in North Indian Population- A case control study

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Abstract- Background: One of the best characterized apoptosis triggering systems is the CD95/Fas/APO-1 pathway. Aim of the study was to evaluate the serum sFas levels in cervical neoplasia and localized cervical cancer patients and examines its role as a discriminator between precancerous and cancerous cervical lesion.

Methods: A case control study was conducted in Department of Obstetrics & Gynaecology, in collaboration with Pathology, CSM Medical University, Lucknow. 5ml venous blood samples were drawn into sterile vials, prior to treatment being administered. sFas levels were measured with an enzyme linked immunosorbent assay in histopathological proven 45 cases of Cervical Intraepithelial Neoplasia (CIN I, II and III), 30 cervical cancer patients (FIGO Stage I and II) and 30 cervical cytology negative healthy volunteers (Pap Smear).

Results: In the present study we observed a significant positive correlation between sFas levels of healthy controls, CIN I, CIN II, CIN III and early invasive localized cancer patients (stage I and II) ($p < 0.001$). It was observed that the three stages of precancer, and stage I and II of cervical cancer although had small difference in their mean sFas levels yet, can be precisely discriminated on the basis of mean sFas level alone. Risk classification matrix obtained using the discriminate function analysis, showed that sFas levels in plasma of patients with CIN I, II and III could helped in better predicting the risk of developing invasive cervical cancer in individual patient. sFas level was able to validate about 98% of cases correctly.

Conclusions: This study demonstrates that sFas levels could be used as a discriminator between precancerous and cancerous cervical lesion. The clear discrimination between precancerous and cancerous cervical lesions by sFas can be used in quantification of the risk to have a better understanding of natural history of disease.

Index Terms- sFas, CIN, Cervical Cancer

I. INTRODUCTION

This study was necessary because it is of clinical use, it helps to understand the natural history of disease (from

CIN → malignancy). Serum soluble Fas levels could be used as discriminator between precancerous and cancerous cervical lesions.

The aim of our study was to evaluate the serum sFas levels in Cervical Intraepithelial Neoplasia patients and localized cervical cancer patients using Enzyme Linked Immunosorbent Assay technique and examine its role as a discriminator between precancerous and cancerous cervical lesion.

It is the second most common cancer among women worldwide. Approximately 500,000 women worldwide develop cervical cancer each year.¹

Human papillomavirus is the single most important etiologic event in the pathogenesis of cervical carcinoma is a well known fact. However, not all women who are infected with the high risk HPV (HPV subtypes 16 and 18) develop cervical carcinoma. It often takes years or decades before persistent dysplasia eventually develops into frank malignancy. This, suggest that other cofactors must be present in the pathogenic pathway between Cervical Intraepithelial Neoplasia and carcinoma.

The fact, that spontaneous regression frequently occurs in CIN type I or II lesion but a part of CIN III progress to invasive carcinoma suggests that selection of cell population with high malignant potential may be closely linked to progression of cervical neoplasia. Apoptosis is an important regulatory mechanism that counteracts uncontrolled growth of malignant cells. In fact, premalignant cervical lesions exhibit reduced apoptotic indices of undifferentiated basaloid cells compared with normal cervical cells^[2], which correlates strongly with the probability of progression to squamous cell carcinomas. Fas/FasL pathway, a member of the tumor necrosis factor receptor superfamily, is the best characterized death receptor pathway inducing apoptosis in normal and malignant cells^[3].

Fas is a type I transmembrane protein which upon triggering by Fas ligand, induces apoptosis through a series of interacting proteins. Fas is characterized by a highly conserved death domain that is responsible for activating the death signal upon activation by Fas ligand^[4]. A multimolecular complex of proteins called the death- inducing signaling complex is triggered by receptor ligand cross linking^[5]. The apoptotic signaling is propagated by procaspase-8 and further by active caspase-8 and caspase-3^[6,7]. Caspase-mediated proteolysis of specific protein targets is central to the execution of apoptosis.

Fas can be present both as a cell surface protein and as a soluble protein called soluble Fas (sFas). sFas is a splice variant generated by alternative mRNA splicing and lacks a transmembrane domain^[8]. Papoff *et al*^[9] have reported that sFas suppresses Fas-mediated apoptosis by competitive binding with FasL. Increased sFas levels in colorectal cancer, bladder, breast, renal cell carcinoma and melanoma have been documented^[10-14]. sFas has been investigated as a prognostic marker in gynecological malignancies by some workers who have correlated it with more invasive, advanced stage tumors^[15,16]. Considering the need of present era and long natural history of cervical neoplasia, where women with cervical intraepithelial neoplasia grade 1 (CIN-I) are normally maintained under observation, since almost 60% of these cases revert spontaneously^[17]. It is essential to have a biomarker which could predict the propensity of conversion of the precancerous cervical lesion to cancerous cervical lesion. Screening through Pap smear followed by the colposcopy of the women with abnormal pap smear and women with unhealthy cervix, and finally the confirmation of the nature of cervical lesion with cervical biopsy (gold standard), could diagnose the preinvasive, microscopic and macroscopic stages of cervical cancer. But none of these methods could predict the natural history of the disease process. So there is a need for a simple and low cost complementary prognostic marker which could assist in determining or predicting the risk of developing cervical cancer.

Involvement of sFas as a discriminator between precancerous and cancerous cervical lesion has not been documented as yet. We hypothesized that the levels of serum sFas in cervical neoplasia may be used as a prognostic marker. This marker could assist in predicting the risk of developing cervical cancer and may add useful information in the natural history of cervical cancer along with the screening techniques, colposcopy and biopsy and thus taking the treatment decision and follow up.

II. METHODS

A case control study conducted in Department of Obstetrics & Gynaecology and in collaboration with Pathology, CSMMU, Lucknow. Venous blood samples of all patients were drawn into sterile vials after detection of Cervical Intraepithelial Neoplasia and Cervical cancer, prior to treatments being administered. Blood samples were kept at 4 degree centigrade, centrifuged at 6000 rpm for 15 min, and then immediately frozen at -20 degree centigrade until assayed.

The study group consisted of 45 women with colposcopic and histopathologic proven diagnosis of CIN (Cervical Intraepithelial Neoplasia), 30 women with clinical and histopathological proven diagnosis of the early invasive cancer of uterine cervix (FIGO stage I and II) All women (N=75) in the present study were diagnosed and treated at Department of Obstetrics and Gynecology, CSMMU, Lucknow. The control group comprised of 30 healthy female volunteers who were cervical cytology negative. All the subjects in this study were enrolled after taking an informed consent. The age of cancer patients, CIN patients and control group ranged from 35 to 68, 26 to 70 and 26 to 65 years, respectively. CIN patients were classified into grade I-mild dysplasia, grade II-moderate dysplasia and grade III-severe dysplasia. CIN I was diagnosed in 15 women, CIN II in 15 women and CIN III in 15 women. Patients with deranged liver function test were excluded from the study. It is important to mention that patients included in this study did not receive any prior treatment (chemotherapy, radiotherapy, and surgery). The ethical clearance for this study was given by Institutional Ethics Committee, Office of the Research Cell, CSMMU (erstwhile King George's Medical University), Lucknow, U.P. (Ref. Code: XXX IX ECM/B-P9 dated 24/10/09). The socio-demographic profile of patients in the study has been shown in Table 1.

Table 1: Distribution of cases in different clinical stages of precancerous and cancerous cervical lesions

Variable	Control	CIN	Stage 1 & 2
Age			
20 – 34 yrs.	10%	16.66%	3.45%
34 – 45 yrs.	50%	46.67%	44.83%
≥ 46 yrs.	40%	36.67%	51.72%
Religion			
Hindu	80%	96.67%	100.0%
Muslim	20%	3.33%	–
Locality			
Urban	60%	63.33%	31.03%
Rural	40%	36.67%	68.97%
Education			
Literate	56.67%	56.67%	31.03%
Illiterate	43.33%	43.33%	68.97%
SE Class			

High	–	13.33%	6.90%
Middle	56.67%	63.33%	41.38%
Low	43.33%	23.34%	51.72%
Diet			
Veg	50%	60%	72.41%
Non – Veg.	50%	40%	27.59%
Tobacco Addiction			
Non-addicted	80%	63.33%	37.93%
Tabacco addicted	20%	36.67%	62.03%
Parity			
P0 – 2	33.33%	20%	10.34%
P3 – 6	56.67%	70%	75.86%
P \geq 7	10%	10%	13.80%
Abortion			
None	50%	56.67%	96.55%
\geq 1	50%	43.33%	3.45%
Contraception Stage			
Non User	50%	40%	82.76%
T.L.	40%	50%	10.34%
Temporary Methods	10%	10%	6.90%
BMI			
\leq 18	16.67%	20%	37.93%
18.1 – 24.9	70%	70%	48.28%
\geq 25	13.33%	10%	13.79%

III. INTERVENTION (FAS SPECIFIC ELISA)

The level of sFas in the serum was determined with a double antibody sandwich Enzyme Linked Immunosorbent Assay kit for quantitative detection of human sFas (Bender Med System, Vienna, Austria) according the producer's protocol. Briefly, the samples were measured and standards were incubated in wells coated with anti-Fas polyclonal antibody. After washing, a peroxidase-conjugated anti-Fas monoclonal antibody was added to each microwell and incubated. After another washing, the peroxidase substrate was mixed with the chromogen and allowed to incubate for an additional period of time. An acid solution is then added to each well to terminate the enzyme reaction and to stabilize the developed colour. The absorbance of each well is then to be measured at 450nm using a microplate reader.

Summary of sFas levels in different clinical stages of precancerous and cancerous cervical lesions is given as Mean \pm SD. The mean of different clinical stages were compared by one way analysis of variance followed by Neuman-Keuls test for individual comparison. Level of significance used is 0.05 for testing the null hypothesis. The discriminatory study of the precancer and cancer cervical stages on the basis of sFas levels

was done by linear discriminate functional analysis. The correct classification of cases has been shown in risk matrix (Table 3).

IV. RESULTS

The mean value of sFas was in increasing order of risk in all the clinical stages of precancer and cancer cervical lesions (Figure 1, Table 2). The mean sFas levels of different clinical stages were tested by one way analysis of variance followed by Neuman Keuls test for individual comparisons. The F value in the analysis was 177.0, which was significantly higher ($p < 0.001$) than the characteristic $F_{4,100,5\%} = 2.46$. This signifies that the mean concentration of sFas was significantly different between two clinical stages.

The significance of individual comparison between each pair of clinical stages has been shown in Table 3. It can be seen that each pair of clinical stages differed significantly with the probability of $p < 0.001$. The significance of clinical stages at such a high level indicate that the precancer and cancer clinical stages were distinct and the mean sFas level were quiet apart at each clinical stage. It signifies that the mean sFas level increases monotonically in each stage of precancerous and cancerous

cervical lesions. In other words Enzyme Linked Immunosorbent Assay test for sFas precisely defined the stages of precancerous and localized cervical cancerous lesions.

On using the discriminate function analysis for the clinical stages we obtained the risk classification matrix (Table 4), which shows the correct classified cases in their own stages as well as misclassified cases into other clinical stages. The risk classification matrix shows the 100% correctly classified cases on the basis of sFas levels was observed in control and CIN I cases. A deviation in the percent correct classification was found in the rest of the clinical stages (i.e., CIN II, CIN III and Stage I & II). Three cases of CIN II have been classified as CIN I on the basis of sFas level, while one case of CIN II has been classified as CIN III on the basis of sFas levels. Six cases of CIN III have been classified as Stage I & II on the basis of sFas levels whereas eight cases of Stage I & II have been classified as CIN III. These

misclassified cases have propensity either to regress or to progress. It is interesting to observe that the Enzyme Linked Immunosorbent Assay method for measuring sFas level is fairly sensitive in discriminating the 3 stages of precancer and stage I & II of cancer. These stages though have small difference in their mean sFas levels, yet they can be precisely discriminated on the basis of mean sFas level alone.

To validate the study 20 patients were diagnosed and evaluated clinically/pathologically. The distribution of diagnosis through DFA has been given in Table 5. The present study revealed that sFas is a potential marker for diagnosing the clinical stages of precancerous and localized cervical cancerous lesions. sFas concentration was able to validate about 98% of cases correctly.

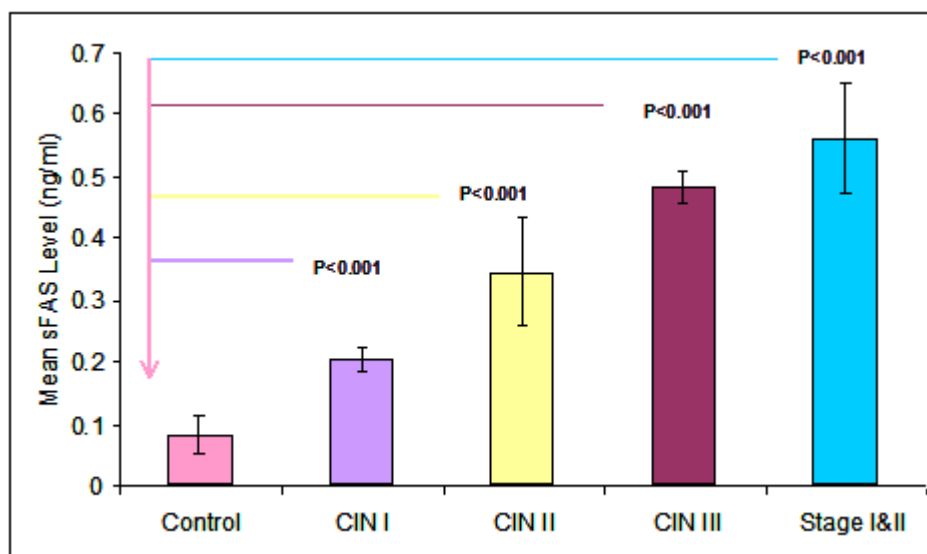


Figure 1: Mean sFas level in different clinical stages of precancerous and cancerous cervical lesions: the mean sFas level here shows a positively increasing trend with the clinical severity of precancerous stages (CIN I, CIN II, CIN III) and cancerous stages I & II. The difference in mean sFas levels at each stage is statistically significant ($p < 0.001$)

Table 2: sFAS Levels in Different Clinical Stages

	Control	CIN I	CIN II	CIN III	Stage I & II
n	30	15	15	15	30
sFas (Mean \pm SD)	0.082 \pm 0.031	0.204 \pm 0.02	0.345 \pm 0.088	0.482 \pm 0.027	0.56 \pm 0.088
95% CI range (ng/ml)	0.0712 – 0.094	0.193 – 0.215	0.297 – 0.394	0.467 – 0.497	0.527 – 0.592

Table 3: The significance of Individual comparison between each pair of clinical stages

Control vs CIN I	P<0.001
Control vs CIN II	P<0.001
Control vs CIN III	P<0.001
Control vs Stage I & II	P<0.001
CIN I vs CIN II	P<0.001
CIN I vs CIN III	P<0.001
CIN I vs Stage I&II	P<0.001
CIN II vs CIN III	P<0.001
CIN II vs Stage I & II	P<0.001
CIN III vs Stage I& II	P<0.001

Table 4: Risk matrix of classification of patients of different clinical stages as obtained from Discriminant Function Analysis (DFA)

	Control	CIN I	CIN II	CIN III	Stage I & II	%age
Control	30	0	0	0	0	100.0
CIN I	0	15	0	0	0	100.0
CIN II	0	3	10	01	1	66.7
CIN III	0	0	0	9	6	60.0
Stage I & II	0	0	0	8	22	73.3

Table 5: Distribution of 20 patients diagnosed and evaluated clinically and pathologically on the basis of sFas level

		Clinically			
		CIN I	CIN II	CIN III	Stage I & II
sFAS	CIN I	1			
	CIN II		1		
	CIN III			5	1
	Stage I&II			1	11

V. DISCUSSION

The natural history of cervical cancer is characterized by stepwise progression from a histologically normal cervix to cervical intraepithelial neoplasia to frank invasive cancer^[18]. In the past considerable attention has been devoted to determine the potential of CIN lesions to progress, and thus varying recommendation have been made for intervention or observation

based on differing interpretation of these data. It was estimated that 60% of CIN I lesion regress, 10% progress to CIN III and just 1% progress to frank malignancy^[19]. Some studies estimated the risk of progression of untreated CIN II to CIS at more than 90% after 14 years of follow up^[20]. Conversely, a meta-analysis of 15 studies spanning almost 35 years yielded an estimate of progression for CIN II of 20%, with 5% progressing to invasive cancer, 40% regressing and 40% persisting unchanged^[19]. Even

after so many years of exhaustive research although it has been proved that CIN I can progress to invasive cancer and even higher grade precancerous lesions sometimes may regress. But, even after establishing the diagnosis of CIN I, CIN II or CIN III, it is still a million dollar question that which of these lesions are going to progress and which will regress.

Owing to the existence of premalignant condition and long latent period in which premalignant lesion or occult cancer can be detected, makes the cervical cancer as the only gynaecological cancer that satisfies the well recognized WHO criteria for screening. The screening for cervical cancer and its precursor lesions currently employs the Pap smear, but this test is subjective and has relatively low sensitivity. The combination of the Pap test with HPV molecular detection achieves significant improvements in sensitivity for detection of cervical cancer, but the last technique is not routinely employed due to methodological and economical reasons. Alternatively, the use of p16INK4a has been proposed as a marker for progression^[21,22], however, disadvantages of this method are that it is mainly confined to biopsies and it is also subjective depending on the pathologist's experience. Similarly colposcopy and cervical biopsy (gold standard) although can establish the diagnosis at given point of time but cannot predict the course of that lesion in future.

Considering the role of apoptosis resistance in tumor progression and considering the need of present era, the objective of present study was to design a simple, low cost, easy and feasible to perform especially in low resource states and a minimally invasive test which may serve to predict more reliably, the risk of developing cervical cancer. Based on sFas levels found in serum we were able to reach the goal of identifying a prognostic marker for precancerous cervical lesions. In the present study, we observed a significant positive correlation between sFas levels of healthy controls, CIN I, CIN II, CIN III and early invasive localized cancer (stage I & II) patients. Data obtained from 45 CIN patients showed that sFas concentration in plasma of women with CIN I, CIN II and CIN III could help in better predicting the progressive and regressive nature of cervical lesions and the risk of developing invasive cervical cancer in individual patient. The clear discrimination between precancerous and cancerous cervical lesions by sFas can be easily used in quantification of the risk, to have a better understanding of the natural history of disease.

Our study is in accordance to the study of Lemarroy et al^[23] where they also found the same positive correlation of sFas in control, CIN and cervical carcinoma patients. In addition they demonstrated an inverse relation between the induction of apoptosis in jurkat cells and the sFas levels and the preinvasive and invasive stage of cervical neoplasia. Hence, they concluded that sFas levels could be an important prognostic tool for cervical cancer. However, sFas concentration in the present study is lower than that of study by Lemarroy *et al.*, amongst various study groups. This difference could possibly be explained based on the differences in ethnicity and dietary habits. sFas concentration is lower among the subjects of Indian origin.

We have found that sFas levels were elevated in the serum of women with cervical cancer as compared to healthy controls. Our data is in agreement with other studies, where elevated levels of sFas in serum of women have been observed in bladder

cancer^[11], breast cancer^[12], renal cell carcinoma^[13], head & neck carcinoma^[24], locally advanced unresectable rectal cancer^[25] and also in autoimmune rheumatic disease^[26]. All these studies have reported much higher level of sFas (greater than 1 upto 60ng/ml), while our samples showed that the level of sFas in pre-cancer and cancer stages of cervix was in the range of 0.15-0.7ng/ml. They all formed distinct group with pre-cancer and cancer stages with small deviation in values. Concerning gynecological tumors, Konno et al., examined the relevance of sFas levels as a prognostic factor in patients with gynecological malignancies in terms of the survival rate; they observed that patients diagnosed with cervical carcinoma have a better survival rate when they have serum sFas levels lower than 1.5ng/ml before therapy than those with a level higher than 1.5ng/ml^[15].

Looking at the sum of our data, we conclude that sFas concentration present in the serum of women could be an important discriminator for cervical neoplasia. However, a follow up study must be made to confirm whether, the natural history or course of cervical lesions found in women diagnosed with CIN I, CIN II and CIN III, was according to our prediction based on sFas concentration or not. Additional studies are also required to identify the mechanism of sFas induction in invasive cervical cancer.

VI. CONCLUSION

It can be concluded that sFas can be used as a discriminator to differentiate between healthy controls, precancerous and cancerous (Stage I & II) cervical lesions. Combining of sFas measurement with Pap smear, colposcopy followed by biopsy will help in better predicting the natural history of cervical neoplasia especially in preinvasive and early invasive stages of cervical cancer.

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REFERENCES

- [1] Parkin DM, Bray F, Ferlay J et al.: Estimating the world cancer burden Globacon 2000. *Int J Cancer* 2001 Oct.15;94(2):153-6.
- [2] Shoji Y, Saegusa M, Takano Y, Ohbu M, Okayasu I: Correlation of apoptosis with tumor cell differentiation, progression and HPV infection in cervical carcinoma. *J Clin Pathol*: 1996;49:134-138.
- [3] Schmitz I, Kirchhoff S, Krammer PH.: Regulation of death receptor mediated apoptosis pathway. *Int J Biochem Cell Biol* 2000;32:1123-1136.
- [4] Peter ME, Krammer PH.: The CD95 (APO-1/Fas) DISC and beyond. *Cell Death Differ* 2003;10:26-35.
- [5] Walczak H, Sprick MR.: Biochemistry and function of the DISC. *Trends Biochem Sci* 2001;26:452-45.
- [6] Boatright KM, Renatus M, Scott FL, Spernadio S, Shin H, Pedersen IM, Ricci JE, Edris WA, Sutherlin DP, Green DR, Salvesen GS.: A unified model for apical caspase activation. *Mol Cell* 2003;11:529-541.
- [7] Donepudi M, Mac Sweeney A, Briand C, Grutter MG.: Insights into the regulatory mechanism for caspase-8 activation. *Mol Cell* 2003;11:543-49.
- [8] Cheng J, Zhou T, Liu C, Shapiro JP, Brauer MJ, Kiefer MC, et al.: Protection from Fas mediated apoptosis by a soluble form of the Fas molecule. *Science* 1994;263:1759-62.

- [9] Pappof G, Cascino I, Eramo A, Starace G, Lynch DH, Ruberti G.: An N-terminal domain shared by Fas/ APO-1 (CD95) soluble variants prevents cell death in vitro. *J Immunol* 1996;156:4622-30.
- [10] Abbasova SG, Vysotskii MM, Ovchinnikova LK, Obusheva MN, et al.: Cancer and soluble Fas. *Bull Exp Biol Med*. 2009;148(4):638–642.
- [11] Mizutani Y, Yoshida O, Bonavida B.: Prognostic significance of soluble Fas in the serum of patients with bladder cancer. *J. Urol* 1998;160:571-6.
- [12] Ueno T, Toi M, Tominaga T.: Circulating soluble Fas concentration in breast cancer patients. *Clin Cancer Res* 1999;5:3529-33.
- [13] Nonomura N, Okuyama A.: Soluble Fas in serum of patients with renal cell carcinoma. *Urology* 2000;55:151-5.
- [14] Ugurel S, Rapp G, Tilgen W, Reinhold U.: Increased soluble CD95 (sFAS/CD95) serum level correlates with poor prognosis in melanoma patients. *Clin Cancer Res* 2001;7:1282-6.
- [15] Konno R, Takano T, Sato S, Yajima A.: Serum soluble Fas level as a prognostic factor in patients with gynecological malignancies. *Clin Cancer Res* 2000;6:3576-80.
- [16] Heffler L, Mayerhofer K, Nardi A, Reinthaller A, Kainz C, Tempfer C.: Serum soluble Fas levels in ovarian cancer. *Obstet Gynecol* 2000;96:65-9.
- [17] Holowaty P, Miller AB, Rohan T: To T. Natural history of dysplasia of the uterine cervix. *J Natl Cancer Inst* 1999;91:252-258.
- [18] Maria ES, Lynne G, Paul DB.: Cervical cancer screening in developing countries. *Prim Care update Ob/Gyn* 2000;7:118-23.
- [19] Ostor AG: Natural History of cervical intraepithelial neoplasia: A critical review. *Int J Gynecol Pathol* 1993;12: 186.
- [20] Richart RM, Barron BA: A follow-up study of patients with cervical dysplasia. *Am J Obstet Gynecol* 1969;105:386.
- [21] Wentzensen N, von Knebel DM: Biomarkers in cervical cancer screening. *Dis Markers* 2007;23:315-330.
- [22] Vinokurova S, Wentzensen N, von Knebel DM.: Analysis of p16INK4a and integrated HPV genomes as progression markers. *Methods Mol Med* 2005; 119:73-83.
- [23] Lemarroy AA, Romero-Romos JE, Andalon VO, Flores GH, Lerma-Diaz JM, Ortiz-Lazcano PC, et al.: Apoptosis induction in Jurkat cells and sCD95 levels in women's sera are related with the risk of developing cervical cancer. *BMC Cancer* 2008;8:99.
- [24] Mojtaba Habibagahi, Mansoor Jaberipour, Mohammad Javad Fattahi, et al.: High Concentration of Serum Soluble Fas in Patients with Head and Neck Carcinoma: A Comparative Study Before and after Surgical Removal of Tumor. *Middle East Journal of Cancer* 2010;1:21-26.
- [25] Qi-lian Liang, Zhou-yu Li, Guo-qiang Chen et al.:Prognostic value of serum soluble Fas in patients with locally advanced unresectable rectal cancer receiving concurrent chemoradiotherapy. *J Zhejiang Univ-Sci B (Biomed & Biotechnol)* 2010; 11(12):912-917.
- [26] Sahin M, Aydintug O, Tunc SE, Tutkak H, Naziroglu M.: Serum soluble Fas levels in patients with autoimmune rheumatic diseases. *Clin Biochem* 2007;40:6-10.

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Acute kidney injury and paralytic ileus- An unusual presentation of hypothyroidism

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Abstract- A 55 year old male patient, known case of hypothyroidism since last four years was admitted to our nephrology unit in a state of drowsiness and confusion. He had paralytic ileus and impaired renal functions at the time of admission. On routine investigations hypokalemia was present, which likely contributed to the paralytic ileus and together with dehydration had lead to renal injury. Nonetheless, hypothyroidism would have been the principal precipitant of both these complications. Both paralytic ileus and acute kidney injury improved with thyroxine replacement.

Hypothyroidism may induce de novo acute kidney injury or it may exacerbate ongoing chronic kidney disease. This rare complication is assumed to be due to the hypodynamic circulatory state as a consequence of thyroid hormone deficiency. Paralytic ileus is even a rarer fatal manifestation of hypothyroidism and is thought to be due to autonomic neuropathy affecting the intestines that can be reversed by the thyroxine replacement.

Index Terms- Acute Kidney Injury, Hypothyroidism, Paralytic ileus, Hypokalemia.

I. INTRODUCTION

Hypothyroidism presenting with acute kidney injury is rare, with only few cases reported so far.^{1,2} Hypothyroidism may induce de novo acute kidney injury (AKI) or may exacerbate ongoing chronic kidney disease³ or contribute to the occurrence of AKI in the presence of other renal insults. AKI is life threatening and identification of possible contributory causes and early treatment is potentially lifesaving. Paralytic ileus is even a rarer fatal manifestation of hypothyroidism⁴. In this interesting case report a patient has been discussed who presented with severe hypothyroidism and both these complications.

II. CASE PRESENTATION

A 55 year old male patient, diagnosed with hypothyroidism four years ago, was admitted to our nephrology unit in a state of drowsiness and confusion. He was on thyroxine replacement therapy (150 µg daily) but was not compliant and stopped treatment for the last 3 months. He did not have any other comorbidities and the cause of hypothyroidism was unknown. In the month prior to time of admission, he had history of constipation, lethargy, and family members had noticed mental

slowing, hoarse voice and changes in facial appearance. The patient was first admitted to a local hospital in a state of confusion and drowsiness with generalized body swelling, where oral thyroxine replacement was started. Patient was referred to our unit within 24 hour due to no improvement in clinical condition. On admission he had typical features of severe hypothyroidism such as coarse myxedematous skin, characteristic facial appearance, dry thin hairs and oedema. He was not hypothermic but was dehydrated. His heart rate was around 56/min, blood pressure was 156/90 mm Hg and there were no clinically detectable pericardial effusion. His respiratory system was clinically normal and abdomen was grossly distended with absent bowel sound, there was no organomegaly and free fluid. He was confused and drowsy (Glasgow coma scale; E-4, M-5, V-4) and had slow-relaxing reflexes.

The records shows that at initial presentation to the local hospital, his TSH (Thyroid Stimulating Hormone) level was 40.5 mIU/µl (Normal 0.4-4.0), Serum free thyroxine (FT4) level was 0.50 ng/dl (0.89-1.76) . One week after the initial presentation and while on thyroxine replacement, his TSH level had dropped to 30.2 mIU/µl, and the FT4 level was 0.61 ng/dl (0.89-1.76) but he was still severely hypothyroid. His serum creatinine had progressively risen from 1.38 mg% (on admission) to 5.11 mg%, with a concomitant drop in urine output (less than 20 ml per hour) over a span of 7th days. There were no active urinary sediments and USG abdomen showed normal kidney size with features of acute parenchymal disease together with bilateral fullness in the pelvicalyceal systems, rest was normal. The creatine phosphokinase (CPK-MM) and serum amylase level was normal. He was not on any nephrotoxic drugs. At the onset of renal impairment, the patient had hyponatraemia (114 meq/l) and was persistently hypokalemic (2.2-3.2 meq/l). Abdominal radiographs showed grossly dilated bowel loops with multiple air fluid levels. To rule out possibility of mechanical bowel obstruction, surgical opinion was consulted, and a surgical cause was thought to be unlikely, clinical features did not support peritonitis. So we kept first probable diagnosis of paralytic ileus and treatment started accordingly. Electrocardiogram was consistent with hypokalemia and there was no pericardial effusion on 2D - echocardiography. CT scan abdomen was not done because of the risk of contrast nephropathy aggravating existing AKI.

The patient was managed on the principles of thyroxine replacement therapy, steroid therapy and supportive therapy on the hypothesis that hypothyroidism and its sequelae were responsible for the clinical picture. Thyroxine 500 µg stat was

given and then replaced with levothyroxine (100 µg/day as standard maintenance dose) via nasogastric tube, intra-venous hydrocortisone 50 mg 6 hourly was started and dehydration was corrected with monitored administration of intravenous fluids with potassium replacement. The patient was nil orally except for the drug therapy. Intravenous levothyroxine is not available in our setting. With hydration and thyroxine replacement, the patient's renal functions improved (serum creatinine dropped to 2.34 mg %) together with increased urine output without renal replacement therapy. Hyponatremia also normalized without

specific treatment. Bowel sounds returned on 6th day and oral feeding was started on 7th day with liquid feeds. The overall condition of the patient including the level of consciousness improved with thyroxine replacement. He became conscious, oriented and was subsequently mobilized within 15 days of hospital admission.

III. INVESTIGATIONS

Investigations	Before admission	At admission	1 week after admission	At discharge
TSH (normal 0.4-4.0)	40.5 mIU/µl	30.2 mIU/µl	22.4 mIU/µl	8.3 mIU/µl
S. Creatinine	-	1.38 mg%	5.11 mg%	2.34 mg%
S. Potassium	-	2.2 meq/l	3.2 meq/l	4.3 meq/l
S. Sodium	-	114 meq/l	136 meq/l	146 meq/l

IV. TREATMENT

He was on thyroxine replacement (150 µg daily) but stopped treatment 3 months back. On admission Thyroxine 500 µg stat was given and was then replaced with levothyroxine (100 µg/day as standard maintenance dose) via nasogastric tube, intra-venous hydrocortisone 50 mg 6 hourly was started and dehydration was corrected with monitored administration of intravenous fluids with potassium replacement. After two week of hospital stay patient was discharged in good condition and is in regular follow up.

V. DISCUSSION

There are several case reports of both acute renal failure^{1,5} and paralytic ileus^{6,7} occurring in untreated hypothyroidism, however both these complications appearing in the same patient has not been reported. The exact pathogenesis of acute kidney injury in hypothyroidism is still unclear and thought to be multi-factorial. However, the predominant mode of kidney injury is thought to be due to reduced plasma flow and glomerular filtration rate due to the hypodynamic circulation². The hypodynamic circulatory state results in a pre-renal insufficiency and this may be aggravated by other multi-systemic effects of hypothyroidism such as reduced cardiac output, low volume status, hyponatremia with associated hemodynamic changes and increased peripheral resistance due to arterial wall stiffness². However, this alone may not explain the extent of acute kidney injury. As per literature histological evidence from biopsy specimens show Primary glomerular and tubular dysfunction in hypothyroidism (thickening of glomerular and tubular basement membranes and inclusions in cell cytoplasm)⁸. These were reversible with thyroxine therapy. Rhabdomyolysis, another rare but known manifestation of hypothyroidism can also result in acute kidney injury but it is usually associated with another precipitating factor such as drugs or trauma⁵. Our patient however had no

evidence of rhabdomyolysis. The available evidence suggests that renal impairment may start as quickly as two weeks in hypothyroid state and it recovers fully with thyroxine replacement⁹. The long term impact (if any) of hypothyroidism on renal function is unknown⁵.

Paralytic ileus in hypothyroidism is assumed to be due to autonomic neuropathy affecting the extrinsic nerves of the colon¹⁰. There are only a few cases of this complication reported in literature with the first one being reported by Bastenie in 1946⁷. Bastenie hypothesized that myxoedematous material deposition in the muscle fibers of intestines interfered with their integration with autonomic ganglia. Later in 1969 and 1977, two case reports of death due to paralytic ileus with hypothyroidism were published^{11,12,13}. In the report by Wells et al¹¹, the patient died after 20 days since presentation and the post mortem at that time gave an insight in to the possible pathogenesis in this unusual complication. Histological sections revealed gross abnormalities in extrinsic nerves innervating the intestines while some less prominent changes were also observed in intrinsic plexus. The authors suggest that the mechanism may be autonomic neuropathy similar to the peripheral neuropathy frequently observed in hypothyroidism. Surgical intervention for hypothyroidism induced paralytic ileus is not recommended as the neuropathy is reversible with thyroxine replacement. However, atonia may take time to reverse and the patients can succumb to complications of ileus⁴.

In addition to paralytic ileus, patients may also present with urinary retention and this observation is also taken as supportive evidence for the autonomic neuropathy in hypothyroidism⁴. The fullness of the pelvicalyceal systems observed on ultrasound scan of our patient was possibly a result of this. We were unable to find any published data as to how the presence of paralytic ileus would have affected the absorption of thyroxine given via nasogastric tube; the non-availability of intravenous liothyronine was a definite, albeit unavoidable, shortcoming in our management.

In the chronology of events, it was noticed that the paralytic ileus precedes the acute kidney injury. The fluid sequestration in the bowels would have led to severe dehydration, hyponatraemia and hypokalaemia. In the patient's background and sequence of events, it is likely that hypothyroidism was the primary cause of paralytic ileus though subsequent hypokalaemia undoubtedly contributed to making it worse. It is unlikely that hypokalaemia was the primary cause of paralytic ileus since hypokalaemia developed later on. The acute kidney injury in this patient is unlikely to be due to rhabdomyolysis as there was no cause and supportive clinical or laboratory evidence. Instead, it is very likely that reduced renal plasma flow caused by hypothyroidism and the fluid sequestration within the intestines due to paralytic ileus in combination resulted in AKI. The paralytic ileus responded to potassium and thyroxine replacement and the concomitant vigorous fluid management would have improved the renal plasma flow. Both these therapeutic measures would have contributed to the rapid recovery of renal function. The relatively rapid recovery of renal function supports hypothyroidism related AKI rather than acute tubular necrosis due to dehydration.

In this patient, the root cause for paralytic ileus and acute kidney injury was the deficiency of thyroxine. The patient was managed on thyroxine replacement and supportive therapy leading to clinical improvement without surgery or invasive procedures, thus our diagnosis of paralytic ileus was correct.

VI. CONCLUSION

- It is important that clinicians are aware of the rare manifestations of hypothyroidism such as acute kidney injury and paralytic ileus.
- The easily reversible thyroxine deficiency may be missed when patients present with such complications unless there is an obvious past history.

REFERENCES

- [1] Birewar S, Oppenheimer M, Zawada ET Jr: Hypothyroid acute renal failure. *S D J Med* 2004, 57:109-110.
- [2] Liakopoulos V, Dovas S, Simopoulou T, Zarogiannis S, Giannopoulou M, Kourti P, Arampatzis S, Eleftheriadis T, Stefanidis I: Acute renal failure: a rare presentation of hypothyroidism. *Ren Fail* 2009, 31:323-326.

- [3] Makino Y, Fujii T, Kuroda S, Inenaga T, Kawano Y, Takishita S: Exacerbation of renal failure due to hypothyroidism in a patient with ischemic nephropathy. *Nephron* 2000, 84:267-269.
- [4] Nathan AW, Havard CW: Paralytic ileus and urinary retention due to hypothyroidism. *Br Med J (Clin Res Ed)* 1982, 285:477.
- [5] Joshi B, Jones D, Rochford A, Giblin L: Hypothyroidism and associated acute renal failure. *J R Soc Med* 2009, 102:199-200.
- [6] Bentley RJ, Browne RJ: Paralytic ileus and dementia in a case of myxoedema. *Postgrad Med J* 1969, 45:779-781.
- [7] Bastenie PA: Paralytic ileus in severe hypothyroidism. *Lancet* 1946, 1:413-416.
- [8] Salomon MI, Di Scala V, Grishman E, Brenner J, Churg J: Renal lesions in hypothyroidism: a study based on kidney biopsies. *Metabolism* 1967, 16:846-852.
- [9] Kreisman SH, Hennessey J: Consistent reversible elevations of serum creatinine levels in severe hypothyroidism. *Arch Intern Med* 1999, 159:79-82.
- [10] Kumar N, Wheeler MH: Hypothyroidism presenting as acute abdomen. *Postgrad Med J* 1997, 73:373-374.
- [11] Wells I, Smith B, Hinton M: Acute ileus in myxoedema. *BMJ* 1977, i:211-212.
- [12] Chadha JS, Ashby DW, Cowan WK: Fatal intestinal atony in myxoedema. *BMJ* 1969, 3:398.
- [13] Chaturaka Rodrigo, Champika SSSK, Gamakaranage, et al.: Hypothyroidism causing paralytic ileus and acute kidney injury-case report. *Thyroid Research* 2011,4:7.

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Proposed Telescopic Op-Amp with Improved Gain

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Abstract- Before venturing further on the design of our operational amplifier, the first line of business is to determine the optimal topology for the given specifications. The factor that clearly stands out is the high dynamic range requirement of 85 db. Several topologies are given for this task, among these telescopic op-amp is selected. Compensation techniques are used with two stage topology of telescopic operational amplifier (op-amp). Miller compensation technique is used with null resistor to obtain such a high gain. The op-amp is designed on 0.13 μ m technology CMOS process with 5 v power supply and achieved a dc gain of 85dB with a 177.1MHz unity gain frequency.

Index Terms- Op-amp, miller capacitance, unity gain frequency, dc gain

I. INTRODUCTION

Designing high-performance analog circuits is becoming increasingly challenging with the persistent trend toward reduced supply voltages. The realization of a CMOS operational amplifier that combines high dc gain with high unity-gain frequency has been a difficult problem. to obtain high gain telescopic cascode op-amp is used[1].

A telescopic cascode op-amp, as shown in Fig.1, typically has higher frequency capability and consumes less power than other topologies. Its high-frequency response stems from the fact that its second pole corresponding to the source nodes of the n-channel cascode devices is determined by the transconductance of n-channel devices as opposed to p-channel devices. In the telescopic op-amp shown in Fig.1, all transistors are biased in the saturation region. M1–M2, M7–M8, and the tail current source M9 must have at least $V_{ds, sat}$ to offer good common-mode rejection, frequency response, and gain [2].

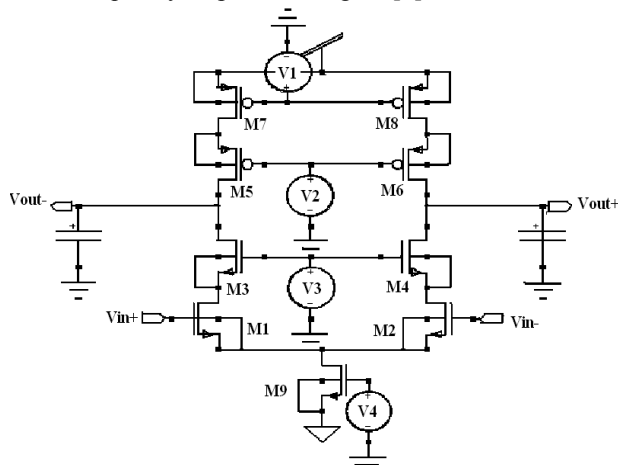


Fig.1 Telescopic cascode operational amplifier

II. COMPENSATION TECHNIQUE

Op-amps with very high dc gain and high unity-gain frequency are needed to meet both accuracy and fast settling requirements of the systems. However, as CMOS design scales into low-power, low-voltage and short-channel CMOS process regime, satisfying both of these aspects leads to contradictory demands, and becomes more and more difficult, since the intrinsic gain of the devices is limited [4]. Therefore, techniques for op-amp open loop gain enhancement are necessary.

To maintain stability in a two-stage amplifier, some form of compensation must be applied inside the feedback loop. Miller compensation technique with two stage topology is used with telescopic op-amp, which significantly reduces the frequency of dominant pole and moves the output pole away from the origin, this effect is called “pole splitting” is a common technique in op-amp design.

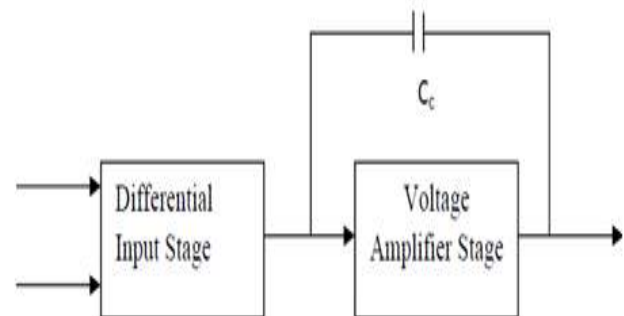


Fig.2.1 Implementaion of pole splitting (Miller Compensation)

In this method, a capacitor, C_c , is connected in parallel with a second stage. Miller's theorem states that the impedances seen in parallel with a gain stage can be modled as an impedance connected from the input of that gain stage to the ground, and an impedance connecting from the output of that gain stage to the ground. Since the impedance in this case is purely capacitive and second stage has inverting gain, the first capacitor has a reflected capacitance of $C_c(1+A)$, where A is the gain of the second stage. When a large capacitance is needed to reduce the pole of the first stage, it can be generated by a smaller capacitor and described Miller multiplication[5][6].The second capacitor has a value much closer to the compensation capacitor C_c , especially for large gains. Compensation capacitor (C_c) between the output of the gain stages causes pole-splitting and achieves dominant pole compensation [8][9].

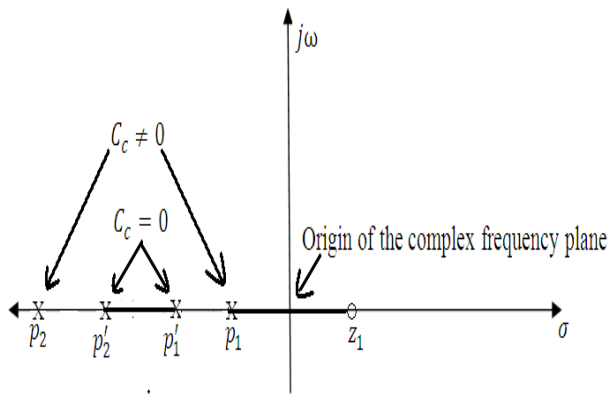


Fig.2.2 Pole splitting

III. PROPOSED STRUCTURE

To achieve higher dc-gain in the simple Telescopic op-amp, Miller compensation method can be used. Fig.3.1 shows the complete structure of the proposed op-amp[4].

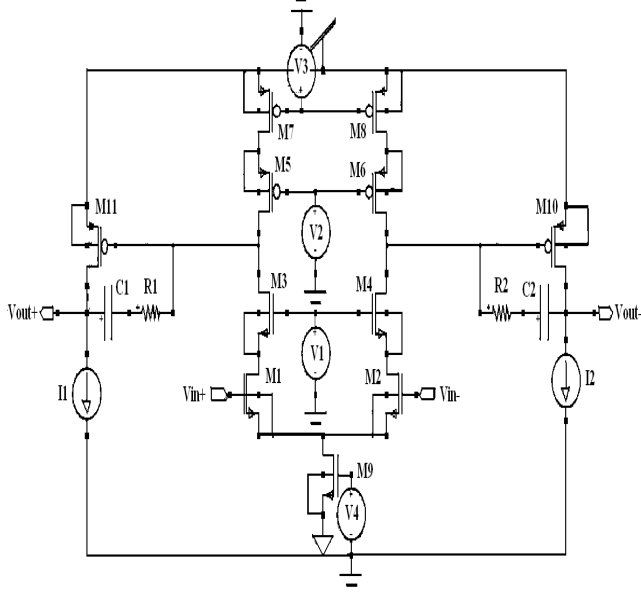


Fig.3.1 Schematic of proposed telescopic operational amplifier

Capacitors C1 and C2 are used as miller capacitors and resistors R1 and R2 are null resistors. All devices are assumed to operate in saturation region using the simplified square law drain current model given by:

$$I_D = \frac{1}{2} \mu C_{ox} \frac{W}{L} (V_{GS} - V_T)^2$$

IV. DC GAIN

As we can see, the total current injected to the output node is

$$I_{out} = \alpha(g_{m1,2}V_{in} + g_{mM1,2}V_{out})$$

The differential dc-gain of this op-amp can be written as:

$$A_{vo} = \alpha \times g_{mM1,2} \times R_{out}$$

By using miller compensation technique, gain of two stage telescopic operational amplifier rises up to 85db. Proposed Telescopic op-amp shows better performance when circuit area is

not a major concern. To get better stability, RC compensation network is used, R was set to be 1 K Ω and capacitor to be 0.2pf.

V. SIMULATION RESULTS

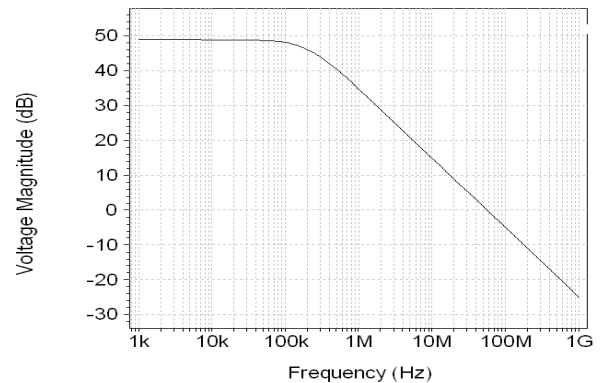


Fig.5.1 Frequency v/s gain response of Conventional telescopic op-amp

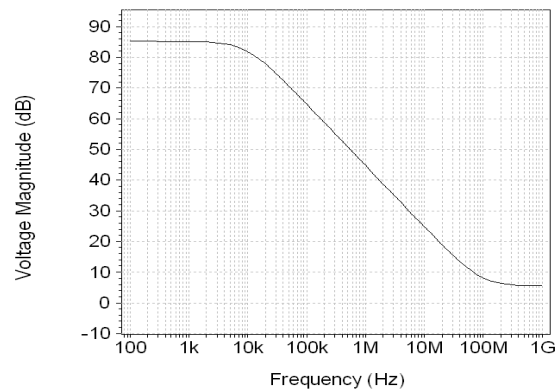


Fig.5.2 Frequency v/s gain response of proposed telescopic op-amp

Simulation result shows that the proposed telescopic op-amp achieves unity gain band width of 177.1 MHz, which is about 3.18 times that of the conventional Telescopic op-amp.

Table 1: (Design Specifications with simulation results)

Parameter	Conventional Telescopic op-amp	Proposed telescopic op-amp
Technology	130 μ m	130 μ m
Power Supply(v)	5v	5v
Compensating Resistance(Ω)	1K
Compensating Capacitance(p.f.)	0.2
Gain(dB)	49	85
Unity gain bandwidth	55.67MHz	177.1MHz

Simulation results shows that the proposed circuit improves the parameters such as the unity gain frequency (GBW), phase margin, gain, stability. The obtained gain is large enough for practical applications. This approach is efficient and viable to improve the gain, bandwidth and the phase margin.

VI. CONCLUSION

In this work a 0.13 μm telescopic operational amplifier, using compensation technique, has been presented and simulated with a supply voltage of 5 V. Telescopic op- amp is selected as it suits best for the purpose.

REFERENCES

- [1] P. Gray and R. Meyer, "Recent advances in monolithic operational amplifier design," IEEE Transactions on Circuits and Systems, vol. CAS-21, no. 3, pp. 317–327, May 1974.
- [2] D. Johns and K. Martin, Analog Integrated Circuit Design. New York: John Wiley & Sons, Inc., 1996.
- [3] J. Huijsing, R. Hogervorst, and K.-J. de Langen, "Low-power low-voltage vlsi operational amplifier cells," IEEE Transactions on Circuits and Systems, vol. 42, no. 11, pp. 841–852, Nov. 1995.
- [4] P. E. Allen and D. R. Holberg, CMOS Analog Circuit Design, 2nd Ed. New York: Oxford University Press, 2002.
- [5] B. Razavi, Design of analog CMOS integrated circuits. New York: McGraw-Hill, 2001.
- [6] R. Eschauzier, L. Kerklaan, and J. Huijsing, "A 100-mhz 100-db operational amplifier with multipath nested miller compensation structure," IEEE J. Solid- State Circuits, vol. 27, no. 12, pp. 1709–1717, Dec. 1992.
- [7] R. Eschauzier and J. Huijsing, Frequency compensation techniques for low-power operational amplifiers. Boston, MA: Kluwer, 1995.
- [8] K. N. Leung and P. Mok, "Analysis of multistage amplifier-frequency compensation," IEEE Transactions on Circuits and Systems, vol. 48, no. 9, pp. 1041–1056, Sep. 2001.
- [9] P. Chan and Y. Chen, "Gain-enhanced feedforward path compensation technique for pole-zero cancellation at heavy capacitive loads," IEEE Transactions on Circuits and Systems, vol. 50, no. 12, pp. 933–941, Dec. 2003.

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Next Generation Computing on the Internet (GRID)

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Abstract- Grid computing is increasingly being viewed as the next phase of distributed computing. Built on pervasive Internet standards, grid computing enables organizations to share computing and information resources across department and organizational boundaries in a secure, highly efficient manner. The next generation Grid will virtualize the notion of distribution in computation, storage and communication over unlimited resources.

The NGG vision, which has emerged as the vision for Grid Technologies, consists of three complementary perspectives the end-user perspective which implies the simplicity of access to and use of Grid technologies. the architectural perspective where the Grid is seen as a large evolutionary system made of billions of interconnected nodes of any type and the software perspective of a programmable and customizable Grid.

Index Terms- Grid Computing, Deployment, Next Generation Grid (NGG). Service Oriented Knowledge Utility (SOKU).

I. INTRODUCTION

Today we are in the Internet world and everyone prefers to enjoy fast access to the Internet. But due to multiple downloading, there is a chance that the system hangs up or slows down the performance that leads to the restarting of the entire process from the beginning. This is one of the serious problems that need the attention of the researchers. So we have taken this problem for our research and in this paper we are providing a layout for implementing our proposed Grid Model that can access the Internet very fast. By using our Grid we can easily download any number of files very fast depending on the number of systems employed in the Grid. When practically implemented, our Grid provides the user to experience the streak of lightening over the Internet while downloading multiple files.

Emerging pervasive wide area Grid computing environments are enabling a new generation of applications that are based on seamless aggregation and integration of resources, services and information. The Grid computing helps in exploiting under utilized resources, achieving parallel CPU capacity, provide virtual resources for collaboration and reliability.

Grid computing is based on the idea of joining individual computers and clusters of computers and organizing them into a single logical entity with a common interface. This interface will act as a meta-computer offering, for example, uniform access control and resource locator services to the user applications. By using these services, applications can be developed and tested on local machines and subsequently submitted to the meta-computer without modifications when a significant increase in computer resources are needed for the project. Grid-based systems fall into two basic categories, depending on the requirements of the

applications. Those that exploit the availability of large quantities of computing power distributed over a network are usually denoted Computational Grids, while those that focus on accessing and displaying large quantities of information, typically to a scientific or business community, are denoted Access Grids. These two types of Grid systems complement one another in giving their users access to globally available information. Both types of Grids will be covered by the proposed center.

A Grid provides an abstraction for resource sharing and collaboration across multiple administrative domains. The term resource covers a wide range of concepts including physical resources (computation, communication, and storage), informational resources (databases, archives, and instruments), individuals (people and the expertise they represent), capabilities (software packages, brokering and scheduling services) and frameworks for access and control of these resources (OGSA – Open Grid Services Architecture, The Semantic Web). At present multiple different.

Grid technologies co-exist, which stimulates creativity in the research community. Ultimately, however, we envision one Grid based on agreed interfaces and protocols just like the Web. Within that environment virtual organizations can co-exist, evolve and interact with each other in a secure way. This should avoid a proliferation of non-interoperable Grids, which would hamper the wide acceptance of Grid technology.

The SOKU Concept

Service Oriented Knowledge Utility paradigm and Next Generation Grids is a computing approach to our future IT architecture. It encompasses several important domains including foundations of service-oriented computing, service-oriented architecture, grid and utility computing, business process management, business integration.

The Service Oriented Knowledge Utility concept:

Service Oriented – the architecture comprises services which may be instantiated and assembled dynamically, hence the structure, behavior and location of software is changing at run-time.

Knowledge – SOKU services are knowledge-assisted ('semantic') to facilitate automation and advanced functionality, the knowledge aspect reinforced by the emphasis on delivering high level services to the user.

Utility – A utility is a directly and immediately useable service with established functionality, performance and dependability, illustrating the emphasis on user needs and issues such as trust.

Fig 2 GRID ARCHITECTURE

II. REASONS FOR USING GRID COMPUTING

When you deploy a grid, it will be to meet a set of customer requirements. To better match grid computing capabilities to those requirements, it is useful to keep in mind the reasons for using grid computing. The easiest use of grid computing is to run an existing application on a different machine. The machine on which the application is normally run might be unusually busy due to an unusual peak in activity. The job in question could be run on an idle machine elsewhere on the grid. There are at least two prerequisites for this scenario. First, the application must be executable remotely and without undue overhead. Second, the remote machine must meet any special hardware, software, or resource requirements imposed by the application.

III. THE GRID VISION

Grid is a socially shared, integrated system consisting of resources shared by multiple administrative/virtual organizations that gives transparent access to affordable and unaffordable resources under commonly agreed set of rules.

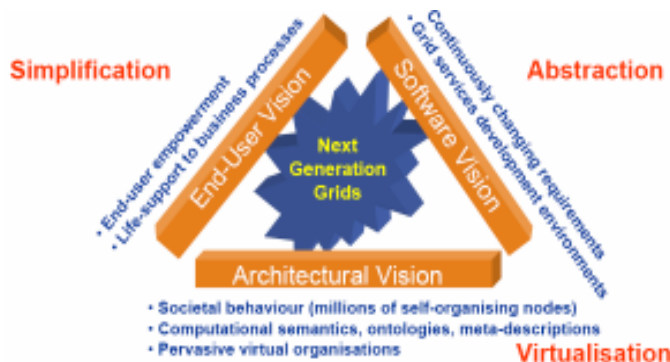
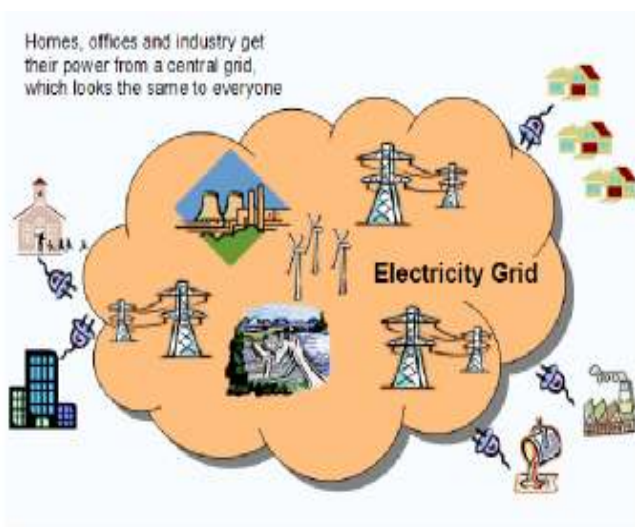


Fig 1 Grid Vision



The three primary types of grids and are summarized below:

Computational Grid

A computational grid is focused on setting aside resources specifically for computing power. In this type of grid, most of the machines are high-performance servers.

Scavenging grid

A scavenging grid is most commonly used with large numbers of desktop machines. Machines are scavenged for available CPU cycles and other resources. Owners of the desktop machines are usually given control over when their resources are available to participate in the grid.

Data Grid

A data grid is responsible for housing and providing access to data across multiple organizations. Users are not concerned with where this data is located as long as they have access to the data.

IV. PROPERTIES OF GRIDS

A. The main issues that characterize computational grids are-

i. Heterogeneity

A Grid involves a multiplicity of resources that are heterogeneous in nature and might span numerous administrative domains across wide geographical distances.

ii. Scalability

A Grid might grow from few resources to millions. This raises the problem of potential performance degradation as a Grids size increases. Consequently, applications that require a large number of geographically located resources must be designed to be extremely latency tolerant.

iii. Dynamicity or Adaptability

In a Grid, a resource failure is the rule, not the exception. In fact, with so many resources in a Grid, the probability of some resource failing is naturally high. The resource managers or applications must tailor their behavior dynamically so as to extract the maximum performance from the available resources and services.

iv. Transparency

The complexity of the Grid architecture is hidden to the final user. The user must be able to use a Grid as it was a unique virtual super computer. Resources must be accessible setting their location apart.

v. Openness

Each sub component of the Grid is accessible independently to the other components.

vi. Fault Tolerance

Grids must be able to work even if a component fails or a system crashes.

vii. Concurrency

Different processes on different nodes must be able to work at the same time.

B. Grid has the following characteristics

- i. Grid Computing is called High Throughput .
- ii. Its a mix of open source, proprietary software /applications/databases
- iii. No Single System Image (SSI), all the connected resources are autonomous
- iv. virtualization of resources
- v. Decentralized scheduling, administering and job management
- vi. Highly volatile, resources join and leave the Grid at their own will and wish.
- vii. unlimited number of nodes/resources
- viii. All the resources are highly heterogeneous in nature (from silicon to applications to application services called web service)
- ix. Internet is used as Information Highway. Grid is built on top of Internet and is used as Computing/Sharing Highway

C. Grid security

i. Authentication

Verifying the validity of a claimed individual and identifying who he or she.

ii. Access Control Assurance that each user.

iii. Data Confidentiality

Assurance that sensitive information must not be revealed to parties that it. Assurance that sensitive information must not be revealed to parties that it was not meant for.

iv. Data Integrity

Assurance that the data is not altered or destroyed in an unauthorized manner.

v. Key Management

The secure generation, distribution, authentication and storage of keys used in cryptography.

V. ACCESSING THE INTRANET GRID

When any user wants to access our proposed Intranet Grid in order to download multiple files over the Internet, then he should follow certain procedures that we consider necessary for the security of our Grid. The main Requirements for Processing in Grid Environment are:

- i. Security Single sign-on, authentication, authorization, and secure data transfer.
- ii. Resource Management Remote job Submission and Management.
- iii. Data Management.
Secure and robust data movement.
- iv. Information Services.
Directory services of available resources and their status.

VI. SERVER VIRTUALIZATION

Virtualization is a method of running multiple independent virtual operating systems on a single physical computer. Virtualization, in computing, is the creation of a virtual (rather than actual) version of something, such as a hardware platform, operating system, a storage device or network resources.

A virtual organization is a collection of people and resources that work in a coordinated way to achieve a common goal. To use grid facilities, any user must subscribe to a virtual organization as a member. Each people or resource can be a member of more virtual organizations at the same time and each virtual organization can contain people or resources belonging to different administration domains.

Server virtualization is the masking of server resources, including the number and identity of individual physical servers, processors, and operating systems, from server users. The server administrator uses a software application to divide one physical server into multiple isolated virtual environments. The virtual environments are sometimes called virtual private server.

Virtual machines are based on the host/guest paradigm. Each guest runs on a virtual imitation of the hardware layer. This approach allows the guest operating system to run without modifications. It also allows the administrator to create guests that use different operating systems.

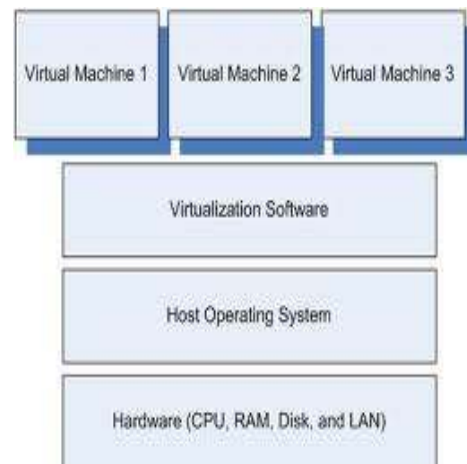


Fig 3 Server Virtualization

VII. CLOUD COMPUTING

Cloud computing is basically an Internet-based network made up of large numbers of servers - mostly based on open standards, modular and inexpensive. Clouds contain vast amounts of information and provide a variety of services to large numbers of people. The benefits of cloud computing are Reduced Data Leakage.

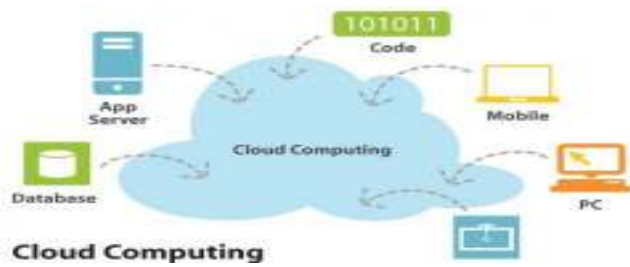


Fig 4 Cloud Computing

A. These services are broadly divided into three categories

- Infrastructure-as-a-Service (IAAS)
- Platform-as-a-Service (PAAS)
- Software-as-a-Service (SAAS).

➤ **Infrastructure-as-a-Service (IAAS)**

Infrastructure-as-a-Service (IAAS) like Amazon Web Services provides virtual servers with unique IP addresses and blocks of storage on demand. Customers benefit from an API from which they can control their servers. Because customers can pay for exactly the amount of service they use, like for electricity or water, this service is also called utility computing.

➤ **Platform-as-a-Service (PAAS)**

Platform-as-a-Service (PAAS) is a set of software and development tools hosted on the provider's servers. Developers can create applications using the provider's APIs. Google Apps is one of the most famous Platform-as-a-Service providers.

➤ **Software-as-a-Service (SAAS)**

Software-as-a-Service (SAAS) is the broadest market. In this case the provider allows the customer only to use its applications. The software interacts with the user through a user interface. .

VIII. CONCLUSION

Traditional computing environments don't provide flexibility for sharing resources to form virtual organizations. Grid Computing provides promising and efficient way of using computing and storage resources. It serves as a "computing on demand" model similar to the way electrical power is used. Ideal for collaborative environments because it provides dynamic resource sharing among different geographic locations and also it hides the complexity from the user who will see the Grid as a huge computing and storage device.

Grid technology has proven that it is the best technology to work over the internet on commerce, businesses, educations, science, researches, and many other projects by eliminating the geographical and economical limitations of the resources. By using this technology now, we can finish our projects in short time and without depending on one main server or super computers.

References

- [1] www.adarshpatil.com
- [2] www.gridforum.org.
- [3] www.ggf.org
- [4] Foster and C. Kasehnan, editors. Computational Grids: The Future of High Performance Distributed Computing. Morgan Kaubann,
- [5] www.gridcomputing.com

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Development, Testing and Monitoring of the Movement of Three Directional Tipper Mechanism

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Abstract- Conventional tipper mechanism an unload materials only at the backside of the tipper using hydraulically operated boom which may cause the problems of road blockage in the limited space area. The prototype model of three direction movement tipper overcomes the problem of unloading the vehicle on side way by using BOOM (D.C. Motor operated). By using Boom the material can be unloaded in all three directions as per requirement. The prototype is developed and tested for its movement in all three possible direction to unload the materials in the tipper trolley and monitor the inclinations for its gradualism (linearity). The results of inclination of the tipper in all three directions are obtained with respect to time period with material and without material as 22.80^0 and 23.24^0 for 100 seconds of operation of tipper respectively.

Index Terms- Tipper, BOOM, D.C. Motor, hinge joint, hydraulic cylinders, control circuit

I. INTRODUCTION

Automobile is made up of two words, i.e. "Auto" and "Mobile" 'Auto' is self-propelled and 'Mobile' is vehicles and as such the meaning of these two words is self-propelled vehicle i.e. all such vehicles which run with their own power are called automobiles. Vehicle is divided into two parts, (1) Chassis (2) Body. Vehicle without body is known as chassis. [1]

An automobile industry is growing sector in India. Automobile sector includes variety of vehicles light duty vehicles, medium duty vehicles and heavy duty vehicles. Heavy duty vehicles include bus, tractors, trucks etc. [1]

The tipper truck is important machinery in mining, construction sector to unload the material on site with minimum help of workers. The purpose of tipper mechanism is to unload the trolley of vehicle without or with little assistance of human. It provides the means for unloading the trolley with minimum time period with no effort.

A tipper truck is nothing but whose material can be emptied without handling the material. The front end of platform can be hydraulically raised so that the load is discharged by gravity which is known as "tipper mechanism". Tippers which are in existence to facilitate unloading of material are in only one direction. But it requires a lot of space and often results in blocking of the road. In order to resolve these problems we are providing the modification in existing system. We are providing the sideways movements of the trolley which could be very useful where there is a shortage of space. This mechanism prevents blocking of the road which saves the time and enhances the productivity. [9]

II. HOW TYPICAL TIPPER WORKS

Tipping mechanism works basically on the followings:

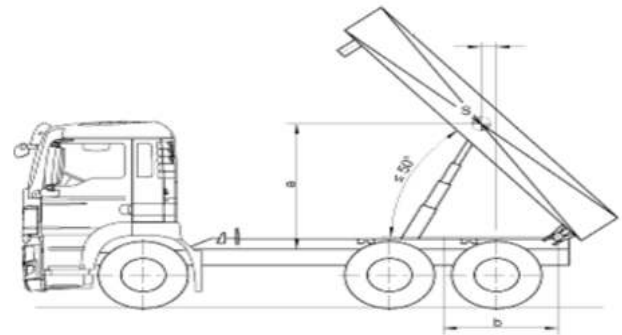


Fig. 1 Line diagram of conventional tipper truck

1) Hydraulic cylinder

A hydraulic cylinder is placed below the body of truck longitudinally at one end of the truck; the piston end of the hydraulic cylinder is connected by the means of a pivot joint to the chassis of truck as well as with the chassis.

In the forward stroke of the cylinder it pushes the truck body upward thus gives necessary lift for tipping. So, in forward stroke of the cylinder truck gets unloaded. In the return stroke of the cylinder the body of the truck comes to its original position.

2) Hinge Joint

The other bottom end of the body of the truck is connected by a hinged joint with the chassis. So, when the hydraulic cylinder pushes the body in its forward stroke the whole body gets tilted about the axis of the hinged joint and the material gets unloaded and by the return stroke of the hydraulic cylinder body comes and seat to its original position with respect to the hinged axis. But in this types of tipper can unload materials only at the backside of the tipper. 3-directional tipper can overcome this problem; it can unload material in all three sides. [7]

III. COMPONENTS OF THREE DIRECTIONAL MOVEMENT TIPPER MECHANISM

1) Chassis

Vehicle without body is known as chassis. Chassis frame are made of steel section so that they are strong enough to withstand the load and also light in weight to reduce dead weight on the vehicle. The functions are as follows:

- 1) To support the load of body, engine, gear box and radiator etc.
- 2) To carry load of material carried in the body.

3) To withstand stresses caused due to load. [1]

2) FRAME

In this work two frames which are placed above the chassis, i.e. upper frame and middle frame are used. The frames used are made of mild steel. A clearance gap of 32 mm is present in between the frame. Upper frame is placed on the four supporting hinges and trolley is fitted on the upper frame.

There are three square shape supporting plates are used. One plate is attached to the chassis on front side and other two plates are attached on both side middle frame. All the booms take the support of the supporting plate and will lift the trolley on the upper side. Two booms are positioned at the middle part of the upper frame from both the sides and one boom is attached from the front side to middle frame.

In this way frames plays an important role in tilting the tipper on all the three sides. Hence we have used two additional frames for giving three way movement of the trolley.

3) Boom (D.C. Motor operated)

The boom used in this work is motor operated screw boom. The main components of boom are D.C. Motor, Lead screw, Hexagonal nut, supporting rod, rectangular cover and ball bearing. The main function of boom is to lift and tilt the trolley with load.

The D.C. Motor used in the boom is connected on the upper end of lead screw and ball bearing is connected to lower end so that lead screw rotates smoothly. A nut is connected with and over lead screw. Two supporting rod (Ni-alloy steel) are welded on two side of nut like one in front of other. As motor rotate lead screw also rotate with help of bearing. Nut mounted on lead screw move up or down according to rotation direction with help of helical screw thread. So that, supporting rod move down. One of supporting rod strike the plate and another rod will use for lifting the trolley.

As it is prototype model, to show mechanism, here used D.C. Motor operated boom for more torque. But, in actual manufacturing of truck, instead of motor operated boom should used hydraulic boom for unloading the more tones of material smoothly.

4) LEAD SCREW

A lead screw also known as a power screw or translation screw is a screw designed to translate turning motion into linear motion. Common applications are machine slides (such as in machine tools), vices, presses, and jacks. Lead screws are manufactured in the same way as other thread forms. A lead screw can be used in conjunction with split nut. [2]

5) Ball-Bearing

A ball bearing is a type of rolling-element bearing that uses balls to maintain the separation between the moving parts of the bearing. The purpose of a ball bearing is to reduce rotational friction and support radial and axial loads. It achieves this by using at least two races to contain the balls and transmit the loads through the balls. Usually one of the races is held fixed. As one of the bearing races rotates it causes the balls to rotate as well. Because the balls are rolling they have a much lower coefficient

of friction than if two flat surfaces were rotating on each other. [1, 3]



Figure 1: Ball Bearing

Ball bearings tend to have lower load capacity for their size than other kinds of rolling-element bearings due to the smaller contact area between the balls and races. However, they can tolerate some misalignment of the inner and outer races. Compared to other rolling-element bearings, the ball bearing is the least expensive, primarily because of the low cost of producing the balls used in the bearing.

6) Transformer

It is an electrical instrument, which is used to step up or to step down supply voltage. Mutually induced emf is the principle of the working transformer. Transformer is a device that increase or decrease the voltage of alternating current. Transformer provides a simple, inexpensive way to change such voltage. They enable electric power companies to transmit alternating current easily and efficiently. They also ensure the proper voltage for the circuit of home appliances and other electric equipment. Transformer consists of two coils of insulated wire. One coil, known as the primary winding, is connected to the sources of the voltage that is to be changed. This voltage is the input voltage of the transformer. The other coil, called the secondary winding, supplies the output voltage to the desired circuit in most transformers; the primary and secondary windings are wound around a hollow core made of thin iron or steel sheets. Most cores have the shape of a ring or a square. The top two coils are not connected to each other. [5]

7) Resistance

The property of substance which oppose the flow of electric current is called resistance. Resistance is a heat dissipating element used for either controlling the current in the circuit or developing a voltage drop across it. There are various types of resistance. This can be classified according to factor depending upon.

1. Material used for fabricating a resistance.
2. Material and physical size.
3. Intended application.
4. Ambient temperature rating and
5. Cost

8) Capacitor

It is a device, which has the circuit and also blocks the passage of direct current through it. Capacitor consist of two conducting plates separated by an insulating medium all dielectric. The dielectric could be air, mica, ceramic, plastic etc. designee of

capacitor is connected with the relation of the proper dielectric material for particular type of application. It is the amount of charge required to create a unit potential different between two plates.



Figure 2: Capacitor

9) Battery

Lead-acid batteries, invented in 1859 by French physicist Gaston Plante, are the oldest type of rechargeable battery. Despite having a very low energy-to-weight ratio and a low energy-to-volume ratio, their ability to supply high surge currents means that the cells maintain a relatively large power-to-weight ratio. These features, along with their low cost, make them attractive for use in motor vehicles to provide the high current required by automobile starter motors.

In this present work motor operated screw boom is used for lifting the trolley. Here uses two batteries which are connected in series with each other. Each battery is of 6V. In this way by connecting two batteries in series developed a potential of 12V for operating the 12V, 30 r.p.m D.C geared motor.



Figure 3: Battery

10) D. C. Motor

In any electric motor, operation is based on simple electromagnetism. A current-carrying conductor generates a magnetic field; when this is then placed in an external magnetic field, it will experience a force proportional to the current in the conductor, and to the strength of the external magnetic field. As you are well aware that opposite polarities attract, while like polarities (North and North, South and South) repel. The internal configuration of a DC motor is designed to harness the magnetic interaction between a current-carrying conductor and an external magnetic field to generate rotational motion.

Every DC motor has six basic parts - axle, rotor (a.k.a., armature), stator, commutator, field magnet(s), and brushes. In most common DC motors, the external magnetic field is produced by high-strength permanent magnets. The stator is the stationary part of the motor -this includes the motor casing, as well as two or more permanent magnet pole pieces. The rotor (together with the axle and attached commutator) rotates with respect to the stator. The rotor consists of windings (generally on a core), the windings being electrically connected to the

commutator. The above diagram shows a common motor layout with the rotor inside the stator (field) magnets.



Figure 4: Exploded view of motor

11) Toggle switch

A toggle switch is a class of electrical switches that are manually actuated by a mechanical lever, handle, or rocking mechanism. Toggle switches are available in many different styles and sizes, and are used in countless applications. For e.g. the control of large amounts of electric current or mains voltages.



Figure 5: Six pin Toggle switch

The word "toggle" is a reference to a kind of mechanism or joint consisting of two arms, which are almost in line with each other, connected with an elbow-like pivot.

12) Push on switch

A push button switch is used to either close or open an electrical circuit depending on the application. Push button switches are used in various applications such as industrial equipment control handles, outdoor controls, mobile communication terminals, and medical equipment, and etc. Push button switches generally include a push button disposed within housing. The push button may be depressed to cause movement of the push button relative to the housing for directly or indirectly changing the state of an electrical contact to open or close the contact. Also included in a pushbutton switch may be an actuator, driver, or plunger of some type that is situated within a switch housing having at least two contacts in communication with an electrical circuit within which the switch is incorporated.



Figure 6: Push to on switch

IV. MODIFICATION IN TIPPER MECHANISM

The three directional tippers can unload materials in all three sides. Internally to control the sides of tipping there needs to be required two more hydraulic booms instead of one boom. But in this present work by using motor operated screw boom instead of hydraulic boom. Also here require special types of hinge joints in this case.



Figure 7: Prototype model of Three-Directional tipper truck

When the front boom fitted on the smaller side of middle frame will activate then, the material will be removed on the backside of tipper.

When the central boom fitted on the bigger left hand side of middle frame will activate and then the material will be removed on the right hand side of tipper when observed from the front end. When the central boom fitted on the bigger right hand side of middle frame will be activated then, the material will be removed on the left hand side of tipper when observed from the front end. At a time only one movement is possible. In this way, the three way tipper mechanism will work. Automation of tipping will be possible by using a power pack with plc control or some similar kind of automation devices.

1) Electrical circuit used in this work

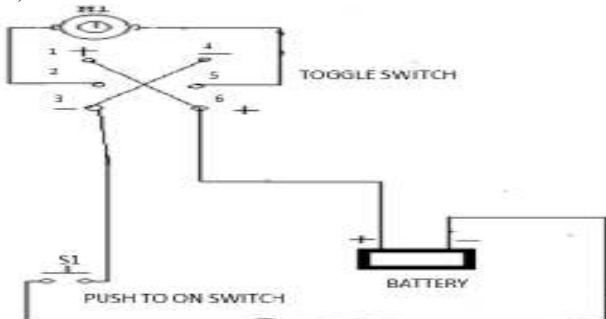


Figure 8: Circuit for single boom operation

The above diagram represents about control system used in activating the boom for tilting purpose. This construction consist of six pin toggle switch which are numbered as 1, 2, 3, 4, 5 and 6 as shown in figure, 30 r.p.m., D.C. motor, push on switch and battery. Both poles of motor are connected to the middle pin 2 and 5 of a toggle switch.

As one move the toggle switch upper side the middle pins 2 and 5 will get internally connected to the upper pins 1 and 4. So, the left end of motor will get positive polarity and right end of will get negative polarity. As one press the push on switch the current

will start flowing through the circuit and the entire circuit will be completed. And hence motor will start rotating.

When one move the toggle switch lower side the pins 2 and 5 as well as pins 3 and 6 will get internally connected and the polarity of motor will changed means left end of motor will have negative polarity and right end will have positive polarity hence due to change in polarity the motor will start rotating opposite direction.

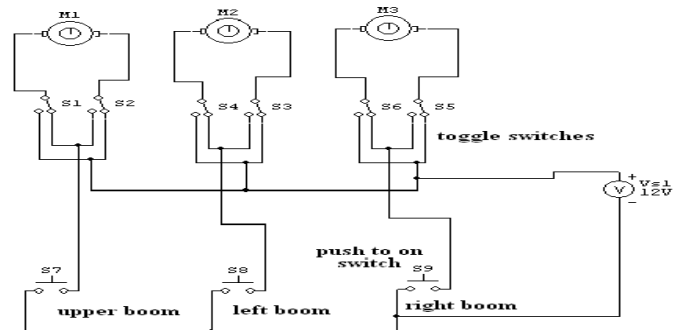


Figure 9: Circuit diagram for boom control

The above circuit consists of three motor, three toggle switch, three push on switch connecting wire and battery are as shown in Fig.10.

Both the end of motor are connected with the middle pins of a toggle switch and one end of toggle switch is connected to push on switch similarly same connection is done for other two motor. Hence all three motor are connected in series with battery. So, one can operate each boom individually according to requirement.

2) Charger

Charger consists of step-down transformer, full wave rectifier, capacitor and connecting wire. Transformer is having primary and secondary winding. Full wave rectifier consists of four p-n junction diode arranged in the form of a bridge. Generally the current supply used for domestic purpose is of 230 volt. When these high voltage alternating current pass through the step down transformer then it will reduced this high voltage current in to low voltage (12 volt). Now this current will pass through the full wave rectifier. The main function of full wave rectifier is to convert the whole of input waveform to one of constant polarity (positive or negative) as its output means it converts this alternating current (AC) to direct current (DC). As the direct current produced is having pulse type wave nature so, to convert this into linear form a capacitor is used which work as a filter in the circuit. In this way charger convert alternating current to direct current more effectively.

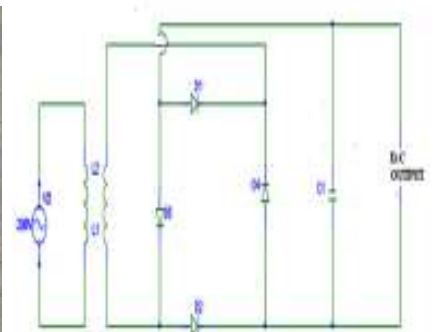


Figure 11: (A and B) Battery charger and Charger Circuit

V. DESIGN AND SPECIFICATION OF DIFFERENT COMPONENTS

1) Design of Lead screw

Assumptions

Outer diameter of lead screw = 10mm

pitch = 2mm

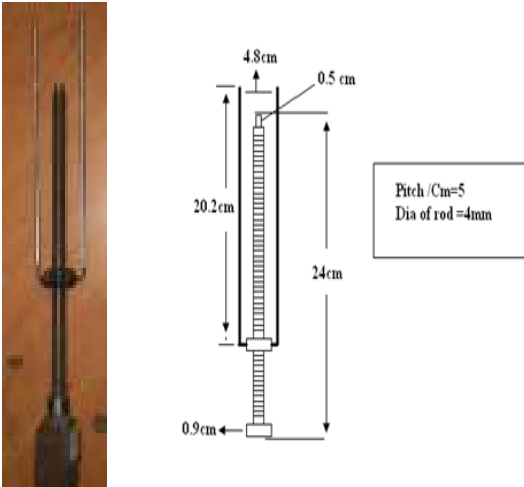


Figure 10: Image and Schematic of Lead Screw

Specification:

Outer Diameter (d_o) = 10 mm

Pitch (P) = 2 mm

Mean Diameter :- ($d_o - p/2$) = 9 mm

Assume $\mu = 0.09$. [4]

Angle of friction at screw (θ) = $\tan^{-1}(\mu)$

$\tan^{-1}(0.09) = 5.14$

Helix Angle (α) = $\tan^{-1}(l/\pi d_m) = 4.04$. [4]

$l = p$ (Pitch)

$l = 2$ mm (single start)

Calculation of Motor power

Power (P) = $2\pi NT/60$

Where $N = 30$ rpm

Total torque (T) = $T_1 + T_c$

Where T_1 = Lifting torque

T_c = Torque due to collar friction (Neglect)

$T_1 = (W d_m/2) \tan(\theta + \alpha)$. [4]

Where, W = Weight

$W = m * g$

= 142.68 N-mm

Power (P) = 0.448 watt = 0.0006Hp

Checking the strength of the column by using buckling equation for long columns

Since $(L/K) = 113 > 90$

Where, $L = 226$ mm

$K = (d_c/4) = 2$ mm

$d_c = d_o - p = 8$ mm

Which is greater than 90.

Hence Euler's formula will be Valid.

Calculation of F_{cr} by Euler's formula

Selecting material SAE 1040. [4]

$S_{yt} = 350$ Mpa,

$E = 203 \times 10^3$

$F_{cr} = (\pi^2 EA) / (L/K)^2$. [4]

Where, $A = (\pi/4) \times 00000d_c^2$

$d_c = d_o - p = 8$ mm

$A = 50.24$ mm²

K = radius of gyration

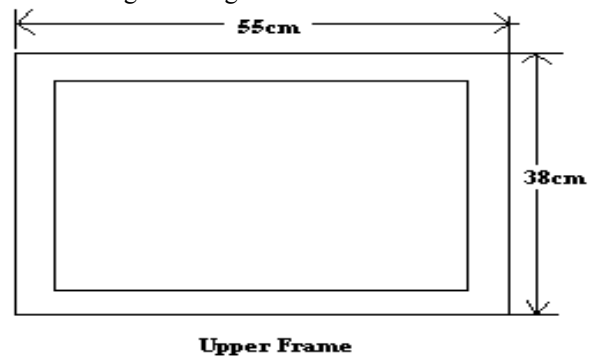
Column constant (n) = 0.25. [4]

Now,

$F_{cr} = 1970.73$ N

For the induced load by the wagon considering F.O.S = 4.

$W = F.O.S \times \text{weight of wagon} = 4 \times 20 \times 9.81 = 784.8$ N



Upper Frame

Figure 11: Frame

But $F_{cr} = 1970.73$ N is greater than 784.8 N.

Hence screw is safe in buckling

Height of Nut

Height of Nut = No of thread x Pitch

Where, n = Number of thread engaged with Nut.

Bearing pressure (P_b) = $W / [(\pi/4) \times (d_o^2 - d_c^2) \times n]$. [4]

Assume $P_b = 10$ Mpa [4]; (safe bearing pressure)

= $[784.8 / (\pi/4(0.01^2 - 0.008^2) \times n)] \times 10^{-7}$

= 2.77

= 3

Height of nut = 3×2

= 6 mm.

2) Chassis

For the design of chassis and frame, used material is mild steel.

The dimensions of cross member 1*1 inch.

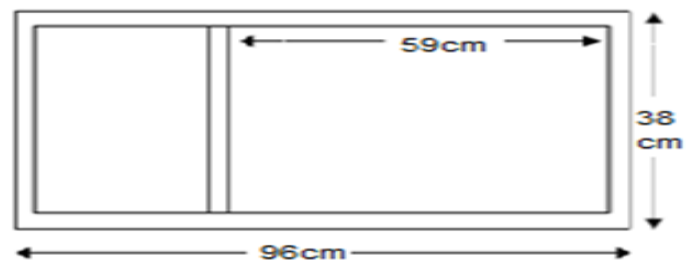


Figure 12: Line diagram of chassis

- Length of the chassis = 96cm.
- Width of the chassis = 38cm.

3) Middle frame and Upper frame

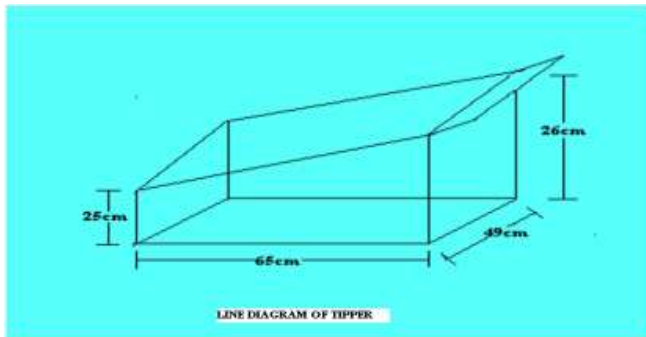


Figure 13: Line diagram of trolley

Material used for frame is mild steel.
Length of middle frame = 65 cm.
Length of upper frame = 55 cm
Width of middle and upper frame = 38cm.

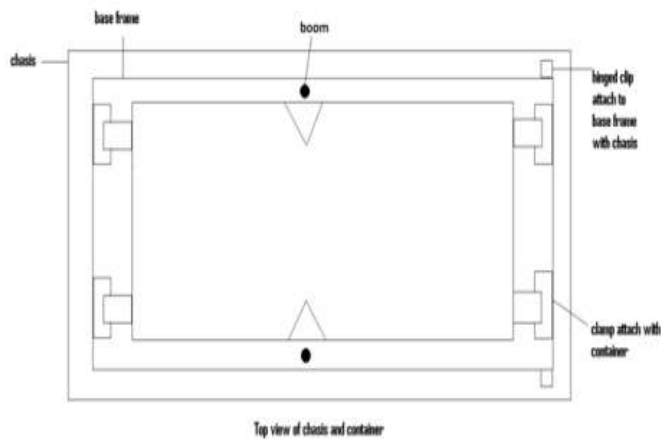


Figure 14: Top view of chassis and container

4) Dimensions & carrying capacity of tipper from standard data

By using the standard specification from Tata Trucks >>>S K 1613 (Tipper) Tipper Body Options - Scoop- 4.5 to 6 m³ and Box - 6 to 8 m³.

Here in this work scoop type tipper is used and the volume of scoop type tipper used in Tata trucks is in the range of 4.5 to 6 m³.

Volume of tipper used in the Tata trucks is taken as = 5m³.

For this work it is assumed that the prototype is 61 times smaller than standard dimension of Tata trucks.

Assume volume of our tipper = 1/61(the volume of Tata tipper)
the volume of our truck = (5000000/61) cm³.
= 8085 cm³.

Now, assume the length & width of our tipper is 65cm & 50cm respectively.

So from this the height tipper can be easily calculated.

Height of our tipper = 80850/ (65*50)
=25 cm.

Hence on the basis above calculation one can easily determine the dimensions of prototype tipper.

VI. TESTING AND RESULTS

For confirming the stability of the tipper mechanism the movement of tipper is tested and balancing of the trolley is checked. In this work various reading are taken. Table 1, 2 3, 4 and Fig.17, 18, 19, 20 represents the variation in angle with time when unloading of tipper on back side and sideways with and without material.

Table-1 Variation of angle with time when unloaded on back side with material

Sr. No	Time(Sec)	Angle (Degree)
1	10	1.76
2	20	2.81
3	30	3.6
4	40	4.92
5	50	5.88
6	60	6.75
7	70	7.66
8	80	8.74
9	90	9.94
10	100	11.3

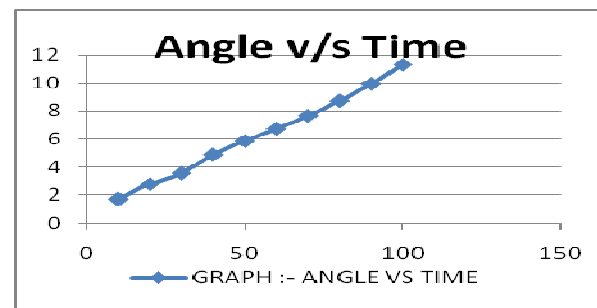


Figure 15: Variation of angle with time when unloaded on back side with material.

Table 1 and fig.17 represents the inclination of the tipper on back side while unloading the material (500gm) from tipper trolley is gradual with variation of 0.9⁰ to 1⁰.

Table- 2 Variation of angle with time when tilted on back side without material

Sr.No	Time(Sec)	Angle (Degree)
1	10	2.02
2	20	3.08
3	30	3.98
4	40	5.27
5	50	6.14
6	60	7.88
7	70	9.17
8	80	10
9	90	11.3
10	100	12.76

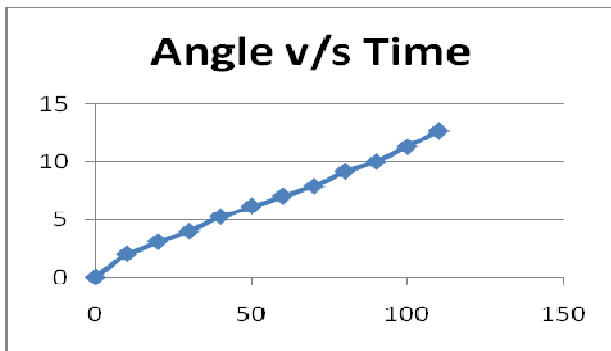


Figure 16: Variation in angle with time when tilted on back side without material.

Table 2 and fig.18 represents the inclination of the tipper on back side while unloading the tipper without from tipper trolley is not gradual but slightly damping with variation of 0.9° to 1.2° .

Table-3 Variation of angle with time when unloaded by side way with material.

Sr.No	Time(Sec)	Angle (Degree)
1	10	4.93
2	20	5.11
3	30	7.65
4	40	9.56
5	50	10.84
6	60	14.43
7	70	15.85
8	80	19.12
9	90	21.26
10	100	22.8

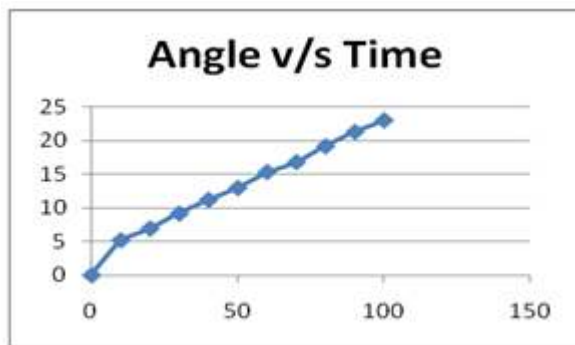


Figure 17: Variation of angle with time when unloaded by side way with material.

Table 3 and fig.19 represents the inclination of the tipper on side way while unloading the material (500gm) from tipper trolley is gradual with variation of 1.3° to 2° .

Table- 4 Variation of angle with time when tilted by side way without material

Sr.No	Time(Sec)	Angle (Degree)
1	10	5.20
2	20	6.94

3	30	9.17
4	40	11.20
5	50	12.96
6	60	15.33
7	70	17.13
8	80	19.16
9	90	21.34
10	100	23.24

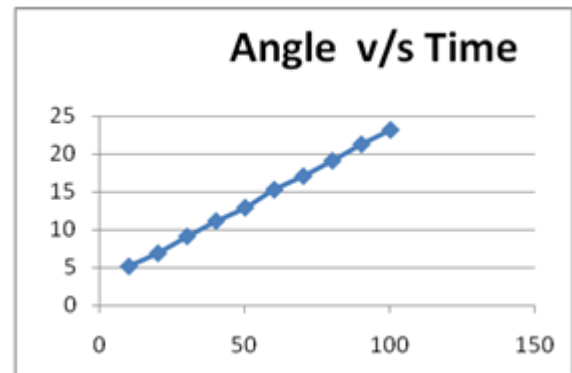


Figure 20: Variation of angle with time when tilted by side way without material.

Table 3 and fig.20 represents the inclination of the tipper on side way while unloading the tipper without from tipper trolley is gradual with variation of 1.3° to 2° .

VII. CONCLUSION

Three Directional tipper mechanisms is the modification of conventional tipper mechanism. The testing and monitoring of inclination confirmed the suitability and proper balancing of this mechanism. Hence with the help of this mechanism one can reduce the time of unloading the material in space constraint area. It prevents the blockage of road in places crossway movement of trucks in back sided tipper. In this present work the problem of unloading the material at the backside of the tipper is overcome by using BOOM (D.C. Motor operated). By using Boom the material can be unloaded in any three directions as required. In this paper the design and development of various components of the BOOM, assembly and finally the testing of the tipper mechanism is explained and the optimum results of inclination of tipper with respect to time, with material and without material as 22.80° and 23.24° in 100 seconds respectively. The D.C. operating BOOM can be replaced by hydraulic boom for heavy application.

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REFERENCES

- [1] Nakara C.P., "Basic Automobile Engineering", (7th Edition), Dhanpat Rai Publishing company, New Delhi, 2005, pp 9-10, 13-16.
- [2] Bhandari V.B., "Design of machine elements", (25th Reprint), Tata McGraw-Hill, New Delhi, 2006, pp 164-184.
- [3] Rattan S.S., "Theory of machine", (21st Reprint), Tata McGraw-Hill, New Delhi, 2004, pp 385-387.
- [4] Shiwalkar B.D., "Design data for machine elements", (3rd Edition), Denett & Co., Nagpur, 22nd June 2008, P.P.31, 39, 93, 94.
- [5] Sasikala B. & Poornachandra C., "Electronic Device and Circuit", (2nd Edition), Scitech Publication Private Limited, India, 2003, pp 2.38, 2.39, 3.1-3.4.
- [6] Kumar Manoj, "Electronic Component and Material", (1st Edition), Satya Prakashan, New Delhi, 2002, pp 115-118, 167, 168, 220-222
- [7] www.brighthub.com/engineering/mechanical/topics/automobiles.aspx?PageIndex=6

- [8] www.fourwheeler.com/techarticles/trail/129_0707_thule_3_way_tipper_trailer/index.html
- [9] www.tatamotors.com/fullforward_controlchasis/1518tippertruck/index.html.

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Enhancing the features of Intrusion Detection System by using machine learning approaches

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Abstract- The IDS always analyze network traffic to detect and analyze the attacks. The attack detection methods used by these systems are of two types: anomaly detection and misuse detection methods. Intrusion detection (ID) is a type of security management system for computers and networks. An ID system gathers and analyzes information from various areas within a computer or a network to identify possible security breaches, which include both intrusions and misuse. An Intrusion detection system is designed to classify the system activities into normal and abnormal. ID systems are being developed in response to the increasing number of attacks on major sites and networks. Intrusion detection is the act of detecting unwanted traffic on a network or a device. Several types of IDS technologies exist due to the variance of network configurations. In this paper, we provide you information about the methods that uses a combination of different machine learning approaches to detect a system attacks.

Index Terms- machine learning, IDS, neural network.

I. INTRODUCTION

Intrusion detection is the act of detecting unwanted traffic on a network or a device. An IDS can be a piece of installed software or a physical appliance that monitors network traffic in order to detect unwanted activity and events such as illegal and malicious traffic, traffic that violates security policy, and traffic that violates acceptable use policies. Several types of IDS technologies exist due to the variance of network configurations. Each type has advantages and disadvantage in detection, configuration, and cost. The IDSs are very useful for detecting, identifying and pursuing internet intruders.

The IDSs always analyze network traffic to detect and analyze the attacks. The attack detection methods used by these systems are of two types: anomaly detection and misuse detection methods [2]. Most misuse detection methods are based on attack signature detection which are determined by network and security experts. After the signatures are determined, they are compared with the network input traffic in order to detect and recognize new attacks. Misuse detection methods have shown to be very efficient [3]. On the contrary, anomaly detection methods always compare suspicious and normal traffics. In fact, they are to prevent unexpected attacks. In order for anomaly detection to take place, they learn normal and abnormal traffic features and then they detect new attacks based on the degree of deviation from normal traffic [4]. Different methods are used for analyzing and learning the traffic.

A Network Intrusion Detection System (NIDS) is one common type of IDS that analyzes network traffic at all layers of the Open Systems Interconnection (OSI) model and makes decisions about the purpose of the traffic, analyzing for suspicious activity. Most

NIDSs are easy to deploy on a network and can often view traffic from many systems at once. Network behavior anomaly detection (NBAD) views traffic on network segments to determine if anomalies exist in the amount or type of traffic. Segments that usually see very little traffic or segments that see only a particular type of traffic may transform the amount or type of traffic if an unwanted event occurs. Host-based intrusion detection systems (HIDS) analyze network traffic and system-specific settings such as software calls, local security policy, local log audits, and more. In the following, a combinatory method based on decision trees, KNN algorithms and neural networks is introduced to take advantage of each of these methods in detecting both anomaly and misuse attacks.

Decision Trees are excellent tools for helping you to choose between several courses of action. They provide a highly effective structure within which you can lay out options and investigate the possible outcomes of choosing those options. Decision tree learning, used in statistics, data mining and machine learning, uses a decision tree as a predictive model which maps observations about an item to conclusions about the item's target value. More descriptive names for such tree models are classification trees or regression trees. Different data mining algorithms are also good solutions for attack detections [5] which is already discussed by Quinlin, J. R. Decision trees one of the most powerful and effective ways of detecting attacks especially in anomaly detections [6, 7,8].

There are many ways by which attack signatures can be found such as decision tree, different types of neural networks and SVM [10]. In the following, a combinatory method based on decision trees, KNN algorithms and neural networks is introduced to take advantage of each of these methods in detecting both anomaly and misuse attacks.

This survey paper contains III section, in which section II deals with the review of related works. Section III focuses on the methods proposed by Hadi Sarvari, Mohammad Mehdi Keikha [1] in IDSCML2. Section IV elaborates the overall conclusion of the paper.

II. REVIEW OF RELATED WORK

The IDSs 1 are one of the important security parts connected to internet networks since there are many ways to violate the security of networks. The IDSs are very useful for detecting, identifying and pursuing internet intruders. The IDSs always analyze network traffic to detect and analyze the attacks. The IDSs 1 are one of the important security parts connected to internet networks since there are many ways to violate the security of networks. The IDSs are very useful for detecting, identifying and pursuing internet intruders. The IDSs always

analyze network traffic to detect and analyze the attacks. As defined in Sun, Merrill, and Peterson (2001), top-down learning goes from explicit to implicit knowledge. They also had better memory recall performance. Typing performance after the top-down learning process was faster than the initial performance of the control group. Three top down learning methods - alphabetical grouping, word based-grouping, and word generation – were designed to provide users with constructive visual search strategies and improve their memory of the keyboard layout during learning sessions.

The second type of techniques is machine learning techniques. These techniques are used when there is no primary knowledge about the pattern of the data. That is why they are sometimes called bottom-up methods. Since our method is based on machine learning methods, we are going to have a brief look at some IDSs which were done by using machine learning methods. Machine learning, a branch of artificial intelligence, is a scientific discipline concerned with the design and development of algorithms that allow computers to evolve behaviors based on empirical data, such as from sensor data or databases. A major focus of machine learning research is to automatically learn to recognize complex patterns and make intelligent decisions based on data; the difficulty lies in the fact that the set of all possible behaviors given all possible inputs is too large to be covered by the set of observed examples (training data).

Nadjaran and Kahani did attack detection by using fuzzy neural networks and fuzzy deduction [12]. First, they use a number of fuzzy neural networks for primary classification and then by applying fuzzy deduction to primary Classifications output, they see whether the system activity flow is normal or it is an attack. If it is an attack, they specify its type.

Considering the two types of attack features as continuous and discrete, Weiming recognizes discrete features with the weak classification of the discrete features and continuous features with the weak classification of the continuous features [13]. After the two steps, he combines the results of continuous and discrete classification so as to use the advantages of continuous and discrete features for attack detections at the same time. The article [14] classifies the input data by using different types of tree classifications and then selects the best classification of the given sample by using Ant Colony. The SSGBML system works in two phases to detect the sample group. Primarily it uses Steady State GA to detect and classify the rules of each class and after analyzing their fitness, it increases the accuracy of this classification by using a Zeroth classifier and getting feedback from the setting. It also tries to improve the classification quality through the mechanism of learning from the environment [15].

The LAMSTAR IDS has increased the ability to learn a variety of attacks and has decreased the learning time of the neural networks by using the sample selector and classifier algorithms. This system selects samples with more information to increase the system accuracy and deletes the irrelevant features of the attack detection and classification in the learning time so that it can decrease the learning time of SOM neural networks used to detect attacks [16]. Supervised machine learning is the search for algorithms that reason from externally supplied instance to produce general hypotheses, which then make predictions about future instances. In other words, the goal of supervised learning is to build a concise model of the

distribution of class labels in terms of predictor features. The resulting classifier is then used to assign class labels to the testing instances where the values of the predictor features are known, but the value of the class label is unknown.

III. USE OF KDD99 CUP & IDSCML SYSTEM

In earlier papers decision tree were used to find out the attacks. Decision trees one of the most powerful and effective ways of detecting attacks especially in anomaly detections [6, 7, 8].

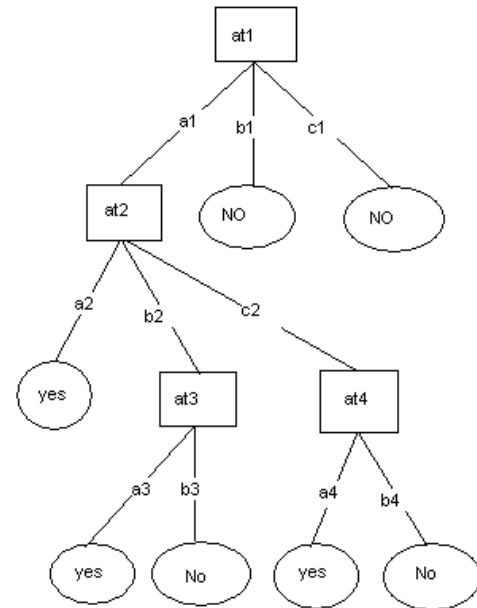


Fig 1: Decision Tree

Table 2: Training Set

at1	at2	at3	at4	Class
a1	a2	a3	a4	yes
a1	a2	a3	b4	yes
a1	b2	a3	a4	yes
a1	b2	b3	b4	no
a1	c2	a3	a4	yes
a1	a2	a3	b4	no
a1	a2	a3	b4	yes

But in some cases decision tree is alone not capable of finding all types of attacks. Data mining (which is the analysis step of Knowledge Discovery in Databases) focuses on the discovery of *unknown* properties on the data.

KDD 99 is a standard source of data for evaluating IDSs which appeared in 1990. The data includes the US air force local network together with a variety of simulated attacks. In this collection, every sample is equal to a connection. A connection is a sequence of TCP packages which starts and ends at a specific time with the flow of data from the source IP address to the destination IP. TCP is a transport layer protocol used by applications that require guaranteed delivery. TCP establishes a full duplex virtual connection between two endpoints. Each endpoint is defined by an IP address and a TCP port number. 41 features were defined for each connection in this collection, which are divided into four major categories namely: primary

features of TCP protocol, content features, time-based and host-based traffic features. Every connection has a label which determines whether it is normal or it is one of the defined attacks. This collection contains 24 different known attacks and 14 unknown ones which have been included in experimental data. TCP provides a communication service at an intermediate level between an application program and the Internet Protocol (IP). That is, when an application program desires to send a large chunk of data across the Internet using IP, instead of breaking the data into IP-sized pieces and issuing a series of IP requests, the software can issue a single request to TCP and let TCP handle the IP details. Due to network congestion, traffic load balancing, or other unpredictable network behavior, IP packets can be lost, duplicated, or delivered out of order. TCP detects these problems, requests retransmission of lost data, rearranges out-of-order data, and even helps minimize network congestion to reduce the occurrence of the other problems. Once the TCP receiver has reassembled the sequence of octets originally transmitted, it passes them to the application program. Thus, TCP abstracts the application's communication from the underlying networking details.

The present attacks are divided into four categories as follows: U2R, R2L, DOS and PROBE. Figure3 illustrates the data distribution for each attack out of one million new KDD 99 packs of data. As it can be seen in Figure3, the major problem with this data set is lack of balance between the numbers of samples in each class.

Table 3: Data Distribution in Training Data set

TYPE	Number Of Training Samples	Percentage Of Samples in Training Set
Normal	812814	75.61
DOS	247287	23.0
Probe	13860	1.29
R2L	979	0.09
U2R	52	0.00

In KDD99cup the problem of balance and unbalanced occur. So in paper [1] IDSCML SYSTEM is used. In this the combination of decision tree and KNN is used. These two methods are separately applied to the data set. 1NN and DT were successful in some detection cases on their own right. By taking advantage of both 1NN and DT, the outputs of 1NN and DT were combined by using a BP neural network in figure 1, which improved the results to some extent. The outcome of this combination turned out to be much better than that of one or both 1NN and DT.

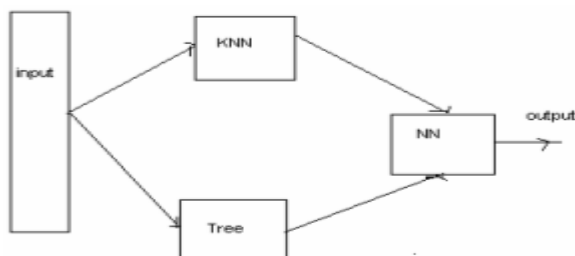
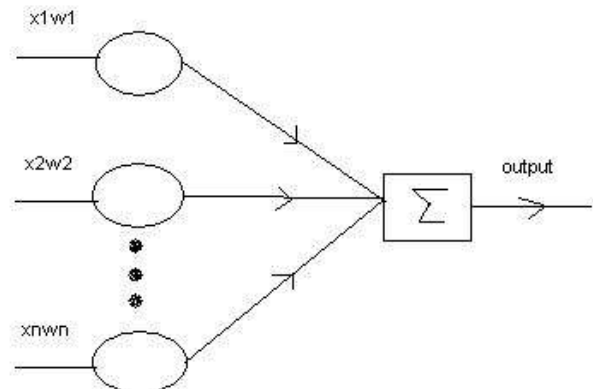


Fig 4: Combining Tree with KNN

Kohonen neural networks are used in data mining process and for knowledge discovery in databases. As all neural networks it has to be trained using training data. The Kohonen neural network library is a set of classes and functions to design, train and calculates results from Kohonen neural network known as self organizing map. The Kohonen neural network differs both in how it is trained and how it recalls a pattern. The Kohonen neural network does not use any sort of activation function. Further, the Kohonen neural network does not use any sort of a bias weight. Output from the Kohonen neural network does not consist of the output of several neurons. When a pattern is presented to a Kohonen network one of the output neurons is selected as a "winner". This "winning" neuron is the output from the Kohonen network. Often these "winning" neurons represent groups in the data that is presented to the Kohonen network.



To continue with, 2NN and 3NN were separately applied to the data and it was revealed that they do better than 1NN and DT. 2NN was added to the combination in figure 1 which again resulted in a better attack detection than the 1NN and DT combination.

Based on these results, it could be predicted that the more the number of classifiers increases, the more the accuracy of the system would be. This motivated us to use other classifiers too. So SVM was added to the system and we gained better results as it has been shown in the seventh row of table 3. Later, LVQ and BP neural networks were added but surprisingly, the results got worse or remained constant. So we revised our prediction and came to the conclusion that the accuracy of the system increases by adding the number of classifiers but this improvement stops at one point and remains constant from that point on.

According to table 1, the U2R and R2L class samples are much fewer than other classes and therefore their detection percentage is less than that of the others, too. This is called the unbalanced data problem with input data for different classes. In order for this problem to be eliminated in the combinatory model, we tried to generate data with features similar to the features of these two classes so that the system could recognize the members of these two classes by observing more samples of their members. In fact, by this way we increased the accuracy of the system in testing step. An entrance was created for a neural network by adding first level classifiers namely, DT, SVM, 1NN, 2NN and 3NN and the results of every classification were saved. Now these results were used as the neural network entrance for the final recognition of samples.

Since the class 4 (R2L) and the class 3 (U2R) samples of data were few and the neural network does not get enough training for the features of these two classes, we have to generate some data for these classes so that it can recognize their attack with more accuracy. Vectors like (*,*,*,*, 3), (*,*,*, 3,*), (*,*, 3,*,*), (*, 3,*,*,*), (3,*,*,*,*) were used to generate data in the third class. Note that *= {1 or 2 or 3 or 4 or 5}, meaning that * can be any class and the favorable result for these data is the third class. It also indicates that only if one classifier recognizes the third class, we indirectly tell the neural network that the proper class for the data is the third class. In this way, we can boost the coefficients of the third class samples. The purpose of adding these data is to make the third class be the final result whenever a classifier recognizes the third class. This addition of the data may generate data which is not in the input data. In other words, we have added an unknown behavior to the system data to make the third class be the final result whenever a classifier recognizes the third class. Class 4 (R2L) also has little data, so we do the same thing for it. But in this case *= {1 or 2 or 4 or 5}.

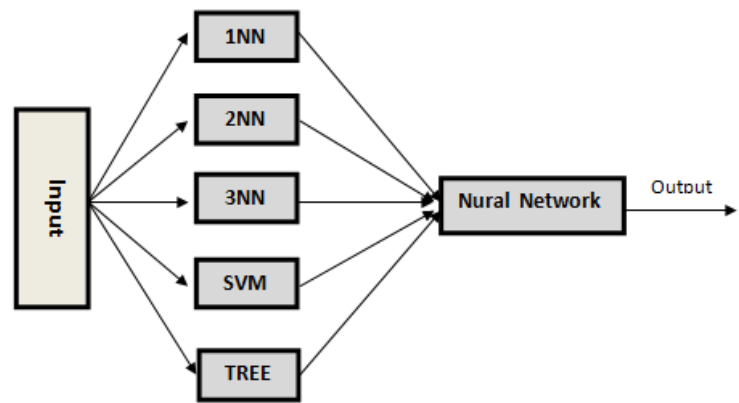


Fig 5: Several Combinatory methods

Here a table is given which indicates the performance of different methods used to find out the attacks.

	Decision Trees	Neural Networks	Naïve Bayes	KNN	SVM	Rule learners
Accuracy in general	**	***	*	**	****	**
Speed of learning with respect to number of attributes and the number of instances	***	*	****	****	*	**
Speed of classification	****	****	****	*	****	****
Tolerance to missing values	***	*	****	*	**	**
Tolerance to irrelevant attributes	***	*	**	**	****	**
Tolerance to redundant attributes	**	**	*	**	***	**
Tolerance to highly interdependent attributes (e.g. parity problems)	**	***	*	*	***	**
Dealing with discrete/binary/continuous attributes	****	***	***	***	**	***
Tolerance to noise	**	**	***	*	**	*
Dealing with danger of overfitting	**	*	***	***	**	**
Attempts for incremental learning	**	***	****	****	**	*
Explanation ability/transparency of knowledge/classifications	****	*	****	**	*	****

The data was given to the system several times in order to have better neural network training. Another advantage of this system is that it works well with both continuous and discrete features. It changes the continuous features to their proper and corresponding discrete features and then they are grouped into different classifiers.

IV. CONCLUSION

We compared the results of IDSCML with other systems in table V. KDD 99 contains 24 different known attacks in the training data and 14 unknown attacks in the testing data. This article proposes a combinatorial system. Primarily, it was concluded that the system accuracy increases by increasing the

number of classes. Then it was revealed that this increase continues to a point at which it stops and remains constant. One of the features of KDD 99 is that their samples are much fewer than those of other classes and since machine learning-based systems do not learn the features of these two classes, their detection accuracy is also much less than other classes. In fact, unknown features have been introduced to the system. The table is given below that indicates the comparison results of different methods with IDSCML.

Table 5: Comparison result of Some Systems with Idscml

Method & Systems	Normal	DOS	Probe	U2R	R2L
MSSGBML [14]	96.32	97.6	37.72	28.85	83.93
ESCIDS[11]	98.2	99.5	84.1	14.1	31.5
Multi classifier [15]	96.34	97.3	88.7	29.8	9.6
PNrule [16]	99.5	96.9	73.2	6.6	10.7
IDSCML (Proposed method)	99.92	98.2	93.22	44.44	93.21

REFERENCES

- [1] Hadi Sarvari, Mohammad Mehdi Keikha, Improving the Accuracy of Intrusion Detection Systems by Using the Combination of Machine Learning Approaches, University of Isfahan, 978-1-4244-7896-5/10/\$26.00_c 2010 IEEE.
- [2] O. Depren, M. Topallar, E. Anarim, and M. KemalCiliz, An intelligent intrusion detection system (IDS) for anomaly and misuse detection in computer networks. Expert Systems with Applications, Volume 29, Issue 4, pp. 713-722, November 2005.
- [3] J. H. Lee, S. G.Sohn, J. H. Ryu, and T. M. Chung Effective Value of Decision Tree with KDD99 Intrusion Detection Data sets for Intrusion Detection System. In International Conference on Advanced Communication Technology, 17-20, pp.1170-1175, Feb 2008.
- [4] R. A. Kemmerer, and G. Vigna, Intrusion detection: A brief history and overview. IEEE Security and Privacy Magazine (supplement toComputer), 35(4), vol. 35 no. 4, pp. 27-30, April 2002
- [5] Quinlin, J. R. Decision Trees and Decision Making. In IEEE Trans. on System (Man and Cybernetic), 20(2), 1990, 339-346.April 1990.
- [6] Abbes, T., Bouhoula, A., and Rusinowitch, M. Protocol Analysis in Intrusion Detection Using Decision Tree. In Proceeding of the International

- Conference on Information Technology: Coding and Computing (ITCC'04) 1, pp .404-408, Vol 1, Las Vegas, April 2004.
- [7] C. Kruegel, and T.Toth, Using Decision Trees to Improve Signature Based Intrusion Detection. In Proceeding of the 5th Recent Advances in Intrusion Detection 2003 (RAID2003), LNCS2820,173- 191.Volume 2, pp.404, April 2004 .
- [8] V. H. Garcia, R.Monroy, and M. Quintana, Web Attack Detection Using ID3. IFIP International Federation for Information Processing,. Springer Santiago, Chile, Vol. 218, pp 323-332, 2006.
- [9] L. Kuang, and M. Zulkernine, an Anomaly Intrusion Detection Method Using the CSI-KNN Algorithm. Proceeding of the 2008 ACM symposium on applied computing. Brazil, pp. 921-926, 2008.
- [10] Y. Li, B. Fang, L. Guo, and Y. Chen, Network Anomaly Detection Based on TCM-KNN Algorithm. Proceeding of the 2nd ACM Symposium on Information, computer and communications security,pp. 13-19, 2007.
- [11] Z. S. Pan, S. C. Chen, G. B. Hu, and D. Q. Zhang, Hybrid Neural Network and C4.5 for Misuse Detection. Proceeding of the Second International Conference on Machine Learning and Cybernetics (Xi'an, 2003). 20463-20467.IEEE in china, pp.2-5 November 2003.
- [12] A. Nadjaran, and M. Kahani, A new approach to intrusion detection based on an evolutionary soft computing model using neuro-fuzzyClassifiers, Computer Communications 30(2007), pp. 2201-2212.July 2007.
- [13] W. Hu, and S. Maybank, Ada Boost-Based Algorithm for Network Intrusion Detection. In IEEE TRANS. ON SYSTEMS MAN ANDCYBERNETICS PARTB: CYBERNETICS, VOL. 38, NO. 2, APRIL 2008.
- [14] L. P.Rajeswari, A. Kannan, and R. Baskaran, An Escalated Approach to Ant Colony Clustering Algorithm for Intrusion Detection System. In International Conference on Distributed Computing and Networking. 393-400.Springer, Kolkata, India, 5-8,,Lecture Notes in Computer Science 4904, January 2008
- [15] W. S. Sharafat., and R. Naoum, Development of Genetic-based Machine Learning for Network Intrusion Detection (GBML-NID).World Academy of Science, Engineering and Technology, pp. 20-24, 2009.
- [16] M. R. Sabhnani, , and G. Serpen, Application of machine learning algorithms to KDD intrusion detection data set within misuse detection context. In Proceeding of International Conference on Machine Learning: Models, Technologies and Applications (Las Vegas, Nevada, USA, 2003). Pp.209-215., CSREA, June 2003, InPress.
- [17] S. B. Kotsiantis, Supervised Machine Learning: A Review of Classification Techniques, Department of Computer Science and Technology University of Peloponnese, Greece End of Karaiskaki, 22100, Tripolis GR.

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A Comprehensive Review of Consumption Pattern and Strategies in Cosmeceutical Market with a Focus on Dermaceuticals in Indian Market

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Abstract- Cosmeceuticals are the largest addition to the health Industry and are described as cosmetic products with drug like activities. The term cosmeceutical was coined by Raymond Reed but the concepts were further popularized by Dr. Albert Kligman in the late 1970's. They are the fastest growth segment in the skin care market. Cosmeceuticals are the advances made within the world of dermatological products with the new beacon in skincare. Cosmeceuticals are topical cosmetic-pharmaceutical hybrids intended to enhance the health and beauty of skin. The use of the cosmeceuticals has drastically risen in recent years. This significantly increases the armamentarium of the clinicians in improving the treatment of skin, hair and other conditions. This comprehensive review attempts to examine the current literature regarding the concepts of drug, cosmetics and Cosmeceuticals. The review also tries to find out various gaps in the cosmetic industry related to consumer behaviour and regulations. The paper tries to find out the consumption patterns of the cosmeceutical products and strategies of the companies to sustain and grow in this emerging market. The review is done through the various published researches in this field across the world. This paper is an earnest endeavour to understand the nuances worldwide and elaborate on the strategies for the Indian market therein. This paper is to expand the recent knowledge about Cosmeceuticals.

Index Terms- cosmeceuticals, cosmetics, consumer behaviour, consumption pattern, skincare, regulations

I. INTRODUCTION

As the lifestyle of the people around the world is changing, due to socio- culture, economic and other influences, many new industries are emerging. The personal care industry is one such industry which has a new hot topic that is "Cosmeceuticals", which is the fastest growing segment of the personal care industry. The term cosmeceutical was coined in 1961 by Raymond Reed, founding member of the U.S. society of chemists. He originally conceived the word to describe "active" and science based cosmetics. The word and concepts were further popularized by Dr. Albert Kligman in the late 1970's. Common usage has expanded the definition to include "a cosmetic that has or proposed to have medicinal property". Cosmeceuticals are created by pharmaceutical companies and the derma genetics line of "genetically customized" skin care product is an example. Gene link, Inc, is a genetic biosciences company with a focus on biomedical projects. The

pharmaceutical companies and hospitals are among the primary customers of Gene link. However, as this specific line of "genetically customized" skin care products are solely being marketed as just that, skin care products, this product will likely be classified as cosmetics. A cosmeceutical's "intended use" - gleaned from the labelling, advertising, promotional materials - determines the regulatory fate of cosmeceutical as a cosmetic or drug. The actual physical effect of the product has no bearing on its intended use. Therefore, cosmeceuticals might indeed have skin altering properties, but so long as the manufacturers are careful in their advertising claims, they will not have to worry about FDA oversight.

II. REVIEW OF LITERATURE

1. Evolution and Growth of Cosmeceuticals

A. Genesis

The word "cosmetic" is derived from the Greek word "Kosmos" meaning "to arrange". In the late 10,000 BC, cosmetics were very important in Egyptian health and Hygiene (*Journal Week.com 2011:26 September 2011:11:00 pm*). Tracing the origin of cosmetics, the first recorded use of cosmetic is attributed to Egyptians, circa 4000 BC (*Narada, 2010*). The ancient Sumerians and Hebrews also applied cosmetics. In other cases, such as European cosmetic known as Cerus was used from the second century to the 19th century (*Kaushik, 2005*). Cosmetics are products that are used to clean and beautify the skin (*Millikan, 2001*). The first recorded use of cosmetics is attributed to Egyptians in 4000 B.C (*Rona et al, 2004*).

B. Growth

As time went on, cultures merged and the Greeks began to move into cosmetic history and adopt the use of Egyptian cosmetics. Centuries later the Roman move in, and use of cosmetic formulation began to evolve into other purposes, such as creating aphrodisiacs. They used sheep fat mixed with blood for nail polish and instead of just using for the traditional body oils created by the Egyptians. Starting around the 1400's those who were tanned were the lower working class, who work outside in the fields. The more refined classes of the people had pale skin and a desire to make it even whiter (*James, 2011*). During the Edwardian society days, around 1900, middle aged women did a lot of entertaining and as hostesses, they had to look their best, which to them, meant looking as younger as possible (*Martell, 2011*). These society women needed all the help they could get to offset the effect of their high life styles. Edwardian women relied on cosmetics, especially face creams and anti-aging

products (Martell, 2011). Sale of cosmetic started with Selfridge (a Saloon) in 1909. Anti aging and skin nourishing products totalled nearly \$ 17.7 billion in worldwide retail sales in 2008, according to Euromonitor. The firm projects that this segment will go to \$ 22.1 billion in worldwide retail sale in 2013. US based cosmetic firm Avon products leads the antiaging/skin nourishing segment with approximately \$ 1.16 billion in 2008 worldwide retail sales, followed by UD peer Proctor & Gamble, with \$ 1.1 billion for its Olay product line.

C. Transition (Phase-I) cover to uncover.

Vigneron and Johnson (1999) report that people's need for appearance and materialism was increasing and hence human being wanted to satisfy the need to look and feel good. This created a boom in the cosmetic industry across the world. Customer behaviour is an ongoing process when individual or group select, purchase, use or dispose of products, services, idea and experiences to satisfy needs and desire (Askegaard, 1999). Askegaard (1999) noted that people do not buy the products to play in our lives go well beyond the task it performs. Men purchase the ideas and images that are associated with the products, to produce a desired identity and self-image (Fiona & Elke, 1998). Kellner (1992) proposes that the various meaning associated with the products are used to mitigate the "fragmented self-image of individuals who want to display and experience situational images felt to be appropriate at a particular time".

D. Transition (Phase-II) female grooming to male grooming.

The cosmetic industry is not restricted to only women. The time is changing and so the thoughts. The male population is becoming conscious about their looks and hence heralded to a new era in the cosmetic industry which is the male grooming industry. In the recent years, men have become more conscious about their image than ever before, resulting in sales on male grooming products to increase by 18 percent globally between 2006 and 2011 (Mermelstein & Felding, 2007). This change in male grooming is becoming a new trend and is expected to blossom in regions where consumers are increasingly adapting to western styles. The gap of distance between men and beauty products or skin products has shorten now a days, their demand for skin care products are revealed to fulfil their pleasure and wellness start from, cream their skin, feed the skin nutrition, antiaging treatment, body and hair cares, spa centres or even beauty institutions (Cole, 2008). Male customers have to seek out the products in specific place as cosmetic counter, perfumery and drug store (Lamb, 2008). Chunhapak (2008) noted that people who have different income have different selection of products. Moreover people who have high income are ready to buy expensive products but people who have low income are not. According to Blanchin (2007) the relation between men and beauty care can be seen as simple relation to his appearance. Men want to feel good about them, to be in harmony and to reach a mental physical equilibrium. Men seek to change their self-image through products due to the need to adapt to the different roles in their lives (Aaker, 1999). Men use products to enhance their selfimage through the transfer of the symbolic meanings from the use of the product, to the image that the consumers' wanted to present (Grubb & Grathwohl, 1967). Sirgy (1982) argue that consumers will be motivated by positively valued products that promote a positive self-image.

E. Present Scenario

i. Country Implications

In 2009 the top five countries of origin for import of cosmetics and skin care products into Hong Kong were France (25 percent), Japan (17 percent), China (15 percent), United States of America (15 percent) and the United Kingdom (35 percent). The total import of cosmetic and skin care products dropped slightly in 2009 after a decade of steady increase. The expected market growth for 2007 to 2012 is established to be 6 percent. Western Europe and Australia which spend a combine \$ 7.7 billion on wrinkle reducing facial creams in 2007, according to Euromonitor Internationals new 2008 cosmetic and toiletries database. Antiaging facial creams are also enjoying booming demand in Latin America, where consumers put a high priority on looks, and the market saw a growth of 15 percent in 2007 to \$ 5.5 billion. In Brazil, more than one in every three US dollars spends on skin care goes towards a facial antiager. Despite challenging economic conditions, the company reportedly generate double digit growth in revenues on a local currency basis in Japan, their largest market. For the fourth quarter, the company's revenue increased approximately 8 percent to \$ 258.7 million from \$ 240.2 million in the fourth quarter of 1997. Revenue for 1998 was reported as 913.5 million compared to \$ 953.4 million in 1997. Cosmeceutical is the fastest growing segment of the natural personal care industry with worldwide annual sales over \$ 14 billion. The category is projected to grow 8 percent to 12 percent annually, according to High Bean Research. Euromonitor forecasts the US market value for nourishing and antiaging products for skin care to reach \$ 2.6 billion in 2011, a 24 percent growth from last year estimate of 2.1 billion. Anderson and He (1998) found quality, price, brand, packaging, advertisement and sale person as influential attributes when Chinese consumers considered using cosmetics in China.

ii. Economic Implications

It is estimated that the European cosmeceutical market will be worth more than \$ 4 billion in 2009, up 5 percent from 2008. In Europe, France and Germany follow behind the US in their demand for drug based beauty products. With sales turnover of nourishes/antiaging products in 2007 at \$ 1.2 billion and \$ 1.1 billion respectively (Kline Group, 2009). In the US, the cosmeceutical market was worth \$ 16 billion in 2007 and forecast for 2012 put the market at \$ 21 billion (Pakaged Facts, 2009). Meanwhile Brazil, with its culture emphasis on looks, has also experienced strong demand for antiaging products, with annual sales of \$ 927 million in 2007, up from \$ 302 million in 2002 (Euromonitor International, 2009). The market is broken down into segments for disease appearance and fitness. The disease treatment segment currently maintains the largest share of the market worth \$ 66 billion in 2008. This should increase at a CAGR of 12.5 percent to reach \$ 119 billion in 2013. It consist of preventive and relative health care for all diseases of aging such as joint and bone health, metabolic disorders, cardiovascular diseases etc (BCC Research, 2009).

F. Nomenclature

Pharmaceuticals are essentially drug products and are defined as products that prevent, mitigate, treat or cure disease and/or affect the structure or function of the body (Vermeer and Gilchrest, 1996). Cosmeceuticals is a deliberate portmanteau of these two terms and is intended to cosmetic drug like benefits

from an otherwise cosmetic product. Kilgman may be described as the father of cosmeceuticals, a term he popularized (Kilgman, 2005), but they first appeared in the world market in 1996 (Draelas, 1997). The purported drug like effect is largely unproven and the term is recognized neither by the United States food and drug administration nor by any other regulatory body. Cosmeceuticals are generally presented as lotions or creams and are mostly targeted at dermatological issues (Choi and Berson, 2006). Recently, orally delivered products of similar claims as cosmeceuticals have been labelled as either oral cosmeceuticals or as nutricosmetics or nutraceuticals. Commonly, all these are simply called cosmeceuticals.

G. Worldwide Growth of Cosmetics

In 2005 Hong Kong remains the largest cosmetic market in the Asia Pacific, leading Singapore, Malaysia, Thailand, Indonesia, India, Australia and Japan. Hong Kong residents spend an average US \$ 166 per month on cosmetics, up from US \$ 102 in 2004. The global cosmetic and toiletries industry saw another year of strong growth in 2007 to reach a value of 290.9 billion. According to Euromonitor International Research the market grew by 6 percent which represents only a slight slowdown of the 2006 figures (274.7 billion). The global ranking of major cosmetic and toiletries manufacturers have not changed since 2006. Procter & Gamble, L'Oreal and Unilever occupy the top three places globally, accounting for 30 percent of the market. Unilever demonstrated the strongest growth, 7.7 percent in 2007, while Procter & Gamble and L'Oreal increased their sales by roughly 5.5 percent each. According to a recent AC Nelson study, the fast moving consumer goods market has shown a steady growth of nearly 20 percent during the last two quarters of 2008. Interestingly, the skin care product growth rate has jumped from just 5 percent to 30 percent in the same time period, this is due, in part, to activities in rural market where there is an increased awareness and an underlining demand for beauty products. In a recent report by AC Nelson, the skin whitening market currently is the fastest growing market segment, at an annual growth rate of 85 percent. With an expected growth of 11 percent in 2009, the personal care segment broke an 18 year old record in the top of mind survey conducted by Datafolha institute (Brazil). Despite market slow down, India remains one of the fastest growing markets globally, growing at 13 percent per annum and valued at \$ 6.3 billion. As the middle class consumer base and its disposable income grows, the market is moving nearly four times faster than the \$ 52 billion valued of mature beauty market, according to a recent report by market research firm Kline & Co. Rounding out the top five in 2008 by global retail sales were France based cosmetic firm L'Oreal's L'Oreal Dermo-Expertise and Lancome brand lines with \$935 million and \$ 557 million respectively, and Germany based Beiersdorf's Nivea Visage/Vital brand line with approximately \$ 739 million in 2008 retail sales, according to Euromonitor. "Antiaging accounts for 23 percent of the total global skin care market in 2008 and grew faster than any other product type with in skin care", says the consultancy. The combined average growth of the antiaging market in BRIC countries was 22 percent in 2008, compared with the global average of 13 percent. "They now account for a fifth of the total \$ 17.5 billion global 2008 value sales of antiaging products", says Euromonitor. The skin care segment will account for 63 percent of all cosmeceutical product

demand through 2012, according to Freedonia. The value of chemicals used in cosmeceutical products is expected to rise by 7.7 percent per year to \$ 1.4 billion in 2012. China alone will account for 13 percent of global antiaging value sales by 2013, according to Euromonitor.

According to IBIS world, while the \$ 60.37 billion cosmetic industry is on track to decline 1.2 percent in 2009, the niche market of cosmeceuticals have become a prospective growth area for business operating in the mature cosmetic industry, the firm noted. Euromonitor projects the US skin care market value to reach \$ 8 billion in 2011 from an estimated \$ 7.7 billion last year. Global skin care sales are projected to grow by 25 percent to reach \$ 69.6 billion in 2010 from 2005. Webster (2000) revealed that a female spouse has decision making power over her husband. Not only women but also men perceived the influence of self image when using product categories in cosmetics. Skincare cosmetics have symbolic or communicative value (Coulter, Feick & Price 2002). Packaging is the combination of science, technology, art and fashion to protect and keep the products to customers that involve with the considerations of products attribute, distribution, storage, use, sale, production, cost, public image, customers etc (Soroka, 2002). You (2003) find that friends or family possibly convinced consumers into purchasing particular products. Monerio (2003) also predicts that there is a huge potential of cosmetics in India. Voss and Parasuraman (2003) suggest that the purchase preference is primarily determined by price than quality during pre purchase evaluation. Sinka (2003) reports that Indian shoppers seek emotional value more than the functional values of shopping. Malhotra (2003) describes the main reason for boom in cosmetic industry as increasing fashion and beauty consciousness coupled with rising incomes and focus on health and fitness.

Skin care leads in terms of absolute growth

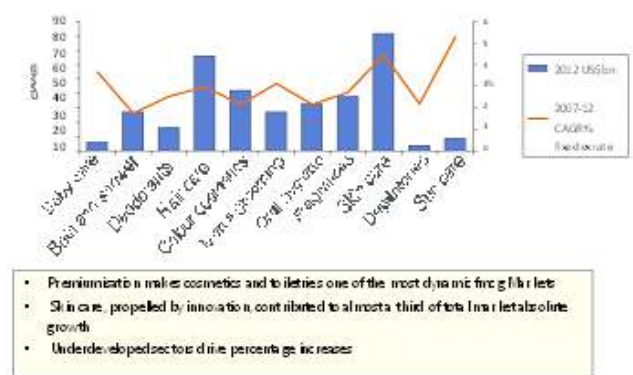


Figure: 1. Source: Euromonitor International

Hu and Jasper (2006) revealed that an individual adopts a behaviour, which complies with other, resulting from the belief that the adoption will enhance the individual's self concept or self image. Rising hygiene and beauty consciousness due to changing and demographic lifestyle, deeper consumer pockets, rising media exposure, greater product choice, growth in retail segment and wider availability are the reasons reported by

(Euromonitor International, 2006). According to Draelos and Thaman (2006), skin care products should provide the maintenance and treatment against the hygienic of the skin under optimal conditions of sanitation and comfort and attending to someone so something. The availability of products in counters or department stores relies on the product brand and image, store image and reputation of departmental store (Christopher, 2007). According to Blanchin (2007), two major communication strategies are classified into the media communication and the non media communication. Relating to the development and purchasing power in consumers and market, it affects to the rapid growth in beauty care industry, especially in this decade (Souiden & Diagne, 2009). Jeff Falk mention in GCI magazine (2009) that, women are more emotional in terms of their product purchasing habits, whereas men are drawn to technical functional things. MarketResearch.com (2009), the forecast for year 2014 suppose to reach to \$ 84.9 billion in this segment. Sales of men specific grooming products valued at \$ 19 billion worldwide in 2009 and is estimated to rise to \$ 28.0 billion by 2014 (MarketResearch.com, 2009).

H. Cosmetics Vs Cosmeceuticals

Cosmetics

- **FD&C Act** defines a cosmetic by its intended use meaning, cleansing, beautifying, promote attractiveness or altering appearance.
- Cosmetic products only deliver their ingredient at a very superficial level into the skin (Anthony, 2009).
- Cosmetics do not delay your skin's aging process because they work at the uppermost layer of the epidermis which is topmost layer of the skin (Anthony, 2009).

Cosmeceuticals

- Cosmeceutical products have pharmaceutical benefits to the skin (Invigor8.com).
- Cosmeceutical products contain active ingredients that act on the skin cellular structure through topical application (O'Lenick, 2009).
- Cosmeceuticals are more concentrated, pure and more effective (O'Lenick, 2009).

I. Classification of Cosmeceuticals

Cosmeceuticals with different names

The term cosmeceuticals is used with different names. For all the terms the definition remains the same i.e. cosmeceuticals are the formulations which were neither pure cosmetics, like lipsticks, nor pure drug, like corticosteroids. It is a hybrid category of products lying on the spectrum between drugs and cosmetics. The various terms by which cosmeceuticals are substituted are: (Kamal, 2007).

According to Jimtaisong (2009), the alternative terms for cosmeceuticals are:

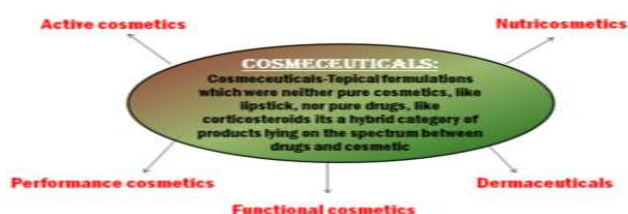


Figure: 3

The cosmetic industry registered impressive sales worth Rupees 422.3 billion (US \$ 9.3 billion) in 2010. The sector has mainly been driven by improving purchasing power and rising fashion consciousness of the Indian population. Moreover, the industry players are readily spending on the promotional activities to increase counter awareness. The growth of this cosmeceutical market is around 10 to 15 percent each year, reports Health World Online. The cosmeceuticals market, particularly skin care, continues to grow at about double the pace of the cosmetic and toiletries market. The cosmeceutical products are classified into three major categories.

According to Kamal (2007), Cosmeceuticals can be classified into the following categories:

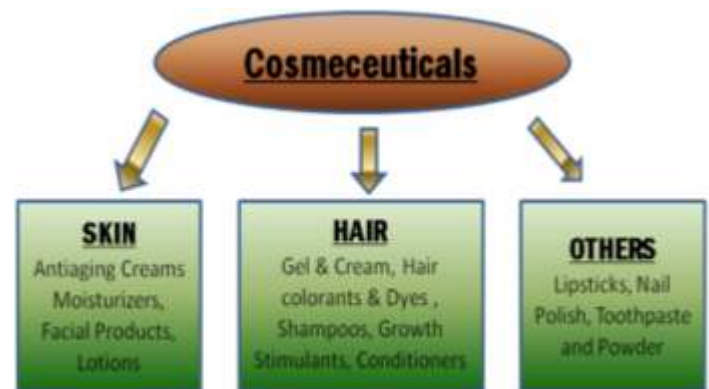


Figure: 4

The term cosmeceuticals is used by many skin care companies, especially those sold or endorsed by dermatologists to give the impression the products have more effective and more biologically active ingredients than just ordinary cosmetics. Cosmeceuticals are nothing more than a marketing term with illusion of grandeur. Even the FDA says cosmeceuticals do not exist and considered these products to be merely cosmetics with clever marketing language attached. Many skin care treatment contains ingredients that affect the biological function of the skin that is why cosmeceuticals differ from cosmetics. The concept of cosmeceuticals is spreading its wings rapidly all over the world and cosmetics are no longer only restricted to beauty and skin care products. Pharmaceuticals are making rooms into the cosmetic world at a great pace and resulting in the genesis of "cosmeceuticals" which are not only contains the cosmetic ingredients but also contains certain pharmaceutically active ingredients.

J. Ingredients used in Cosmeceuticals

The ingredients that are used in cosmeceutical products can be divided into five categories:

Ingredients play as one of the important role in safety using the cosmetic product. As mentioned by (EWG, 2007) through a new investigation of 833 name-brand sunscreens, they found widespread evidence that many products on the market are not safe and effective, including one of every eight high-SPF sunscreens that does not protect from UVA radiation. They have also identified 135 products that offer very good sun protection with ingredients that present minimal health risks to users.

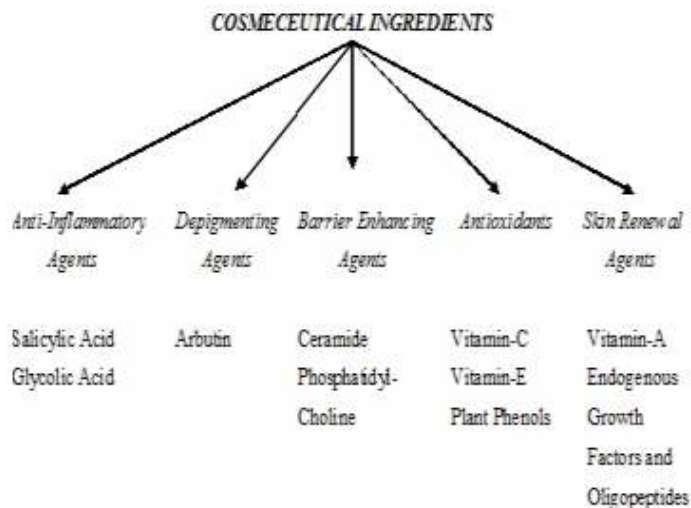


Figure: 5

Most of the ingredient in the cosmetic product involve of chemical rather than natural elements that will influence the skin of cosmetic users. According to Rodda (2004), the two common active ingredients in skin care and beauty products are AHA (alpha hydroxyl acid) and BHA (beta hydroxyl acid).

K. Consumption Pattern of Cosmeceutical Products

The whole process in cosmetic consumption always involved in knowing the degree or level of the consumer awareness towards the effects. Some consumers did not care whether the cosmetic will give the negative or positive effect. Another important consideration is the role of branding which is very much associated with the advertising, environment and beliefs. Branding can be in the form of a general name of a product. Through branding it reflect the user perception to the image of the product. Prescott (2006) suggests that brand managers need to keep a close eye on brand-related search terms and adjust paid search and affiliate marketing efforts to keep brand-related searches going to brand sites. Moreover brand also influences the decision to buying or not as the name brands play a major role in purchasing decisions. Advertising and packaging build awareness, which shoppers use them to guide through category clutter and says that past experience plays an important role in product selection and brand loyalty. Marketing mix play an important role in order to introduce the brand of the product and increase the loyalty brand. A good price on a name brand can tip the scales on initial use for consumers, who then stayed with the product based on its performance (Ball, 1989). Unlike the earliest use of scents as primary concerned, the need for better image creation through branding greatly mould the development of cosmetic industry (Hulme, 2001). A consumer's buying behaviour is also influenced by his unique personal characteristics. For instance, youngsters' consumption attitudes differ from those of elder people; re-tired people purchase differently from young married couples. These personal characteristics include a consumer's age and life-cycle stage, occupation, economic situation, lifestyle, personality and self-concept. (Kolter, et al., 2005) consumption patterns change over time. In marketers' views, consumers tend to formulate about particular products or services, and their consumption behaviours will be influenced by those product and brand images made up

by beliefs (Kolter, et al., 2005). To study the consumption pattern of cosmeceutical products we divided the study into two major segments so as to better understand the consumption pattern. These two segments are as follows:

L. Consumption Pattern in the Western World

1. Europe has a relatively under developed antiaging market, but as economic fortunes in the region rise, so does interest in age delaying beauty care, and sale of facial antiagers nearly tripled in 2002-2007 to \$ 3.9 billion, according to a new Euromonitor International figures. With so much innovation going on within the market, keeping the spot light on facial antiagers and maintaining consumer interest, it is little wonders that new Euromonitor International forecasts point t growth of almost 8 percent per year 2007 to 2012, more than twice the predicted gains in the cosmetic and toiletries market overall. The weak economic climate is also having an impact on the German consumers beyond the cosmetic purchase decision. Germany's birth rate, for example, is at an all-time low and is currently one of the lowest in Europe. While Germany's population is aging, young Germans are concerned about the uncertain political and economic situation. Consequently, the trend is to delay having a family or simply opt not to have a family at all. This, in turn, is affecting the demand for related products, with a strong decline in baby care products, for example, while the aging population is increasing the call for nourishing/ anti-agers and anti-cellulite body care. In Germany, the discounter channel is the most popular, for cosmetics and toiletries. The consumers in these markets have become experts at hunting out bargains, effectively shrinking cosmetics and toiletries sales (Emerging Markets: A New Spin, 2007).

Meanwhile from a European country like France the women there are active and dynamic too. They have more natural look than US women, but they can be very sophisticated too. The French women are playing a growing role in community life. 40 percent of them belong to a community association of some kind or other. Of these, 20 percent hold executive positions in their associations, for the first time exceeding the percentage of men doing so (18percent). More men (45percent) still belong to an association, but the difference is mainly explained by their greater involvement in sports associations. Moreover, this gap is likely to narrow in that a growing number of women regularly take part in sporting activities (48 percent in 2000 as against 9 percent in 1968 and 32.5 percent in 1997). As the role of the French women is also growing in community life, they consider the appearance is very important even though they have more natural look than US women. According to Anna Lempereur, director of marketing for Parfums Caron, the French woman loves her favorite fragrance although she enjoys experiencing new scents. Taking care of her skin is crucial for her and takes part of daily beauty ritual. She usually learned from her mother in her childhood and continues to use the same skin products. Day cream, night cream, eye cream, and cleansing milk, etc., cover the shelves of her bathroom (cited in Weber 2002). She uses make-up but has fewer products than the US woman. She washes her hair frequently, but less often than her US counterpart (Weber, 2002). Consumers aged 21 to 50 years are in their working period, earning their own income and therefore they have sufficient purchasing power to buy skin care products (Cosmetics Design, 2005). Men have become more comfortable

about buying products and services to improve or enhance their personal appearance and men move beyond the basics of washing and shaving to embrace more sophisticated products and grooming concepts (Imogen, 2005). Men's skin is oilier, tougher and bigger prone and older look than the real age, L'Oreal Paris Research Report (Imogen, 2005).

2. Consumption Pattern in the Eastern World.

In Japan and much of the Asia-Pacific market, cosmeceuticals are making inroads largely in the form of skin whitening and depigmentation products and powerful sunscreens. Japan's lead in innovation and product development may suggest the evolving future of cosmeceuticals. For example, Japanese consumers have already embraced the concept of the "skinceutical," where beauty-enhancing products are added to food, such as Shiseido's Pure White skin whitening drink. Also gaining ground, the Indian cosmeceuticals market is one of the fastest growing due to the increasing wealth among the middleclass. As a result, the Indian cosmetics and toiletries market has witnessed major changes both in terms of user perception and product availability during the past five years. According to figures provided by the Confederation of Indian Industries (CII), the total Indian beauty and cosmetic market was valued at \$950 million in 2008, exhibiting 15-20% growth per year. The overall beauty and wellness market, which includes beauty services, stands at about \$2.7 billion, according to CII estimates. In India the high growth of economy means that purchasing power and willingness to spend are on the rise. According to a recent Merrill Lynch and Capgemini's Asia-Pacific Wealth Report (cited in Bhattacharya, 2007), there are more millionaires coming from the emerging markets than from the developed nations. Talking about the market, Didier Villanueva, Managing Director of L'Oreal India, says, "The Indian middle class is growing rapidly and so is its demand for the best quality products. Today they want to use the international brands whether they are mass market or premium." As the economic and spending power of the Indian grows, both skin care and color cosmetics have seen the steady growth throughout the past five years. Color cosmetics have been growing at a steady rate of more than 30 percent annually during this time.

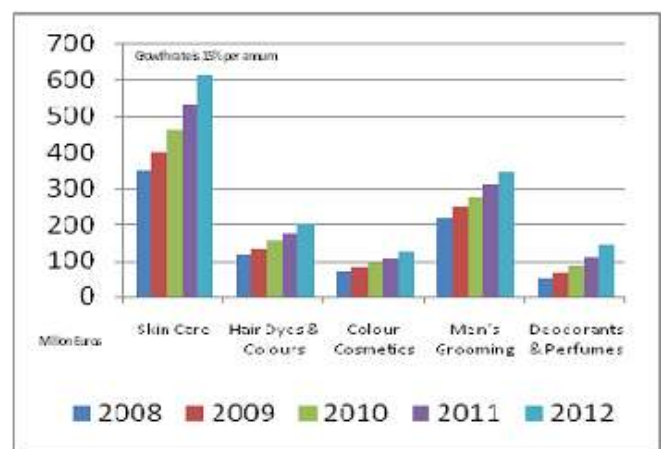
According to the latest Euromonitor report on the Indian cosmetics and toiletries market, the color cosmetics market stands at \$113.4 million and skin care at \$346.9 million (Emerging Markets: A New Spin, 2007). The Japanese cosmetics market is still the largest Asian buyer, but the growth rate is reaching a stable condition. China, the second largest in Asia Pacific, is witnessing increased demand due to improving lifestyles and rising disposable income of the population. The South Korean market is growing at a faster rate than developed regions. There is a clear trend of the market heading toward premium cosmetic products. The younger populace is looking for general skin care and hair care products while the older generation has more specific needs for their cosmetics products according to Lovejeet Alexander. Antoinette (2004) and L'Oreal report (2010) said that younger generation tend to open to skin care products more than older generation. The word brand is primarily considered as main element as competitive advantage to differentiate it from others if the company the reputed brand as a commercial application (Clifton, 2004). Amanda (2004) revealed that men who are in the 18 to 24 age group were driving

appeal spending and are increasingly spend more on appearance products as well. Briney (2004) describes an interesting trend among Indian cosmetic consumers, while other global countries are taking to the traditional Indian herbal and ayurvedic applications for beauty solutions. Indian consumers are increasingly looking to international personal care brands as lifestyle enhancement products, in the belief that the association with and use of an international brand confer one with a sophisticated and upper class image.

M. Indian Scenario of Cosmeceutical Market

The Indian cosmetics industry has witnessed rapid growth over the last couple of decades. With every passing year, the range of cosmetic and beauty products in India has widened tremendously. Beauty product manufacturers in India have mostly been catering to the great demand for cosmetics and toiletries that fall into the low- or medium-priced categories as the greatest demand in India always revolve around economically priced products. Recent cosmetics business market analysis reveals that many international companies are now outsourcing cosmetics to India and that the cosmetics market in India is growing at 15-20% annually, twice as fast as that of the U. S. and European markets. The growth rate in the cosmetics market reflects increasing demand for beauty care products in India (Alexander, 2010). Global cosmetic giants are attracted to India's favourable demographics. The modern, urban Indian women are becoming increasingly conscious about their style and looks, with great emphasis on lightening of skin tone. Skin care and color cosmetics have witnessed solid growth for the last few years, with more than half of the skin care market comprising skin lightening creams.

Projected market for cosmetics in India



Source: itaiindia.com

Cosmeceuticals
professional skincare science

Figure: 6

Lip products form a majority of the color cosmetics market. In India, small pack sizes are very popular as they offer a lower cost and the chance to try new products, according to Alexander. "The FMCG sector will witness more than fifty percent growth in rural and semi-urban India by 2010," according to a study titled "Prospects in the FMCG sector," recently made public by

ASSOCHAM. The Indian FMCG sector has grown to become the fourth largest sector in the economy with a market size in excess of \$14.7 billion. "Skin care and cosmetics account for more than Rs.18.5-billion market size while the hair care market is worth more than Rs.80 billion. Companies like Pond's and Fair & Lovely rule the roost in this segment" says Alexander. Half a decade ago, when celebrated Indian film actor Shah Rukh Khan took a dip in a bathtub to endorse Lux, he did much more than just promotes a soap brand. He set a precedent. Back then, the male grooming market was almost nonexistent and the Indian market had few dedicated products to offer men. Soon after Khan's commercial, Emami Group entered the men's fairness cream market. Market talk was that a noticeable proportion of sales of Fair & Lovely, a women's cream, were from men. Emami decided to push the opportunity. In 2005, Emami created history by launching Fair and Handsome, a fairness cream for men, which still dominates the space with close to 70% market share. The company calls this brand the world's No. 1 fairness cream. The company achieved sales of \$13 million in 2008-09. In 2007, Hindustan Unilever launched Fair & Lovely Menz Active but it could not gather much share. Over the past year, multinationals such as Beiersdorf (Nivea for Men) and L'Oréal (Garnier PowerLight) launched a series of products for men's skin care. The market was soon offering male fairness creams, hair care products beyond dyes, scrubs and face washes. Today, the male grooming segment in personal care is ready for its next round of product expansions and additions. Now, as the segment evolves, there is a queue of Bollywood actors including Shahid Kapoor and John Abraham who are endorsing male grooming products. The men's personal care segment is estimated at over \$200 million, with Gillette having the largest market share. In the personal care category, skin care products are the most popular, offering significant room for growth. In India, fairness creams dominate the space with more than a 45% share, followed by moisturizers at 22%. Now, the market seems to be looking beyond fairness creams. Emami is poised to expand its Fair and Handsome brand to include products such as shaving cream and foam. In five years, Fair and Handsome has become a Rs.100 crore brand, growing at 45% per annum and contributing 15% to Emami's revenues. "The trend is shifting toward the mainstream and there are other brands entering the segment with extensive product launches in the fairness category, along with a number of product extensions," says Harsh Vardhan Agarwal, director, Emami. Hindustan Unilever is currently advertising Fair & Lovely MAX Fairness for Men. It has also extended its Vaseline brand to the men's grooming segment with the introduction of the Vaseline for Men skin care range, including fairness creams, face wash, body lotions and body washes. The popularity of fairness products saw Garnier launch its men's grooming range, PowerLight, in May 2009. According to a recent study by Hindustan Unilever, men in India's southern states are most enthusiastic users of skin whitening creams and consume the most of the fairness products, although the love for fair skin is spread evenly all across the country. "Inspired by the changing grooming behavior of Indian men, in May 2009 we entered the men's grooming market with Garnier Men. Within three months, Garnier Men became the number two player in the men's skin care market, which is currently less than five percent of the total skin care market but growing fast. Within that, fairness

comprises 85 percent, cleansing 10 percent, and body, sun care and hydration 1 percent each. The potential lies in converting male users of women's skin care products to products developed specifically for them," says Dinesh Dayal, chief operating officer, L'Oréal India. The Indian cosmetics market, which was traditionally a stronghold of a few major players like Lakme and Pond's, has seen a lot of foreign entrants to the market within the last two decades.

N. Segmentation in Cosmeceutical Market

The market is broken down into segments for disease appearance and fitness. The disease treatment segment currently maintains the largest share of the market worth \$ 66 billion in 2008. This should increase at a CAGR of 12.5 percent to reach \$ 119 billion in 2013. It consist of preventive and relative health care for all diseases of aging such as joint and bone health, metabolic disorders, cardiovascular diseases etc (*BCC Research, 2009*). The appearance segment poses the second largest share of the market, worth more than \$ 64 billion in 2008; it is expected to generate more than \$ 105 billion by 2013, representing a CAGR of 10 percent. Facial rejuvenation, skin rejuvenation, hair care and body shaping products are the main component of this market (*Datamonitor, 2009*). The fitness segment has the third largest share and worth almost \$ 32 billion in 2008. The fitness market consists of bioregenerative, gym, spa and massage services and is expected to reach nearly \$ 50 billion in 2013, for a CAGR of almost 10 percent (*Datamonitor, 2009*). The service sector makes up a major proportion of the global antiaging market, accounting for more than 54 percent in 2008; its share will increase to 56 percent in 2013, for a CAGR of almost 12 percent. The products market will increase from \$ 73 billion in 2008 to almost \$ 200 billion in 2013, for a CAGR of more than 10 percent (*Datamonitor, 2009*). The service sector stands at about US \$ 2,680 million, according to CII. It is estimated that the European cosmeceutical market will be worth more than \$ 4 billion in 2009, up 5 percent from 2008. In Europe, France and Germany follow behind the US in their demand for drug based beauty products, with sales turnover of nourishes/antiaging product in 2007 at \$ 1.2 billion and \$ 1.1 billion respectively (*Kline Group, 2009*). Another major segment in the cosmeceutical market is the Anti-aging segment and wrinkle reducing segment (*Molander, 2010*). The cosmeceutical market is also segmented on the basis of demographic characteristics. Freedonia says that "due to America's obsession with a youthful appearance, the cosmeceutical market continues to expand beyond the traditional 45 years and older demographic to include much younger individuals". According to a CII report, US \$0.68 per capita is spent for cosmetics, which might be lower than some other countries, but this indicates a growing awareness among consumers. "There are two major factors that are swaying the buying decision among women. First obviously the television and media exposure they have today and the other is the corporate dressing culture, which slowly is evolving in the Indian market. Females working in MNC's today have money to spend on separate set of products specially cosmeceuticals" said Abdul Rahim, managing director GR fragrances Pvt Ltd. According to a source of L'Oréal India, women in the age group of 30 and above are getting very selective about the type of the products they choose. "Antiaging accounts for 23 percent of the total global skin care market in 2008 and drew faster than any other

product type with in skincare” says the consultancy. The skin care segment will account for 63 percent of all cosmeceutical product demand through 2012, *according to Freedonia*. In addition there is wider availability of antiagers for different skin types and area of the body such clean under eye, neck and chest, *according to Euromonitor*. Both male and female consumers form a major segment of buyers of beauty products in India (*Moniteiro, 2003*). *According to Malhotra (2003)*, there is a tremendous increase in the female cosmetic consumers. This is due to increasing number of women becoming the earning members of the family due to their increased level of literacy and growing influence of the media. Cosmetics have witnessed a growing demand for the low and lower – middle income households. The premium labels are being used in urban area, where as regional and national brands in the rural areas are, were close to 70 percent of the Indian population resides and price determine purchasing decisions. Both male and female consumers form a major segment of buyers of beauty products in India (*Menterio, 2003*). The 21st century witnessed the formation of large cosmetic companies and the value of the industry growing into the billions of dollars. Many cosmetics of today originated in Asian countries, especially the herbal kind, with India being a major source. “The beauty business has been overwhelmingly taken over by the herbal cosmetics industry here, as organic and ayurvedic cosmetics gain precedence over chemical concoctions,” said Shahnaz Husain, an Indian beauty expert (*Janakiraman, 2011*).

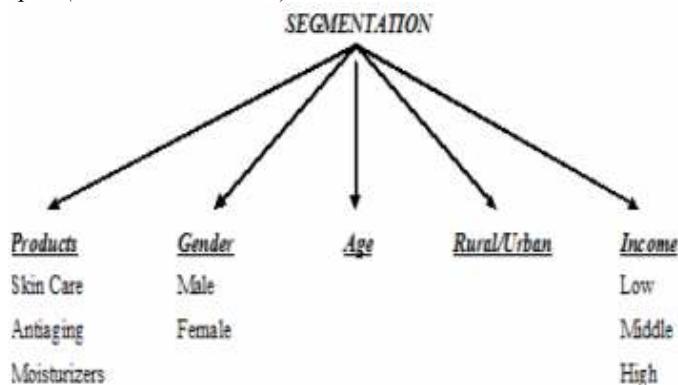


Figure: 7

O. Targeting in Cosmeceutical Market

In Hong Kong, people aged 30-39 are the main imported cosmetics consumers. This age group comprises 36% of the total population (of 2.5 million) and has the highest disposable income. Other significant consumers are those aged 15-19 (17.5% of total population) and 20-29 (37%). Men are also becoming an important target market. They are much focused on their appearance and frequently purchase cosmetics. Expatriates in Hong Kong are also a major consumer group. Hong Kong tourists continue to provide another major cosmetics market. Hong Kong receives an average 22 million visitors each year. In China, big city dwellers in Beijing, Shanghai, Shenzhen and Guangzhou are the main consumers of branded cosmetics. With growing disposable incomes, this demographic is predicted to remain a major market. China's rural population is also an emerging potential market as income levels grow and distribution channels become more efficient. The middle class, with annual

incomes between AUD\$9,900-\$82,800, has enormous growth potential. Only 5% of China's current population is middle class but this is predicted to grow to 45% by 2020. Once again, the major cities will experience the most growth. Women are still the main consumers of cosmetics in China. In Beijing, Shanghai and Guangzhou, 61-68% of women use skin care products. Most are aged 35-45, are well educated and hold white-collar jobs. Children and babies are an emerging market. With only one child to pamper, Chinese parents tend to buy quality baby and child care products. Men are also a smaller, emerging sector although, unlike Hong Kong, the focus is on the young, affluent, fashion-conscious city dwellers. Targeting the growing young consumer market, a number of second-line brands have made in-roads into the market in recent years, making the overall market more diversify and competitive. In particular, children's skin care products will become increasingly popular as developments in this area have been minimal and even joint venture enterprises, such as Johnson & Johnson and Zwitsal, cannot fully meet consumer needs. The age remains an important factor in the way of consumption, especially in the beauty market. The younger generation is more open to cosmetics than the former one. This target (18-35 years) constitutes an interesting market for the cosmetics companies, especially when you know that 42% of the 15-30 years want to be attractive. Seniors represent a market that needs to be sensitized, because they have an important purchasing power and for the majority they seek a better quality of physical and mental life. As can be seen on the following graph, the young generation is more sensitive and less ashamed than the seniors. Young adults like new experiences and are more open minded toward the cosmetic industry. The demographic trends have an impact on the consumer: the population tends to get older but she does not want to lose the illusion of her youth. People want to take care of their skin and to make it more attractive. After the women, the men become conscious of keeping fit their “health capital”. Besides the ageing of the population in developed countries, people work harder and longer and are more easily exposed to unemployment, situation changes, stress, vexations. Whether it is in private life or in professional life, people have to be ready to bounce back and to respond.

P. Positioning in Cosmeceutical Market

Pricing of the product and the nature of the product usage are the two criteria that define brand positioning. For instance products falling under the price range of Rs. 45 to Rs. 200 are in the mass market category. The middle market price can range from Rs. 200 up to Rs. 800. In the high end market, pricing can range from Rs. 800 to about Rs. 5000. Finally there is a premium range of products where the pricing can touch upto Rs. 35,000. Lakme and Color Bar are positioned as mass-market products and focus on the younger consumer and women with low purchase power. For the mid-tier price range, brands include Revlon, Chambor, Diana of London, Bourjois and Pupa. The high-end market features Clarins, Shiseido, MAC, Christian Dior, Nina Ricci, YSL, and Lancôme. La Prairie represents the premium niche. “Today it is important for big brands to define different brand positioning to retain the right market share. L’Oreal pushes Mabelline and synergic ranger to the younger generation and also in the lower income group mass market. While L’Oreal range of cosmetics and skin care products are for

the middle and higher middle class women and Vichy is for high end users”, explain the source at L’Oreal India. Brands such as Lakme and Color bar are being pushed as mass market products and focus on younger women and women with lower buying power. Then there is Revlon, Chambor, Diana of London that makes the middle range while Clarins, Shiseido, Lancome etc make the higher end. La Prairie touches the premium end of the market. *According to global cosmetic industry report, 2004*, the advance education provided by brands about the products ingredients and benefits have made today consumer more aware of what they are putting on their bodies and making them more willing to pay. Television and men’s magazine seems to be the most used communication media for skin care products to reach me customers (*Feng, 2008*). Female revive information from family and friends before they buy products more than men. Foreign players have focused more on product innovation, re-launches and brand extensions spread across multiple price points and streamlined their ad spent to effect savings that has allowed them revamp their pricing strategy as well as offer gifts to retain consumers. Men’s skin is oilier, tougher and bigger prone and older look than the real age, L’Oreal Paris research reported (*Imogen, 2005*). *According to Datamonitor*, “male grooming trends profiting in 2009 and beyond” report released in March, price was considered as primary factor on men in order to their personal care product.

The increasing competition within men’s grooming market generate more alternative outlets and retail to combine the skin care with other services as gym, salons and direct marketing in order to promote it to be new chance assessing to men market (*Meunier, 2004*). It is stated that men with healthy and young looking skin have better opportunities in occupational achievements in their competitive era (*Manager, 2004*). Many leading skin care providers have paid more attention on giving the comfortable in shop environments allowing male customers to feel more content to felicitate their purchase (*Meunier, 2004*). The selling price-fixing is defined after the study of various data about the market, the demand and the offer. More precisely, the price which the firm chooses to impose depends on the cost of the product, on the positioning choice, on the evaluation of the competition or of the vision of quality and the value perceived by the price. The price gives an element of differentiation to the customer; moreover it influences its choice and the image which he guesses of the product. Indeed “the price-setting must be set in relation with the value offered to the customer and perceived by him”. Besides the relationship existing between the price and the customer, the price takes part in the decision of the volume of the sales, of the rate of the profit and its global volume. Unilever and Gillette ad campaigns are noticeable alike are straight forward motive man to use the products in order to be irresistible in women aspect (*Antoinette, 2005*). A key difference when it comes to male product and packaging is that men are more interested in what the product for them says space NK funder Nicky Kinnaird (*Woods, 2005*). With women, you can still touch upon beauty and appealing to the opposite sex. That won’t work for men, Zunkertnan said, president of G-abriella Z ltd. Male customers pay attention on ingredients whether it will suit their skin or not (*Imogen, 2005*). Herbal cosmetics are the current rage not only in Asian countries like India, but also countries like US, UK and Australia (*Neem.com*). The herbal premium cosmetic

sector is growing at 15% P.A. Neem will be in huge demand for manufacturing a range of cosmetics in the coming time. “The beauty business has been overwhelmingly taken over by the herbal cosmetics industry here, as organic and ayurvedic cosmetics gain precedence over chemical concoctions,” said Shahnaz Husain, an Indian beauty expert.

III. REGULATIONS IN COSMECEUTICALS

There is no regulatory category for cosmeceuticals. In fact, FDA does not even recognize the word as an official product type (*Steve, 2009*). However, it regulates cosmetics under the Federal Food, Drug and Cosmetics Act (FDCA), which define cosmetics as “intended to be rubbed, poured, sprinkled, or spray on, introduced into, or otherwise applied to the human body...for cleansing, beautifying, promoting attractiveness or altering the appearance”. To avoid drug regulation, cosmeceuticals must not be intended to diagnose, cure, mitigate, treat or prevent disease. FDA has stated marketing claims, consumer’s perception of a products intentions and incorporation of certain ingredients well know to the public as therapeutic can all trigger drug regulations. This leaves cosmeceuticals in a similar situation to that of functional foods and dietary supplements, so the same amount of marketing and formulation care will be required.

IV. CONCLUSION

Cosmeceuticals are the products that forms an interlink between the drug and cosmetics. Cosmeceuticals are found to be a new emerging market not only for men but also for women. Now a day’s male are also becoming conscious about their looks and hence cosmeceutical companies specifically making products for them. Even in Indian market cosmeceuticals are emerging and among these cosmeceuticals the skin care products are more popular. Most of the developed countries are now entering into the Indian market focusing on this particular segment. Earlier it was found that cosmetics are only meant for ladies but the scenario is changing and due to intensed competitive environment men also want to look good. Among the skin care products most popular are the anti aging and anti wrinkle products. The consumption pattern of these cosmeceuticals is different among different aged people. Mostly the target audience of cosmeceutical companies is the younger generation or millennials that falls under the age group from 20 to 35 years. In this market companies poisoned themselves on different parameters. Some companies positioned their product on the basis of price while some on the social class of person. There are no strict regulations for these cosmeceutical products and the regulations are different in different countries. There are very few market research studies that are conducted on cosmeceutical products and there is a vast scope of this market in India. There are a number of gaps that are to be fulfilled in this new emerging market.

REFERENCES

- [1] Naqvi, M 2009, Skin care Industry in India, viewed 08 2011, <<http://www.slideshare.net/shekharpiscasian/skincare-industry-in-india>>
- [2] RNCOS Industry Research Solutions, 2011, Indian Cosmetic Sector Analysis 2009-2011, viewed 03 October 2011, <<http://rncos.com/Report/IM192.htm>>

- [3] Maheshwari, S 2011, Skin Care Market Set To Shine In India, viewed 16 October 2011, <<http://www.prlog.org/11298337-skin-care-market-set-to-shine-in-india.html>>
- [4] RNCOS Industry Research Solutions, 2011, Indian Skin Care Market Set For Rapid Expansion, viewed 03 October 2011, <http://www.rncos.com/Press_Releases/Indian-Skin-Care-Market-Set-for-Rapid-Expansion.htm>
- [5] RNCOS Industry Research Solutions, 2011, Indian Cosmetic Industry Set For Tremendous Growth, viewed 03 October 2011, <http://www.rncos.com/Press_Releases/Indian-Cosmetic-Industry-Set-for-Tremendous-Growth.htm>
- [6] Kirillov, A 2008, Annual State of Cosmetic and Toiletry Industry , viewed 15 September 2011, <<http://www.skininc.com/spabusiness/trends/20387014.html>>
- [7] Ankutse, E 2011, 2011 The Year of Male's Grooming, viewed 26 August 2011, <<http://www.apetogentleman.com/brands/industry-report-male-grooming-2011/>>
- [8] Chaudhari P.M, Kawade P.V, Funne S.M 2011, Cosmeceuticals – A Review, viewed 18 October 2011, <<http://www.ijptonline.com/wp-content/uploads/2009/10/774-798.pdf>>
- [9] Beauty Report 2006, Cosmeceuticals, viewed 13 August 2011, <<http://www.beauty2market.com/press/DFNI-Jun-1-39.pdf>>
- [10] Babari, M, Dharod, M 2009, FMCG Sector, viewed 03 November 2011, <<http://www.ghallabhansali.com/admin/file/FMCG.pdf>>
- [11] Chen, C 2011, Sales Promotional Plan for Lumene OY on Chinese Market, viewed 06 August 2011, <http://publications.theseus.fi/bitstream/handle/10024/29978/Chen_Cheng.pdf?sequence=1>
- [12] CPD Zone 2011, Skin Care, viewed 19 September 2011, <<http://www.tabpi.org/2011/dg.pdf>>
- [13] TNS Research International China, 2010, Leveraging the Trends of the Chinese Skin Care Product Market, viewed 12 October 2011, <<http://www.tns-global.com.hk/images/published/China%20Skin%20Care%20Market.pdf>>
- [14] The Gallup Organization, 2005, Men's Facial Skincare, viewed 23 July 2011, <<http://www.multisponsor.com/cat/Beauty%20and%20Personal%20Care/Personal%20Care/Mens%20Facial%20Care%2025003.PDF>>
- [15] Bailli, D 2007, Unilever in India, 27 September 2011, <http://www.unilever.com/images/ir_Unilever-in-India_tcm13-113961.pdf>
- [16] Health Product Association, 2011, China Updates, viewed 28 August 2011, <<http://uschinahpa.org/wp-content/uploads/2011/08/HPA-China-Updates-Cosmetic-Issue-4-2011-10-25.pdf>>
- [17] CIFA, 2007, Cosmetic, Toiletry, and Fragrances Association of South Africa Annual Report 2007, viewed 30 July 2011, <<http://www.ctfa.co.za/medialib/Downloads/Downloads/CTFA%202007%20Annual%20Report%20A4.pdf>>
- [18] Teikoku Databank America, Inc., 2007, Cosmetics and Toiletries Industry, viewed 25 July 2011, <<http://www.teikoku.com/ProdSample/industry.pack.pdf>>
- [19] Millik, L E 2001, Cosmetology, Cosmetics, Cosmeceuticals: Definitions and Regulations, viewed 22 September 2011, <<http://www.unifra.br/professores/martafarm/cosmetology,%20cosmetics,%20comeceutical.pdf>>
- [20] L'Oreal, 2010, The UK Beauty Industry 2010 Trends, viewed 12 August 2011, <http://www.loreal.co.uk/_en/_gb/pdf/Beauty_Trends.pdf>
- [21] Wilde, P S 1982, Cosmetics industry achieves long-term productivity gains, viewed 28 July 2011, <<http://www.bls.gov/opub/mlr/1982/12/art4full.pdf>>
- [22] Moumna, Mauritani, 2007, L'Oreal 2007 sustainable report, viewed 05 September 2011, <<http://www.sustainabledevelopment.loreal.com/pdf/downloads/2007-sd-report.pdf>>
- [23] Labord, C 2011, L'Oreal Plus, viewed 30 October 2011, <<http://www.bordier.com/files/r/L-OREAL-Fiche-110907-Investment-case-PLUS-A.pdf>>
- [24] Jetro, 2011, Cosmetics, viewed 28 October 2011, <<http://www.jetro.go.jp/mexico/mercadeo/1Ecosme.pdf>>
- [25] Beauty world, 2011, The Largest International Trade Fair for Beauty Products, Hair, Fragrances and Wellbeing in the Middle East, viewed 06 November 2011, <http://www.beautyworldme.com/downloads/Beautyworld_Brochure_2011.pdf>
- [26] Alexeyev, y 2007, Russian cosmetic and perfumery industry's analysis and strategy paradoxes of 'Kalina' OJSC, viewed 25 July 2011, <http://www.gurkov.ru/ten_theor/2007/cosmetics.pdf>
- [27] Gediya, S K, Mistry, R B, Patel, U K, Blessy, M and Jain, H N 2011, Herbal Plants: Used as a cosmetics, viewed 18 October 2011, <<http://scholarsresearchlibrary.com/JNPPR-vol1-iss1/JNPPR-2011-1-1-24-32.pdf>>
- [28] Baye, K 2004, The Anti Aging Trend: Capitalism, Cosmetics and Mirroring the Spectacle, viewed 28 July 2011, <<http://gnovisjournal.org/files/Kathy-Bayer-Anti-Aging-Trend.pdf>>
- [29] Cheng, F S, Ooi, C S, and Ting, D H 2010, Factors Affecting Consumption Behavior Of Metrosexual Toward Male Grooming Products , viewed 06 September 2011, <<http://www.bizresearchpapers.com/40.Hooi-One.pdf>>
- [30] Mansor, N Ali, DEBM, and Yaacob, M R 2010 , Cosmetic Usage in Malaysia: Understanding of the Major Determinants Affecting the Users, viewed 08 October 2011, <http://www.ijbssnet.com/journals/Vol._1_No._3_December_2010/27.pdf>
- [31] ADA Cosmetics, 2009, ADA Cosmetics International Continues to Strengthen its Position in Asia, viewed 17 October 2011, <http://www.ada-cosmetics.com/ada-media/presse/pl/Press-info_ADA-Formia-en.pdf>
- [32] Barry, D 2002, How to Win Face in the Korean Cosmetics Market, viewed 22 October 2011, <http://www.trade.gov/exportamerica/SuccessStories/ss_SKorea.pdf>
- [33] Kaist, 2006, MISSHA: The Cosmetic Revolution - How to Penetrate the Cosmetic Market and Survive, viewed 25 July 2011, <<http://www.business.kaist.ac.kr/upload/paper/2005-001.pdf>>
- [34] Lieblei, C 2008, Cosmetics Industry Avon, viewed 08 October 2011, <http://www.centaurmaintenancesupplies.com/carla_personal/Carla/mba/Lieblein_SWOT_MMBA6390_001.pdf>
- [35] Cosmetics in Russia, 2010, Russian perfumery and cosmetics market: analytics and information, viewed 13 July 2011, <<http://www.cosmeticsinrussia.com/includes/media-kit/media-kit.pdf>>
- [36] Pinnoc, S 2011, Toiletry and Cosmetic Industry Guide, viewed 27 September 2011, <http://www.bl.uk/bipc/pdfs/toiletries%20cosmetics_industry_guide.pdf>
- [37] Business insights, 2004, Youth Marketing in Cosmetics and Toiletries, viewed 23 September 2011, <<http://www.globalbusinessinsights.com/content/rbcg0027m.pdf>>
- [38] Itlia, 2009, The cosmetic sector of India – Profile 2009, viewed 30 August 2011, <<http://italiaindia.com/images/uploads/pdf/cosmetics-sector-2009.pdf>>
- [39] Xerfi, 2011, Perfume and Cosmetics Groups in the World - Market Analysis – 2011-2016 trends – Corporate Strategies, viewed 16 September 2011, <<http://www.xerfi.fr/etudes/0XCHE08.PDF>>
- [40] Rose, J Ruegeme, L 2010, Lancôm, viewed 09 August 2011, <http://www.theproduct.com/marketing/lancome_notes.pdf>

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Probabilistic inventory model for deteriorating items in presence of trade credit period using discounted cash flow approach

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Abstract- In this paper, we are using discounted cash flow approach for deteriorating items in the presence of trade credit period. Here it is assumed that the demand during the period $(0, T)$ is a random variable x with continuous probability density function $f(x)$ and the demand rate is a power demand pattern. Shortages are not allowed and deterioration follows the Weibull distribution rate. Mathematical models are derived for three different cases: Instantaneous cash flows, credit only on units in stock, fixed credit period. Inflation and time value of money is also considered.

Index Terms- credit-period, deterioration, inventory, probabilistic

I. INTRODUCTION

Many authors have considered economic order quantity models for deteriorating items. Ghare & Schrader (1963) were the first who studied inventory models of deteriorating items. They assumed the constant market demand. With the passage of time several other researchers developed the inventory model for deteriorating items with time dependent demand rate. Donaldson (1997) derived an optimal algorithm for solving classical inventory model with no shortage analytically with linear trend in demand over fixed time horizon. Dutta and Paul (1997) considered the both deterministic and probabilistic version of power demand pattern with variable rate of deterioration. Hariga (1995) studied the effects of inflation and time value of money on an inventory model with time dependent demand and shortages. Bhunia et al (1998) developed an inventory model of deteriorating items with lot size dependent replenishment cost and linear trend in demand.

Generally it is assumed that the buyer must pay for the items as soon as he receives them from the supplier, but in reality supplier will allow a certain fixed period called credit period, for settling the amount the retailer owes to him for the items supplied. The credit period reduces the buyer's cost of holding stock because it reduce the amount of capital invested in stock for the duration of the permissible period. Chung (1989) used the discounted cash flows (DCF) approach for studying the optimal inventory policy in the presence of the trade credit, which permits an explicit recognition of the exact timing of cash flows associated with the inventory system.

A DCF approach permits a proper recognition of the financial implication of the opportunity cost and out of pocket costs in inventory system. Aggarwal and Jaggi (1994) analyzed the credit financing in economic ordering policies of deteriorating items in the presence of trade credit using a DCF approach. Liao et al. (2000) presented a model with deteriorating items under inflation, when delay in payments is permissible. Chang (2004) presented an EOQ model with deteriorating items under inflation when the supplier provides a permissible delay of payments for a large order that is greater than or equal to the pre-determined quantity. Shah and Shah (1998) presented a probabilistic inventory model with cost in case delay in payments is permissible. Chang et al. (2001) developed a finite time horizon inventory model with both deterioration and monetary time value when payment periods are offered. Huang and Chung (2003) discussed replenishment and payment policies to minimize the total cost of cash discount and payment delays. Huang (2003) considered an EOQ model in which supplier offers a credit period to retailer and retailer offers a credit period to the customers.

Demand also depends on the retailers sales efforts. This situation was discussed by Taylor (2002). He proved that coordination cannot be achieved with linear rebates and returns or target rebates alone. He provided a properly designed target rebate and returns contracts to get coordination. Krishanan et al. (2004) analysed the coordination of contracts for decentralized supply chains with the retailer promotional efforts. They found that a buy back policy cannot be utilized to coordinate the channels and they provided three contracts to achieve channel coordination. Liang et al. (2005) discussed an inventory model with non-instantaneous receipt under trade credit in which the supplier provides not only a permissible delay but also a cash discount to the retailer and obtained the optimal order cycle and orders receipt period so that the total relevant cost per unit time is minimized. Tripathi (2011) presented the economic ordering policies of time dependent deteriorating items in presence of trade credit using discounted cash flow approach. In the last model we have taken deterministic power demand. But, since in most of the practical situations, demand is not deterministic, rather it varies from cycle to cycle. Hence, we are considering the probabilistic version of demand. Effects of inflation and time value of money is also considered.

II. ASSUMPTIONS

1. Deterioration of items starts after a definite time.
2. Deterioration rate varies with time and follows a two parameter Weibull distribution.
3. Replenishment is instantaneous.
4. Lead time is zero.
5. Shortages are not allowed.
6. There is no repair or replacement of deteriorating items during the period under consideration.
7. Inflation and time value of money is considered.
8. The demand during the period (0, T) is a random variable x with continuous probability density function

$f(x)$, $x \in (0, \infty)$ and demand rate is power demand pattern,

$$D(t) = \frac{mx}{T^m} t^{m-1}, \text{ where } m \in (0, \infty) \text{ is the pattern index.}$$

III. NOTATIONS

1. 'C' is unit cost of the item.
2. 'Q' is the order quantity.
3. 'D(t)' is the demand rate at time 't'.
4. 'i' is Inventory holding cost fraction.
5. 'iC' is the out-of-pocket inventory carrying cost per unit time.
6. 'R' is constant representing the difference between the discount rate and inflation rate.
7. 'H' is the ordering cost per unit.
8. I(t) is the inventory level at time t.
9. T_1 is the optimal cycle time for case I.
10. T_2 is the optimal cycle time for case II.
11. T_3 is the optimal cycle time for case III.
12. $Z_1(T)$ is the present value of all future cash-flows for case I.
13. $Z_2(T)$ is the present value of all future cash-flows for case II.
14. $Z_3(T)$ is the present value of all future cash-flows for case III.
15. $Z_1(T_1)$ is the optimal value of all future cash-flows for case I.
16. $Z_2(T_2)$ is the optimal value of all future cash-flows for case II.
17. $Z_3(T_3)$ is the optimal value of all future cash-flows for case III.
18. T is the inventory cycle time.

IV. MATHEMATICAL FORMULATION

The level of inventory I(t) at time 't' is depleted due to both market demand and deterioration. The differential equation describing the inventory system over (0, T) is given by

$$\frac{dI(t)}{dt} + \alpha \beta t^{\beta-1} I(t) = -\frac{mx}{T^m} t^{m-1}, \quad 0 \leq t < T \quad (1)$$

with the boundary condition, $I(T) = 0$

The solution of equation (1) is given by

$$I(t) e^{\alpha t^\beta} = -\int \frac{mx}{T^m} t^{m-1} e^{\alpha t^\beta} dt + C_1$$

$$= -\frac{mx}{T^m} \int t^{m-1} (1 + \alpha t^\beta) dt + C_1$$

$$mx \left[\frac{t^m}{m} + \frac{\alpha t^{m+\beta}}{m+\beta} \right]$$

[Assuming a very small value of α

$(0 \leq \alpha < 1)$, the approximate solution is obtained by neglecting the second and higher order terms of α]

Now $I(T) = 0$

$$\Rightarrow C_1 = \frac{mx}{T^m} \left[\frac{T^m}{m} + \frac{\alpha T^{m+\beta}}{m+\beta} \right]$$

$$I(t) = \frac{mx}{T^m} \left[\frac{T^m}{m} + \frac{\alpha T^{m+\beta}}{m+\beta} - \left(\frac{t^m}{m} + \frac{\alpha t^{m+\beta}}{m+\beta} \right) \right] e^{-\alpha t^\beta} \quad (2)$$

$$\text{Order quantity, } Q = I(0) = x \left(1 + \frac{\alpha T^\beta m}{m+\beta} \right) \quad (3)$$

The number of deteriorating units during one cycle,

$$D(T) = Q - \int_0^T D(t) dt$$

$$= Q - \int_0^T \frac{mx}{T^m} t^{m-1} dt$$

$$x \left(1 + \frac{\alpha T^\beta m}{m+\beta} \right) - x = \frac{m \alpha x T^\beta}{m+\beta} \quad (4)$$

Using DCF approach, we have three cases on the trade credit terms.

Case I: Instantaneous cash-flows

In this case, we present the DCF approach to the inventory model of time-dependent deteriorating items under instantaneous inventory holding cost.

Hence at the beginning of each cycle, there will be cash out flows of ordering cost and purchasing cost. Since, the inventory carrying cost is proportional to the value of the inventory, the out-of-pocket inventory carrying cost per unit time at 't' is $iCI(t)$. Hence, the present value of cash flow for the first order cycle $z_1(T)$ is

$$\begin{aligned} z_1(T) &= H + CQ + iC \int_0^T I(t) e^{-Rt} dt \\ &= H + Cx \left[1 + \frac{m\alpha T^\beta}{m+\beta} \right] + iC \int_0^T \frac{mx}{T^m} \left[\frac{T^m}{m} + \frac{\alpha T^{m+\beta}}{m+\beta} - \frac{t^m}{m} - \frac{\alpha t^{m+\beta}}{m+\beta} \right] [1 - \alpha t^\beta - Rt] dt \\ &= H + Cx \left[1 + \frac{m\alpha T^\beta}{m+\beta} \right] + \frac{iCmx}{T^m} \int_0^T \left[\frac{T^m}{m} + \frac{\alpha T^{m+\beta}}{m+\beta} - \frac{t^m}{m} - \frac{\alpha t^{m+\beta}}{m+\beta} - \frac{\alpha t^\beta T^m}{m} + \frac{\alpha t^{m+\beta}}{m} - \frac{RT^m t}{m} \right. \\ &\quad \left. - \frac{\alpha Rt T^{m+\beta}}{m+\beta} + \frac{Rt^{m+1}}{m} + \frac{\alpha Rt^{m+\beta+1}}{m+\beta} \right] dt \\ &= H + Cx \left[1 + \frac{m\alpha T^\beta}{m+\beta} \right] + iCmx \left[\frac{T}{m+1} + \frac{\alpha \beta T^{\beta+1}}{(\beta+1)(m+\beta+1)} - \frac{RT^2}{2(m+2)} - \frac{\alpha RT^{\beta+2}}{2(m+\beta+2)} \right] \end{aligned} \quad (5)$$

Hence the present value of all future cash flows is

$$Z_1(T) = \sum_{n=0}^{\infty} z_1(T) e^{-nRT} = \frac{z_1(T)}{1 - e^{-RT}}$$

Since $e^{-RT} \approx 1 - RT$ (approx.)

$$\therefore 1 - e^{-RT} \approx 1 - (1 - RT) = RT$$

\therefore Equation (5) becomes

i.e.

$$\begin{aligned} Z_1(T) &= \frac{1}{RT} \left[H + Cx \left(1 + \frac{m\alpha T^\beta}{m+\beta} \right) + iCmx \left\{ \frac{T}{m+1} + \frac{\alpha \beta T^{\beta+1}}{(\beta+1)(m+\beta+1)} - \frac{RT^2}{2(m+2)} - \frac{\alpha RT^{\beta+2}}{2(m+\beta+2)} \right\} \right] \\ &= \frac{1}{R} \left[\frac{H}{T} + Cx \left(\frac{1}{T} + \frac{m\alpha T^{\beta-1}}{m+\beta} \right) + iCmx \left\{ \frac{1}{m+1} + \frac{\alpha \beta T^\beta}{(\beta+1)(m+\beta+1)} - \frac{RT}{2(m+2)} - \frac{\alpha RT^{\beta+1}}{2(m+\beta+2)} \right\} \right] \end{aligned} \quad (6)$$

The optimal value of T can be found by solving $\frac{\partial Z_1(T)}{\partial T} = 0$

Diff. equation (6) partially w.r.t. 'T', and equating to zero, we get

$$\frac{\partial Z_1(T)}{\partial T} = \frac{1}{R} \left[\frac{-H}{T^2} + Cx \left(\frac{-1}{T^2} + \frac{m\alpha(\beta-1)T^{\beta-2}}{m+\beta} \right) + iCmx \left\{ \frac{\alpha \beta^2 T^{\beta-1}}{(\beta+1)(m+\beta+1)} - \frac{R}{2(m+2)} - \frac{\alpha R T^\beta (\beta+1)}{2(m+\beta+2)} \right\} \right] = 0 \quad (7)$$

and

$$\frac{\partial^2 Z_1(T)}{\partial T^2} = \frac{1}{R} \left[\frac{2H}{T^3} + Cx \left(\frac{2}{T^3} + \frac{m\alpha(\beta-1)(\beta-2)T^{\beta-3}}{m+\beta} \right) + iCmx \left\{ \frac{\alpha \beta^2 (\beta-1)T^{\beta-2}}{(\beta+1)(m+\beta+1)} - \frac{\alpha R \beta (\beta+1)T^{\beta-1}}{2(m+\beta+2)} \right\} \right] > 0$$

Thus optimum value of T can be found from equation (7). Let it be ' T_1 '. Then, the optimum value of order quantity

$Q_1 = x \left(1 + \frac{\alpha T_1^\beta m}{m+\beta} \right)$ and minimum cost $Z_1(T_1)$ can be found from equation (6).

Case II: Credit only on the items in stock

In this case, payment is connected to the subsequent use of items. Here, there exist a credit period M. During this period, the customers make payment to the supplier immediately after the use of the items and the remaining balance is paid by the customer on the last day of the credit period. Here we have two cases depending on the value of 'T' and credit period 'M'.

Sub case I: If $T \leq M$, then the present value of cash flows for the first cycle is

$$\begin{aligned} z_2(T) &= H + C \int_0^T \frac{mx}{T^m} t^{m-1} e^{-Rt} dt + CD(T) e^{-RM} + iC \int_0^T I(t) e^{-Rt} dt \\ &= H + C \frac{mx}{T^m} \int_0^T \{ t^{m-1} (1 - Rt) \} dt + C \frac{m\alpha x T^\beta}{m+\beta} e^{-RM} + iC \frac{mx}{T^m} \left[\frac{T^m}{m} + \frac{\alpha T^{m+\beta}}{m+\beta} - \frac{t^m}{m} - \frac{\alpha t^{m+\beta}}{m+\beta} \right] [1 - \alpha t^\beta - Rt] dt \\ &= H + Cx \left[1 - \frac{RmT}{m+1} \right] + \frac{Cm\alpha x T^\beta}{m+\beta} e^{-RM} + iCmx \left\{ \frac{T}{m+1} + \frac{\alpha \beta T^{\beta+1}}{(\beta+1)(m+\beta+1)} - \frac{RT^2}{2(m+2)} - \frac{\alpha RT^{\beta+2}}{2(m+\beta+2)} \right\} \end{aligned}$$

The present value of all future cash flows is

$$Z_2(T) = \frac{z_2(T)}{1 - e^{-RT}} = \frac{z_2(T)}{RT}$$

$$\begin{aligned} \therefore Z_2(T) &= \frac{1}{R} \left[\frac{H}{T} + Cx \left(\frac{1}{T} - \frac{Rm}{m+1} \right) + \frac{Cm\alpha x T^{\beta-1}}{m+\beta} e^{-RM} \right. \\ &\quad \left. + iCmx \left\{ \frac{1}{m+1} + \frac{\alpha \beta T^\beta}{(\beta+1)(m+\beta+1)} - \frac{RT}{2(m+2)} - \frac{\alpha RT^{\beta+1}}{2(m+\beta+2)} \right\} \right] \end{aligned} \quad (8)$$

The necessary condition for $Z_2(T)$ to be minimum is $\frac{\partial Z_2(T)}{\partial T} = 0$

$$\begin{aligned} \frac{\partial Z_2(T)}{\partial T} &= \frac{1}{R} \left[\frac{-H}{T^2} + Cx \left(\frac{-1}{T^2} \right) + \frac{Cm\alpha x (\beta-1)T^{\beta-2}}{m+\beta} e^{-RM} \right. \\ &\quad \left. + iCmx \left\{ \frac{\alpha \beta^2 T^{\beta-1}}{(\beta+1)(m+\beta+1)} - \frac{R}{2(m+2)} - \frac{\alpha R (\beta+1)T^\beta}{2(m+\beta+1)} \right\} \right] = 0 \end{aligned}$$

$$\frac{\partial^2 Z_2(T)}{\partial T^2} = \frac{1}{R} \left[\frac{2H}{T^3} + \frac{2Cx}{T^3} + \frac{Cm\alpha x(\beta-1)(\beta-2)T^{\beta-3}}{(m+\beta)e^{RM}} \right. \\ \left. + iCmx \left\{ \frac{\alpha\beta^2(\beta-1)T^{\beta-2}}{(\beta+1)(m+\beta+1)} - \frac{\alpha R\beta(\beta+1)T^{\beta-1}}{2(m+\beta+1)} \right\} \right] > 0$$

Sub Case II: If $T > M$, then the present value of cash flows for the first cycle is

$$z_2(T) = H + C \int_0^M \frac{mx}{T^m} t^{m-1} e^{-Rt} dt + C \left(Q - \int_0^M \frac{mx}{T^m} t^{m-1} dt \right) e^{-RM} + iC \int_0^T I(t) e^{-Rt} dt \\ = H + C \frac{mx}{T^m} \left(\frac{M^m}{m} - \frac{RM^{m+1}}{m+1} \right) + C \left(x + \frac{m\alpha x T^{\beta-1}}{m+\beta} - \frac{xM^m}{T^m} \right) e^{-RM} \\ + iCmx \left\{ \frac{T}{m+1} + \frac{\alpha\beta T^{\beta+1}}{(\beta+1)(m+\beta+1)} - \frac{RT^2}{2(m+2)} - \frac{\alpha RT^{\beta+2}}{2(m+\beta+2)} \right\}$$

The present value of all future cash flows is

$$Z_2(T) = \frac{z_2(T)}{1 - e^{-RT}} = \frac{z_2(T)}{RT} \\ \therefore Z_2(T) = \frac{1}{R} \left[\frac{H}{T} + \frac{Cmx}{T^{m+1}} \left(\frac{M^m}{m} - \frac{RM^{m+1}}{m+1} \right) + C \left(\frac{x}{T} + \frac{m\alpha x T^{\beta-1}}{(m+\beta)} - \frac{xM^m}{T^{m+1}} \right) e^{-RM} \right. \\ \left. + iCmx \left\{ \frac{1}{m+1} + \frac{\alpha\beta T^{\beta}}{(\beta+1)(m+\beta+1)} - \frac{RT}{2(m+2)} - \frac{\alpha RT^{\beta+1}}{2(m+\beta+2)} \right\} \right], T > M \quad (10)$$

The necessary condition for $Z_2(T)$ to be minimum is $\frac{\partial Z_2(T)}{\partial T} = 0$

$$\Rightarrow \frac{1}{R} \left[\frac{-H}{T^2} - \frac{Cmx(m+1)}{T^{m+2}} \left(\frac{M^m}{m} - \frac{RM^{m+1}}{m+1} \right) + C \left(-\frac{x}{T^2} + \frac{m\alpha x(\beta-1)T^{\beta-2}}{(m+\beta)} + \frac{(m+1)xM^m}{T^{m+2}} \right) e^{-RM} \right. \\ \left. + iCmx \left\{ \frac{\alpha\beta^2 T^{\beta-1}}{(\beta+1)(m+\beta+1)} - \frac{R}{2(m+2)} - \frac{\alpha R(\beta+1)T^{\beta}}{2(m+\beta+2)} \right\} \right] = 0 \quad (11)$$

$$\frac{\partial^2 Z_2(T)}{\partial T^2} = \frac{1}{R} \left[\frac{2H}{T^3} + \frac{Cm(m+1)(m+2)x}{T^{m+3}} \left(\frac{M^m}{m} - \frac{RM^{m+1}}{m+1} \right) + C \left(\frac{2x}{T^3} + \frac{m\alpha x(\beta-1)(\beta-2)T^{\beta-3}}{(m+\beta)} \right. \right. \\ \left. \left. - \frac{(m+1)xM^m(m+2)}{T^{m+3}} \right) + iCmx \left\{ \frac{\alpha\beta^2(\beta-1)T^{\beta-2}}{(\beta+1)(m+\beta+1)} - \frac{\alpha R\beta(\beta+1)T^{\beta-1}}{2(m+\beta+1)} \right\} \right] > 0$$

and the optimum value of $T = T_2$ can be found from equation (9) and (11).

Hence if the payments to the supplier is done immediately after the use of materials and if the credit period (M) is longer

than cycle length (T), then only out of pocket cost and the discounted cost of deterioration are relevant in finding the optimal cycle length. When $T \leq M$, then there would be no opportunity cost in the expression of total cash flows because in this case, the firm finances the inventory investment with the trade credit offered by its supplier.

Case III: Fixed Credit Period : In this case credit period is fixed and hence, the customer pays the full purchase amount on the last day of the credit period. The present value of cash-flows for one cycle, $z_3(T)$ is

$$z_3(T) = H + CQe^{-RM} + iC \int_0^T I(t) e^{-Rt} dt \\ = H + Cx \left[1 + \frac{\alpha m T^{\beta}}{m+\beta} \right] e^{-RM} + iCmx \left\{ \frac{T}{m+1} + \frac{\alpha\beta T^{\beta+1}}{(\beta+1)(m+\beta+1)} - \frac{RT^2}{2(m+2)} - \frac{\alpha RT^{\beta+2}}{2(m+\beta+2)} \right\}$$

The present value of all future cash-flows is

$$Z_3(T) = \frac{z_3(T)}{1 - e^{-RT}} = \frac{z_3(T)}{RT} \\ \therefore Z_3(T) = \frac{1}{R} \left[\frac{H}{T} + Cx \left(\frac{1}{T} + \frac{\alpha m T^{\beta-1}}{m+\beta} \right) e^{-RM} + iCmx \left\{ \frac{1}{m+1} + \frac{\alpha\beta T^{\beta}}{(\beta+1)(m+\beta+1)} - \frac{RT}{2(m+2)} - \frac{\alpha RT^{\beta+1}}{2(m+\beta+2)} \right\} \right] \quad (12)$$

For optimum value of T,

$$\frac{\partial Z_3(T)}{\partial T} = 0 \\ \Rightarrow \frac{1}{R} \left[\frac{-H}{T^2} + Cx \left(\frac{-1}{T^2} + \frac{\alpha m(\beta-1)T^{\beta-2}}{m+\beta} \right) e^{-RM} + iCmx \left\{ \frac{\alpha\beta^2 T^{\beta-1}}{(\beta+1)(m+\beta+1)} - \frac{R}{2(m+2)} - \frac{\alpha R(\beta+1)T^{\beta}}{2(m+\beta+2)} \right\} \right] = 0 \quad (13)$$

$$\frac{\partial^2 Z_3(T)}{\partial T^2} = \frac{1}{R} \left[\frac{2H}{T^3} + Cx \left(\frac{2}{T^3} + \frac{\alpha m(\beta-1)(\beta-2)T^{\beta-3}}{m+\beta} \right) e^{-RM} \right. \\ \left. + iCmx \left\{ \frac{\alpha\beta^2(\beta-1)T^{\beta-2}}{(\beta+1)(m+\beta+1)} - \frac{\alpha R\beta(\beta+1)T^{\beta-1}}{2(m+\beta+2)} \right\} \right] > 0$$

Hence the optimum value of $T = T_3$ can be obtained from equation (13) and the corresponding optimal order quantity is

$$Q = Q_3 = x \left(1 + \frac{\alpha T_3^{\beta} m}{m+\beta} \right)$$

The corresponding optimal present value of all future cash-flows $Z_3(T) = Z_3(T_3)$ is obtained from equation (12). Equation (13) contains trade credit, the correct opportunity cost and the cost of deterioration, which are the discounted cost of deterioration. This results that effective capital cost should be less than that of the instantaneous payments.

V. CONCLUSION

In this paper, we have considered power demand pattern with variable rate of deterioration under the effect of inflation. Since it

is not possible to forecast exact demand in advance, so we have considered probabilistic version of demand. Here, the demand pattern is same as deterministic but it depends on the value of x which may vary from 0 to ∞ . Discounted cash flow approach for deteriorating items in presence of trade credit period is used for three cases. The optimal value of all future cash flows is found for three cases : instantaneous cash-flows, credit only on units in stock, fixed credit period.

REFERENCES

- [1] Aggarwal, R., Rajput, D. and Varshney, N. K. 2009. Integrated inventory system with the effect of inflation and credit period. *International Journal of Applied Engineering Research*, Vol .4, No. II, pp. 2234-2248.
- [2] Aggarwal, S.P. and Jaggi, C.K. 1995. Ordering policies of deteriorating items under permissible delay in payments. *Journal of the Operational Research Society*, Vol. 46, pp.658 — 662.
- [3] Chang, H.J. Dye, C.Y. 2001. An inventory model for deteriorating items with linear demand under condition of permissible delay in payments. *Production planning and control*, Vol.12, pp. 2 74-282.
- [4] Chung, K.J. and Hwang, Y.F. 2003. The optional cycle time for EOQ inventory model under permissible delay in payments, *International Journal of Production Economics*, Vol. 84, pp. 307-318.
- [5] Chung, K.J. and Hwang, Y.F., and Huang, C.K. 2002. The replenishment decision for EOQ inventory model under permissible delay in payments. *Op search*, Vol. 39. No.5 & 6, pp.327- 340.
- [6] Covert, R.P. and Philip, G.C. 1973. An EOQ model for deteriorating items with Weibull distributions deterioration. *AHE Trans.* Vol.5, pp.323-332.
- [7] Deb, M. and Chaudhuri, K.S. 1986. An EOQ Model for items with finite rate of production and variable rate of deterioration: *Opsearch*, Vol.23, pp. 175-181.
- [8] Heng, K.J., Lambban, J., Linn, R.J. 1991. An order level lot—size inventory model for deteriorating items with finite replenishment rate. *Computers and Industrial Engineering*, Vol .20, pp. 187-197.
- [9] Hou, K.L. and Lin, L.C. 2009. A cash flow oriented EOQ Model with deteriorating items under permissible delay in payments. *Journal of Applied Sciences*, Vol. 9, No.9, pp. 1791-1794.
- [10] Huang, Y.F. 2003. Optimal Retailer's ordering policies in the EOQ model under trade credit financing. *Journal of the Operational Research Society*, Vol.54, pp. 1011-1015.
- [11] Huang, Y.F. 2007. Economic order Quantity under conditionally permissible delay in payments. *European Journal of operational Research*, Vol.176, pp. 911-924.
- [12] Hung, Y.F., and Chung, K.J. 2003. Optimal replenishment and payment policies in the EOQ model under cash discount and trade credit, *Asia-Pacific Journal of operations Research*, Vol.20, pp. 171- 190.
- [13] Hwang, H. and Shinn, SW. 1997. Retailer's pricing and lot- sizing policy for exponentially deteriorating product under condition of permissible delay in payments. *Computers and Operations Research* Vol.24. pp. 539-547.
- [14] Jaggi, C.K. and Aggarwal, S.P. 1994. Credit financing in economic ordering policies of deteriorating Items. *International Journal of Production Economics*, Vol.34. pp. 151-159.
- [15] Jaggi, C.K., Goyal S.K., and Goel, S.K. 2008. Retailer's optimal replenishments decisions with credit-linked demand under permissible delay in payments. *European Journal of Operational Research*. Vol. 190. pp. 130—135.
- [16] Lee, W.N. and Wu, J-W, 2002. An EOQ model for items with Weibull distributed deterioration, shortages and Power Demand Patterns, *Information and Management Sciences*, Vol. 13, Number 2, pp 19-34.
- [17] Liao, H.C., Tsai, C.H. and Su, CT. 2000. An inventory model with deteriorating items under inflation when a delay in payments is permissible, *International Journal of production Economic*, Vol.63, pp. 207-214.
- [18] Misra, R.B. 1979. A study of inflation effects on inventory system. *Logistic spectrum*. Vol.9. pp. 260- 268.
- [19] Roy Choudhary, M. and Chaudhuri, KS. (1983). An order level inventory model for deteriorating items with finite rate of replenishment. *Opsearch*, Vol.20, pp. 99 —106.
- [20] Shah N.H. 1993. Probabilistic time scheduling model for an exponentially decaying inventory when delay in payments are permissible. *International Journal of Production Economics*, Vol.32. pp.77- 82.
- [21] Teng, J.T., and Chang, C.T.2005. Economic production quantity models for deteriorating items with price and stock dependent demand, *Computers and Operational Research*, Vol.32, pp.297 — 308.
- [22] Tripathi, R.P. and Misra, S.S.2010. Credit financing in economic ordering policies of non-deteriorating items with time-dependent demand rate. *International Review of Business and Finance* Vol.2, No.1, pp. 47-55.
- [23] Tripathi, R.P. and Kumar, Manoj, 2011. *International Journal of Business, Management and Social Sciences*, Vol. 2, No. 3, 1, pp 75-84 credit financing in economic ordering policies of time-dependent deteriorating items.
- [24] Wen-Chuan, 2002, *Information and management sciences*, an EOQ model for items with Weibull Distributed Deterioration, Shortages and Power Demand Pattern.

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Extraction of user specified web knowledge using Spatial Data Mining

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Abstract- Nowadays the World Wide Web has becoming one of the most comprehensive information resources. It probably, if not always, covers the information need for any user. Those differences make it challenging to fully use Web information in an effective and efficient manner. Web mining is the application of data mining techniques to extract knowledge from web data including web documents, hyperlinks, log usage of website etc. In this paper we extract data from web using spatial data mining. Spatial data mining is the process of trying to find patterns in geographic data. Spatial data mining is the application of data mining techniques. Spatial data mining follows along the same functions in data mining, with the end objective to find patterns in geography. In this paper we provide an introduction of spatial data mining as well as web. Then we focus on how data is extracted from web using some preprocessing techniques or some steps. It describes a method to extract useful information from a web page using spatial data mining. We are extracting hyperlinks and email from single and multiple websites that's why it is using spatial data mining because in spatial mining data is extracted from different locations. Different websites will have different web servers means different locations. This method includes some preprocessing steps to extract information. That extracted information will be knowledge.

Index Terms- spatial data mining, web mining, preprocessing techniques, hyperlinks, email extraction

I. INTRODUCTION

Data mining, a branch of computer science and artificial intelligence, is the process of extracting patterns from data. Data mining is seen as an increasingly important tool by modern business to transform data into business intelligence giving an informational advantage. It is currently used in a wide range of profiling practices, such as marketing, surveillance, fraud detection, and scientific discovery. The related terms data dredging, data fishing and data snooping refer to the use of data mining techniques to sample portions of the larger population data set that are (or may be) too small for reliable statistical inferences to be made about the validity of any patterns discovered. These techniques can, however, be used in the creation of new hypotheses to test against the larger data populations. Generally, data mining (sometimes called data or knowledge discovery) is the process of analyzing data from different perspectives and summarizing it into useful information - information that can be used to increase revenue, cuts costs, or both. Data mining software is one of a number of analytical tools

for analyzing data. It allows 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.

A. Spatial data mining

Spatial data mining is considered a more complicated challenge than traditional mining because of the difficulties associated with analyzing objects with concrete existences in space and time. As with standard data mining, spatial data mining is used primarily in the world of marketing and retail. Spatial data mining is the process of trying to find patterns in geographic data. Most commonly used in retail, it has grown out of the field of data mining, which initially focused on finding patterns in textual and numerical electronic information. It is a technique for making decisions about where to open what kind of store. It can help inform these decisions by processing pre-existing data about what factors motivate consumers to go to one place and not another. Spatial data mining is the application of data mining techniques to spatial data. Spatial data mining follows along the same functions in data mining, with the end objective to find patterns in geography. It has grown out of the field of data mining, which initially focused on finding patterns in textual and numerical electronic information. Spatial data mining is considered a more complicated challenge than traditional mining because of the difficulties associated with analyzing objects with concrete existences in space and time. Spatial data mining is the application of data mining techniques to spatial data. Spatial data mining follows along the same functions in data mining, with the end objective to find patterns in geography. data mining and Geographic Information Systems have existed as two separate technologies, each with its own methods, traditions and approaches to visualization and data analysis. As with standard data mining, spatial data mining is used primarily in the world of marketing and retail. It is a technique for making decisions about where to open what kind of store. It can help inform these decisions by processing pre-existing data about what factors motivate consumers to go to one place and not another.

B. Spatial Data

Also known as geospatial data or geographic information it is the data or information that identifies the geographic location of features and boundaries on Earth, such as natural or constructed features, oceans, and more. Spatial data is usually stored as coordinates and topology, and is data that can be mapped. Spatial data is often accessed, manipulated or analyzed through Geographic Information Systems. Spatial data is about information that has several dimensions. It is sometimes referred

to as spatial data. It includes both geospatial data and structo-spatial data.

C. Process of Spatial Mining

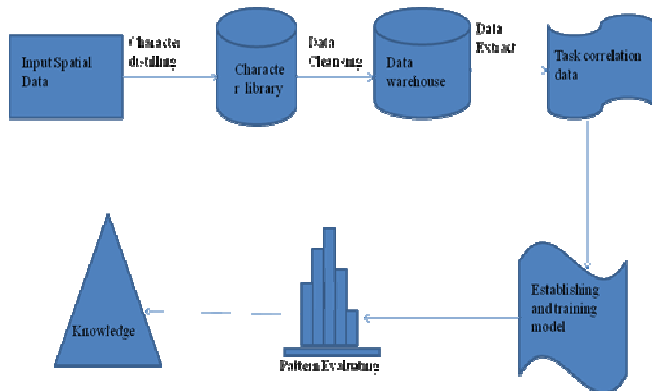


Figure 1: Process of Spatial Data Mining

1. *Input Spatial Data*: It is the input to the spatial mining process.
2. *Character Library*: Feature extraction and Feature database establishment. Spatial datum is the object of data mining. Because the existing databases, data warehouses, OLAP and data-mining technologies can not be used to process spatial datum, it is necessary to convert non-structuring spatial datum into structuring relational table or extensional table firstly, in order to take full advantage of such technologies. Store the features extracted out and the original pixel value in the feature data base, which is one source of data mining case set.
3. *Data Warehouse*: This definition of the data warehouse focuses on data storage. The main source of the data is cleaned, transformed, catalogued and made available for use by managers and other business professionals for data mining, online analytical processing, market research and decision support. However, the means to retrieve and analyze data, to extract, transform and load data, and to manage the data dictionary are also considered essential components of a data warehousing system. Many references to data warehousing use this broader context. Thus, an expanded definition for data warehousing includes business intelligence tools, tools to extract, transform and load data into the repository, and tools to manage and retrieve metadata.
4. *Data Extraction*: Data extraction is the act or process of retrieving (binary) data out of (usually unstructured or poorly structured) data sources for further data processing or data storage (data migration). The import into the intermediate extracting system is thus usually followed by data transformation and possibly the addition of metadata prior to export to another stage in the data workflow.
5. *Establishing and Training Model*: Data mining model is an abstract data structure, created, filled and provided query by data mining algorithm. Through the input and output strings of specified data mining model and the

use of mining algorithm, data mining algorithm can set up an empty data mining model structure; and through inserting the training set into data mining model, the training of the model is implemented.

6. *Pattern Evaluating*: A data mining system can discover thousands of patterns. Many of the patterns discovered may be uninteresting to the given user. The challenge is to develop techniques able to assess the interestingness of discovered patterns. Evaluating the mined-out model, discovering the hidden knowledge. Usually large numbers of models are to be found in a training set, and among these models some cases are low in support and reliability. So, it is necessary to evaluate the model discovered. Through evaluation, eliminate unreasonable models and meanwhile, store the considerably reliable models into the data mining model as "knowledge", to prepare for further analysis and forecast by using knowledge.
7. *Knowledge*: All the useful information at the end will be knowledge.

D. Web mining

Nowadays, the World Wide Web has becoming one of the most comprehensive information resources. It probably, if not always, covers the information need for any user. However, the Web demonstrates many radical differences to traditional information containers such as databases, in schema, volume, topic-coherence. Those differences make it challenging to fully use Web information in an effective and efficient manner. Web mining is right for this need. In fact, Web mining can be considered as the applications of the general data mining techniques to the Web. However, the intrinsic properties of the Web make us have to tailor and extend the traditional methodologies considerably. Firstly, even though Web contains huge volume of data, it is distributed on the internet. Before mining, we need to gather the Web document together. Secondly, Web pages are semi-structured, in order for easy processing, documents should be extracted and represented into some format. Thirdly, Web information tends to be of diversity in meaning, training or testing data set should be large enough. Even though the difficulties above, the Web also provides other ways to support mining, for example, the links among Web pages are important resource to be used. In general web mining tasks can be classified into three categories: Web content mining, web structure mining, web usage mining. All of the three categories focus on the process of knowledge discovery of useful information from the web. Each of them focuses on different mining object from the web.

II. PROBLEM STATEMENT

Nowadays, the World Wide Web has becoming one of the most comprehensive information resources. It probably, if not always, covers the information need for any user. Before mining, we need to gather the Web document together. Secondly, Web pages are semi-structured, in order for easy processing; documents should be extracted and represented into some format. In this paper the method has to extract all hyperlinks and email from a web page as well as multiple web pages.

III. PROPOSED METHOD

This paper addresses how to filter knowledge from a web page as well as multiple web pages. We propose a method to extract some predefined knowledge by some preprocessing techniques. Instead of removing noise or redundant data from a web page this method prefers to extract useful information based on our method. Before data mining algorithms can be used, a target data set must be assembled. As data mining can only uncover patterns already present in the data, the target dataset must be large enough to contain these patterns while remaining concise enough to be mined in an acceptable timeframe. Pre-process is essential to analyze the multivariate datasets before clustering or data mining. The target set is then cleaned. Cleaning removes the observations with noise and missing data.

Data preprocessing techniques can improve the quality of data, thereby helping to improve the accuracy and efficiency of the mining process. Data preprocessing is a very important step in knowledge discovery process. This method of extraction of data includes some steps like giving input, read input, pattern evaluation, cleaning and then data extraction.

A. Read Input

In this step reading of input is done provided by the user in a web page format.

B. Pattern Evaluation:

A data mining system can discover thousands of patterns. Many of the patterns discovered may be uninteresting to the given user. The challenge is to develop techniques able to assess the interestingness of discovered patterns. Usually large numbers of models are to be found in a training set, and among these models some cases are low in support and reliability. So, it is necessary to evaluate the model discovered. Through evaluation, eliminate unreasonable models and meanwhile, store the considerably reliable models into the data mining model as knowledge to prepare for further analysis and forecast by using knowledge.

C. Cleaning:

Data cleaning is one of the most important preprocessing techniques. It is used to clean redundant data. Data cleaning removes entries which are unused to data analyzing and mining. Data cleansing or data scrubbing is the process of detecting and correcting (or removing) corrupt or inaccurate records from a record set, table, or database. Used mainly in databases, the term refers to identifying incomplete, incorrect, inaccurate, irrelevant etc. parts of the data and then replacing, modifying or deleting this dirty data.

D. Data extraction:

Data extraction is the act or process of retrieving (binary) data out of (usually unstructured or poorly structured) data sources for further data processing or data storage (data migration). The import into the intermediate extracting system is thus usually followed by data transformation and possibly the addition of metadata prior to export to another stage in the data workflow. Usually, the term data extraction is applied when (experimental) data is first imported into a computer from primary sources, like measuring or recording devices. Today's electronic devices will usually present a electrical connector through which raw data' can be streamed into a personal computer.

IV. PERFORMANCE EVALUATION

To evaluate the performance of method we use a proper sequence of preprocessing steps. First user enters a url then the whole data of the web page is extracted and stored in html format. Then data is readied in the html format. We are extracting all the url's and email id present in the web page. For this we match the patterns of url's and email id's in the web page data. After pattern evaluation the data other than url's and email id's is cleaned. Because that data is redundant means unused. Then at the end data extraction is done means the data we want all the url's and email id's is extracted from the web page. This extracted data is knowledge.

A. Experiment Result:

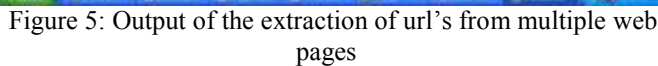
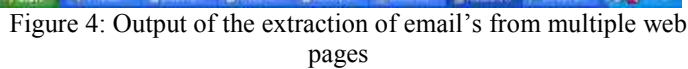
In above experiment we use an example of a web site. When user enters a website url then the data of the website is stored in html format. Then in the pattern evaluation phase the pattern of the url's and the pattern of the email's is evaluated. In this example there is website of a collage and all url's and email id's is extracted from a web page. These url and email are the knowledge.



Figure 2: Output of the extraction of url's from single web page.



Figure 3: Output of the extraction of email's from single web page.



The research area of spatial mining has focused on the category of Web mining. Later in the paper when I had discussed spatial mining, and web mining. In this paper we provide an efficient method to extract useful information from a web page an multiple web pages. We explore the extraction of some predefine knowledge from a website. Our approach is based on some preprocessing steps in data mining. The method identifies all url's and email's presented at the web page. First the method is applied to single web page after that to multiple web pages because in spatial data mining data is extracted from different locations. Multiple websites have different web servers. The result obtains from a real world website shows that the result is correct.

- [1] He yue-shun ding qiu technique research on data mining based on semi structured data source. Journal of hurbin institute of technology.
- [2] Raymond Kosala, Hendrik Blockeel, Web Mining Research: A Survey, ACM SIGKDD Explorations Newsletter, June 2000, Volume 2 Issue 1.
- [3] Jidong Wang, Zheng Chen, Li Tao, Wei-Ying Ma, Liu Wenyin, Ranking User's Relevance to a Topic through Link Analysis on Web Logs, WIDM'02, November 2002.
- [4] Han, J., Kamber, M. Kamber. Data mining: concepts and techniques. Morgan Kaufmann Publishers, 2000.
- [5] Wang Jicheng, Huang Yuan, Wu Gangshan, Zhang Fuyan. Web mining: knowledge discovery on the Web. Systems, Man, and Cybernetics, 1999.
- [6] Cooley, R.; Mobasher, B.; Srivastava, J.; Web mining: information and pattern discovery on the World Wide Web. Tools with Artificial Intelligence, 1997. Proceedings., Ninth IEEE International Conference. Page(s):558 – 567 - 3-8 Nov. 1997.
- [7] L. Getoor, Link Mining: A New Data Mining Challenge. SIGKDD Explorations, vol. 4, issue 2, 2003.
- [8] O. Etzioni. The world wide web: Quagmire or gold mine. Communications of the ACM, 39(11):65-68, 2007.
- [9] www.google.com
- [10] www.wikipedia.com

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Clustering of Web Log Data to Analyze User Navigation Patterns

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Abstract- As we know the amount of data available online is increasing day by day, the World Wide Web has becoming one of the most valuable resources for information retrievals and knowledge discoveries. Web mining technologies are the right solutions for knowledge discovery on the Web. Application of web usage data can be used to better understand web usage, and apply this specific knowledge to better serve users. Web usage mining is the base for navigation pattern mining and approach of clustering is used to perform that Mining, usage mining deals with the discovery and analysis of usage patterns from Web data, specifically web logs, in order to improve web based applications. A web navigation behavior is helpful in understanding what information of online users demand. In our study we extract the common pattern and do clustering, following that, the analyzed results can be seen as knowledge to be used in intelligent online applications, refining web site maps, web based personalization system and improving searching accuracy when seeking. The experimental results shows the clusters of navigation patterns of user and also the approach can improve the quality of clustering for user navigation pattern in web usage mining systems. These results can be used for predicting user's intuition in the large web sites.

Index Terms- web usage mining, pre-processing, pattern discovery, pattern analysis, navigation pattern mining, clustering

I. INTRODUCTION

The web is vast, varied and dynamic and thus raises the scalability, multimedia data and temporal issues respectively. The expansion of the web has resulted in a large quantity of data that is now freely available for user access. The different types of data have to be managed and organized in such a way that they can be accessed by different users effectively and efficiently. Therefore, the application of data mining techniques on the web is now on the focus of an increasing number of researchers. The Web Mining is the set of techniques of Data Mining applied to extract useful knowledge and implicit information from Web data. As more organizations rely on the Internet to conduct daily business, the study of Web mining techniques to discover useful knowledge has become increasingly important. However, with the magnitude and diversity of available information from the Internet, it is not insignificant to locate the relevant information to satisfy the requirements of people with different backgrounds. Web mining enables one to discover web pages, text documents, multimedia files, images and other types of resources from web generally;

data mining (sometimes called data or knowledge discovery) is the process of analyzing data from different perspectives and summarizing it into useful information that can be used to increase revenue, cuts costs, or both. Data mining software is one of a number of analytical tools for analyzing data. It allows users to analyze data from many different dimensions or angles, categorize it, and summarize the relationships identified.

A. Web Mining

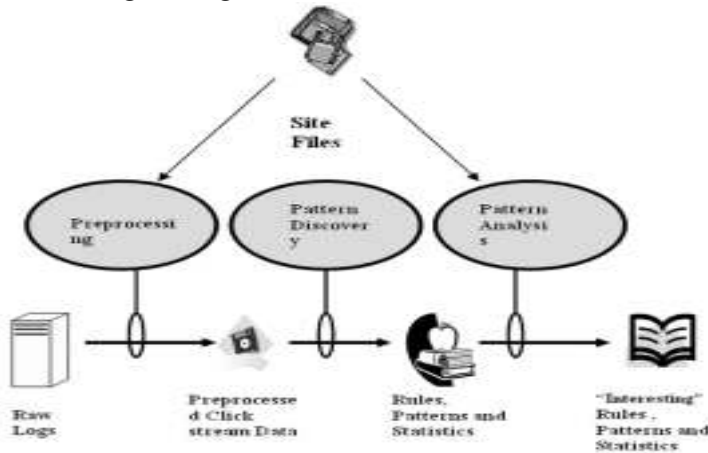
Web mining can be categorized into three different classes based on which part of the Web is to be mined. These three categories are (i) Web content mining, (ii) Web structure mining and (iii) Web usage mining. Web Usage Mining (WUM) is the process of extracting knowledge from Web user's access data by exploiting Data Mining technologies. It can be used for different purposes such as personalization, system improvement and site modification. Web usage mining tries to make sense of the data generated by the web surfer's session or behaviors. While the web content and structure mining utilize the real or primary data on the web, web usage mining mines the secondary data derived from the interactions of the users while interacting with the web.

B. Web Usage Mining

In our study we will give emphasize on Web usage mining. As Now a day the web is not the place where only transaction has occurred. Millions of visitors interact with the web in daily life which generates an enormous amount of data. Web usage mining helps to know information about users' behaviors and their usage patterns, can lead to interesting results that go over. Web Usage Mining (WUM) is the automatic discovery of user access pattern from web servers. Organizations collect large volumes of data in their daily operations, generated automatically by web servers and collected in server access logs. It can also provide information on how to restructure a website to service effectively. The Web Usage mining includes the data from the web server access logs, proxy server logs, browser logs, user profiles, registration data, user sessions or transactions, cookies, user queries, bookmark data, mouse clicks and scrolls, and any other data as the results of interactions. Web Usage Mining is the discovery of meaningful patterns from data generated by client-server transactions on one or more Web localities. Web usage mining focuses on techniques that could predict user behavior while the user interacts with the web. As mentioned before the mined data in this category are the secondary data on the web as the result of interaction. These data could range very widely but generally it is classified into usage data that resides in the web client, proxy server and servers. The aim of understanding the navigation preferences of the visitors is to enhance the quality of

electronic commerce services ecommerce, to personalize the Web portals or to improve the Web structure.

C. Web Usage Mining Architecture



1) Pre-processing

Pre-processing "consists of converting the usage, content, and structure information contained in the various available data sources into the data abstractions necessary for pattern discovery". This step can break into at least four sub steps: Data Cleaning, User Identification, Session Identification and Formatting. Unneeded data will be deleted from raw data in web log files in the data cleaning step. At least two log file formats exists: Common Log File format (CLF) and Extended Log File

2) Pattern Discovery

After data preparation phase, the pattern discovery method should be applied. This phase consists of different techniques derived from various fields such as statistics, machine learning, data mining, pattern recognition, etc. applied to the Web domain and to the available data. The task for discovering the patterns offer some techniques as statistical analysis, association rules, sequential pattern analysis, clustering and so on. Here we will briefly describe some techniques to discover patterns from processed data.

- Statistical Analysis such as frequency analysis, mean, median, etc.
- Clustering of users help to discover groups of users with similar navigation patterns (provide personalized Web content).
- Classification is the technique to map a data item into one of several predefined classes.
- Association Rules discover correlations among pages accessed together by a client.
- Sequential Patterns extract frequently occurring inter-session patterns such that the presence of a set of items s followed by another item in time order.
- Dependency Modelling determines if there are any significant dependencies among the variables in the Web.

3) Pattern Analysis

Pattern Analysis is the final stage of WUM (Web Usage Mining), which involves the validation and interpretation of the mined pattern.

Validation: To eliminate the irrelevant rules or patterns and to extract the interesting rules or patterns from the output of the pattern discovery process.

Interpretation: The output of mining algorithms is mainly in mathematic form and not suitable for direct human interpretations

II. PROBLEM STATEMENT

The proposed system aims at presenting a useful information extraction system from web access log files of web servers and using them to achieve clusters from related pages in order to help web users in their web navigation. In our work we prepare a tool to help the website owners to keep the record of their visitors. This will be helpful as they will be able to know how many times the website is being visited and who all their visitors are. The information will be beneficial as they can customize the website and the contents according to the people visiting it. It will also be commercially able to benefit as it will help them plan their advertisements. Before mining, we need to gather the Web document together. Secondly, Web pages are semi-structured, in order for easy processing; documents should be extracted and represented into some format. The main objective of our work is basically clustering of common browsing patterns these records are in the form of pattern they follow to leaf through the site. In our work the common pattern will be the path the user navigates through the site.

III. DESIGN CONSIDERATION

Various steps are involved in identifying the clusters of user navigation pattern are shown below: first data is collected which is known as web logs then preprocessing techniques are applied to that web log so that we can get relevant information Generally, several pretreatment tasks need to be done before performing web mining algorithms on the Web server logs. Data pretreatment in a web usage mining model (Web-Log preprocessing) aims to reformat the original web logs to identify all web access sessions. The Web server usually registers all users' access activities of the website as Web server logs.

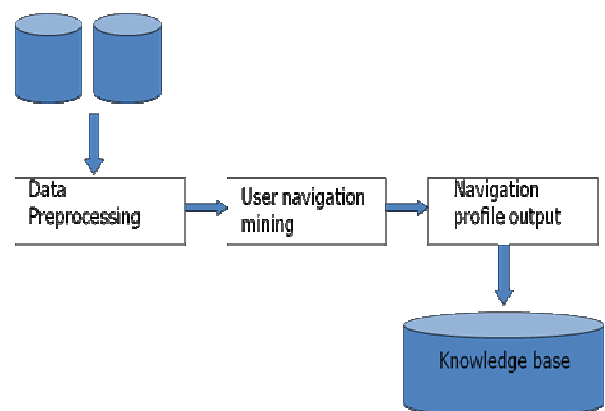


Fig. 1 Model of the System

A. Web Logs

Data sets consisting of web log records collected from own fashioned website. Web log is unprocessed text file which is

recorded from the Server. Web log consist of various attributes with the data values in the form of records

This log records restrain session id, login date, username user IP address and email id.

B. Data Preprocessing

Generally, several preprocessing tasks need to be done before performing web mining algorithms on the Web server logs. Data preprocessing a web usage mining model (Web-Log preprocessing) aims to reformat the original web logs to identify user's access sessions. This is done by following methods which was proposed in [1].

1. Data collection: This is done mostly by the web servers; however there exist methods, where client side data are collected as well.
2. Data cleaning: As in all knowledge discovery processes, in web usage mining can also be happen that such data is recorded in the log file that is not useful for the further process, or even misleading or faulty. These records have to be corrected or removed.
3. User identification: In this step the unique users are distinguished, and as a result, the different users are identified. This can be done in various ways like using IP addresses, cookies, direct authentication and so on.
4. Session identification: A session is understood as a sequence of activities performed by a user when he is navigating through a given site. To identify the sessions from the raw data is a complex step, because the server logs do not always contain all the information needed. There are Web server logs that do not contain enough information to reconstruct the user sessions; in this case (for example time-oriented or structure-oriented) heuristics can be used.

C. Navigation Pattern Mining

After the data pre-processing step, we perform navigation pattern mining on the derived user access session. As an important operation of navigation pattern mining, clustering aims to group sessions into clusters based on their common properties. User navigation patterns are described as the common browsing behaviors among a group of users. Since many users may have common interests up to a point during their Navigation, navigation patterns should capture the overlapping interests or the information needs of these users. In addition, navigation patterns should also be capable to distinguish among web pages based on their different significance to each pattern We extract the common pattern and do clustering while the user browses the site and apply it to knowledge base. As navigation output clusters of patterns are made which is done by observing common pattern. In our work common browsing behavior is the path in which user trace the site.

D. Knowledge Base

Following that, the analyzed results can be seen as knowledge to be used in intelligent online applications, refining web site maps, web based personalization system and improving searching accuracy when seeking. To analyze the path the administrator can understand what pages the visitors like most or how long path they like to visit in a web site. The algorithm which we use is as follows.

1. Input: Set of web page $P = \{X_1, X_2, \dots, X_n\}$

2. Output: Web page Clusters
3. Begin

4. For $i=1$ to m do
5. $X_i \rightarrow Pattern_i$
6. cluster= m ;
7. while cluster $> \tau$ do
8. Begin
9. For $i=1$ to cluster do
10. Begin
11. Find Two Cluster With max similarity();
12. if Condition() then
13. Begin
14. CombineTwoCluster();
15. cluster --;
16. End
17. End
18. End
19. End

IV. EXPERIMENTAL EVALUATION

Measuring the quality of the clustering in navigation patterns mining systems needs to characterize the quality of the results obtained. The experimental evaluation was conducted using Log file of our own adaptive website The only cleaning step performed on this data was the removal of references to auxiliary files (e.g., image files). No other cleaning or preprocessing has been performed in the first phase. The data is in the original log format.

Step wise results are shown below for records

Fig 1shows the different paths that user follows while navigate through the site with unique session id. Cluster patterns of similar path each time user login the site with the unique session id.



Fig 1: Navigation patterns

Fig 2 screen shows the output after we apply the clustering technique. Now the clusters of navigation patterns are made by which we get the number of users who follows similar type of pattern while browsing the site.



Fig 2: Cluster of Patterns

V. CONCLUSION

Web usage and data mining to find patterns is a growing area with the growth of Web-based applications. Application of web usage data can be used to better understand web usage, and apply this specific knowledge to better serve users. Web usage mining is the base for navigation pattern mining and approach of clustering is used to perform Navigation Pattern Mining. The web is a most important medium to conduct business and commerce. Therefore the design of web pages is very important for the system administrator and web designers. These features have great impact on the number of visitors. So the web analyzer has to analyze with the data of server log file for detecting pattern. In this paper we tried to give a clear understanding of the web usage mining and clustering of patterns formed while navigation. By this we can shorten the pages which are not in the user pattern, also we can record the information of the user. This will also help in evaluating address campaigns, restructuring and redesigning of website also it will remove the page which is in the category of low access or it can merge into the page which is frequent access. Since this is a huge area, and there a lot of work to do, we hope this paper could be a useful starting point for identifying opportunities for further research.

REFERENCES

- [1] Pattern Discovery of Web Usage Mining Shahnaz Parvin Nina, Md. Mahamudur Rahaman, Md. Khairul Islam Bhuiyan, Khandakar Entenam Unayes Ahmed Computer Science & Engineering Shahjalal University of

Science & Technology Sylhet, Bangladesh 978-0-7695-3892-1/09 \$26.00 © 2009 IEEE DOI 10.1109/ICCTD.2009.199

- [2] International Journal of Information Technology and Knowledge Management July-December 2010, Volume 2, No. 2, pp. 279-283 AN ALGORITHMIC APPROACH TO DATA PREPROCESSING IN WEB USAGE MINING
- [3] R. Baraglia and F. Silvestri, "Dynamic personalization of web sites without user intervention," Communications of the ACM, vol. 50, pp.63-67, 2007.
- [4] A New Clustering Approach based on Graph Partitioning for Navigation Patterns Mining 978-1-4244-2175-6/08/\$25.00 ©2008 IEEE
- [5] Journal of Theoretical and Applied Information Technology © 2005 - 2008 JATIT. All rights reserved. www.jatit.org 1125 WEB USER NAVIGATION PATTERN MINING APPROACH BASED ON GRAPH PARTITIONING ALGORITHM
- [6] Jalali, M., Mustapha, N., Sulaiman, N.B. and Mamat, A. (2008c) A web usage mining approach based on LCS algorithm in online predicting recommendation systems, 12th International Conference Information
- [7] "An Online Recommender System for Large Web Sites," Proceedings of the Web Intelligence, IEEE/WIC/ACM International Conference on (WI'04)-Volume 00, pp. 199-205, 2004.
- [8] Expectation Maximization Clustering Algorithm for User Modeling in Web Usage Mining Systems European Journal of Scientific Research ISSN 1450-216X Vol.32 No.4 (2009), pp.467-476
- [9] Classification and Clustering of Web Log Data to Analyze User Navigation Patterns Volume 1, No. 1, August 2010_Journal of Global Research in Computer Science
- [10] Jaideep Srivastava, Robert Cooley, Mukund Deshpande, Pang-Ning Tan, Web Usage Mining: Discovery and Applications of Usage Patterns from Web Data, SIGKDD Explorations, Volume 1, Issue 2- Pages 12-23.[2].
- [11] Adel T. Rahmani and B. Hoda Helmi, EIN-WUM an AIS-based Algorithm for Web Usage Mining, Proceedings of GECCO'08, July 12-16, 2008, Atlanta, Georgia, USA, ACM978-1-60558-130-9/08/07 (Pages 291-292)
- [12] www.google.com
- [13] www.wikipedia.com
- [14] www.webmining.com

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Explore the Impact of Workplace Spirituality on Motivations for Earnings Management-An Empirical Analysis

Dr. Amalendu Bhunia, Sri Amit Das

Abstract: This paper attempts to examine the influences on motivations for earnings management from the perspectives of workplace spirituality. The findings suggest that workplace spirituality is a new perception of individuals toward their lives and selves under the influence of the workplace. Such influence further affects the individuals on the acknowledgement of self-group relationships, and the actions of individuals. Therefore, spiritual awareness shows a mediating effect between organizational spirituality and earnings management. Moreover, the mediating effect is greater than the direct effect of organizational spirituality on the motivations of earnings management. In addition, this paper proves that there are no significant variances in the awareness of workplace spirituality among people who have different religious beliefs. Most literatures address earnings management from the perspectives of audits or business ethics, and suggest that moral education is the best way to cope with this issue. However, a sole reliance on the awaking and realization of the individual ethics may not be sufficient to amend current chaotic situations regarding earnings management. In fact, earnings management, in essence, is highly relevant to the opportunistic behaviors of management.

Index Terms- Earnings management, workplace spirituality, motivations for earnings management

I. INTRODUCTION

In recent years, there have been increased incidents of corporate frauds around the world. Many of these incidents involve false financial reporting, irregular transactions, inflated revenues, and assets embezzlement. The frauds have resulted in investors losing confidence in the management teams and financial reports of many listed companies. Although the government authorities of securities exchanges and auditing industries around the world have established various legal regulations to enhance frauds prevention, levied punitive measures on unscrupulous behaviors, and devoted continuous efforts on education of business ethics, the financial tsunami in 2008 left financial industries in shambles. The public has more doubts on the professional ethics of corporate management and auditors.

The practice of altering transactions and financial reports to mislead the judgments of investors into believing reported corporate performances and influencing contract results based on falsified accounting books is called earnings management (Healy and Wahlen, 1999). Most of the discussions of earnings management are from financial perspectives. However, earnings management reflects the interests of management, instead of the

real operating results of companies. Earnings management is in fact a managerial behavior, not mere financial variations (Goel and Thakor, 2003; Chung et al., 2002). Therefore, many researches have suggested that the analysis of these issues should be dealt with from psychological or behavioral aspects, such as human nature. Some have indicated that when individuals are facing pressures from the managers or organizations, they may go against their own nature. In other words, the spontaneous behavior based on personal attitudes, values, and beliefs may lose their natural nature under pressure (Lightner et al., 1982; Lord and DeZoort, 2001).

In fact, the true purpose of all economic activities, reflects the will, experiences, and emotions of people, and often emphasizes the nature of human existence or moral contents. At the end of 20th century, people have begun to face spiritual emptiness, moral abnormalities, twisted social values, greed, and all kinds of crimes, against the backdrop of the formation of knowledge economy and the acceleration of material satisfactions due to technological advancements. This has caused an imbalance between material and spiritual life. Therefore, people have become increasingly concerned about the nature of human existence, and there have been more and more discussions and explorations on this issue (Jurkiewicz and Giacalone, 2004; Klenke, 2005; Sheep, 2006), as well as a wave of studies of spirituality in management (Cavanagh, 1999; Marschke, 2007). Jue and Wedemeyer (2002) suggested that the management model based on human nature in the industrial economy is under challenge because management theories in the industrial age cannot entirely explain, let alone resolve, the current dilemma. Therefore, in the field of management study, discussions on spirituality have emerged, and it is hoped that spiritual management can become effective in this era of knowledge economy (Sheep, 2006; Moore and Casper, 2006). Harrington et al. (2001) indicated that at the beginning of a new century, employees experienced a fundamental change of work values. This paradigm shift was as profound as the information age, and such changes began the exploration of spirituality and spiritual feelings resulting from workplaces, which are called "workplace spirituality".

However, most of the studies on spirituality focus on the spiritual feelings of individuals. Reed (1997) and Thompson (1993) indicated that excess attention on details causes an intellectual myopia, which prevents an overall view of the workings of organizational powers and control relationships. Therefore, this paper suggests that workplaces are not simply entities, groups, or hierarchical organizations, but rather, they are an aggregation of different levels, rather than a combination of

single layers. Therefore, the Hierarchical Linear Model is adopted for analysis.

II. REVIEW OF RELATED LITERATURES

2.1 WORKPLACE SPIRITUALITY

At the end of the 1960s, many researches proposed that humanism is too self centric and narrow, and hence, has the tendency of evolving into solipsism. Therefore, some scholars have began to explore deeper psychological aspects (Danicls, 1988), which is how transpersonal psychology emerged. Many scholars have pointed out that the old paradigms are not sufficient to respond to all human experiences, and proposed a fourth level, namely spirituality. Generally speaking, spirituality is considered a life essence that exceeds the self and is a higher level of human awareness (Jarvis, 2001; English and Gillen, 2000). After proposing his five-level needs theory, Maslow (1969) suggested that spirituality is the highest level of needs, exceeds self-realization, and is a part of the essence of human existence. Without spirituality, human nature is incomplete. It is true that the self, self-recognition, and an inner core are a part of a happy life. However, the field of organization management is trapped under the limitations of rational myth; in other words, emotional factors should be excluded if an organization is to operate smoothly. The inner world of organizational members is confined to a model of complete rationality, leaving no room for spirituality. Therefore, the issues surrounding spirituality have been ignored by organizational management (Robbins, 2002).

As people are facing spiritual emptiness, moral abnormalities, twisted social values, greed, and all kinds of crimes, the phenomena have caused an imbalance in material and spiritual life, and created serious impacts on work values and workplace ethics of employees. Mitroff and Denton (1999) found that most of the interviewed employees indicated that their 'souls' have been damaged by work. However, this is often not seen on the surface. Ashmos and Duchon (2000) indicated that from the 1980s to 1990s, many companies made extensive efforts in downsizing, reengineering, and streamlining in order to stimulate the drives of their organizations. However, the result was disappointing as morale steeply declined. Elliott and Lemert (2006) suggested that maintaining an aggressive, but liberal personality, able to interact appropriately with others/subjects, and upon one's own identity, within a global environment, is the new individualism.

As workplaces become the center of everyday life, social contact and interpersonal concerns have been reduced, thus, many scholars have attempted to identify effective ways to stimulate internal strengths of employees through the introduction of spirituality into organizational management. Second, the encouragement of workplace spirituality is also deemed as a response to the greed emerged in the 1980s, and an expression of reflections of corporations (Jurkiewicz and Giacalone, 2004; Carole and Robert, 2004; Kale and Shrivastava, 2003). Valente (1995) argued that the confusion over life and the desire to seek meanings of life have resulted in increased curiosity in oriental religions and philosophies, such as Buddhism and Confucianism, which encourage seeking spiritual values and shared

identification through meditation, reflection, and activities that stress loyalty to organizations. Dehler and Welsh (1994) suggested that contemporary organizations must provide physical, mental, emotional, and spiritual energies to employees.

This paper summarizes relevant literature, and suggests that workplace spirituality is mutual contributions of individuals and work groups that enhance the meaning of work and the enlightenment of self transcendence, in order to allow individuals to feel the value and completion of life. In addition, workplace spirituality is different from individual spirituality with the exploration of life and work meanings, by individuals, through work. Therefore, workplace spirituality enhances multiple impacts. For example, Sheep (2006) examined spirituality from the perspectives of organizational society, and found that the influence of workplace spirituality transcends that of individuals, organizations, and societies. Garcia-Zamor (2003) also suggested that the purpose of spiritual pursuits by individuals in the workplace is to discover the meaning of spirit to enhance freedom at work. The purpose for organizations to develop spirituality at workplaces is to link spirituality and ethics, which echoes the organizational culture and improves organizational productivity. Therefore, this paper divides workplace spirituality into two levels for analysis, which are spiritual awakening of individuals and organizational spirituality. Spiritual awakening refers to realizing life's value and meaning via experiences through work or workplaces. It is an introspective process, where individuals connect with others, societies, and all beings in the nature in a profound manner, in order to generate a new set of conceptions, awareness, and perceptions that go beyond usual sensory experiences. Organizational spirituality is the establishment of the identity and concerns shared within an organization. Employees feel a meaning to life that work creates via spiritual conversations, listening, and coping with pressures and challenges through spiritual learning and growth.

2.2 IMPLICATIONS OF EARNINGS MANAGEMENT MOTIVES

Earnings management aims to achieve certain purposes by manipulating relevant accounting practices, under generally accepted accounting principles, so that the earnings shown on financial reports achieve predetermined targets. There are three major prerequisites based on this definition, as follows:

- III. Under the generally accepted accounting principles, adjustments and changes are purposefully made in order to report earnings that meet the expected targets.
- IV. The treatment of accounting and compilation of reports are manipulated purposefully in order to meet the expectations of management or certain individuals.
- V. Creative adjustments or twisting of the actual financial performances is made in order to meet operational targets.

The studies on the motivations or incentives of earnings management are mostly conducted on the basis of audits, and few studies have focused on the perspectives of behavior. Relevant literature can be divided into two categories: 1) risk assessment, which aims at developing analytical or predicative indicators to evaluate degrees of earnings management, and assist in differentiating the quality of earnings information (Hansen et al., 1996; Summers and Sweeney, 1998); 2)

assessment of fraud, which aims to analyze the discerning skills of auditors of unscrupulous behavior (Bernardi, 1994; Reckers and Schultz, 1993).

The motivations of earnings management can be divided into the following categories:

(1). Attitudes and convictions

This refers to the perceptions and behavior tendencies of individuals toward the practice of earnings management and can be classified into altruism (i.e. for the benefit of companies by avoiding share price slumps), selfishness (i.e. for personal gains, such as bonuses), and behavior beliefs (i.e. the expectations of potential pros and cons resultant from the behavior of earnings management). Fischer and Rosenzweig (1995) found that accountants are more sensitive to accounting manipulations, whereas managers are more tolerant toward operating manipulations. Merchant and Rockness (1994) and Elias (2002) indicated that the interviewees of varying professional backgrounds show significant variances in the moral judgment of earnings management.

(2). Pressures from affiliated parties

This refers to the tendency of management to become engaged in earnings management due to requests from financially affiliated parties, such as supervisors, colleagues, accountants, shareholders, creditors, or analysts. Ayres (1994) suggested that the motivations for earnings manipulations may be to meet expectations of shareholders regarding dividend distributions. DeZoort and Lord (1994), Becker et al. (1998), and Lord and DeZoort (2001) indicated that accountants may be engaged in earnings management under pressure from peers, clients, or supervisors.

2.3 WORKPLACE SPIRITUALITY AND EARNINGS MANAGEMENT

Earnings management is highly relevant to human greed (Scott, 2006). The demand for business ethics cannot effectively prevent earnings management by corporate managers (Brooks, 2000). However, Merchant and Rockness (1994), and Elias (2002) indicated that the interviewees of various professional backgrounds show significant variances in moral judgments of earnings management. Therefore, an important issue in organizational management studies is what new methods are available to curb earnings management. As Scott (2006), Goel and Thakor (2003), and Dechow and Skinner (2000) emphasized, earnings management is an economic activity of managers, and therefore, relevant discussions should return to their behaviors. Although many scholars have addressed the issues of earnings management from psychological or behavioral aspects, such efforts remain insufficient (Goel and Thakor, 2003). Earnings management is an economic activity, and the purpose of operational activities is to present the existing value of people. Therefore, the focal point of discussions on earnings management should be centered on the value of human existence in order to gain a true understanding of the purposes of such activities. The value of human existence is one of the basic concepts of workplace spirituality.

From the ethical points of view, the main purpose of earnings management is to mislead interested parties in false belief of the operational performances of a company (Healy and Wahlen, 1999), in order to enhance personal gains of management at the expense of shareholders' rights (Goel and Thakor, 2003; Turner,

2002). Therefore, earnings management violates corporate ethics, and is detrimental to social justice. Schmidt-Wilk et al. (2000) argued that the development of spirituality with a focus on principles, virtues, ethics, values, emotions, intelligence, and intuition can enhance ethics established on human nature, courage, and intelligent capacity. Nix (1997) and Freshman (1999) also suggested that spirituality helps to improve social responsibilities of workplaces, and gives a sense of responsibility of organizational members. This new framework for the interpretation of ethics is based on spirituality and social justice. In other words, the development of workplace spirituality can transfer ethics and social justice into values, from within individuals, rather than a set of external restrictions imposed by regulations concerning moral standards. Jurkiewicz (2002) indicated that workplace spirituality can be combined with multiple ethics, and be integrated into work and personal values by reducing regulations and standards of formal ethics. Ebaugh (2002) stated that workplace spirituality helps individuals to avoid behaviors that may jeopardize their own career developments. Thompson (2000) suggested that the enhancement of spirituality can greatly enhance shareholders' value and returns on investments. On the other hand, the main influence of earnings management is the influence of specific purposes for the managers on shareholders' value. Therefore, workplace spirituality should reduce the motivations of earnings management.

Forster (2008) emphasized that the management of modern companies should be based on spiritual elements, rather than the manipulation of financial reporting in order to show maximum profits. Giacalone and Jurkiewicz (2003) further indicated that there is a strong mutual connection between workplace spirituality and earnings perspectives. Fernando and Jackson (2006) pointed out that the concept of workplace spirituality of leaders exhibits influence on their decision behaviors. Empirically, the practice of earnings management in financial accounting (Kaplan, 2001), and budgetary inflations in management accounting (Douglas and Wier, 2000), are highly relevant to the inner values of leaders. Therefore, this paper suggests that workplace spirituality can enhance the inner ethics and moral standards of individuals or organizations, and influence various decision behaviors, thereby resulting in reduced occurrences of earnings management.

III. MATERIALS AND METHODS

3.1 RESEARCH DESIGN

The construction and influence of workplace spirituality contains many levels, therefore, this study adopts a Hierarchical Linear Model for analysis. The reality in a given organization is nested, with one phenomenon layered on top of another, thus, the use of a Hierarchical Linear Model is can provide a better understanding on organizational operations.

3.2 SAMPLING THEMES

In this study, a focus group seminar was conducted to collect information before the questionnaires survey in order to take into consideration cross-cultural issues. Then, this study followed the principle of critical incident techniques (CIT) for task analysis to analyze the content of the gathered data, and designed the questionnaires based on the results.

3.3 FOCUS GROUP TARGETS

Since the subjects of workplace spirituality were workers/employees, and there was no difficulty in accessing sample sets throughout Taiwan, this study adopted stratified sampling by dividing Taiwan into northern, central, and southern regions. Two colleges/universities were selected in each region, and then contact was made with the faculties and departments offering programs to full-time working professionals to arrange interviews, totaling 51 people. However, since this study only sampled working professionals, who were studying part-time in colleges/universities, the majority of respondents were highly educated, below 45 years old, single, and high earners. Meanwhile, 70.59% had never taken part in any spiritual (potential) development program, and 31.37% were religious. All the respondents were invited to express their opinions, and the influence of their experiences or religious beliefs was expected to be insignificant.

3.4 QUESTIONNAIRE SURVEYS

The analysis of earnings management requires statistical data of financial reports, therefore, this study sampled listed companies of the Taiwan Stock Exchange and OTC, but excluded the financial industry (including banks, insurance companies, and securities firms) because the industry characteristics, earnings calculations, and business models are unique. It also adopted a Hierarchical Linear Model with the research levels consisting of personal and organizational levels. In order to avoid the sourcing of data from the same respondents and the resulting common method variance (CMV), Scott and Bruce (1994), and Podsakoff and Organ (1986), suggested that difference versions of questionnaire should be developed for employees and supervisors. Therefore, this study divided the questionnaires into financial/accounting personnel and supervisors. The questionnaires for the former were filled out by the financial/accounting staff of the sampled companies, and their answers represent spiritual awakenings and motivations for earnings management at an individual level. Meanwhile, the results of questionnaires filled out by supervisors of the sampled companies were considered as data representing organizational spirituality at the organizational level. Paired samplings were performed, and the list of pairs was based on the list of financial/accounting supervisors, as provided by the databank of the Taiwan Economic Journal. After the questionnaires were distributed for the first time, the receipt of the questionnaires was confirmed via phone, and if the respondents were different, the questionnaires were resent. A total of 902 companies received copies of the questionnaires, and 265 effective questionnaires were returned; the valid return rate was 29.38%. A total of 338 valid questionnaires were filled out by supervisors, and 650 were filled out by financial/accounting personnel.

In order to avoid errors due to differing times of questionnaire recovery, this study divided the questionnaires returned in 2008 and 2009 into two groups, and conducted t-tests on the sampled data to verify whether any response errors occurred by analyzing the genders, ages, educational levels, marital statuses, work histories, service tenures, monthly incomes, life philosophies, and religious beliefs of the two sampled groups. The test showed that none of the p-values of individual variables reached a significance level, indicating that the timing of the questionnaire

recovery did not lead to any differences in sampled data. Therefore, this study concluded that there should be no significant variances in the respective variables, concerning the respondents and non-respondents. The lack of response difference has limited impact on this research project.

3.5 QUESTIONNAIRE DESIGN

Since cultural differences must be taken into account, this study first collected data from focus group interviews, and content analysis for workplace spirituality. The results served as a basis for the design of a Likert 5-point scale, and pre-testing was conducted before the formal questionnaire survey.

The design of the focus group interviews was mainly based on literature review. Since workplace spirituality is perceived or developed by organizational members in relation to their workplaces, the questionnaire asked the interviewees to indicate whether they have ever experienced the essence of life, the value of their own existence, or a relationship between an individuals and the universe, after working for a period of time. The interviewees described each scenario and their feelings at that time. The description included the reasons and impacts on the body and mind.

With prior consent from the interviewees, this study recorded the interviews and transcribed the contents before conducting a content analysis of the transcripts based on the CIT principle. First, it invited three scholars to serve as coders. These scholars were well versed regarding workplace spirituality, familiar with the content analysis, and all had work experiences in the business circles. (Most people are unlikely to be familiar with both workplace spirituality and content analysis.) Then, this study referred to the abovementioned literature, and summarized the contents of relevant concepts in order to create the principles for the theme extracts. The themes were extracted from transcripts word by word. In other words, the sentences or paragraphs that met the research purposes and the above principles were identified for integration into analysis units for further processing. A total of 99 themes were synthesized. Second, the coders classified the individual themes into appropriate concepts. After confirmation by the coders, this study asked the coders to determine the levels of agreement (i.e. the number of agreed themes/total number of themes), and the average value was 0.88. This study then calculated reliability (number of people* level of mutual agreement)/(1+ (number of people-1) × level of mutual agreement), and the computed reliability was 0.98.

After the confirmation of the reliability of the individual themes, the themes were integrated and classified into corresponding concepts for establishing questionnaire items. The 27 items measured the concepts in workplace spirituality, and the last item was a rhetorical question. Finally, this study designed the questionnaires for the supervisors (that is, the measurement of organizational spirituality), and for financiers/accountants (that is, the measurement of spiritual awakening). The content of the items was presented with a Likert 5-point scale, except for the part dealing with personal and company basic data.

This study addressed issues concerning the motivations for earnings management, from the perspectives of behavioral

intentions in the questionnaire design. It referred to the earnings management intention questionnaire developed by Gillett and Uddin (2002), and the earnings management scenarios questionnaire developed by Merchant and Rockness (1994), and Fischer and Rosenzweig (1995). The above measurements are mature and well-established, and have been adopted and verified by many studies; therefore, this study did not perform pre-testing. The questionnaire included 20 items; items 1 to 14 were the measurements of attitudes and convictions, and items 15 to 20 were the measurements of pressures from affiliated parties, which were all presented in Likert 5-point scale.

IV. EMPIRICAL ANALYSIS

In the present study, KMO model and hierarchical linear model have been used on the assumption that (i) spiritual initiation, organizational spirituality and motivations are not significantly impact on inner satisfaction, self growth and experiences of organizational supervisors; (ii) there are no relationships between workplace spirituality and motivations for earnings management and (iii) the spiritual initiation of individuals is not influenced by organizational spirituality.

4.1 FACTOR ANALYSIS AND RELIABILITY ANALYSIS

This study conducted a KMO (Kaiser-Meyer-Olkin) test and a Bartlett test on the data of spiritual awakening, organizational spirituality, and motivations for earnings management in order to determine whether it was appropriate to perform factor analysis. The results showed that the KMO value of organizational spirituality is 0.93 ($p < 0.001$), and that of spiritual awakening is 0.92 ($p < 0.001$), and that of motivations for earnings management is 0.94 ($p < 0.001$). Therefore, Varimax is employed for factor analysis.

The measurement of organizational spirituality is based on questionnaires filled out by financial/accounting supervisors of sampled companies. The assessment by supervisors represented the results of an organizational level. Some supervisors worked in the same companies, therefore, this study calculated the average values of these respondents, and used the average to represent their companies. The results of the factor analysis on organizational spirituality extracted five factors, which could explain an accumulation of 72.07% variables. The factor loadings of all the questions are greater than 0.5, thus, all items are retained. Based on relevant literature, the items are named as follows:

(1). Inner satisfaction

It infers that an organization should provide a sense of security and belonging for employees, allowing them to accept themselves and others in order to create their own satisfactions and happiness. In this way, they are more willing to have concerns over the organizational issues and become involved in tasks.

(2). Self growth

It refers to guidance provided by an organization to employees, regarding self reflections, development of inner stability, and self identity in order to nurture characteristics, such as honesty, equality, and love.

(3) Diversified experience

It refers to the initiatives driven by an organization to develop the employees' ability to face different aspects of life. With a

diversified pool of contacts and developments, employees can broaden their experience and embrace changes free from the past.

(4). Helping others

It refers to positive and tolerant attitudes fostered by an organization to encourage employees to actively take responsibility, work hard, and make efforts to finish tasks.

(5). Pressures/dynamics

It refers to appropriate challenges and competitiveness in workplaces, as well as a mechanism in place to guide employees in a positive direction, which in turn, drives changes.

The measurement of spiritual awakening was a questionnaire filled out by financial/accounting personnel of the sampled companies. The results of the factor analysis on spiritual awakening extracted five factors, which could explain an accumulation of 63.50% variables. The factor loadings of all the questions are greater than 0.5, thus, all items are retained. Based on relevant literature, the items are named as follows:

(1). Realization of the meaning and value of life

It refers to the nourishing effects of workplace spirituality on inner spiritual life, the affirming processes of self-existence and harmonious feelings with external environments, thus, achieving growth and satisfaction in work responsibilities and self awareness.

(2). Inner explorations

It is an introspective action, with which individuals can self reflect, thinking in different lights in order to sense their direction from within, and thus, realize themselves.

(3). Mutual assistance

It refers to tolerance, caring, and helping others through characteristics, such as honesty, equality, and love.

(4). Transcendent experience

Transcendence is a self-aware experience, which requires flexibility for change, and a diversified environment to encourage such an experience. Therefore, interaction with different types of people and groups, as well as a wide range of experiences in the workplace, helps to develop individual acknowledgement of workplace spirituality.

(5). Mental challenges

Mental challenges are the scenarios that prompt or guide spiritual growth and changes of individuals under stressed and challenging situations.

Two factors were extracted from the analysis of the factors influencing the motivations for earnings management, which could explain 68.03% (accumulative) variances. The factor loadings of all the questions are greater than 0.5, thus, all items are retained. Based on relevant literature, the items are named as follows:

(1). Attitudes and convictions

It refers to the motivations for earnings management as a response to any potential crisis, which a company or individual may face (such as the avoidance of a loss of confidence by banks, the avoidance of share price collapse, the reduction of tax burdens, or threshold achievements of a public company), and the conviction in the expected results (such as the expectations for potential pros and cons resulting from earnings management).

(2). Pressures from affiliated parties

It refers to the tendency of management to become engaged in earnings management due to requests from financially affiliated parties, such as supervisors, colleagues, accountants, shareholders, creditors, or analysts.

This study used Cronbach's α as the tool to perform reliability tests. The Cronbach's α of the measurement for spiritual awakening was 0.937; that of the measurement for organizational spirituality was 0.933, and that of the measurement of the motivations for earnings management was 0.964. The Cronbach's α values of all the constructs were above 0.8, indicating good reliability.

4.2 RELEVANCE ANALYSIS

According to the relevance analysis of the variables, there is a significant correlation among individual variables; however, it does not reach a high correlation of close to ± 1 . There is a significant and positive correlation between the variables of organizational spirituality (i.e. inner satisfaction, self growth, diversified experience, helping others, and pressures/dynamics), and the variables of spiritual awakening (that is, understanding of life meaning and values, inner exploration, mutual assistance, transcendent experience, and mental challenges). The correlation coefficients are between 0.41 and 0.5. There is a significant negative correlation between the variables of organizational spirituality and the motivations for earnings management (e.g., attitudes, convictions, and pressures from affiliated parties), as well as between the variables of spiritual awakening and the motivations for earnings management. The correlation coefficients are between -0.42 and -0.63.

4.3 HIERARCHICAL LINEAR MODEL

4.3.1 CLUSTER ANALYSIS OF ORGANIZATIONAL LEVEL VARIANCES

This study employed ICC and rwg coefficients to confirm whether there is a consistency in the determination and judgment by different supervisors in an organization, and whether there are any variances across different organizations. The results are shown in Table 1. The rwg values of the five organizational spiritual factors are all greater than 0.90. The ICC (1) coefficients are between 0.23 and 0.49, greater than 0.12; the ICC (2) coefficients are between 0.81 and 0.92, greater than 0.60. Therefore, it could be concluded that the aggregation of the organizational level variances with the five organizational spiritual factors measured with the sampling of individual supervisors is appropriate.

Table 1 Cluster Analysis of Organizational Level Variables

Factors	ICC(1)	ICC(2)	r_{wg}
Inner satisfaction	0.30	0.92	0.95
Self growth	0.49	0.92	0.94
Diversified experience	0.39	0.88	0.92
Helping others	0.41	0.89	0.91
Pressures/ dynamics	0.23	0.81	0.92

4.3.2 NULL MODEL ANALYSIS

This study inferred that the variables of the individual level (spiritual awakening) and the variables of the organizational level (organizational spirituality) had influences on the motivations of

financial/accounting personnel for earnings management. In order to validate this hypothesis, this study applied a null HLM model to confirm that there are variances in the motivations of financial/accounting personnel for earnings management, and such variances are due to differences in organizations. The analysis model is as follows:

Level-1: Motivations for earnings management $_{ij} = \beta_{0j} + r_{ij}$

Level-2: $\beta_{0j} = \gamma_{00} + U_{0j}$

As shown in Table 2, analysis found that the residual variance of the intercept of the motivations of earnings management ($\tau_{00} = 0.56$, $p < 0.001$) reached a significant level. Therefore, through null model testing, this study examined the front-end factors influencing the motivations for earnings management. It was suggested that a cross-level analysis model should be constructed to validate its reasonability, and the result is initially supported. This study further examined the ρ_1 (ICC) of 0.26, indicating that 26% of the variances in the motivations for earnings management are due to different organizations, whereas, the remaining 74% variances could be explained by the internal variances of a given organization. Therefore, it was impossible to conduct an analysis through a simple regression model; rather, intra-group variances were taken into account.

Table-2: Null Model Test

Independent variables	Fixed Effects	Random Effects		ρ_1 (ICC)
	γ_{00}	Standard errors	τ_{00}	σ_2
Motivations for earnings management	6.30*	0.12	0.56*	1.62
				0.26

Note: * indicates $p < .001$

4.3.3 CONTEXTUAL MODEL ANALYSIS

This study applied intercepts as outcomes for the testing of the contextual model. The first level of HLM was defined as a complete model, and the intercept of the first level of the regression model was used as a variable for the second level. This model incorporated the variables of the second level to test whether the predictive variables of the second level reported any direct influence on the independent variables.

The contextual model defined age, work history, and monthly income as control variables at the individual level; and industry, region, and revenue volatility as control variables at the organizational level. The model concerning the relationship of organizational spirituality to spiritual awakening was established based on the research hypothesis, expressed as follows:

Level-1: Spiritual awakening $_{ij} = \beta_{0j} + \beta_{1j}(\text{age}_{ij}) + \beta_{2j}(\text{work history}_{ij}) + \beta_{3j}(\text{monthly income}_{ij}) + \gamma_{ij}$

Level-2: $\beta_{0j} = \gamma_{00} + \gamma_{01}(\text{organizational spirituality}_{ij}) + \gamma_{02}(\text{industry}_{ij}) + \gamma_{03}(\text{region}_{ij}) + \gamma_{04}(\text{revenue volatility}_{ij}) + \mu_{0j}$

The models of the influence of spiritual awakening and organizational spirituality on the motivations for earnings management are as follows:

Level-1: Motivations for earnings management $_{ij} = \beta_{0j} + \beta_{1j}(\text{spiritual awakening}_{ij}) + \beta_{2j}(\text{age}_{ij}) + \beta_{3j}(\text{work history}_{ij}) + \beta_{4j}(\text{monthly income}_{ij}) + \gamma_{ij}$

$$\text{Level-2: } \beta_{0j} = \gamma_{00} + \gamma_{01}(\text{organizational spirituality}_{ij}) + \gamma_{02}(\text{industry}_{ij}) + \gamma_{03}(\text{region}_{ij}) + \gamma_{04}(\text{revenue volatility}_{ij}) + \mu_{0j}$$

Table 3 shows the analysis results. The fixed effects of organizational spirituality on spiritual awakening are significantly positive ($\beta=1.340$, $p<0.001$), with a R^2 of 0.619. The β coefficient of spiritual awakening to the motivations for earnings management is -0.629 ($p<0.001$); and that of organizational spirituality to the motivations for earnings management is -0.215 , ($p<0.001$), with a R^2 of 0.764. The test for intervening effects also supports the hypothesis ($F=259.234$, $p<0.001$).

Table-3: Contextual Model Test

Independent variables		Spiritual awakening	Earnings Management motivations
Item		β coefficient	β coefficient
Interception		6.155 *	23.552*
Individual level	Predictive variable		
	Spiritual awakening		-0.629*
	Control variable		
	Age	0.108	0.186
	Work history	0.068	-0.109
Organizational level	Monthly income	0.014	-0.014
	Predictive variable		
	Organizational spirituality	1.340*	-0.215*
	Control variable		
	Industry	0.197*	-0.337*
F	Region	0.050	0.138
	Revenue volatility	1047.291*	0.031
		1047.291*	259.234*
R^2		0.619	0.764

Note: * indicates $p<.001$

V. CONCLUSIONS

While earnings management is an extremely pertinent to human greed and the value of human existence is one of the basic concepts of workplace spirituality, therefore, workplace spirituality can enhance the inner ethics and moral standards of humans, so resulting in reduced occurrences of earnings management.

There are many disputes and issues waiting for clarification with regard to the definition and scope of workplace spirituality.

Based on literature review and focus group interviews, this study found that many studies on workplace spirituality ignore the essence and concepts of the workplaces. Therefore, this study adopted the perspectives of a Hierarchical Linear Model, and divided workplace spirituality into two aspects, which are spiritual awakening on the individual level, and organizational spirituality on the organizational level. The empirical analysis results confirmed that spiritual awakening and organizational spirituality are different constructs, and exist at different levels. Further analysis confirmed a negative correlation between workplace spirituality and earnings management. In other words, workplace spirituality can reduce the motivations for earnings management. In addition, the coefficient of spiritual awakening is significantly greater than that of organizational spirituality. This means that the motivations for earnings are more subject to the influence of spiritual awakening, which is consistent with the above-mentioned status of people as the center of economic activities. The empirical study also found that the spiritual awakening of individuals is highly subject to the influence of organizational spirituality, and spiritual awakening is an important intervening factor. This study did not find any similar conclusion from past literature. Undoubtedly, this is an encouraging result, and one of the major theoretic contributions of this paper.

According to results of background variables testing, it is worthy of note that, believers of different religious do not exhibit any significant variances in their perceptions of workplace spirituality. This result is consistent with Mitroff and Denton (1999), Claude and Zamor(2003), and Twigg and Parayitam (2006), that workplace spirituality is not necessarily related to religion.

REFERENCES

- [1] Ayres F (1994). Perceptions of earnings quality: what managers need to know. *Management Accounting*. 75(9): 27-29.
- [2] Becker CL, Defond ML, Jiambalvo J, Subramanyam KR (1998). The effect of audit quality on earning management. *Contemporary Accounting Research*. 15(1): 1-24.
- [3] Bernardi RA (1994). Fraud detection: the effect of client integrity and competence and auditor cognitive style. *A Journal of Practice and Theory*. 13(1): 68-84.
- [4] Brooks LJ (2000). *Business and Professional Ethics for Accountants* (2/e). Cincinnati, OH, South-Western College Publishing.
- [5] Carole LJ, Robert AG (2004). A values framework for measuring the impact of workplace spirituality on organizational performance. *Journal of Business Ethics*. 49(2): 129-138.
- [6] Cavanagh GF (1999). Spirituality for managers: Context and critique. *Journal of Organizational Change Management*. 12(3): 186-200.
- [7] Chung R, Firth M, Kim JB (2002). Institutional monitoring and opportunistic earnings management. *Journal of Corporate Finance*. 8 (1): 29-48.
- [8] Claude J, Zamor G (2003). Workplace spirituality and organizational performance. *Public Administration Review*. 63(3): 355-363.
- [9] Danicls M (1988). The Myth of Self-Actualization. *Journal of Humanistic Psychology*. 28(1): 7-38.
- [10] Dechow P, Skinner D (2000). Earnings management: Reconciling the views of accounting academics, practitioners, and regulators. *Accounting Horizons*. 14(2): 235-250.
- [11] Dehler GE, Welsh MA (1994). Spirituality and organizational transformation, implications for the new management paradigm. *Journal of Managerial Psychology*. 9(6): 1-10.

- [12] DeZoort FT, Lord AT (1994). An investigation of obedience pressure effects on auditors' judgments. *Behavioral research in accounting*. 6: 1-30.
- [13] Donde PA, Dennis D (2000). Spirituality at work: A conceptualization and measure. *Journal of Management Inquiry*. 9(2): 134-146.
- [14] Douglas PC, Wier B (2000). Integrating ethical dimensions into a model of budgetary slack creation. *Journal of Business Ethics*. 28(3): 267-277.
- [15] Ebaugh HR (2002). Return of the sacred: Reintegrating religion in the social sciences. *Journal for the Scientific Study*. 41(3): 385-395.
- [16] Elias RZ (2002). Determinants of earnings management ethics among accountants. *Journal of Business Ethics*. 40 (1): 33-45.
- [17] Elliott A, Lemert C (2006). *The New Individualism: The Emotional Costs of Globalization*. Routledge New York NY.
- [18] English LM, Gillen MA (2000). Introduces a series of articles on the spiritual context of adult education. *New Directions for Adult and Continuing Education* (#85). San Francisco Jossey-Bass.
- [19] Fernando M, Jackson B (2006). The influence of religion-based workplace spirituality on business leaders' decision-making: An inter-faith study. *Journal of Management and Organization*. 12 (1): 23-39.
- [20] Fischer M, Rosenzweig K (1995). Attitudes of students and accounting practitioners concerning the ethical acceptability of earnings management. *Journal of Business Ethics*. 14 (6): 433-444.
- [21] Forster K (2008). *Spiritual Business: Creating a Business Form the Heart* Dogma Publishing.
- [22] Freshman B (1999). An exploratory analysis of definitions and applications of spirituality in the workplace. *Journal of Organizational Change Management*. 12 (4): 318-327.
- [23] Garcia-Zamor JC (2003). Workplace spirituality and organizational performance. *Public Administration Review*. 63(3): 355-363.
- [24] Giacalone RA, Jurkiewicz CL (2003). *Toward a science of workplace spirituality. The Handbook of Workplace Spirituality and Organizational Performance* M.E. Sharpe Armonk New York NY.
- [25] Gillett PR, Uddin N (2002). The effects of moral reasoning and self-monitoring CFO intentions to report fraudulently on financial statements. *Journal of Business Ethics*. 40(1): 15-32.
- [26] Goel AM, Thakor AV (2003). Why Do Firms Smooth Earnings?. *The Journal of Business*. 76(1): 151-192.
- [27] Hansen JV, McDonald JB, Messier WF Jr., Bell TB (1996). A generalized qualitative-response model and the analysis of management fraud. *Management Science*. 42(7): 1022-1032.
- [28] Harrington WJ, Preziosi RC, Gooden DG. (2001). Perceptions of workplace spirituality among professionals and executives. *Employee Responsibilities and Rights Journal*. 13(3): 155-165.
- [29] Healy PM, Wahlen JM (1999). A review of the earnings management literature and its implications for standards setting. *Accounting Horizons*. 13(4): 365-383.
- [30] Jarvis P. (2001). *Learning in Later Life: An Introduction for Educators and Careers*. Kogan Page London.
- [31] Jue RW, Wedemeyer RA (2002). *The Inner Edge: Effective Spirituality in Your Life and Work*. The McGraw-Hill Companies Inc.
- [32] Jurkiewicz CL (2002). The phantom code of ethics and public sector reform. *Journal of Public Affairs and Information*. 6(3): 1-19.
- [33] Jurkiewicz CL, Giacalone RA (2004). A values framework for measuring the impact of workplace spirituality on organizational performance. *Journal of Business Ethics*. 49 (2): 129-135.
- [34] Kale SH, Shrivastava S (2003). The enneagram system for enhancing workplace spirituality. *The Journal of Management Development*. 22(4): 308-328.
- [35] Kaplan SE (2001). Ethically related judgments by observers of earnings management. *Journal of Business Ethics*. 32(4): 285-298.
- [36] Klenke K (2005). Introducing spirituality. *International Journal of Organizational Analysis*. 13(1): 4-8.
- [37] Lightner SM, Adams SJ, Lightner KM (1982). The influence of situational ethical and expectancy theory variables on accountants' underreporting behavior. *Journal of Practice and Theory*. 2(1): 1-12.
- [38] Lord AT, Dezoort FT (2001). The impact of commitment and moral reasoning on auditors' responses to social influence pressure. *Accounting Organizations and Society*. 26(3): 215-235.
- [39] Marschke E (2007). Workplace spirituality: A complete guide for business leaders. *Journal of Applied Management and Entrepreneurship*. 12(2): 108-111.
- [40] Maslow AH (1969). Theory Z. *Journal of Transpersonal Psychology*. 1(2): 31-47.
- [41] Merchant KA, Rockness J (1994). The ethics of managing earnings: an empirical investigation. *Journal of Accounting and Public Policy*. 13(1): 79-95.
- [42] Mitroff II, Denton EA (1999). A study of spirituality in the workplace. *MIT Sloan Management Review*. 40(4): 83-92.
- [43] Moore TW, Casper WJ (2006). An examination of proxy measures of workplace spirituality: A profile model of multidimensional constructs. *Journal of Leadership and Organizational Studies*. 12(4): 109-118.
- [44] Nix W (1997). *Transforming your workplace for Christ*. Broadman and Holdman Publishers Nashville TN.
- [45] Podsakoff PM, Organ DW (1986). Self-reports in organizational research: problems and prospects. *Journal of Management*. 12(4): 531-544.
- [46] Reckers PM, Shultz JJ Jr. (1993). The effects of fraud signals evidence order and group-assisted counsel on independent auditor judgment. *Behavioral Research in Accounting*. 5: 124-144.
- [47] Reed M (1997). In praise of duality and dualism: Rethinking agency and structure in organizational analysis. *Organization Studies*. 18(1): 21-42.
- [48] Robbins SP (2002). *Organizational Behavior*. Prentice-Hall NJ.
- [49] Schmidt O, Theopold U, Strand MR (2000). Innate immunity and evasion by insect parasitoids. *BioEssays*. 23: 344.
- [50] Scott SG, Bruce RA (1994). Determinants of innovation behavior: A path model of individual innovation in the workplace. *Academy of Management Journal*. 37(3): 580-607.
- [51] Scott WR (2006). *Financial Accounting Theory*. Prentice Hall.
- [52] Sheep ML (2004). Nailing down gossamer: A valid measure of the person organization fit of workplace spirituality. Paper presented at the Academy of Management New Orleans.
- [53] Sheep ML (2006). Nurturing the whole person: The ethics of workplace spirituality in a society of organizations. *Journal of Business Ethics*. 66(4): 357-369.
- [54] Summers SL, Sweeney JT (1998). Fraudulently misstated financial statements and insider trading an empirical analysis. *Accounting Review*. 73(1): 131-146.
- [55] Thompson P (1993). Postmodernism: Fatal distraction. in Hassard J. and Parker M (eds.). *Postmodernism and Organizations*. London Sage: 181-203.
- [56] Thompson WD (2000). Can you train people to be spiritual?. *Training and Development*. 54(12): 18-19.
- [57] Turner L (2002). Testimony and statements before the committee on banking housing and urban affairs. United States Senate. Available at: http://banking.senate.gov/02_02hrg/022602/turner.htm.
- [58] Twigg NW, Parayitam S (2006). Spirit at work: spiritual typologies as theory builders. *Journal of Organizational Culture Communication and Conflict*. 10(2): 117-133.
- [59] Valente RL (1995). Addressing domestic violence: The role of the family law practitioner. *Family Law Quarterly*. 29(2): 187-191.

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Studies on Anti Diarrhoeal Activity of Synbiotic Plums Juice

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Abstract- This study evaluated that effect of prebiotic food containing oligosaccharide to enhance the growth and activity of probiotic strains. Plums juice probioticated using different strains of probiotics are *Lactobacillus kefir*, *Candida kefir*, and *saccharomyces boluradii*. To select a suitable prebiotics like inulin for the development of synbiotic plums juice and for food preservation. Synbiotic plums juice tested for antibacterial activity against diarrhoea causing pathogen such as *Escherichia coli*, *Staphylococcus aureus*, *Salmonella paratyphi A*, *Shigella dysenteriae*, *Vibrio cholerae*. Analysis of identified compound from synbiotic plums juice using GC-MS.

Index Terms- Antibacterial activity, GC-MS analysis, Plums, Probiotics, Synbiotics

I. INTRODUCTION

Diarrhoea is a common symptom of intestinal disorders and it is a global threat to human health. It is a leading cause of morbidity and mortality, with over 1000 million episodes and over 4 million deaths annually in children under 5 years of age. Diarrhoeal infection is a second killer disease of children in the developing countries. Diarrhoea caused by *Escherichia coli* is common in India with occasional outbreaks (Kahali et al., 2004). Where as *Escherichia coli* (58.4%) *Salmonella* sp (20%) and *Shigella* sp (20%) were found to be extremely uncommon agents of childhood diarrhea making only 1.6 per cent of the positive culture in Yeman (Banajeh et al., 2001). Synbiotic is a supplement that contains both a prebiotic and a probiotic that work together to improve the friendly flora of the human intestine. Research and development of synbiotic products have been increasingly focusing on evidence of functional benefits including resistance to infection, antibacterial activity, and improved immune status (Gibson and Roberfroid, 1995). A synbiotic product should be considered a functional food rather than some obscure chemistry formulation. In the synbiotic present scenario, food is no longer consumed for satisfaction of hunger alone but for promoting nutrition and health. The concept of functional foods has gained universal acceptance as a preventive and therapeutic approach to combat many disease that decrease the work productivity due to poor health. The objectives of the study were to isolate and identify the beneficial bacteria [probiotics] from fermented milk sample such as yoghurt, kefir, butter, cheese, and koumiss. Effective probiotic organisms identified, and inoculated with plums juice and allowed for fermentation. Administration of prebiotics, the non-digestible

food ingredients that beneficially affect the host by selectively stimulating the growth and /or activity of one or a limited number of bacteria in the column thus improving host health offers an attractive alternative. Among prebiotics, non-digestible carbohydrate like inulin and oligofructose have received much attention. Inulin consists of 2-60 fructose units linked by a β -(2-1) glycosidic linkage often with a terminal glucose unit. Many researches proved that consumption of prebiotics, such as inulin, could stimulate intestinal peristalsis by means of increasing fecal bulk and moisture (Gibson et al., 1995). The keeping above facts in view present investigation was undertaken to evaluate prebiotics strains for their compatibility with plums juice in the presence of inulin for synbiotic fruit juice preparation.

Plums have the natural nutritional components of 0.95 grams protein, 17 calories and 1.4 grams of dietary fiber and it also contain potassium, phosphorus, magnesium, calcium, iron, sodium, zinc, copper, manganese, selenium, vitamin C, niacin, vitamin B1, vitamin B2, vitamin B6, folate, pantothenic acid, vitamin A, K, E, and also contain some other vitamins in small amounts. In addition to that fermented juice with inulin might be a good source of probiotic and also nutritional components even after 2 weeks storage at 4°C so inulin act as food preservative.

II. MATERIALS AND METHODS

A. Preparation of synbiotic plums juice

Plums was purchased from a local market. Juice was prepared from homogenized skin less slices and was filtered it properly and 100ml of plums juice were inoculated with 2ml of MRS broth containing probiotic bacteria and yeast (*Lactobacillus kefir*, *Candida kefir*, and *saccharomyces boluradii*) they were allowed for fermentation (Yoonky et al., 2006) After fermentation juice were separated into two different container. One of that container inulin could be added and it was used for antibacterial analyses.

B. Test organisms

The bacterial test organisms were *Escherichia coli*, *Staphylococcus aureus*, *Salmonella paratyphi A*, *Shigella dysenteriae*, *Vibrio cholerae* were obtained from Microbial Type Culture Collection (MTCC), IMTECH, Chandigarh, India. The organisms were maintained on agar slant and were subsequently subcultured into newly prepared nutrient agar media. All the chemicals and medium used in this study were supplied by Himedia Pvt. Ltd., Mumbai, India.

C. Preparation of Inoculum

Inoculum was prepared by adding one loopful of test pathogen in 50ml of BHI broth and then incubated at 37°C for 24hrs.

D. Isolation and Characterization of Probiotics

Fermented milk samples such as yoghurt, kefir, cheese, and koumiss were collected from market. The milk samples were enriched and inoculated into the MRS broth (Man rogosa sharpe) The enriched samples were incubated under static conditions for a week. Probiotic isolation was carried out by streaking the enriched milk sample on MRS agar media and incubated at 37°C. Isolated bacterial cultures were characterized using colony morphology, bio-chemical test and in selective medium, carbohydrate fermentation (Table 1).

E. Agar well diffusion assay

The antibacterial activity of synbiotic plums juice was evaluated by agar well diffusion method. (Chung et al., 1990) Muller Hinton agar medium was prepared and poured into the petriplates and allowed to solidify. Then it was inoculated with a swab of culture and spread through out the medium uniformly with a sterile cotton swab. Using sterile cork borer (10mm diameter) wells were made in the agar medium. The test compound was introduced into the separate well in a single plate.(fermented juice, fermented juice with inulin) All the plates were incubated at 37°C for 24h. The antagonistic test was performed intriplicate and their efficiency was determined by measuring the diameter of zone of inhibition around the well. In triplicate assay mean value was taken for analysis (Table 2).

F. GC-MS analysis

The volatile constituents from juice was analysed using GC-MS (GC Clarus 500 Perkin Elmer) with Elite-1 column and a mass detector, which was operated in EI mode at 70eV. Injector and detector temperatures were set at 250°C (Al-Delaimy and Ali, 1970). Plums juice (1µl) was injected and analysed with a column held initially at 110°C for 2min and then increased by 5°C per min up to 280°C. Helium was used as carrier gas (1ml/min). The relative amount of individual components of the total juice expressed as percentage peak area relative to total peak area. Quantitative identification of the different constituents was performed by comparison of their relative retention times and mass spectra with those of authentic reference compounds, or by retention indices (RI) and mass spectra.

III. RESULT AND DISCUSSION

As Table 1, shows isolation characteristics of probiotic bacteria and yeast. From these observation all the three strains characterized by morphology, biochemical test, different growth condition of pH, temperature and salt concentrations. Probiotics such as *Lactobacillus kefiranofaciens*, *Candida kefir*, *saccharomyces boluradii* grown well temperature range of 20-30°C at 6.5 salt concentration and mainly characterized by 18

type of carbohydrate fermentation. In some cases week and negative sugar fermentation was observed.

From Table 2 it is very clear that both fermented plums juice and fermented plums juice with inulin showed growth inhibition activities of five diarrhoeal causing test pathogens. Fermented plums juice with inulin shows the higher antibacterial activity than the normal fermented plums juice (Fig 1).

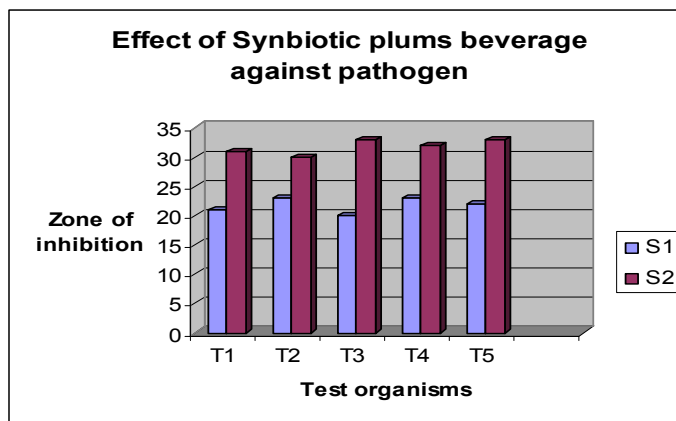


Figure 1: Effect of Synbiotic plums beverage against pathogen

S₁-Juice probicated with organism, S₂-Fermented beverage with Inulin

T1 – *Staphylococcus aureus*
T2 – *E.coli*
T3 – *Salmonella Paratyphi A*
T4 – *Shigella dysenteriae*
T5 – *Vibrio Cholerae*

Similar type of work was to evaluated the influence of prebiotic additives on gluten-free breads, and to assess the effectiveness of selected prebiotics inulin (Grzelak, 2006). Since both fruit juice extract showed unique range of zone of inhibition. To further study the nature of components present in the fruit juice extract GC-MS was performed (Fig 2).

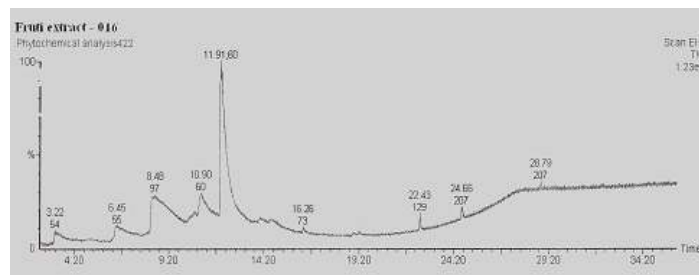


Figure 2: Gas Chromatography Mass Spectrum analysis of fermented plums juice

The major compounds of GC-MS analysis and their retention time were listed in Table 3, these include 1 H-Imidazole, 2,4 dimethyl (2.71%), 4 H-Pyran-4-one, 2,3, dihydro-3,5 dihydroxy-6-methyl (6.02%), 2- furancarboxaldehyde, 5-hydroxymethyl (

34.64%), 1,2,3,5- cyclohexaneterol (55.35%), Hexanedioic acid, bic 20ethylhexyl ester (0.64%), and 1,2- Benzenedicarboxylic acid, dissooctyl ester (0.65%). These observation when correlated with water soluble compounds common in most plant which may be responsible for its antibacterial activity (**Astal, 2004**).

Probiotic approach through plums juice increases residence bacteria which are beneficial to human health. The inhibitory action of probiotic bacteria and yeast is mainly due to accumulation of main primary metabolites such as lactic acid , acetic acid, ethanol and carbondioxide. It is earlier reported as lactic acid bacteria were also able to control the growth of gram

negative pathogens including food borne pathogens by the production of organic acids and hydrogen peroxide (**Lu and Walker, 2001 and Ito et al., 2003**). Similar type of incidence have been reported as Production levels and the proportions among these compounds depend on the strain, medium compounds and physical parametrs (**Tannock, 2004**). The chromato graphic analysis of oils obtained from the juice of fatty acid, palmitic acid, stearic and the unsaturated acids, ollic besides metalinic acids (benzene dicarboxylic acid) fatty oils of fermented plums juice can be used as natural “anti bacterial potential activity” after further studies. It can be concluded that fatty oils of ‘fermented plums juice’ can be used for developing plant derived anti microbial drugs.

Table: 1

Isolation characteristics of Probiotics

Characteristics	<i>Lactobacillus kefiranofaciens</i>	<i>Candida kefir</i>	<i>Saccharomyces boluradii</i>
Cellwall	G+ve	Chitin mannose PPM, PLM	Chitin mannose PPM, PLM
Morphology	Rod	Yeast like pseudohyphae	Pseudohyphae
Motility	NM	-	-
Spore forming	NS		
Selectivemedium	MLR	YMA	SGA
Growth at 15 ⁰ C-20 ⁰ C 20 ⁰ C -30 ⁰ C 30 ⁰ C-40 ⁰ C 40 ⁰ C-50 ⁰ C	+	+	+
pH 3.5 4.5 6.5 8.5	+	+	+
Salt 6.5 10%	+	+	+

Carbohydrate fermentation			
Arabinose	+	+	+
Cellobiose	+	+	W
Esuculin		+	-
Fructose	+	+	+
Galactose	+	+	-
Gluconic acid	+	-	+
Lactulose	+	+	+
Maltose	+	-	+
Mannitol	+	-	+
Mannose	+	-	+
Melibiose	+	+	+
Raffinose	-	-	+
Rhamnose	-	-	+
Ribose	+	-	+
Salicin	+	-	+
Sorbitol	+	-	-
Sucrose	+	-	+
Xylose	-	-	+

(++) - Luxurious growth
(+) - Growth
(W) - Weak Growth
(-) - No growth

PPM – Phosphopetidomannan
PLM – Phospholipomannan
MLR – Modified Lactobacillus Agar medium
TJA – Tomato Juice Agar medium
LBB – Lacto bacillus bulgaricus agar medium
YMA – Yeast morphology agar medium
SGA – Sabrouds glucose medium
NM – Nonmotile
NS - Nospore

Table – 2
Antibacterial activity of Plums juice

Pathogens	S₁	S₂
<i>Staphylococcus aureus</i>	+	++
<i>Escheriacoli</i>	+	++
<i>Salmonella paratyphi A</i>	+	++
<i>Shigella dysenteriae</i>	+	++
<i>Vibriocho lerae</i>	+	++

S₁ - Juice probicated with organism
S₂ - Fermented beverage with Inulin

Table – 3

Major compounds identified from the fermented Plums juice

No.	Retention time (min)	Name of the Compound	Pear Area %
1	3.22	1H – Imidazole, 2,4 dimethyl	2.71
2	6.45	4H – Pyran-4-one, 2,3,dihydro-3.5-dihydroxy-6-methyl-	6.02
3	8.48	2-Furancarboxaldehyde, 5-(hydroxymethyl)-	34.64
4	11.91	1,2,3,5-Cyclohexanetetrol	55.35
5	22.43	Hexanedioic acid, bic (20ethylhexyl) ester	0.64
6	24.66	1,2 – Benzenedicarboxylic acid, diisooctyl ester	0.65

REFERENCES

- [1] Al-Delaimy, K.S. and Ali, S.H. 1970. Antimicrobial action of vegetable extracts on the growth of pathogenic bacteria. *Journal of the science of Food and Agriculture*. 21:110-112.
- [2] Astal, Z.E. 2004. The inhibitory action of aqueous garlic extract on the growth of certain pathogenic bacteria. *Eur. Food Res Technol*. 218:460-464.
- [3] Banajeh, S.M., Ba-Oum, N.H. and Al – Sanabani, R.M, 2001. Bacteria aetiology and anti-microbial resistance of childhood diarrhea in Yemen. *J. Trop. Pediatr*, 47:301-303.
- [4] Chung, K.T., Thomarson, W.R. and Wu Tuan, C.D. 1990. Growth inhibition of selected food borne bacterial *particularia listeria* monocytogens by plant extracts. *J.Appl. Bacteriology*. 69:498-509
- [5] Gibson, G.R., Beatty, E.R., Wang, X., Cummings, J.H. 1995. Selective stimulation of *bifidobacteria* in the human colon by oligofructose and inulin. *Gastroenterology*. 108:975-982.
- [6] Gibson, G.R., Roberfroidl, M.B. 1995. Dietary modulation of the human colonic microbiota: introducing the concept of prebiotics. *J.Nutr*. 125:1401-1412.
- [7] Grzelak, K., Achremowicz, K., Sabat, R. 2006. Influence of prebiotic additions on the quality of Gluten-free bread and on the content of inulin and Fructooligosaccharides. *Food Science and Technology International*. 12(6):489-495.
- [8] Ito, S., Sato, H.; Kudo, S., Sato, H., Nakajima and Toba, T. 2003. The screening of hydrogen peroxide producing lactic acid bacteria and their application to inactivating Psychrotrophic food borne pathogens. *Curr. Microbiology*. 47:231-236
- [9] Kahali, S., Salkar, B., Rajendran, K., Khanan, J., Yamasaki, S., Nandy, R.K., Bhattacharya, S.K. and Ramamurthy, T. 2004. Virulence characteristics and molecular Epidemiology of enteroaggressive *Escherichia coli* isolated from hospitalized diarrhoeal patients in kolkata. *Ind. J. Clinl. Microbiol*. 42:4111-4120.
- [10] Lu, I. and Walker, W.A. 2001. Pathologic and physiologic interaction of bacteria with the gastrointestinal epithelium. *AMJ. Clin. Nutr*, 73:11245-11305
- [11] Tannock, G.W., Munro, K., Harmsen, H.J., Welling, G.W., Smart, J., Gopal, P.K. 2000. Analysis of the fecal microflora of human subjects consuming a probiotic product containing *Lactobacillus rhamnosus* DR20. *Appl. Environ. Microbiol*. 66:2578-2588.
- [12] Yoon ky, Woolams, E., Hang, Y.D. 2006. Production of probiotic plums juice by lactic acid bacteria. *J. biortech*, 97 (12): 1427-30
- [13] Yoon ky, Woodams, E., Hang, Y.D. 2004. Probiotication of tomato juice by lactic acid bacteria *J. Microbiol*, 4: 315-18

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Occupational Health Hazards & Efficacy of Protective Masks in Threshing Operation

Sudesh Gandhi, M. Dilbaghi, M. Mehta, Neelam Pruthi

Abstract- The study was conducted on 20 farm workers to identify the occupational health hazards in threshing operation. Four different protective masks were given and tested on various parameters. Respondents reported respiratory health problems which were mainly due to heat and organic dust in the surroundings. All respondents reported irritation in eyes and throat followed by nose (85.0%) and ears (75.0%). Musculo-skeletal problems were reported showing severe to very severe discomfort in lower arms (m.s.=3.8), upper back (3.6) and upper arms (3.4). Overall discomfort score (ODS) was 7.6 depicting high level of discomfort. Peak expiratory flow rate was reduced by 6.6 % depicting reduced capacity of lungs after day long work in polluted environment. Hood mask was highly acceptable as it showed lowest breathing resistance. Leakage of dust from sides and rate of sweating was medium. Hence, use of hood mask would be helpful to achieve the ergonomics objective of reducing health problems and improving performance.

Index Terms- peak flow rate, respiratory problems, breathing resistance, overall discomfort score

I. INTRODUCTION

Wheat being a major staple crop is grown in most part of India. Harvesting of wheat is commonly done in the month of March-April. After cutting crop, farmers hire the thresher and work continuously day and night to complete the threshing process. Agriculture, being a family occupation, most of the family members including women, are involved in performing this activity.

In harvesting season, farmers are exposed to high levels of organic dust during threshing of crops leading to many health hazards. Grain dust inhalation may induce respiratory diseases including chronic bronchitis, granulomatous pneumonitis and toxic pneumonitis which finally may lead to decreased lung function [1 -2]. With combine harvester, situation goes even much worse. As volume of dust generated is so high that even people living in nearby area are affected and breathing problem cases increase during the harvesting season. Studies reveal that respiratory diseases due to organic dust, dust mites, molds and other organic antigens, are also common in the developing countries during these kinds of activities that cause chronic health hazards to the workers.

No doubt farmers have been using indigenous techniques to protect themselves during threshing operation i.e. covering their face and head by using a cloth but its efficacy is very limited. Along with breathing problems, people working in such environment without well-protected clothing may lead to physical fatigue resulting in the reduction of work. Hence, protection from dust is very essential as it would reduce

microbial exposure. In light of the above, different types of masks were designed and tested to alleviate the farmers from exposure to dust with the objectives: i) Studying the occupational health hazards in threshing activity ii) testing the efficacy of protective masks against health hazards.

II. METHODOLOGY

The present study was carried out on 20 farm workers including men (10) and women (10) doing wheat threshing in the month of March-April, 2010. The experiment was conducted for one hour and their observations were recorded. Experiment was conducted in two phases -

Phase I- Occupational health hazards & preventive measures

Under phase 1, data were collected on occupational health hazards of threshing operations studying their health problems, musculo-skeletal discomfort and overall discomfort score. Health problems of various body parts were recorded using observation sheet on 3 point continuum ranging from never (1) to mostly (3). Musculo- skeletal discomfort were studied using human body map to identify incidences of problems in different parts of the body [3] on a five point scale ranging from very severe pain (5) to very mild pain (1). For the assessment of overall discomfort rating, a psycho-physical rating scale at 10 point continuum, 0 being the lowest point showing no discomfort and 10 being the uppermost point showing extreme discomfort was used [3]. Various indigenous techniques adopted by rural people as precautions to protect themselves during threshing process were studied recording frequency of use on 3 point continuum i.e. always, sometimes and never.

Phase II- Efficacy testing of protective masks

Under phase II, four types of face masks viz beak-mask, face mask, hood mask and scarf mask developed by Dept. of Textile and Apparel Designing, CCS HAU, Hisar were tested for its efficacy on three point continuum of performance viz. low (1), medium (2) and high (3).

These masks were used to protect the inhalation of organic dust as well as exposure of various body parts i.e. head, face, ears and neck. Various statements were prepared to test the suitability performance in terms of breathing resistance, dust filtration performance, leakage of air from sides, feeling of tightness on face, rate of sweating and acceptability on three point continuum scale. These were given ranks on the basis of scores. Peak flow meter was used to measure the peak expiratory flow rate of the worker before and after the work.

Different Masks

	Face mask
	Beak Mask
	Hood Mask
	Scarf Mask

III. RESULTS AND DISCUSSIONS

A. Occupational health hazards and preventive measure

Occupational health hazards during threshing revealed that health problems during threshing were mainly due to heat and dust (Table 1). This shows that mostly they suffered with irritation in eyes, throat, nose and ears affecting their respiratory tract. It was almost difficult to stand there for collecting data during the experiment.

Moreover, while working the temperature was 43.8 C that was making work environment more uncomfortable so heat stroke was also observed as hazards for many. So, this worsened the situation & caused headache to majority of the respondents. Cuts and abrasions were also observed due to pricking of dry straws while collecting and lifting the crop bundles for feeding into chute of the thresher. Cent percent respondents reported irritation in eyes and throat followed by nose (85.0%) and ears (75.0%). Respondents reported these problems as common & occurring mostly to the respondents during threshing. Half of the respondents reported headache mostly followed by sometimes (30.0%). Occurrence of breathing problem was sometimes (40.0%). Problems which were occurring sometimes were heat stroke (45.0%), cuts and abrasion (45.0%), sun burn (40.0%), hearing problems (25.0) and nausea (20.0%). Problems occurring mostly during threshing process were irritation in eyes, throat, nose and ear.

Table1. Health problems while wheat threshing

Problems	Mostly	Some times	Never	Mean score
Eyes Irritation	20(100.0)	-		3
Nose Irritation	17(85.0)	3(15.0)		2.9

Throat Irritation	20(100.0)	-		3
Irritation in ear	15(75.0)	4(20.0)	1(5.0)	2.7
Headache	10(50.0)	6(30.0)	1(20.0)	2.2
Breathing problem	2(10.0)	8(40.0)	10(50.0)	1.5
Coughing	-	3(15.0)	17(85.0)	1.2
Nausea	-	4(20.0)	16(80.0)	1.2
Hearing difficulty	-	5(25.0)	15(75.0)	1.3
Sunburns	2(10.0)	8(40.0)	10(50.0)	1.6
Heat stroke	4(20.0)	9(45.0)	7(35.0)	1.9
Cuts/Abrasion	-	9(45.0)	11(55.0)	1.5
Skin allergies	3(15.0)	3(15.0)	14(70.0)	1.5

B. Musculo-skeletal discomfort

Body discomfort in different parts depicted that during threshing severe to very severe discomfort was in wrists, ankle/feet (4.7 each), hands (4.6) and shoulders (4.5). Moderate to severe discomfort was reported in lower arms (3.8), upper back (3.6) upper arms (3.4) and legs (3.4)(Fig 1). This was mainly due to the women were lifting and fetching the wheat bundles for collecting near the thresher site. They were handling over to the men standing near the feeding chute of the thresher. As they were lifting and fetching 12 bundles weighing about 22 kg/each bundle during the experiment. While doing this activity, they adopted unnatural body postures comprising bending, lifting weight with shoulders and arms stretching upwards for holding bundle as head load & releasing it by throwing this head load at the collection site of thresher. During the process, she puts strain on her wrists, ankles, feet, shoulders, arms, upper back & neck leading to various musculo-skeletal discomforts.

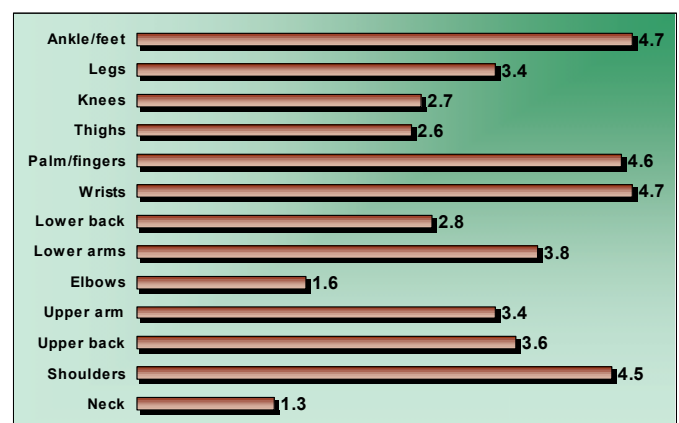


Figure 1: Musculo-skeletal discomfort during threshing activity

C. Overall discomfort score

Results reveal that overall discomfort score on 10 point scale was 7.6 for threshing activity interpreting that respondents felt this activity as very heavy activity & they reported quite high level of discomfort during the activity.

D. Prevention measures

The preventive measures taken during threshing operations in table 2 reveal that majority of the respondents (90.0%) covered their nose and mouth always by tying a piece of cloth during activity to protect themselves from the organic dust entering in their respiratory track. Majority of the respondents used to wear full sleeved clothing (85%) followed by drinking plenty of water (80%) while only 5 percent respondents used eye glasses sometimes to protect their eyes. Preventive measures were taken to protect themselves partially from dust and dirt but not the other health hazards.

Table 2 Preventive measures taken while threshing operation

Measures taken	Always	Sometimes	Never
Cover head	10(50.0)	8(40.0)	2(10.0)
Cover neck		6(30.0)	14(70.0)
Cover nose and mouth	18(90.0)	2(10.0)	
Use full sleeved clothing	17(85.0)	3(15.0)	

E. Peak expiratory flow rate (PEFR)

Peak expiratory flow rate before the activity was 241 L/min which reduced to 225 L/min after the activity. There was reduction of 16 L/min in peak expiratory flow rate after day long activity. Percentage reduction in peak flow meter reading was 6.6% depicting reduced capacity of lungs after day long working in dust and sun.

F. Efficacy testing of dust protectors

Four different masks viz., beak mask, face mask, hood mask and scarf mask were given to rural women and were tested on various parameters.

Table 3. Performance testing of dust protectors(mean score)

	Beak mask	Face mask	Hood mask	Scarf mask
Breathing resistance	1.1	1.2	1.2	1.0
Dust filtration performance	1.4	1.6	1.2	2.1
Comfortable during	1.5	1.2	2.4	2.2

wear				
Rate of Sweating	2.0	1.8	1.8	1.6
Acceptability	2.2	2.3	2.8	2.4

Table 3 reveals that breathing resistance was low (1-1.2) among the four mask interpreting that they could breathe easily in all the masks. Dust filtration was low in all the masks. It may be due to reason that masks were made of single layer of cloth which was not able to filter the air. Regarding feeling of tightness on face, beak mask and face mask were fine whereas hood mask and scarf mask were lights. Rate of sweating was medium (1.6 to 2.0) in all the masks. Regarding acceptability, beak mask face mask and scarf mask were medium acceptable whereas hood mask was highly acceptable. Regarding ranks hood mask scored 1st rank followed by beak mask (2nd), face mask (3rd) and beak mask (4th).

Acceptability—Rank as per preference and acceptability

Type of mask	Rank
Beak-mask	4 th
Face mask	3 rd
Hood mask	1 st
Scarf mask	2 nd

REFERENCES

- [1] Melbostad, E., Eduard, W., & Magnus, P. (1997). Chronic bronchitis in farmers. Scand J Work Environ Health, 23, 271–80.
- [2] Swan, J.R.M., & Crook, B. (1998). Airborne microorganisms associated with grain handling. Ann Agric Environ Med, 5, 7–15.
- [3] Corlette, E.N. and Bishop, R.P. 1976. 'A technique for assessing postural discomfort, Ergonomics 19(2): 175-180

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Software Support for Xml Schema Design Patterns and Pattern Matching of Xml Schemas

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Abstract- In current era, XML schema design patterns are used in vast extent to exchange data and to employ the modules for reusability. XML as in plain text format can be transmitted between different applications with different platforms, operating systems and browsers. Design patterns play important role in reusability of already existing solutions. The different XML schema design patterns namely GOF, abstract factory, template, singleton, MVP, MVC are used in varied applications. Softwares like Rational Rose support the design patterns in UML models which in turn can be converted to XML schemas. Rational Rose also supports comparison of two schemas. Softwares like NetBeans IDE and .NET also support XML schema design patterns. This paper focuses on conversion of XML schema design pattern into java code, so that a string can be used from client interface to pattern match the XML schema in servers. This reduces the whole XML schema or UML class diagram to be transmitted from client. XML schema can be converted into java code with help of EMF Framework and other aided plug ins which help in easy searching of existing design patterns for reuse.

Index Terms- XML schema design patterns, UML diagrams, EMF model, regular expression, GoF pattern

I. INTRODUCTION

In many real world applications today, XML becomes as the tool for sharing and transporting data between different applications. XML data is in plain text format which makes it easier to get upgraded in different operating systems, applications and browsers.

Even a simple java code can be able to read external XML file and process it. XML files can be converted into java code with the help of frameworks .Java is also platform independent which helps easy sharing of data between applications. In this paper, XML schema matching using different tools is discussed. Also the pattern matching using java classes and methods is discussed and a comparison of the best approach is accomplished. Data can be exchanged between incompatible machines over the internet easily with the help of XML.

II. LITERATURE SURVEY

The growing need for exchange of data between different applications over the internet creates a greater need for easy and comfortable format for transfer of data. Design patterns play important role in reusability of the already developed software. Combining the above two issues results in XML schema design

patterns which are now implemented in most of the software platforms aiding in easy storage and transport of data.

In this paper fast and easy means of identifying and mapping the already existing XML schema design patterns is implemented. The already existing papers discusses on matching two xml schemas and the algorithms that exist for matching and comparing the schemas [2]. XML schema matching algorithms also exist which aid in pattern matching. In this paper matching of a regular expression pattern against XML schema is considered. By this approach the burden of clients to construct UML class diagrams which in turn to be converted to XML schema and transmission of whole schema is avoided. Instead only a string for example mentioning a main class like library for library management reusable pattern can be used which can be matched against the java code generated from corresponding XML schemas.

In java various pattern matching classes and methods are available which helps in easy and fast matching of patterns. Today various ADDONS and Plug ins are also coming up. In this paper various softwares in use are analyzed and the approach for easy comparison is also discussed.

Various GoF patterns are used and aid the developer in reusability of many software components. The best XML schema design pattern is chosen so that schema understanding and matching is easier.

In this paper the convenient means of matching a regular expression pattern given by a client to be matched against java code generated from xml schema design pattern is suggested.

A. Rational Rose UML to XML Schema design pattern generation and reverse engineering.

Rational rose supports generation of UML diagrams in which patterns can be inserted using stereo types which can be converted into corresponding XML schemas. Rose also supports reverse engineering that is generating class diagrams from XML schemas. The example of reverse engineering done is shown in the Fig.1 and XML schema below.

```
<!-- DTD for novel -->
<! ELEMENT novel. log
(preface,chapter+,biography?,criticalessa y*)>
<! ELEMENT preface (paragraph+)> <! ELEMENT chapter
(title, paragraph+, section+)>
<! ELEMENT section (title, paragraph+)>
<! ELEMENT biography (title, paragraph+)>
```

```
<! ELEMENT critical essay (title,
section+)>
<! ELEMENT paragraph
```

The screenshot shows the Rational Rose UML tool interface. The 'Project Explorer' on the left shows a project named 'UML' containing a package 'UML' and a class 'UML'. The 'Diagram Explorer' on the right shows a diagram named 'UML' with a single class 'UML'. The 'Diagram' area in the center displays a UML class diagram with a single class 'UML' and its attributes: 'name: String', 'age: Integer', 'gender: String', and 'email: String'. The 'Properties' pane on the right shows the 'UML' class selected, with its 'Name' property set to 'UML'.

[illegible]

The diagram illustrates the MVC pattern with the following components and interactions:

- USER INTERACTION:** Indicated by a double-lined arrow pointing down to the **VIEW**.
- VIEW:** The component that receives user input and displays the application state.
- CONTROLLER:** The component that manages the application logic and updates the view.
- MODEL:** The component that represents the application data.
- Interactions:**
 - A solid arrow points from the **VIEW** to the **CONTROLLER**, labeled **PASSES CALLS TO**.
 - A dashed arrow points from the **VIEW** to the **MODEL**, labeled **FIRES EVENTS**.
 - A large curved arrow points from the **CONTROLLER** back to the **VIEW**, labeled **MANIPULATES**.

B. NetBeans Enterprise Pack XML schema design pattern

The XML tools in NetBeans Enterprise Pack can be used for creating xml schema design patterns and also aids in switching from one design pattern to another design pattern.[5]

Design patterns can be applied to xml schemas by selecting the corresponding xml schema .xsd file.

```

graph TD
    UI[USER INTERACTION] --> V[VIEW]
    V -- "UPDATES" --> P[PRESENTER]
    P -- "PASSES CALLS TO" --> V
    P -- "MANIPULATES" --> M[MODEL]
    M -.-> |"FIRES EVENTS"| P
    style M stroke-dasharray: 5 5
  
```

The diagram illustrates the MVC pattern with the following components and interactions:

- USER INTERACTION**: An external input that triggers the **VIEW**.
- VIEW**: The user interface component that receives user input and sends **UPDATES** to the **PRESENTER**.
- PRESENTER**: The control component that **PASSES CALLS TO** the **VIEW** and **MANIPULATES** the **MODEL**.
- MODEL**: The data component that **FIRES EVENTS** back to the **PRESENTER** (indicated by a dashed arrow).

Design patterns improve reusability of business logic by separating the three components required to generate and manage a specific user interface (such as a single Web page). The Model contains the data that the View (the Web page) will display and allow the user to manipulate. The Controller or Presenter links the Model and the View, and manages all interaction and processing of the data in the Model [4].

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testability, as all the logic and processing occurs within the Presenter, but it does add some complexity to the implementation because updates must pass from the Presenter to the View [4]. The other design patterns supported by .NET are The Service Agent, Proxy, Broker Patterns, The Repository Pattern, The Singleton Pattern etc.,

III. XML SCHEMA DESIGN PATTERN CHOOSING

Russian doll, Venetian blind, Salami, Garden of Eden is some of the XML schema design patterns available. Venetian blind is considered best because the name complexity is highly reduced because there is only single root element, one global element and all local elements defined inside the global namespace. This also favours the easy matching of schemas [3].

Venetian Blind

Example: <xsd:schema>

```
<xsd: simpleType name="Husband"> <xsd: restriction
base="xsd: string"> <xsd: minLength value="1"/> </xsd:
restriction>
```

```
</xsd: simpleType> <xsd:simpleType name="Wife">
<xsd:restriction base="xsd:string"> <xsd: minLength
value="1"/> </xsd: restriction>
```

```
</xsd: simpleType>
```

```
<xsd: element name="Couple">
```

```
<xsd:complexType>
```

```
<xsd:sequence>
```

```
<xsd: element name="Husband"
```

```
type="Husband"/>
```

```
<xsd: element name="Wife"
```

```
type="Wife"/>
```

```
</xsd: sequence>
```

```
</xsd: complexType>
```

```
</xsd:element>
```

```
</xsd: schema>
```

Other patterns like garden of eden, salami slice, Russian doll can also be used depending on the application which have their own advantages and disadvantages.

Design patterns like Russian Doll and Garden of Eden can be selected depending on the requirements like single global element or multiple global elements.

Venetian slice and Garden of Eden are considered as best as they support multiple global elements which will be useful when pattern matching in xml schemas are considered

IV. TOOLS THAT SUPPORT XML SCHEMA MATCHING

Many tools are available today for XML schema comparison. Some of them are AltovaXMLspy, Difflog, ExamXML, Eclipse hyper model etc., The result generated by comparing two xml files using Exam XML is shown below[9].

V. GENERATING AN EMF MODEL USING XML SCHEMA

ECORE model can be generated from xml schema stored anywhere in the workstation using EMF Framework. The xml schema can also be loaded from a rose class model [8].

There are two ways to generate an ecore model [8]

- From XSD to ecore
- Creating ecore models from mdl files

A. Java code can be generated from the Ecore model .

EMF generates Java files. In java java.util.regex package supports regular expression processing. A regular expression is a string of characters that describes a character sequence. This general description called a pattern can then be used to find matches in other character sequences. Regular expressions can specify a regular expression that represents a general form that can match several different specific character sequences [1].

There are two classes that support regular expression processing. Pattern and matcher. Pattern is used to define a regular expression. Match the pattern against another sequence using matcher. So in java finding the matching patterns is easy as instead to compare two xml schemas in case of rational rose and other softwares used to compare XML schema design patterns.

Java is also platform independent. So it is easy to use than other softwares. Also EMF supports both importing UML and converting to EMF model and then to java file. Also any XML schema can be imported and converted to EMF.

Few example sample code in java for Pattern matching is shown below

Simple example for Pattern Matching in Java

```
Import java.util.Regex.* Class Regex {
Public static void main (String args[])
```

```
{
```

```
Pattern pat; Matcher mat; Boolean found;
```

```
pat=pattern. compile ("library"); mat=pat. matcher ("library");
found=mat. matches (); System.out.println ("The matching
pattern in this sentence is library");
```

```
if (found)
```

```
System.out.println ("MATCHES"); Else
```

```
System.out.println ("NO MATCHES");
```

```
}
```

```
}
```

Applying regular expressions on the contents of a file

```
import java.util.regex.*; import java.io.*; import java.nio.*;
```

```
import java.nio.charset.*; import java.nio.channels.*;
```

```
public class CharBufferExample { public static void
main(String[] args)
```

```
throws Exception {
```

```
// Create a pattern to match comments
```

```
Pattern p = Pattern.compile ("/*.*$",
```

```
Pattern.MULTILINE);
```

```
// Get a Channel for the source file File f = new File(" LIBRARY
MANAGEMENT.java");_FileInputStream fis = new
```

```
FileInputStream (f);
```

```
FileChannel fc = fis.getChannel ();
```

```
// Get a CharBuffer from the source
```

```
file
```

```
ByteBuffer bb =
```

```
fc.map (FileChannel.MAP_RO, 0, (int) fc.size ());
```

```
Charset cs = Charset.forName ("8859_1");
```

```
CharsetDecoder cd = cs.newDecoder ();
```

```
CharBuffer cb = cd.decode (bb); // Run some matches
```

```
Matcher m = p.matcher (cb); while (m.find ())
```

```
System.out.println ("Found comment: "+m.group ());
```

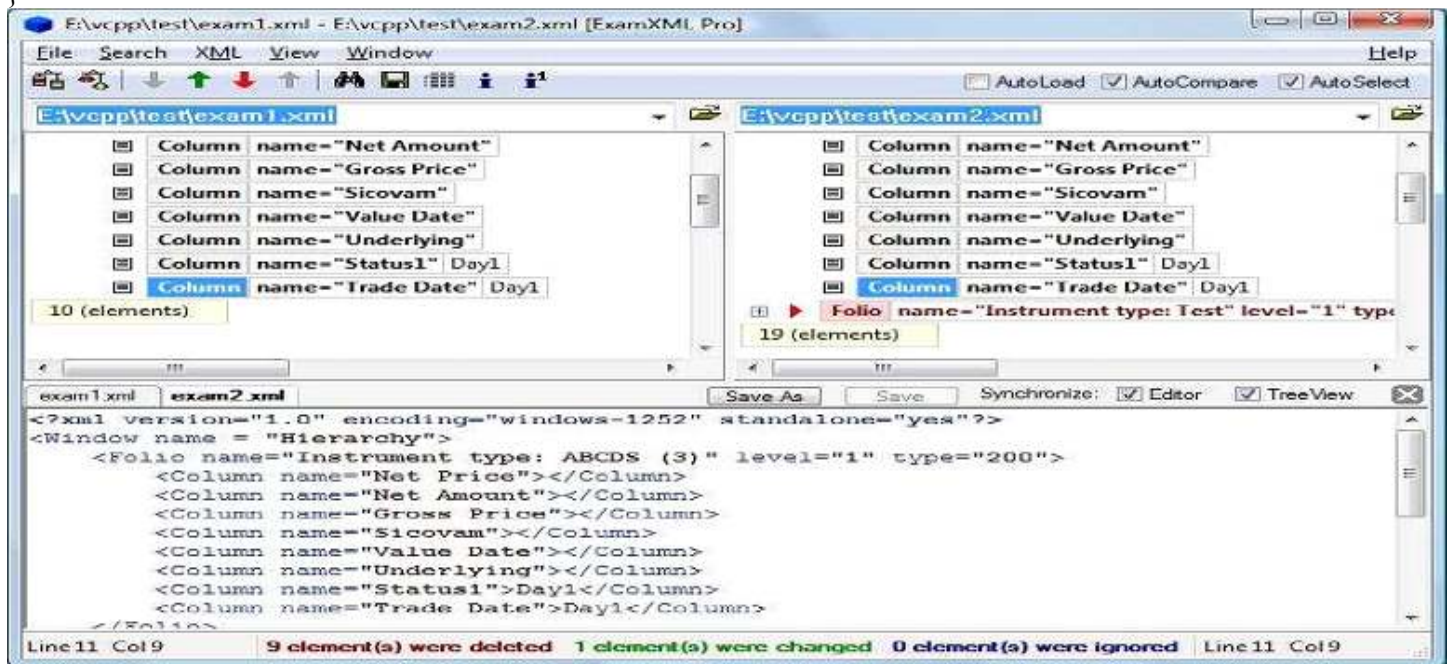


Fig. 5 XML file comparison using EXAMXML

VI. GENERATING AN EMF MODEL USING XML SCHEMA

A. XML Schema Size Vs Efficiency

As the size of the XML schema design pattern increases in size the efficiency is low as the time taken for comparison is ultimately more. If the number of lines of comparison is more it takes more time to compare, even the schema with which it is compared is of less size. But if a single string is used to match a pattern using regular expression classes and methods in java for example pattern and matcher classes the time taken for comparison is very less.

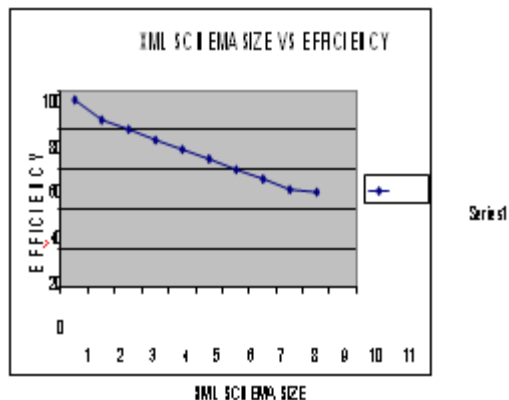


Fig.6 XML schema size vs. Efficiency

B. Time Taken For Comparison Vs Efficiency

Time taken for comparison and efficiency are inversely proportional. If the size of XML schema to be transmitted increases bandwidth increases, time taken for transmission over the network increases, time taken for comparison increases

, thus increasing the total time taken and ultimately efficiency is reduced.

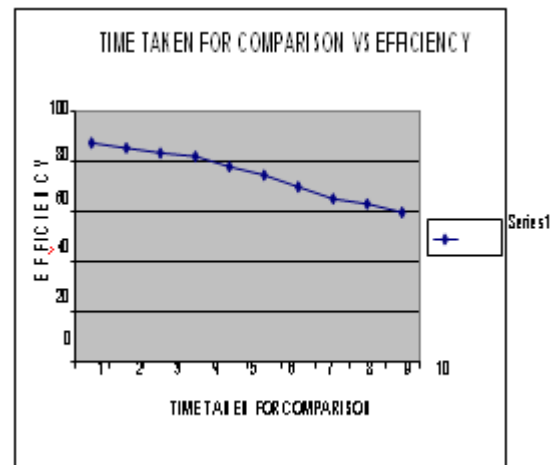


Fig.7 Time Taken for Comparison vs Efficiency

VII. CONCLUSION

Thus pattern matching using a string when the XML Schema or UML model is converted to java code is very simple and consumes less bandwidth memory space and time for comparison as compared to matching two xml schemas. So it is necessary whenever the MVC OR MVP type of models or applications implementing XML schema design patterns are being developed, all the mentioned issues have to be considered. XML schema design patterns or when the patterns are generated from any

UML models like Rational Rose there is facility for converting into java code with the help of EMF like frameworks and other ADDONS and plug-inns. Thus this paper discusses various issues regarding XML schema design patterns that aid in easy transport of data and reusability in many applications.

REFERENCES

- [1] Herbert Schildt, Java The Complete Reference 7th Edition McGraw-Hill Osborne Media; 7 edition.
- [2] A new algorithm for mapping XML Schema to XML schema <http://ieeexplore.ieee.org>
- [3] A novel method for measuring Semantic similarity for XML Schema matching Available online: www.sciencedirect.com
- [4] W3C XML Schema Design Patterns: msdn.microsoft.com/en-us/library/aa468564.aspx
- [5] ASP.NET Patterns every developer Should know <http://www.developerfusion.com/>
- [6] XML Support in NetBeans IDE <http://xml.netbeans.org/>
- [7] Eclipse Modeling Framework (EMF)–Tutorial. <http://www.vogella.de/>
- [8] Innovative XML solutions <http://www.a7soft.com>
- [9] Generating an EMF Model using XML Schema (XSD) <http://help.eclipse.org/>
- [10] Metamodeling with EMF: Generating concrete, reusable java Snippets <http://www.ibm.com>

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A Study on the Effect of Radio Frequency Emitted By Mobile Phones on Human Body

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Abstract- With the multiple functions the cell phones have captured great importance in the life of modern man but the latest studies say that we are carrying a silent killer with us. The present paper deals with the functioning of Mobiles and its ill effects of the prolonged usage and the studies related to them. In contrast it also highlights how essential the cell phones are in the present world. Though the majority of industry funded studies prove that usage of cell phones on a long run do not cause permanent damages to our body, but still some studies conclude that it indeed increases the risk of getting cancer. Some non-peer, reviewed, meta-studies showed that there was a link between mobile users and brain tumors. Some other independent studies stated that mobile users are not only prone to tumors but are likely to face other problems like salivary gland tumors, increased heart rate during calls. . Through this paper we wanted to bring awareness among the users of mobiles about these effects.

Index Terms- . effect of mobile phone, disease mobile phone radio frequency,, Radio frequency (RF), Electro- magnetic Radiation, Malignant (Cancerous cells), Gliomas, Benign, Meningiomas, Genotoxic, Phenotypic, Magnetic field, Leukaemia, Carcinogenic, Astrocytoma

I. INTRODUCTION

Man's one of the most amazing invention of this electronic age is the mobile phones. The present situation is that life without a mobile phone is impossible to even imagine as it has become part of human body. This tiny gadget which is always attached to you has become an inevitable device of human life. Not only grownups but also the children have become very much used to it for its multiple functions. It is also considered as tiny piece of entertainment. With a mobile in our hand, we think we have the whole world shrunk into our hands. But the fact is that we are carrying world of miseries with this gadget as it is recently proved that a mobile is a silent human longevity sucker but man has got addicted to this device in such a way that our brain is forced to be defunct without it.

The cell phone usage in India and the world over has reached new heights. Lately the scientists from all over the world are trying to throw some light on the potentially damaging effects of prolonged mobile usage and want to bring awareness among the mobile users.

II. OBJECTIVES AND AIMS

It's the foremost preliminary step for proceeding with any research work writing. While doing this go through a complete

It is proved that the radio frequency (RF) which is a kind of electro-magnetic radiation has ill effects on the human body. The same radio frequency is emitted from the cell phones and cordless phones but with lower frequency. There are two thought groups with totally different views about the effects of prolonged usage of mobiles. Considering all varied views through this paper we are going to present all views about the effects of mobiles on the human body and its impact on the environment as well. Cell phones and cancer are in the news all the time now it seems. But almost everyone uses cell phones. All over the world, tens of millions of people are pressing them against their heads for hours every day. In the U.S. it is estimated that there were at least 100 million cell phone users, as of early 2002, and that number has continued to climb.

III. STUDIES, FACTS AND EVIDENCES

A. What is the radiation produced by a cell phone?

Like televisions, alarm systems, computers, and all other electrical devices, Cell phones (also called mobile phones) are radio devices that use Radiofrequency (Rf) energy emit electromagnetic radiation. They operate at low power (less than 1 watt) by transmitting and receiving electromagnetic radiation in the radiofrequency (RF) end of the spectrum. Radiation which is called "ionizing" can be absorbed by tissue and break molecules apart, such as gamma rays and x-rays, are known to cause cancer. The concern is that the cell phone and it's antenna (the source of the radiation) are held close against the head can damage the DNA molecules is thought to be the cause. The radiation that a cell phone uses is also part of the same electromagnetic spectrum, but is not ionizing. For this reason, the US FDA can regulate these devices to ensure that the radiation doesn't pose a health hazard to users, but only once the existence of a public health hazard has been established. RF energy was mistakenly thought to similarly cause cancer.

There are three main reasons why people are concerned that cell phones (also known as "wireless" or "mobile" telephones) may cause certain types of cancer or other health problems:

- 1) Cell phones emit radiofrequency (RF) energy (radio waves), which is a form of radiation that has been under study for many years for its effects on the human body (1).
- 2) Cell phone use began in Europe in the 1980s but did not come into widespread use in the United States until the 1990s. The technology is constantly evolving. The recent Interphone study is one of the few large studies

of the effects of RF energy from cell phones on the human body.

- 3) The number of cell phone users has increased rapidly. As of 2009, there were more than 285 million subscribers to cell phone service in the United States, according to the Cellular Telecommunications and Internet Association. This is an increase from 110 million users in 2000 and 208 million users in 2005.

For these reasons, it is important to learn whether RF energy from cell phones affects human health. RF is a type of Electro Magnetic radiation.

IV Types of Electro Magnetic radiation

Electromagnetic radiation can be divided into two types: Ionizing (high-frequency) and non-ionizing (low-frequency). RF energy is a type of non-ionizing electromagnetic radiation. Ionizing Radiation, such as that produced by x-ray machines, can pose a cancer risk. There is currently no conclusive evidence that non-ionizing radiation emitted by cell phones is associated with cancer risk.

Studies suggest that the amount of RF energy produced by cell phones is too low to cause significant tissue heating or an increase in body temperature. However, more research is needed to determine what effects, if any, low-level non-ionizing RF energy has on the body and whether it poses a health danger.

V How does a cell phone emit RF?

A cell phone's main source of RF energy is produced through its antenna. The antenna of newer hand-held cell phones is in the handset, which is typically held against the side of the head when the telephone is in use. The closer the antenna is to the head, the greater a person's expected exposure to RF energy. The amount of RF energy absorbed by a person decreases significantly with increasing distance between the antenna and the user. The intensity of RF energy emitted by a cell phone depends on the level of the signal. When a call is placed from a cell phone, a signal is sent from the antenna of the phone to the nearest base station antenna. The base station routes the call through a switching center, where the call can be transferred to another cell phone, another base station, or the local land-line telephone system. The farther a cell phone is from the base station antenna, the higher the power level needed to maintain the connection. This distance determines, in part, the amount of RF energy exposure to the user. A cell phone user's level of exposure to RF energy depends on several factors, including:

- 1) The number and duration of calls.
- 2) The amount of cell phone traffic at a given time.
- 3) The distance from the nearest cellular base station.
- 4) The quality of the cellular transmission.
- 5) The size of the handset.
- 6) For older phones, how far the antenna is extended.
- 7) Whether or not a hands-free device is used.

There is concern that RF energy produced by cell phones may affect the brain and other tissues in the head because hand-held cell phones are usually held close to the head. Researchers have

focused on whether RF energy can cause Malignant (cancerous) brain tumors, such as gliomas (cancers of the brain that begin in Glial Cells, which surround and support the Nerve Cells), as well as Benign (noncancerous tumors, such as Acoustic Neuromas tumors that arise in the cells of the nerves that supplies the ear) and meningiomas tumors that occur in the meninges, which are the membranes that cover and protect the brain and spinal cord. The salivary glands also may be exposed to RF energy from cell phones held close to the head.

Numerous studies have investigated the relationship between cell phone use and the risk of developing malignant and benign brain tumors.

The most significant study of long-term use is the 13-country Interphone study, which is a multinational consortium of Case control studies. Interphone was coordinated by the International Agency for Research on Cancer (IARC). The primary objective of the Interphone study was to assess whether RF energy exposure from cell phones is associated with an increased risk of malignant or benign brain tumors and other head and neck tumors. Participating countries included Australia, Canada, Denmark, Finland, France, Germany, Israel, Italy, Japan, New Zealand, Norway, Sweden, and the United Kingdom.

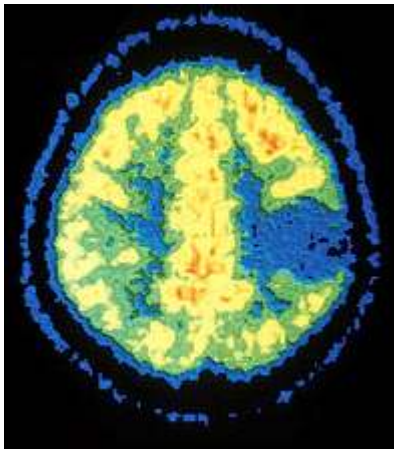
Interphone researchers reported that, overall, cell phone users have no increased risk for two of the most common types of brain tumor—glioma and meningioma. In addition, they found no evidence of increasing risk with progressively increasing number of calls, longer call time, or years since beginning cell phone use. For the small proportion of study participants who reported spending the most total time on cell phone calls, there was some increased risk of glioma, but the researchers considered this finding inconclusive. The study was published online May 17, 2010, in the International Journal of Epidemiology.

Additional studies have investigated the risk of developing glioma, meningioma, and acoustic neuroma. Results from the majority of these studies have found no association between hand-held cell phone use and the risk of brain cancer; however, some, but not all, studies have suggested slightly increased risks for certain types of brain tumors.

390% increased risk for brain tumors

Professor Lennart Hardell, Sweden has made a large study with 1251 cases of brain tumors were compared. The risk increased the more years and the more hours per year the phone had been used. The increased risk was 390% for mobile phones and 190% for cordless phones. The greatest risk was for Astrocytoma, a malignant tumor.

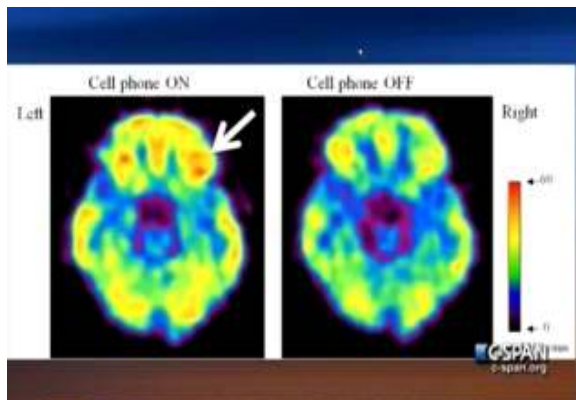
Below you find a brain scan showing a tumor at the right side (blue rounded area), close to where the mobile phone had been held.



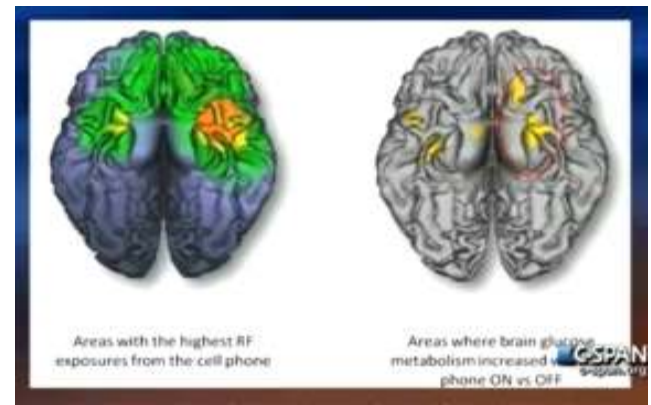
Comments: This study that was of high scientific quality, differently from most industry-sponsored studies, showed a clear dose-response relationship between the amount of radiation and risk. This adds importantly to the proof that mobile phone radiation increases the risk for brain tumors. The evidence is strong enough today to conclude that mobile phones cause brain tumors. Almost only industry-sponsored studies indicate the opposite, while almost all independent studies have reported an increased risk. This study adds to our conviction that industry-sponsored studies finding no tumor risk are faked and should not be considered.

Here are some brain scan images from this study, taken as snapshots from the above video:

The scanned photos of brain before and after using the mobile phone



The scan to the left shows the brain after mobile phone exposure. The more red color the more brain cell activity (indicated by increased glucose metabolism) There is a general increase and especially so on the right side where the mobile phone was. Compare with the scan to right taken when mobile was off.



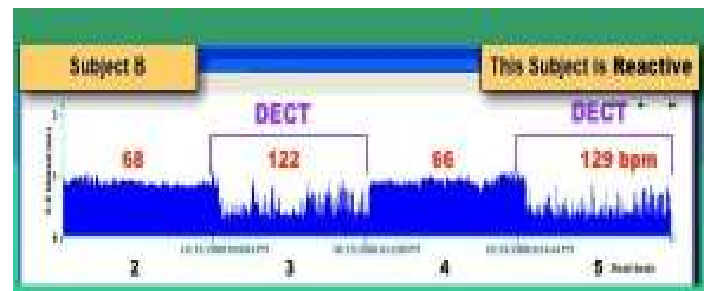
The scan to the left shows that the side that was exposed to the mobile phone (right side) was more activated (orange and green color) than the other side. Compare to the scan to the right, taken when the mobile phone was off.

VI Important discovery: Cordless phones affected the heart

Intensity of exposure was 200 times lower than approved by safety norms. Cordless phones impacted heart rate according to research by Professor Magda Havas of Trent University, Canada.

See diagram below.

Doubling of heart rate during exposure to cordless phone radiation



"DECT" marks the period of exposition to cordless phone radiation. Immediately at the start of radiation exposure, the pulse frequency almost doubled (lower blue peaks - 122 and 129 beats per minute respectively) and returned to normal (66 BPM) immediately as the phone was turned off. The subject did not know when he was exposed.

VII The impact of RF on human DNA:

Radio waves from mobile phones harm body cells and damage DNA in laboratory conditions, according to a new study majority-funded by the European Union, researchers O. The so-called Reflex study, conducted by 12 research groups in seven European countries, did not prove that mobile phones are a risk to health but concluded that more research is needed to see if effects can also be found outside a lab.

The \$100 billion a year mobile phone industry asserts that there is no conclusive evidence of harmful effects as a result of electromagnetic radiation.

About 650 million mobile phones are expected to be sold to consumers this year, and over 1.5 billion people around the world use one.

The research project, which took four years and which was coordinated by the German research group Verum, studied the effect of radiation on human and animal cells in a laboratory.

After being exposed to electromagnetic fields that are typical for mobile phones, the cells showed a significant increase in single and double-strand DNA breaks. The damage could not always be repaired by the cell. DNA carries the genetic material of an organism and its different cells.

"There was remaining damage for future generation of cells," said project leader Franz Adlkofer. This means the change had procreated. Mutated cells are seen as a possible cause of cancer.

The study also measured other harmful effects on cells. Because of the lab set-up, the researchers said the study did not prove any health risks. But they added that "the genotoxic and phenotypic effects clearly require further studies on animals and human volunteers."

Adlkofer advised against the use of a mobile phone when an alternative fixed line phone was available, and recommended the use of a headset connected to a cellphone whenever possible.

"We don't want to create a panic, but it is good to take precautions," he said, adding that additional research could take another four or five years.

Previous independent studies into the health effects of mobile phone radiation have found it may have some effect on the human body, such as heating up body tissue and causing headaches and nausea, but no study that could be independently repeated has proved that radiation had permanent harmful effects.

None of the world's top six mobile phone vendors could immediately respond to the results of the study.

There will be always another side for all the stories. The same way with this theory about the ill effects of the usage of mobiles. Some scientists believe that The RF emitted by the mobiles are of so lower frequency that they are incapable of showing any kind of ill effect on the human body.

VIII Latest News:

WHO now admits that mobile phones may increase the risk for brain tumors

1. While formerly declaring that cellphones are innocuous, referring to the Interphone study (that actually was inconclusive due to severe weaknesses, see here), now WHO has changed its stance after a meeting of 31 scientists from 14 countries (the IARC expert committee).

2. (Reuters) - Using a mobile phone may increase the risk of certain types of brain cancer in humans and consumers should consider ways of reducing their exposure, World Health Organisation WHO.L cancer experts said on Tuesday. A working group of 31 scientists from 14 countries meeting at the WHO's International Agency for Research on Cancer IARC.L said a review of all the available scientific evidence suggested cell

phone use should be classified as "possibly carcinogenic".
Source: Reuters press release May 31, 2011.

3. ScienceDaily (Feb. 22, 2011) — In a preliminary study, researchers found that 50-minute cell phone use was associated with increased brain glucose metabolism (a marker of brain activity) in the region closest to the phone antenna, but the finding is of unknown clinical significance, according to a study in the February 23 issue of *JAMA*.

4. May 17, 2010 - According to the International Agency for Research on Cancer (funded in part by WHO, the World Health Organization) using a cell phone for as little as 30 minutes may increase your risk of getting a brain tumor (glioma). The study is reported to have included 13,000 participants over 10 years. But we have not seen the details of this study. As soon as we find a source, we'll publish a link to it.

5. March 30, 2008 – Mobile phones more dangerous than smoking' - A self-published and non-peer reviewed meta-study by Dr. Vini Khurana, an Australian neurosurgeon, presented an "increasing body of evidence ... for a link between mobile phone usage and certain brain tumours" and that it "is anticipated that this danger has far broader public health ramifications than asbestos and smoking". On Larry King on May 27, 2008, Dr. Khurana said: "the concern is not just brain tumors, but other health effects associated or reported to be associated with cell phones, including behavioral disturbances, salivary gland tumors, male infertility and microwave sickness syndrome". However, according to Wikipedia, this was criticized as '...an unbalanced analysis of the literature, which is also selective in support of the author's claims.'

6. February 2008: Tokyo Women's Medical University compared phone use in 322 brain cancer patients with 683 healthy people and found that regularly using a mobile did not significantly affect the likelihood of getting brain cancer. "Using our newly developed and more accurate techniques, we found no association between mobile phone use and cancer, providing more evidence to suggest they don't cause brain cancer," Naohito Yamaguchi, who led the research, said. His team's findings were published in the British Journal of Cancer.

7. December 5, 2006 - Scientists in Denmark tracked over 420,000 cell phone users over the course of 21 years in an attempt to determine if cell phone use causes cancer. As reported in A B C News, they found the RF energy produced by the phones did not correlate to an increased incidence of the disease. From the article: 'This so-called Danish cohort "is probably the strongest study out there because of the outstanding registries they keep,' said Joshua Muscat of Pennsylvania State University, who also has studied cell phones and cancer. 'As the body

8. of evidence accumulates, people can become more reassured that these devices are safe, but the final word is not there yet,' Muscat added."

9. May 17, 2005 - - A Swedish study finds that users of digital phones in rural areas may be at greater risk of brain cancer. Its authors say the link is troubling, although they acknowledge that the amount of data is small and wider research is needed to amplify the findings. The chance of developing a malignant brain tumor was roughly eight times higher for cell phone users in the Swedish countryside than in urban areas. The risk of developing

any brain tumor was four times higher for country dwellers using mobile phones for five years or more, compared with those who did not use the devices. The BBC present a program) which countered Dr Lennart Hardell's claims, " The National Radiological Protection Board (NRPB), which advises the government on safety levels, said the study "the study did not involve enough people to offer compelling evidence, and any difference in risk it did find was not statistically significant. . "

10. March 21, 2005 – FOX News and CNN News both report that on March 16, 2005, a federal appeals court in Maryland reinstated five class-action lawsuits that allege that the cell phone industry has failed to protect consumers from unsafe levels of radiation. Fox quotes a Dr. Henry Lai, a bioengineering professor at the University of Washington, as saying that electromagnetic radiation emitted from cell phones may damage DNA and cause benign brain tumors. Dr. Lai also agrees with EHSO's recommendation to use a headset to minimize potential exposure.

In the United States, mobile phones operate in a frequency ranging from about 850 to 1900 megahertz (MHz). In that range, the radiation produced is in the form of non-ionizing radiofrequency (RF) energy. This RF energy is different than the ionizing radiation like that from a medical x-ray, which can present a health risk at certain doses.

Ionizing gamma rays and x-rays can cause cancer when their energy is absorbed by the tissue and chemical bonds are broken, damaging DNA. RF energy, on the other hand, produces heating of tissue. Although there is a small amount of experimental evidence that suggests RF energy can impact DNA in rats, this data has been contradicted by several other animal studies and is not well substantiated. Even if true, the doses administered in these animal studies were much larger than the exposure in humans and may have no relevance to cell phone use at all. So although the RF energy emitted by cell phones is in the electromagnetic spectrum, and other forms of electromagnetic radiation can cause cancer, RF energy is very different and has not been shown to cause cancer.

At high enough levels, RF energy, too, can be harmful, because of its ability to heat living tissue to the point of causing biological damage. In a microwave oven, it's RF energy that cooks the food, but the heat generated by cell phones is small in comparison.

A mobile phone's main source of RF energy is its antenna, so the closer the antenna is to a phone user's head, the greater the person's expected exposure to RF energy.

Because RF energy from a cell phone falls off quickly as distance increases between a person and the radiation source (actually, by the distance squared), the safety of mobile phones with an antenna mounted away from the user, like on the outside of a car, has been presumed to be safe. The distance and the effect of the car acting as a Gaussian cage would virtually eliminate the radiation inside the car. Also not presently in doubt is the safety of those so-called cordless phones that have a base unit attached to a home's telephone wiring and operate at much lower power levels than cell phones.

Many experts say that no matter how near the cell phone's antenna—even if it's right up against the skull--the six-tenths of a watt (typically) of power emitted couldn't possibly affect human health.

Beyond this planned research, according to the industry association, there are hundreds of scientific studies completed or in progress around the world to investigate RF's possible health effects, with half of them specifically addressing the frequencies used by wireless phones. FDA is a leading participant in the World Health Organization's International EMF (electric and magnetic fields) project to coordinate research and the harmonization of international radiation standards.

Ziff-Davis reports that researchers in Australia have reported their hypothesis that normal mobile phone use can lead to cancer. The research group, lead by radiation expert Dr Peter French, principal scientific officer at the Centre for Immunology Research at St Vincent's Hospital in Sydney, said that mobile phone frequencies well below current safety levels could stress cells in a way that has been shown to increased susceptibility to cancer.

The paper, published in the June 2001 issue of the science journal, "Differentiation", says that repeated exposure to mobile phone radiation acts as a repetitive stress, leading to continuous manufacture of heat shock proteins within cells.

Their theory is that these proteins, which are sensitive to heat, are always present in cells at a low level, but are manufactured in larger amounts when the cell is stressed by heat or other environmental factors. These proteins repair other proteins that are adversely affected by the conditions, and are part of the cell's normal reaction to stress. However, if they are produced too often or for too long, they are known to initiate cancer and increase resistance to anti-cancer drugs.

However, this group has reported neither absolutely evidence nor studies to substantiate this - it is only a theory.

More recently, a Finnish survey of some of the world's most popular mobile phones found the amount of radiation they emit is well below agreed limits and largely in line with data published by manufacturers. The survey conducted by Finland's Radiation and Nuclear Safety Authority (STUK) covered 16 new models made by top handset makers including Finland's own Nokia, Motorola of the United States and South Korea's Samsung Electronics. At this level, the study found that head tissue does not warm significantly and no other harmful effects have been proved scientifically. STUK said the SAR levels in all the 28 models tested so far ranged from 0.45 to 1.12 watts per kilogram.

"It is important that also in the future the limits set for radiation from mobile phones and base stations are based on current and confirmed scientific proof of the effects of radiation on health,"

Kari Jokela, a researcher at STUK, said in a statement. STUK also said that some of its studies have indicated that microwave radiation from mobile phones may cause small changes in how cells operate, but the findings were insufficient for concluding what effects of this radiation had on health. STUK will start testing third-generation UMTS-standard mobile phones during 2005, focusing on the most popular models. Other phones in the current study were made by Sony Ericsson and Siemens.

Finally, as the non-ionizing radiation does have a small heating effect, it is postulated that the effect would be greatest on the eyes and testes, due to the lower amount of blood vessels to help cool these areas.

In March 2003, The International journal of Oncology suggested that prolonged mobile phone usage had 30% increased risk of brain tumours called acoustic neuromas that occur close to the ear. It has been proved that even the short exposure to the mobile phone radiation kills the brain cells in rats affecting the functions of movement, memory and learning. It also affects the intra uterine development in rats and also affects the human embryo. Dr. Kjell Hansson Mild in Sweden studied radiation risks in 11000 mobile users and discovered the symptoms such as fatigue, headache, burning sensation on the skin in the mobile users. But the truth is that no one knows for sure but it looks as though the health risks for an individual person with normal pattern of use are extremely low and almost nonexistent.

In Oct 2004 scientists at the Karolinske Institution in Stockholm gave a warning in the journal of Epidemiology about mobile phone radiation and brain tumours like acoustic neuromas. They found that long term users of mobiles were 4 times as likely to develop growths on the side they held phones and twice as likely as non users.

The latest studies may support the generally held position that cell phone radiation is not a substantial hazard, but they will never be able to prove cell phones to be absolutely safe. It is logically impossible to prove a negative, that cell phones can not cause cancer.

EHSO has seen no credible evidence to date that cell phones cause cancer or brain tumors. It is illogical to believe that evidence of unusual brain tumors is covered up when there are

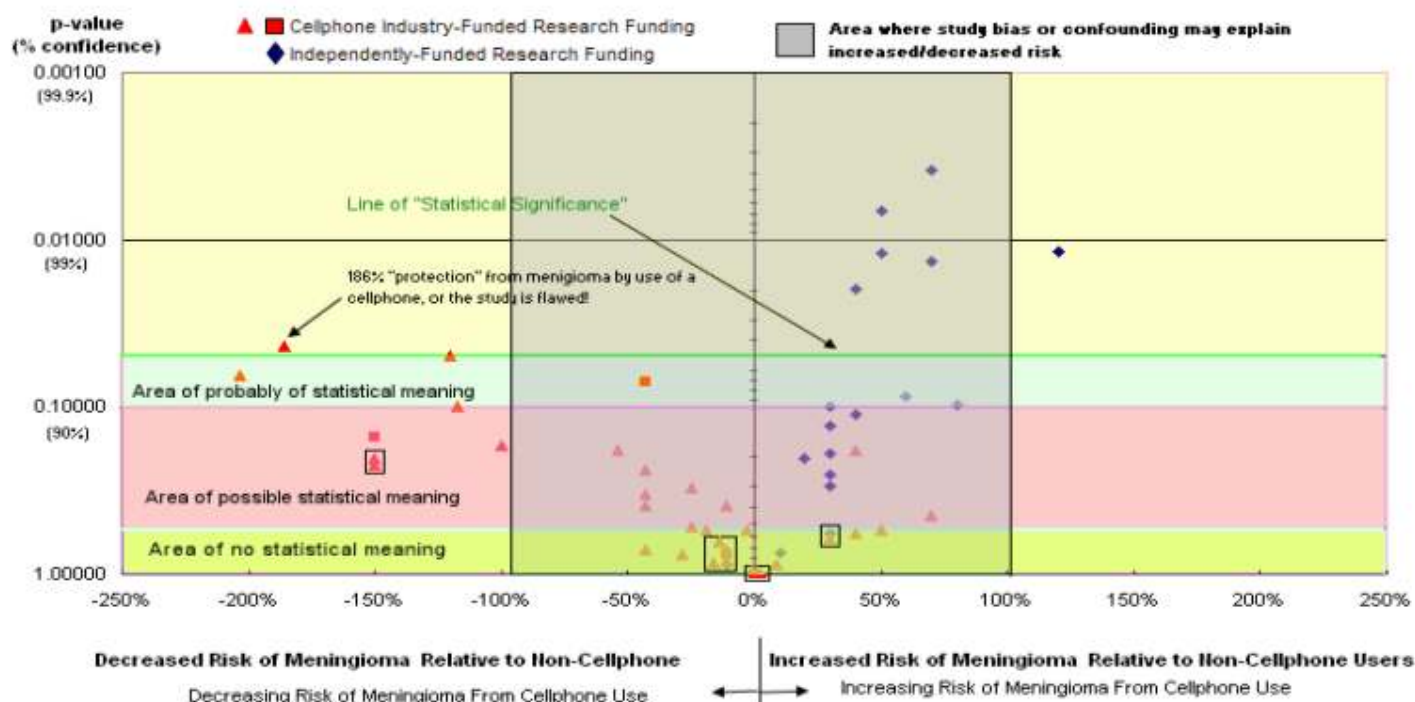
hundred's of millions of people using cell phones worldwide. There is a TREMENDOUS amount of junk science and thoroughly ignorant (as in untrained, uneducated) people running around naming themselves as experts and publishing their opinions on the internet. This hype and fear-mongering has only one goal: to puff up the egos and wallets of those propagating nonsense. And the supposed link between mobile-phone use and cancer is even listed among the American Cancer Society's Top 10 Cancer Myths

However, cell phones are still relatively new, and while science does not support that the radiation may not be likely to cause cancer, time may prove differently! And in any case, it may cause some other type of damage (certainly accidents in cars from being distracted while fumbling with the phone!)

IX Highly suspect industrial results

For the brain tumor, meningioma, a striking difference was found between industry funded research (red triangles) and independent studies (blue squares). The most absurd result was an industry study indicating 186% reduction of the risk (the red triangle at the point of the arrow at the left side).

While almost no industry funded study found any hazards, all independent studies reported increased risk, though it was not statistically significant in all cases (the more significant the higher up in the graph).



Source: (Powerwatch) Bias and confounding

This confirms what common sense says. We cannot trust industry funded research because it produced scientists who are dependent on a party that has huge economic interests in suppressing the real truth about the hazards of mobile phones.

The truth is that independent scientists have found strong reasons to believe that mobile phones are hazardous while corrupt industry dependent scientists have an opinion that is not worth the paper it is printed on.

X Prevention Measures

1. As the children have smaller heads, thinner skulls and higher tissue they may absorb more radio energy from a given phone than adults. Hence, children should be kept away from cell phones.
2. Cell phones should be used for emergencies and for long conversations.
3. A small chip- like cell phone microwave protection device is available, which has the ability to absorb electro-magnetic energy waves from your mobile phone. It helps in reducing the potential harmful effects of the emissions to the human body.
4. Using a mobile head set is a good idea. You don't have to hold phones next to your ears all the time.
5. Hand free devices cut exposure by keeping the instrument away from your head and your body
6. Mobile phones should not be used in Intensive Care Units of the hospitals as they can pose a danger to the patients by interfering with the working of pacemakers and defibrillators.
7. People with hearing aids should not use mobile phones reproductive success, or growth and development. However, the changes observed are not consistent. A possible explanation of observed effects is that radio frequency fields discourage some bird species and encourage others or affect the insects they feed on. Other factors such as pollution might play a role.
8. Base stations, which have low powered antennae on their terrace to communicate with cell phones, should not be located near children's schools and play grounds.

XI Environmental effects of electromagnetic fields

Migratory birds rely on magnetic fields for orientation



Credit: Michael Hatherly

Field studies on individual animal and plant species living in close proximity to sources of electromagnetic fields provide information on possible effects on ecosystems. Past field studies have mainly focused on wild birds and on potential effects on reproduction and orientation. Though some new study results have recently been published, overall, the current database is inadequate for the purposes of the assessment of possible risks due to environmental exposure to Radio, Intermediate and Extremely-low frequency fields.

9.1 Several studies indicate that exposure of wild birds to radio frequency fields can, under certain circumstances, lead to changes, for instance in behavior,

9.2 The possible effects of extremely low frequency fields on reproduction have been studied in birds of prey living around overhead power lines, but findings vary widely, and no clear overall conclusion can be drawn. A field study observed a reduction of the biological activity in the soil surrounding a buried electricity transmission cable, but the environmental significance of this finding is unclear.

Studies on plants have shown that ELF magnetic fields can promote the growth of certain plant species.

XII Opinions on electromagnetic fields

10.1 There is no evidence that exposure to radio frequency fields through the use of mobile phones increases the risk of cancer when used for a period of up to 10 years, and data are still too limited to conclude on the use of mobile phones over longer periods. Self-reported symptoms like headaches, fatigue, or concentration difficulties have not been linked to exposure to radio frequency fields, but may be due to the individuals' expectation that such exposure is harmful. Information on potential effects of radio-frequency fields on children is still limited.

10.2 Because data for the intermediate frequency fields are sparse, the assessment of health risks of short-term exposure to high levels of intermediate frequency fields is currently based on known biological effects at lower and higher frequencies. Proper assessment of possible health effects from long-term exposure is important because exposure to such fields is increasing, especially at certain workplaces, due to the use of new technologies.

10.3 The past conclusion that extremely low frequency magnetic fields are possibly carcinogenic is still valid. This was concluded based on studies indicating that children exposed to relatively strong magnetic fields from power lines were more likely to develop leukaemia. New studies on human populations indicate a possible increase in Alzheimer's disease arising from exposure to extremely low frequency fields. The results related to leukaemia and Alzheimer's have not been confirmed or explained by experiments on animals and cell cultures. Further research on

cells is needed to examine effects on specific diseases. No consistent relationship between self-reported symptoms and extremely low frequency fields has been demonstrated.

10.4 New applications of strong static magnetic fields, used alone or in association with other fields, will require risk assessments for people who use these new technologies at work, as for instance operators of MRI scanners.

10.5 The data on how electromagnetic fields may affect animals and plants are insufficient to assess possible risks due to environmental exposure to radio frequency, intermediate frequency and extremely low frequency fields.

10.6 To fill the important gaps in knowledge, research efforts are recommended, notably on long- term exposure and effects on children and personnel dealing with equipment generating strong fields.

XIII CONCLUSION

Globalization is the new mantra in this electronic age. It is very difficult not to have technology. But with technology, come certain hazards. The only way to bear these is again working for a better technology. Electromagnetic radiation is everywhere. More and more wireless communication services (cellular phones, paging, and wireless internet) are expected so is the artificial electromagnetic radiation. It seems that there is no way to reverse this trend. Scientists and engineers are developing better and safer wireless systems and devices. Smaller cell size better base station antennas and other more advanced technologies will allow future phones to radiate much lower power. So one can only hope that cell phone hazards will be reduced. If we go through the pages of history of the world we will come across so many medicines and devices that were used vigorously in the past but proved to be harmful now. It seems for me that until and unless the western world come up with an alternative technology for the mobiles they won't declare that the mobiles are harmful to the human body. So it suggests that we each take some prudent precautions while using the mobiles by keeping them away from the children and by keeping our talk brief.

REFERENCES

- [1] Ahlbom A, Green A, Kheifets L, Savitz D, Swerdlow A. Epidemiology of health effects on radiofrequency exposure. *Environmental Health Perspectives* 2004; 112(17):1741-1754.
- [2] U.S. Food and Drug Administration (2009). Radiation-Emitting Products: Reducing Exposure: Hands-free Kits and Other Accessories. Silver Spring, MD. Retrieved May 17, 2010, from: <http://www.fda.gov/Radiation-EmittingProducts/RadiationEmittingProductsandProcedures/HomeBusinessandEntertainment/CellPhones/ucm116293.htm>.
- [3] Cardis E, Richardson L, Deltour I, et al. The INTERPHONE study: Design, epidemiological methods, and description of the study population. *European Journal of Epidemiology* 2007; 22(9):647-664.
- [4] International Agency for Research on Cancer (2008). INTERPHONE Study: Latest results update—8 October 2008. Lyon, France. Retrieved September 8, 2009, from: <http://www.iarc.fr/en/research-groups/RAD/Interphone8oct08.pdf>.
- [5] The INTERPHONE Study Group. Brain tumour risk in relation to mobile telephone use: Results of the INTERPHONE international case-control study. *International Journal of Epidemiology* 2010; published online ahead of print May 17, 2010.
- [6] Inskip PD, Tarone RE, Hatch EE, et al. Cellular-telephone use and brain tumors. *New England Journal of Medicine* 2001; 344(2):79-86.
- [7] Hepworth SJ, Schoemaker MJ, Muir KR, et al. Mobile phone use and risk of glioma in adults: Case-control study. *British Medical Journal* 2006; 332(7546):883-887.
- [8] Klæboe L, Blaasaas KG, Tynes T. Use of mobile phones in Norway and risk of intracranial tumours. *European Journal of Cancer Prevention* 2007; 16(2):158-164.
- [9] Takebayashi T, Varsier N, Kikuchi Y, et al. Mobile phone use, exposure to radiofrequency electromagnetic field, and brain tumour: A case-control study. *British Journal of Cancer* 2008; 98(3):652-659.
- [10] Johansen C, Boice Jr. JD, McLaughlin JK, Olsen JH. Cellular telephones and cancer: A nationwide cohort study in Denmark. *Journal of the National Cancer Institute* 2001; 93(3):203-207.
- [11] Schuz J, Jacobsen R, Olsen JH, et al. Cellular telephone use and cancer risk: Update of a nationwide Danish cohort. *Journal of the National Cancer Institute* 2006; 98(23):1707-1713.
- [12] Schoemaker MJ, Swerdlow AJ, Ahlbom A, et al. Mobile phone use and risk of acoustic neuroma: Results of the Interphone case-control study in five North European countries. *British Journal of Cancer* 2005; 93(7):842-848.
- [13] Hours M, Bernard M, Montestrucq L, et al. [Cell phones and risk of brain and acoustic nerve tumours: The French INTERPHONE case-control study.] *Revue d'Epidemiologie et de Sante Publique* 2007; 55(5):321-332.
- [14] Christensen HC, Schuz J, Kosteljanetz M, et al. Cellular telephone use and risk of acoustic neuroma. *American Journal of Epidemiology* 2004; 159(3):277-283.
- [15] Lonn S, Ahlbom A, Hall P, Feychting M. Mobile phone use and the risk of acoustic neuroma. *Epidemiology* 2004; 15(6):653-659.
- [16] Hardell L, Carlberg M. Mobile phones, cordless phones and the risk for brain tumours. *International Journal of Oncology* 2009; 35:5-17.
- [17] Christensen HC, Schuz J, Kosteljanetz M, et al. Cellular telephones and risk for brain tumors: A population-based, incident case-control study. *Neurology* 2005; 64(7):1189-1195.
- [18] Lonn S, Ahlbom A, Hall P, Feychting M, Swedish Interphone Study Group. Long-term mobile phone use and brain tumor risk. *American Journal of Epidemiology* 2005; 161(6):526-535.
- [19] Lahkola A, Auvinen A, Raitanen J, et al. Mobile phone use and risk of glioma in five North European countries. *International Journal of Cancer* 2007; 120(8):1769-1775.
- [20] Lahkola A, Salminen T, Raitanen J, et al. Meningioma and mobile phone use—a collaborative case-control study in five North European countries. *International Journal of Epidemiology* 2008; 37(6):1304-1313.
- [21] Altekruse SF, Kosary CL, Krapcho M, et al. SEER Cancer Statistics Review, 1975–2007. Bethesda, MD: National Cancer Institute. Retrieved May 14, 2010, from: http://seer.cancer.gov/csr/1975_2007.
- [22] Stang A, Anastassiou G, Ahrens W, et al. The possible role of radiofrequency radiation in the development of uveal melanoma. *Epidemiology* 2001; 12(1):7-12.
- [23] Linet MS, Taggart T, Severson RK, et al. Cellular telephones and non-Hodgkin lymphoma. *International Journal of Cancer* 2006; 119(10):2382-2388.
- [24] Lonn S, Ahlbom A, Christensen HC, et al. Mobile phone use and risk of parotid gland tumor. *American Journal of Epidemiology* 2006; 164(7):637-643.
- [25] Sadetzki S, Chetrit A, Jarus-Hakak A, et al. Cellular phone use and risk of benign and malignant parotid gland tumors—a nationwide case-control study. *American Journal of Epidemiology* 2008; 167(4):457-467.
- [26] Lahkola A, Salminen T, Auvinen A. Selection bias due to differential participation in a case-control study of mobile phone use and brain tumors. *Annals of Epidemiology* 2005; 15(5):321-325.

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Efficient Microwave-Assisted Synthesis and Antibacterial Activity of Some 1,2,4 trisubstituted Imidazolin-5-One

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Abstract- A successful application of microwave irradiation has been studied in which series of different 2-aryl-4-arylidene-1-carboxymethyl-2-imidazolin-5-one (3a-f) were synthesized in high yield using a microwave method. More chemistry techniques have many advantages i.e. very rapid reactions, low energy, consumptions and safe operation, high yield, less time.

Index Terms- Synthesis of 1,2,4-trisubstituted imidazolin-5-one, microwave irradiations and antibacterial activity

I. INTRODUCTION

The nitrogen heterocycles have received considerable attention in recent years due to their biological and physiological activity. Their properties like central nervous system depressant [1] anticonvulsant [2] and monoamine inhibitors are of great significance. Amino acids are precursors of various macromolecules in biological systems [3] with a view to extend the scope and validity of these observations a new imidazolinones containing amino acids moiety is synthesized and screened for their antimicrobial activity.

In recent years, microwave irradiation using commercial domestic ovens has been rapidly increased for optimization and acceleration of organic synthesis under solvent free conditions [4-9]. It has been reported for the variety of reactions such synthesis of heterocycles[10] and more recently for synthesis of imidazolylpyrimidine[11], because of advantages such as reduction in reaction time, improved energy utilization, potential for lower processing temperature and improved product uniformity.

In conventional method, for the synthesis, several 1,2,4-trisubstituted imidazolynones and heated with the molar ration of saturated sodium carbonate solution was dissolved in (10ml) ethanol and rebluxed for 1 hr for effective condensation [12]. In microwave irradiation method, for the synthesis of 1,2,4-trisubstituted imidazolynones and heated with the saturated sodium carbonate solution was dissolved in (10ml) ethanol the reactions are completed within 3 min in equimolar proportions and almost in all the cases afford the product in high yields[12]. The products were characterized on the basis of their M.P., ¹HNMR, Elemental analysis and their Antimicrobial activity.

II. MATERIALS AND METHODS

All the synthesized heterocyclic compounds were purified by re-crystallization by using ethanol. The melting points were

recorded on melting point apparatus in open capillaries and are uncorrected. All the purity of compounds was checked by TLC. All reaction were carried out in a commercially available IFB domestic microwave oven having a maximum power out put of 110 W operating at 2450 MHz. IR spectra were recorded in an a Perkin Elmer 1800 spectrophotometer using KBr discs, mass spectra were recorded on Finnigan MAT 8200 spectrophotometer, ¹HNMR spectra were recorded using AC Bruker 300F. The nitrogen elements analyses were found to be within the permissible limits.

Method-A (Conventional)

Synthesis of 2-aryl-4-arylidene-1-carboxymethyl-2-imidazoline-5-one (3a-b)

2-aryl-4-aryldiene-4-carbethoxymethyl-2-imidazolin-5-one (2a-k) (0.01mole) (2.44g) was dissolved in ethanol (15ml) and heated with saturated sodium carbonate solution (10ml). The contents were refluxed on water bath for 1 hr. After refluxing it was cooled and acidified using dilute HCl. The product formed was filtered, washed with cold water, dried and followed by re-crystallization from ethanol.

Yield 48%, MP 250°C

Method-B (Microwave Irradiations)

Synthesis of 2-aryl-4-arylidene-1-carboxymethyl-2-imidazoline-5-one (3a-b)

2-aryl-4-aryldiene-4-carbethoxymethyl-2-imidazolin-5-one(2a-k) (0.01mole), (2.44g) was dissolved ethanol (15ml) and heated with saturated sodium carbonate solution (10ml). The contents were thoroughly mixed. The reaction mixture was subjected to microwave irradiation in a commercially available IFB domestic microwave oven having a maximum power output of 110W. Operating at 2450 MHz intermittently at 30 sec. intervals for 3 min. After refluxing it was cooled and acidified using dilute HCl. The product formed was filtered washed with cold water, dried and followed by recrystallization from ethanol (3a).

Yield 80%; wt. 1.95g; MP 250°C

III. RESULTS AND DISCUSSION

The synthesis of 2-aryl-4-aryldiene-4-carboxymethyl-2-imidazolin-5-one (3a-f) were synthesized 2-aryl-4-aryldiene-4-carboxymethyl-2-imidazolin-5-one (2a-k) were dissolved in

(10ml) ethanol and heated with sodium carbonate solution (10ml) was heated under reflux for 1 hr under conventional technique reflux for 3 min under microwave technique.

TABLE 1 : PHYSICAL DATA OF 1,2,4-TRISUBSTITUTED IMIDAZOLYNONES OF CONVENTIONAL METHOD 'A' (3a-f)

Compd	R ¹	R ²	R ³	M.F.	M.P. °C	Method-A yield/T %/h	N. Analysis F/(Calc.) (%)
3a	C ₆ H ₅	CH ₃	CH ₂ COOH	C ₁₃ H ₁₂ N ₂ O ₃	250	48/1	<u>11.3</u> (11.5)
3b	C ₆ H ₅	C ₆ H ₅	CH ₂ COOH	C ₁₈ H ₁₄ N ₂ O ₃	198	46/1	<u>9.2</u> (9.1)
3c	4-Cl- C ₆ H ₄	C ₆ H ₅	CH ₂ COOH	C ₁₈ H ₁₃ N ₂ O ₃ Cl	216	51/1	<u>8.3</u> (8.1)
3d	4-OCH ₃ - C ₆ H ₄	C ₆ H ₅	CH ₂ COOH	C ₁₉ H ₁₆ N ₂ O ₄	195	48/1	<u>8.4</u> (8.1)
3e	2-Cl- C ₆ H ₄	C ₆ H ₅	CH ₂ COOH	C ₁₈ H ₁₃ N ₂ O ₃ Cl	198	47/1	<u>8.3</u> (8.15)
3f	4-CH ₃ -C ₆ H ₄	4-OCH ₃ - C ₆ H ₄	CH ₂ COOH	C ₁₉ H ₁₅ N ₂ O ₃ Cl	190	48/1	<u>7.8</u> (7.9)

TABLE 2: PHYSICAL DATA OF 1,2,4-TRISUBSTITUTED IMIDAZOLYNONES OF MICROWAVE IRRADIATION METHOD 'B' (3a-f)

Compd	R ¹	R ²	R ³	M.F.	M.P. °C	Method-B yield/T %/min	N. Analysis F/C (%)
3a	C ₆ H ₅	CH ₃	CH ₂ COOH	C ₁₃ H ₁₂ N ₂ O ₃	250	80/2	<u>11.3</u> (11.5)
3b	C ₆ H ₅	C ₆ H ₅	CH ₂ COOH	C ₁₈ H ₁₄ N ₂ O ₃	198	82/2	<u>9.2</u> (9.1)
3c	4-Cl- C ₆ H ₄	C ₆ H ₅	CH ₂ COOH	C ₁₈ H ₁₃ N ₂ O ₃ Cl	216	75/2	<u>8.3</u> (8.1)
3d	4-OCH ₃ - C ₆ H ₄	C ₆ H ₅	CH ₂ COOH	C ₁₉ H ₁₆ N ₂ O ₄	195	76/2	<u>8.4</u> (8.1)
3e	2-Cl- C ₆ H ₄	C ₆ H ₅	CH ₂ COOH	C ₁₈ H ₁₃ N ₂ O ₃ Cl	198	76/2	<u>8.3</u> (8.15)
3f	4-CH ₃ - C ₆ H ₄	4-Cl ₃ - C ₆ H ₄	CH ₂ COOH	C ₁₉ H ₁₅ N ₂ O ₃ Cl	190	79/2	<u>7.8</u> (7.9)

¹HNMR for compound (3a) in (CDC/3/DMSO : δ ppm): 358 (S, 3H – OCH₃) 8 4.49 δ (S, 2H – CH₂), 9-8.2 δ (m, 9H, Δγ - H)
Mass for compound (3a); M/Z – 336 (M⁺), 305, 291, 277, 162, 146, 134, 117, 105, 77

Antimicrobial activity

The compound (2a-3f) was tested for their antibacterial activity against E. Coli and S. typhimurium by Cup plate method at a concentration of 100 µg in acetone. Chloramphenicol was used as standard drug. The zone of inhibition was compared with the standard drug after 24 h of incubation at 37°C for antimicrobial activity. Most of the compound showed good activity against the two bacterial strains. The activity of some of the compound is found to be very close to the standard drug.

IV. CONCLUSION

The proposed method is simple, precise, accurate, and rapid for the synthesis of medicinal compounds. It is now possible to carry out number of microwave organic synthesis. The use of MW technique can lead to substantial saving in time and high yield. Chloromphenol was used as a standard drug compared with the synthesized compound showed good activity against the too bacteria strains. The activity of the compound is found to be

close to the standard drug.

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REFERENCES

- [1] S.S. Tiwari, R. Agarwal and R. K. Satsang, J. India Chem. Soc. 1980; 57, 10410.
- [2] D. Mukherji, S. R. Nautiyi and C. R. Prasad, Indian Drugs, 1981; 18, 125.
- [3] R. F. Borne, R. L. Peden, I. W. Watus, J. M. Weinem and M. Wall, J. Med. Chem. 15, 1925 (1972).
- [4] (a) Ghiya B. J. and Lohiya S. B. Indian J. Chem. 1986;25B, 279.
(b) S. B. Lohiya Ph.D Thesis : Oxygen nitrogen containing heterocyclic compounds, their synthesis and mechanism of reaction, Nagpur University 1983.
- [5] Ashok K. Rathod et al. Int. J. Pharm. Tech. Res. 2011;3(1), 197-200.
- [6] Reimlinger H; Lingr W. R F and Vandewalle J J. M. Synthesis, 1970;2, 433
- [7] Prabha V. s. and Sheshadri S; Indian Journal of Chemistry, 1985;24B, 137 .
- [8] Rashed N, El Wassry A. M. El Ashry. El-Sayed H; Amer. A. and Zimmer H, Journal of Heterocyclic Chem. 1990;27, 691.
- [9] Potls K. T., and Burter H. R, J. Org. Chem. 1996;31, 251.
- [10] Moghilaiah K, Rama Sudhakar G. and Reddy N. V., Indian Journal of Chemistry, 1985;42B, 1753.
- [11] R. S. Verma, Pure Appl. Chem. 2001;73, No.1, 193-198.
- [12] Ashok K. Rathod et al. Ind. J. Pharm. Tech. Res. 2011; 3(1), 435-441 .

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Analysis of Several 2:1 Multiplexer Circuits at 90nm and 45nm Technologies

Ila Gupta, Neha Arora, Prof. B.P. Singh

Abstract- The increasing prominence of portable system and the need of limit power consumption in very high density VLSI chip have led to rapid and innovative development in low-power design during the recent years. A multiplexer, sometimes referred to as a "MUX", is a device that selects between a numbers of input signals. This paper represents the simulation of different 2:1 MUX configurations and their comparative analysis on different parameters such as Power Supply Voltage, Operating Frequency and Temperature etc.

Index Terms – CMOS Logic, Low power, 2:1 Multiplexer and VLSI.

I. INTRODUCTION

Low power has emerged as a principal theme in today's electronics industry. The need for low power has caused a major paradigm shift where power dissipation has become as important a consideration as performance and area. A 2:1 multiplexer is a basic building block of the "switch logic". The concept of the switch logic is that logic circuits are implemented as combination of switches, rather than logic gate. Multiplexers are used in building digital semiconductors such as CPUs and graphics controller, as programmable logic devices, in telecommunications, in computer networks and digital video. This paper compares the different 2:1 multiplexer circuits on the basis of the power dissipation, speed, operating frequency range and their temperature dependence.

II. LITERATURE REVIEW OF DIFFERENT 2:1 MULTIPLEXER CIRCUITS

2.1 NMOS Multiplexer Circuit

The schematic diagram of NMOS 2:1 MUX is shown in Fig. 1(a). This circuit is based on Complementary Pass Transistor Logic. It reduces the count of transistors used to make different logic gates, by eliminating redundant transistors [1]. Transistors are used as switches to pass logic levels between nodes of a circuit, instead of as switches connected

2.2 CMOS Multiplexer Circuit

Fig. 1(b) is depicting the circuit diagram of CMOS 2:1 multiplexer based Double Pass Transistor Logic. DPL eliminates some of the inverter stages required for complementary pass transistor logic by using both N and P channel transistors, with dual logic paths for every function. While it has high speed due to low input capacitance, it has only limited capacity to drive a load [2].

2.3 MSL Multiplexer Circuit

MSL stands for multiplexer single with level restoration block which is shown in Fig.1(c). One problem with the CPL or DPL circuits is the requirement of both non-inverting and inverting signals, which leads to a large wiring area [2]. So a logic design based on CPL like circuits called MSL arised, which uses only the non-inverting output of the original CPL multiplexer circuit appended by a p-latch inverter which is the heart of this circuit [3].

2.4 MD Multiplexer Circuit

Schematic of MD circuit is shown in the Fig. 1(d). MD stands for multiplexer double. With the help of this circuit we find the inverted output also [3].

2.5 MDL Multiplexer Circuit

Schematic of MDL Based circuit is shown in the Fig. 1(e). MDL stands for multiplexer double with level restoration block. With the help of this level restoration block we can avoid swing problems, but it has high-area and high-power drawbacks [3].

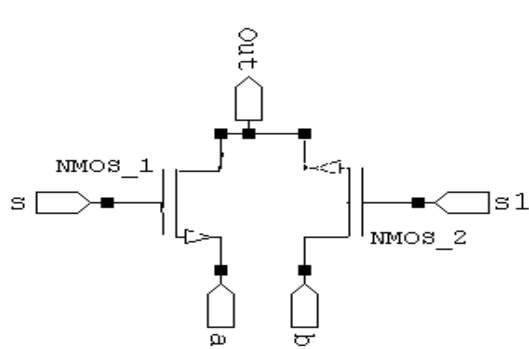
2.6 DCVSL MULTIPLEXER Circuit

Schematic of DCVSL circuit is shown in the Fig. 1(f). Cascode Voltage Switch Logic (CVSL) refers to a CMOS-type logic family which is designed for certain advantages. A logic function and its inverse are automatically implemented in this logic style. The pull-down network implemented by the NMOS logic tree generated complementary output. This logic family is also known as Differential Cascode Voltage Switch Logic (DCVS or DCVSL).The advantage of DCVSL is in its logic density that is achieved by elimination of large PFETS from each logic function. It can be divided it to two basic parts: a differential latching circuit and a cascaded complementary logic array [4], [5], [6].

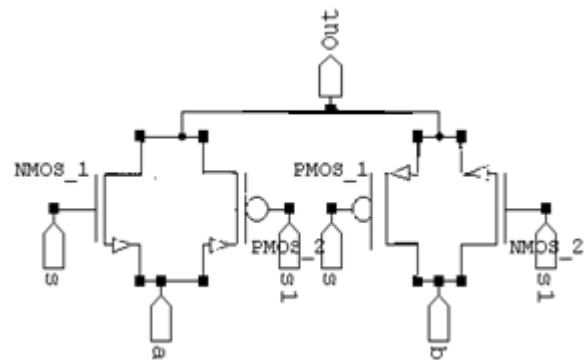
III. SIMULATION AND ANALYSIS

3.1 simulation environment

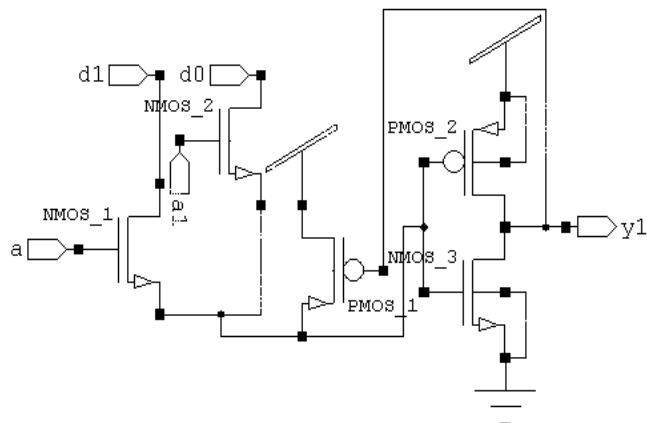
A simulation of various 2:1 multiplexer is done using Tanner EDA Tool on version 13.0. Various 2:1 multiplexer circuits simulations are performed on BSIM3v3 90nm and 45nm technologies with supply voltage ranging from 0.6V to 1.4V. In order to find out the optimized design in terms of power, delay, power-delay product, the simulation have been carried out at varying supply voltages, temperatures and operating frequencies.



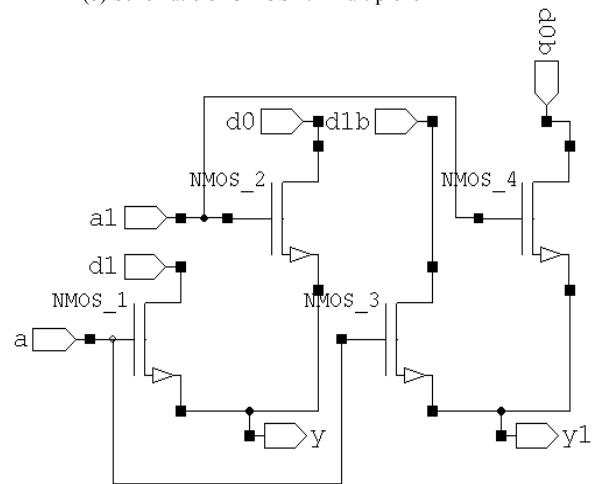
(a) Schematic of NMOS 2:1 Multiplexer



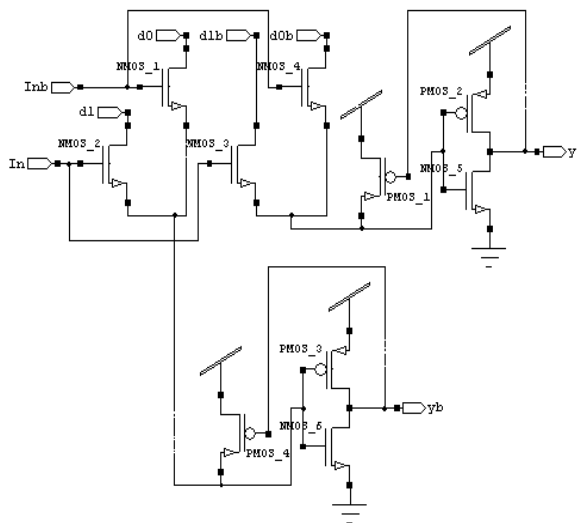
(b) Schematic of CMOS 2:1 Multiplexer



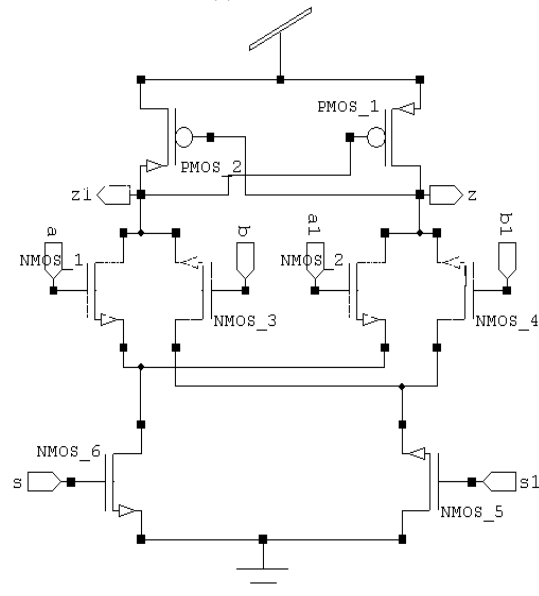
(c) Schematic of MSL circuit



(d) Schematic of MD circuit



(e) Schematic of MDL circuit



(f) Schematic of DCVSL circuit

Fig.1 Different 2:1 Multiplexer's Topologies (a) NMOS Design (b) CMOS Design (c) MSL Design (d) MD Design (e) MDL Design (f) DCVSL Design

To establish an impartial simulation circumstance, each circuit have been tested on the same input patterns which covers every possible combination of input a, b and s.

3.2 simulation analysis

The graph shown in Fig.2, Fig.3, Fig.10, Fig.11 and Fig.12 reveals that the power consumption of DCVSL circuit is remarkably reduced than the other approaches at 90nm and 45nm technology. The delays of all the circuits are shown in Fig.4, Fig.5, Fig.13 and Fig.14. DCVSL approach shows slightly more delay than the delay of other design for input voltage ranging from 0.6V to 1.4V. Similar results for power consumption Vs operating frequency and power consumption Vs temperature are shown in Fig.6, Fig.7, Fig.15, Fig.8, Fig.9 and Fig.16 respectively at 90 and 45 nm technology. As it is found from the simulations DCVSL circuit shows better performance for the range of operating frequency and

At 90 nm technology

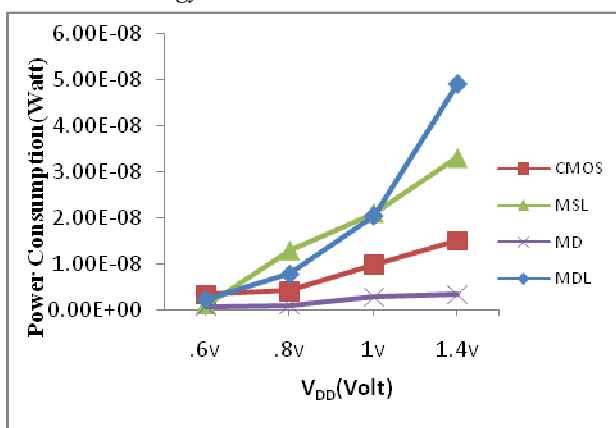


Fig.2 Power consumption comparison of various 2:1 multiplexer technologies at different supply voltages

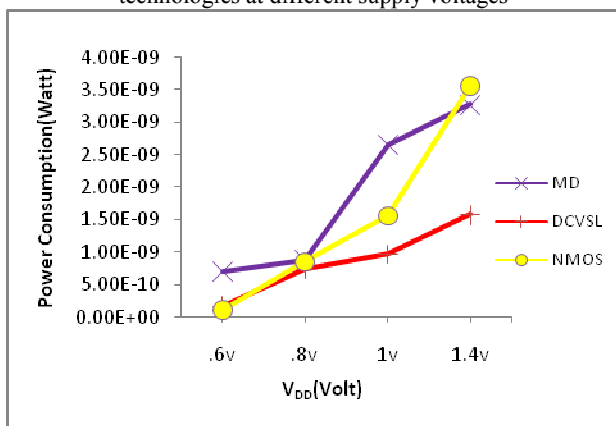


Fig.3 Power consumption comparison of various 2:1 multiplexer technologies at different supply voltages

operating temperature among all the other design approaches for 2:1 Multiplexers.

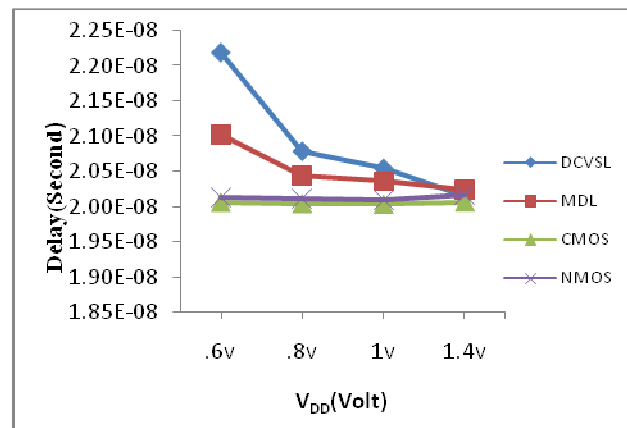


Fig.4 Delay comparison of various 2:1 multiplexer technologies at different supply voltages

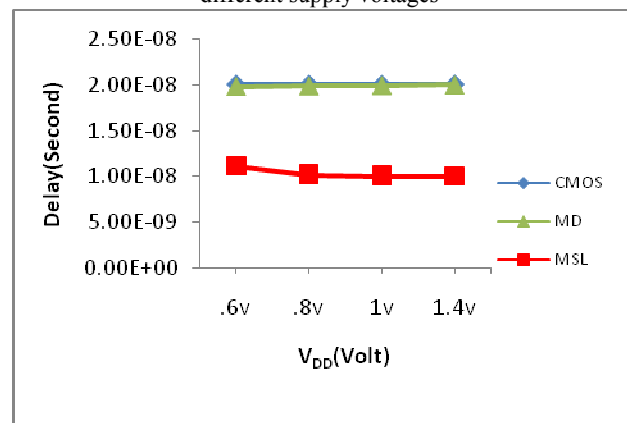


Fig.5 Delay comparison of various 2:1 multiplexer technologies at different supply voltages

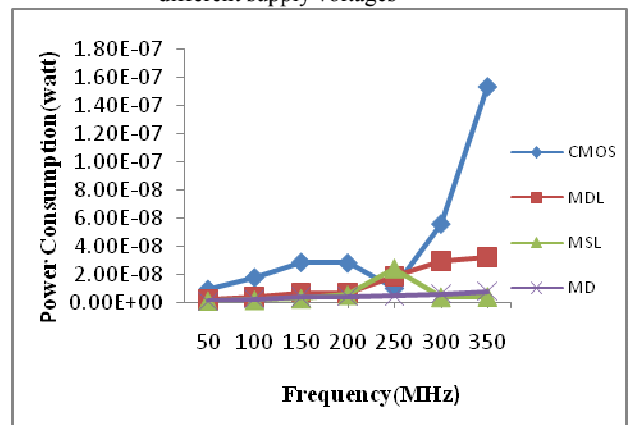


Fig.6 Power consumption comparison of various 2:1 multiplexer technologies at different operating frequencies

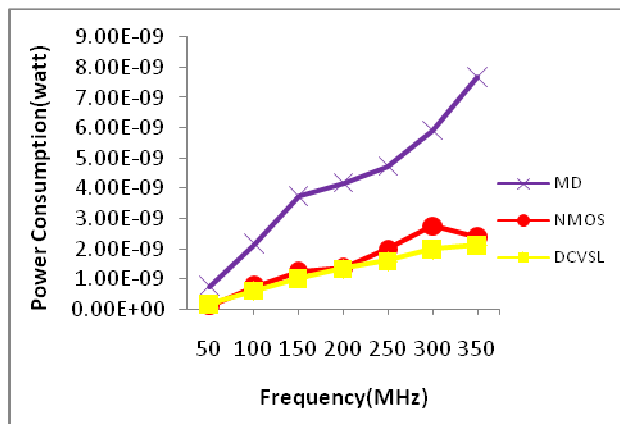


Fig.7 Power consumption comparison of various 2:1 multiplexer technologies at different operating frequencies

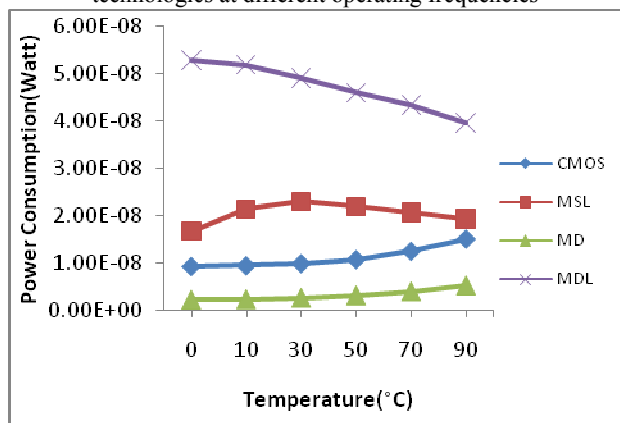


Fig.8 Power consumption comparison of various 2:1 multiplexer technologies at different temperatures

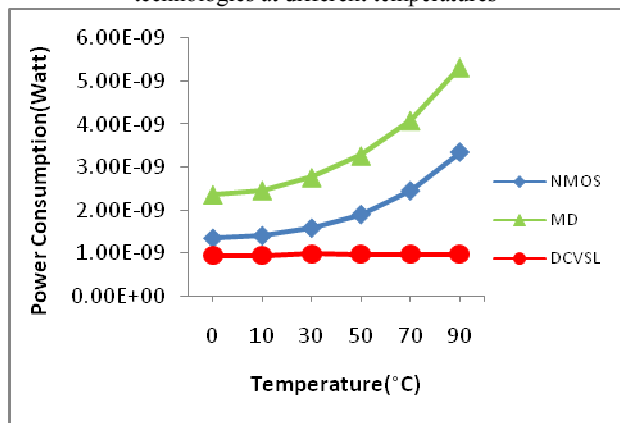


Fig.9 Power consumption comparison of various 2:1 multiplexer technologies at different temperatures

At 45nm technology

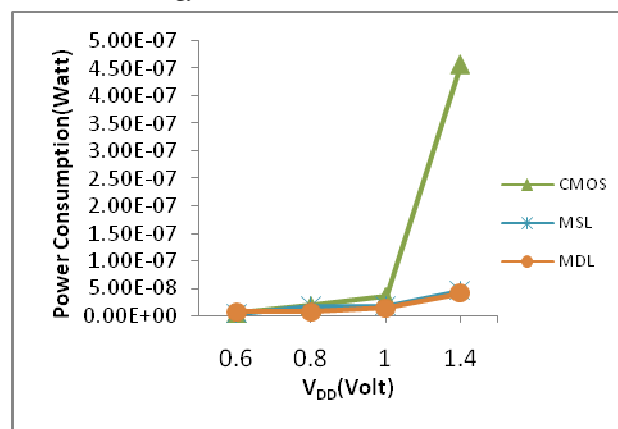


Fig.10 Power consumption comparison of various 2:1 multiplexer technologies at different supply voltages

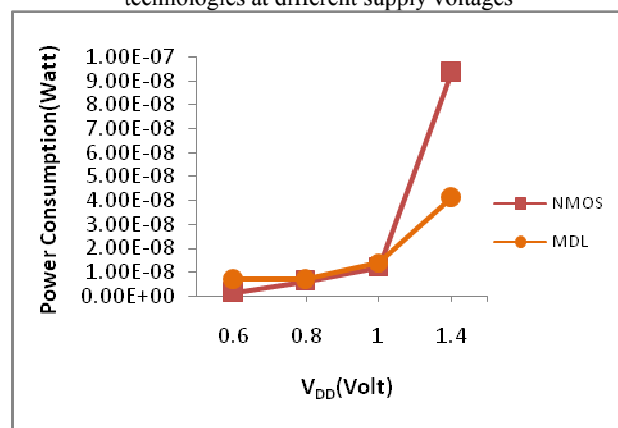


Fig.11 Power consumption comparison of various 2:1 multiplexer technologies at different supply voltages

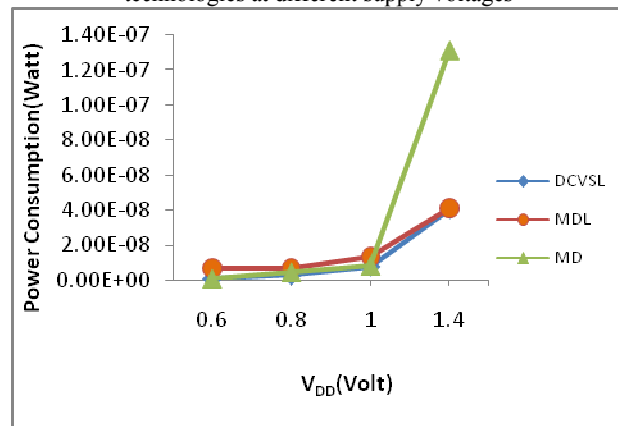


Fig.12 Power consumption comparison of various 2:1 multiplexer technologies at different supply voltages

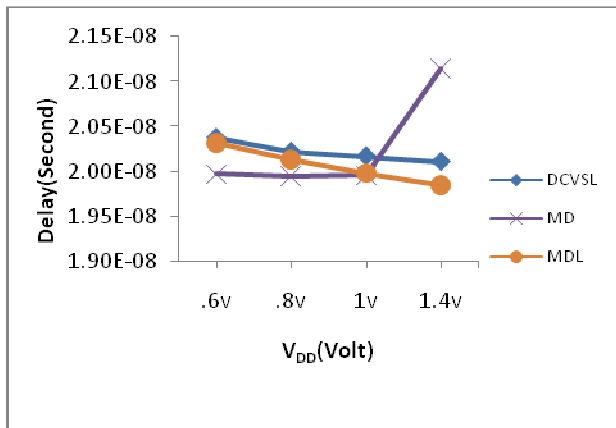


Fig.13 Delay comparison of various 2:1 multiplexer technologies at different supply voltages

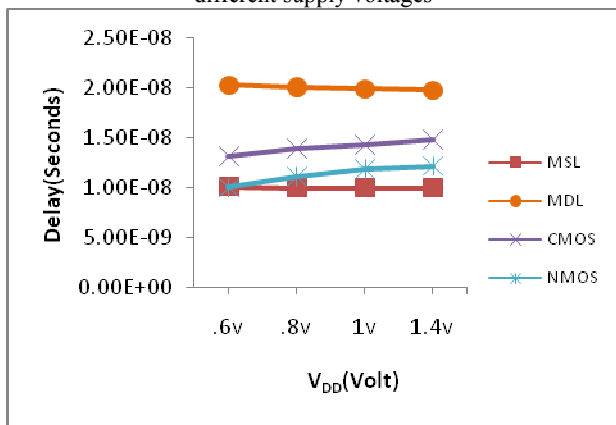


Fig.14 Delay comparison of various 2:1 multiplexer technologies at different supply voltages

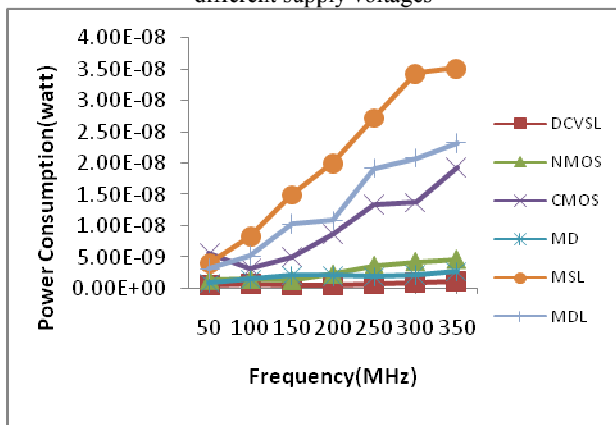


Fig.15 Power consumption comparison of various 2:1 multiplexer technologies at different operating frequencies

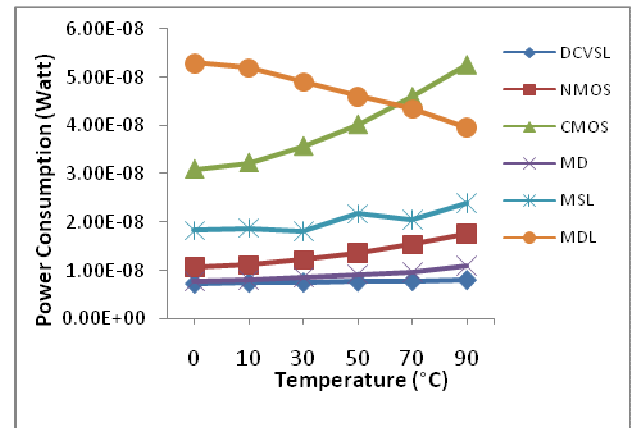


Fig.16 Power consumption comparison of various 2:1 multiplexer technologies at different temperatures

Table I and Table II show the Power delay product over a range of power supply voltages at 90nm and 45nm technology and as it is shown in the table that DCVSL circuit for 2:1 multiplexer shows minimum Power Delay Product.

Different 2:1 Mux circuits	Power Delay Product (90nm) (Watt-sec)			
	V _{DD} =.6v	V _{DD} =.8v	V _{DD} =1v	V _{DD} =1.4v
NMOS	2.17E-18	1.71E-17	3.13E-17	7.18E-17
CMOS	6.54E-17	7.94E-17	1.96E-16	3.00E-16
MSL	1.08E-17	1.31E-16	2.12E-16	3.32E-16
MD	1.39E-17	1.76E-17	5.30E-17	6.56E-17
MDL	4.61E-17	1.57E-16	4.15E-16	9.94E-16
DCVSL	3.70E-18	1.52E-17	2.00E-17	3.18E-17

Table I. Power delay product comparison of different 2:1 multiplexer circuits at 90 nm technology

Different 2:1 Mux circuits	Power Delay Product (45nm) (Watt-sec)			
	V _{DD} =.6v	V _{DD} =.8v	V _{DD} =1v	V _{DD} =1.4v
NMOS	1.34E-17	7.07E-17	1.61E-16	1.14E-15
CMOS	7.41E-17	2.59E-16	5.00E-16	6.82E-15
MSL	4.11E-17	1.78E-16	1.83E-16	8.55E-16
MD	1.73E-17	9.12E-17	1.65E-16	2.78E-15
MDL	1.38E-16	1.36E-16	2.73E-16	8.23E-16
DCVSL	1.24E-17	5.10E-17	1.52E-16	8.16E-16

Table II. Power delay product comparison of different 2:1 multiplexer circuits at 45 nm technology

IV. CONCLUSION

For low-leakage and high-speed circuits concern should be on both the factors Speed and Power[7]. This paper concluded with the efficient approach of multiplexer at 90nm and 45nm technology. Differential Cascade Voltage Switch Logic (DCVSL) shows least Power Consumption over a range of Power Supply Voltage, Power-Delay product, operating frequency and operating temperature over other circuit design of 2:1 multiplexer.

REFERENCES

- [1] Yano, K., Sasaki, Y., Rikino, K. and Seki, K. (1996) "Top-down pass transistor logic design", IEEE Journal of Solid-State Circuits 31(6), 792–803.
- [2] Shen-Fu Hsiao, Jia-Siang Yeh and Da-Yen Chen,"High-performance Multiplexer-based Logic Synthesis Using Pass-transistor Logic", VLSI Design, 2002 Vol. 15 (1), pp. 417–426.
- [3] Kiseon Cho and Minkyu Song," Design Methodology of a 32-bit Arithmetic Logic Unit with an Adaptive Leaf-cell Based Layout Technique" VLSI Design, 2002 Vol. 14 (3), pp. 249–258.
- [4] P. K. Lala and A. Walker, "A Fine Grain Configurable Logic Block for Self-checking FPGAs", VLSI Design 2001, Vol. 12, No. 4, pp. 527-536.
- [5] Jan M. Rabaey, Digital Integrated Circuits; a design prospective, Upper Saddle River: Prentice-Hall, 1996.
- [6] Heller, L. G. et al., "Cascode Voltage Switch Logic: A differential CMOS Logic Family", Proceedings of 1984 IEEE International Solid-state Circuits Conference, pp. 16-17.
- [7] Bellaouar, Mohamed I. Elmasry, "Low-power digital VLSI design: circuits and systems", 2nd Edition.

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Wind Turbine Blade Efficiency and Power Calculation with Electrical Analogy

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Abstract- Wind turbines work by converting the kinetic energy in the wind first into rotational kinetic energy in the turbine and then electrical energy that can be supplied. The energy available for conversion mainly depends on the wind speed and the swept area of the turbine. A 1kW @ 11m/s, 1 meter diameter wind turbine designed with the support of software. The wind turbine blades power and efficiency has been measured at different tip-speed-ratios as well as calculated using software tool. The wind turbine blades power and efficiency has been measured at different tip-speed-ratios and a maximum efficiency of 30% at a TSR of 11.6 was recorded, verifying the blade calculator's accuracy. This paper is an insight into the design aspects of a wind turbine, like turbine blade design, wind power and output power calculation.

Index Terms- wind turbine, betz limit, tip speed ratio (TSR), blade efficiency

I. INTRODUCTION

Power production from a wind turbine is a function of wind speed. The relationship between wind speed and power is defined by a power curve, which is unique to each turbine model and, in some cases, unique to site-specific settings. In general, most wind turbines begin to produce power at wind speeds of about 4 m/s (9 mph), achieve rated power at approximately 13 m/s (29 mph), and stop power production at 25 m/s (56 mph). Variability in the wind resource results in the turbine operating at continually changing power levels. At good wind energy sites, this variability results in the turbine operating at approximately 35% of its total possible capacity when averaged over a year. The amount of electricity produced from a wind turbine depends on three factors:

- 1) Wind speed : The power available from the wind is a function of the cube of the wind speed. Therefore if the wind blows at twice the speed, its energy content will increase eight-fold. Turbines at a site where the wind speed averages 8 m/s produce around 75-100% more electricity than those where the average wind speed is 6 m/s.
- 2) Wind turbine availability : This is the capability to operate when the wind is blowing, i.e. when the wind turbine is not undergoing maintenance. This is typically 98% or above for modern European machines.
- 3) The way wind turbines are arranged : Wind farms are laid out so that one turbine does not take the wind away from another. However other factors such as environmental considerations,

visibility and grid connection requirements often take precedence over the optimum wind capture layout.

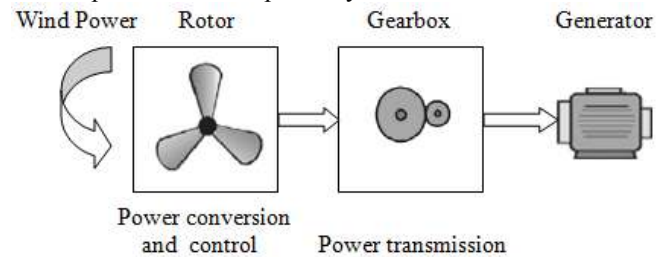


Figure 1: Mechanical components of wind turbine.

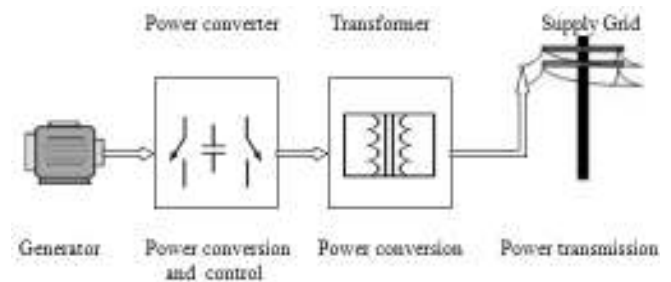


Figure 2 : Electrical components of wind turbine.

Usually, WTBs are designed to operate for a period of 20 years. But, no final statement can be made yet concerning the actual life expectancy of modern WTBs as, until now, no operational experience of such period is available.

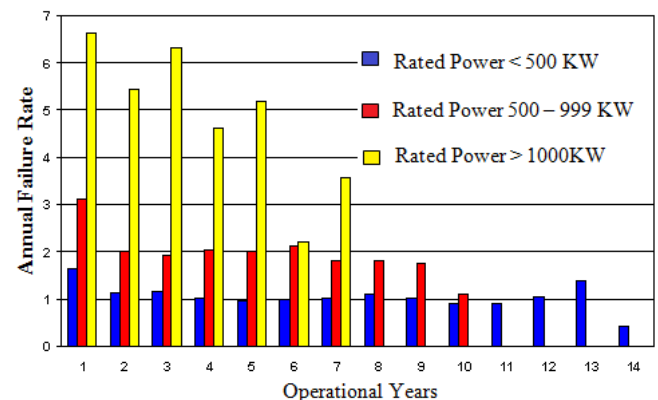


Figure 3 : Frequency of 'failure rate' with increasing operational age

Changes in reliability with increasing operational age can, however, provide indications of the expected lifetime and the amount of upkeep required. Reliability can be expressed by the

number of failures per unit of time, i. e. 'Failure Rate'. In the following, the failure rates of WTBs depending on their operational age will be depicted (Fig. 3).

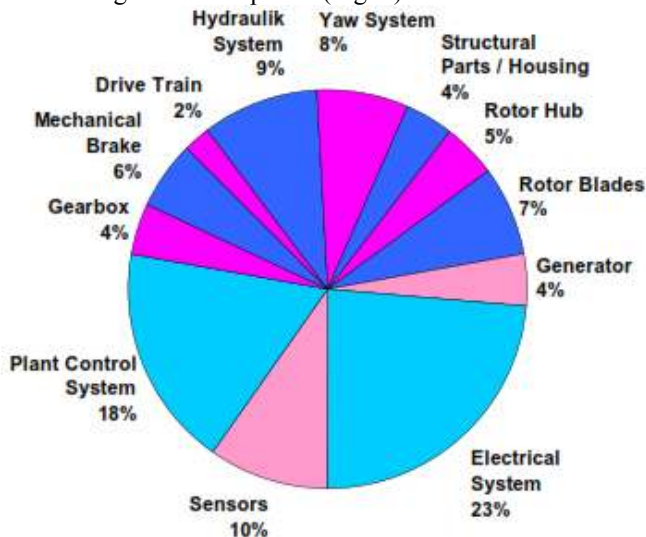


Figure 4: Share of the main components of total number of failures

It is clear that the failure rates of the WTs now installed, have almost continually declined in the first operational years. This is true for the older turbines under 500 kW and for the 500/600 kW class. However, the group of mega-watt WTs show a significantly higher failure rate, which also declines by increasing age. But, including now more and more mega-watt WTB models of the newest generation, the failure rate in the first year of operation is being reduced.

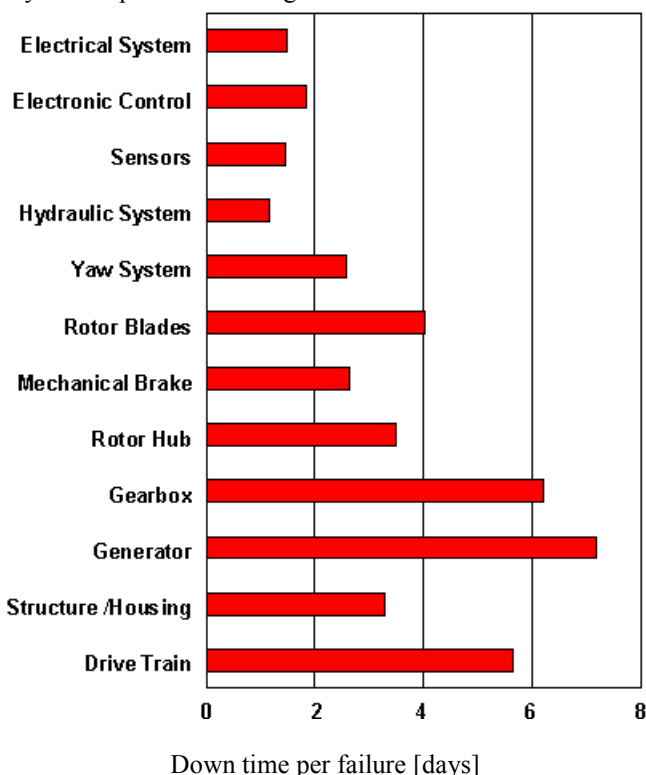


Figure 5 : Down time of wind turbine system components

Wind turbines achieve an excellent technical availability of about 98% on average, although they have to face a high number of malfunctions.

II. IMPROVING SYSTEM LIABILITY

A. Identify Critical Components

Within any complex system, certain components will stand out as high-risk items, either because they are 'weak points' that are demonstrated to be failure prone, are absolutely essential to turbine operation, or are expensive and time-consuming to diagnose and repair. Identifying the critical components allows the O&M staff to direct their monitoring, training, inventory, and logistics efforts on areas that will provide the most benefit.

Although to some extent the critical components depend on the manufacturer, configuration, and operating environment, certain candidates for attention (gearboxes, generators, and power converters, for example) are well known throughout the industry. Minor components, though perhaps less costly to replace or repair, may be elevated to a critical status if their frequency of failure is high.

B. Characterize Failure Modes

Understanding the failure mode allows the maintenance staff to focus monitoring efforts and potentially delay or prevent catastrophic failures. A generator short may be difficult to predict, but gearbox bearing or gear wear may be detected early with scrupulous lubricant monitoring and/or "condition" monitoring, and the progression of damage possibly mitigated with more frequent oil changes or better filtering. An understanding of the way in which a failure progresses is essential to ensuring that staff avoid consequential damage due to unanticipated breakage.

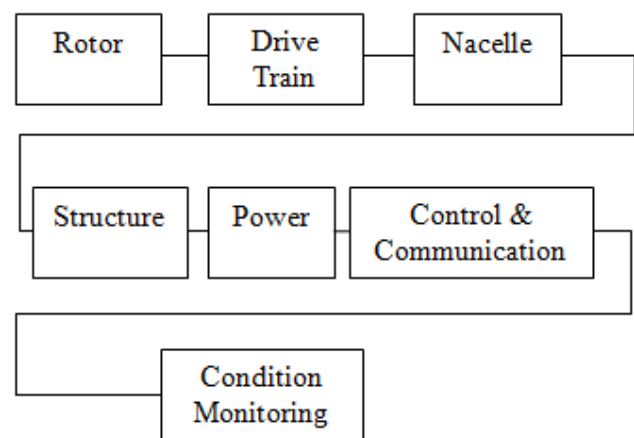


Figure 6: Reliability block diagram of wind turbine

C. Determine the Root Cause

Although the wind plant operator may be primarily interested in replacing a failed component and getting their machine back on-line, a failure always represents an opportunity for improvement. Most wind turbine manufacturers include failure analysis as an essential part of their continuous quality improvement process. Evaluating the root cause of a major component failure is essential to determining if the failure is due to manufacturing quality, product misapplication, design error, or inappropriate design assumptions. This information, in turn,

assists the manufacturer in determining if the problem is an isolated instance or a systemic problem that is likely to result in serial failures. In the latter case, retrofits or redesigns will be required and a field replacement plan will be developed.

It can be assumed that these good availability figures can only be achieved by a high number of service teams who respond to turbine failures within short time. In order to further improve the reliability of WTBs, the designers have to better the electric and electronic components. This is particularly true and absolutely necessary in the case of new and large turbines.

III. TURBINE BLADE DESIGN

Tip Seep Ratio(TSR) : Select a value for the Tip Speed Ratio (TSR) which is defined as : $TIP\ SPEED\ RATIO\ (TSR) = (tip\ speed\ of_blade)/(wind\ speed)$. The tip speed ratio is a very important factor in the different formulas of blade design. Generally can be said, that slow running multi bladed wind turbine rotors operate with tip speed ratios like 1-4, while fast runners use 5-7 as tip speed ratios.

The task is now to fit the known generator capacity and revolutions to the wind speed and to the swept rotor area. Two formulas are needed:

$Power\ (W) = 0.6 \times C_p \times N \times A \times V^3$, $Revolutions\ (rpm) = V \times TSR \times 60 / (6.28 \times R)$, C_p = Rotor efficiency, N = Efficiency of driven machinery, A = Swept rotor area (m^2), V = Wind speed (m/s) TSR = Tip Speed Ratio, R = Radius of rotor, Rotor efficiency can go as high as $C_p = 0.48$, but $C_p = 0.4$ is often used in this type of calculations.

This concept works without transmission. If a transmission with efficiency of 0.95 was to be included this means that

$$N = 0.95 \times 0.7,$$

Tip speed ratio "TSR" = 7"

Wind speed "V" = 8.6 m/s

Rotor efficiency "Cp" = 0.4

Generator efficiency "N" = 0.7

Swept rotor area "A" = 2.11 M2

Radius of rotor = 0.82 m

Revolutions = 701 rpm

Power output = 226 W.

The width of the blade is also called the blade chord. A good formula for computing this is: $Blade\ Chord\ (m) = 5.6 \times R^2 / (i \times Cl \times r \times TSR^2)$, R = Radius at tip, r = radius at point of computation, i = number of blades, Cl = Lift coefficient, TSR = Tip Speed Ratio.

IV. CALCULATION OF WIND POWER

There are many complicated calculations and equations involved in understanding and constructing wind turbine generators however the layman need not worry about most of these and should instead ensure they remember the following vital information:

1) The power output of a wind generator is proportional to the area swept by the rotor - i.e. double the *swept area* and the power output will also double.

2) The power output of a wind generator is proportional to the cube of the wind speed.

Kinetic Energy = $0.5 \times Mass \times Velocity^2$, where the mass is measured in kg, the velocity in m/s, and the energy is given in

joules. Air has a known density (around $1.23\ kg/m^3$ at sea level), so the mass of air hitting our wind turbine. (which sweeps a known area) each second is given by the following equation: $Mass/sec\ (kg/s) = Velocity\ (m/s) \times Area\ (m^2) \times Density\ (kg/m^3)$. Therefore, the power (i.e. energy per second) in the wind hitting a wind turbine with a certain swept area is given by simply inserting the mass per second calculation into the standard kinetic energy equation given above resulting in the following vital equation: $Power = 0.5 \times Swept\ Area \times Air\ Density \times Velocity^3$, where Power is given in Watts (i.e. joules/second), the Swept area in square metres, the Air density in kilograms per cubic metre, and the Velocity in metres per second.

The equation for wind power(P) is given by $P = 0.5 \times \rho \times A \times C_p \times V^3 \times N_g \times N_b$ where, ρ = Air density in kg/m^3 , A = Rotor swept area (m^2).

C_p = Coefficient of performance

V = wind velocity (m/s)

N_g = generator efficiency

N_b = gear box bearing efficiency.

The world's largest wind turbine generator has a rotor blade diameter of 126 metres and so the rotors sweep an area of $\pi \times (diameter/2)^2 = 12470\ m^2$! As this is an offshore wind turbine, we know it is situated at sea-level and so we know the air density is $1.23\ kg/m^3$. The turbine is rated at 5MW in 30mph (14m/s) winds, and so putting in the known values will give, $Wind\ Power = 0.5 \times 12,470 \times 1.23 \times (14 \times 14 \times 14)$, which gives us a wind power of around 21,000,000 Watts. Why is the power of the wind (21MW) so much larger than the rated power of the turbine generator (5MW)? Because of the Betz Limit, and inefficiencies in the system. The Betz law means that wind turbines can never be better than 59.3% efficient. The law can be simply explained by considering that if all of the energy coming from wind movement into the turbine were converted into useful energy then the wind speed afterwards would be zero. But, if the wind stopped moving at the exit of the turbine, then no more fresh wind could get in - it would be blocked. In order to keep the wind moving through the turbine, to keep getting energy, there has to be some wind movement on the outside with energy left in it. There must be a 'sweet spot' somewhere and there is, the Betz limit at 59.3%.

V. WIND TURBINE BLADE CALCULATION AND POWER CALCULATION

Power, rotational speed and torque of the wind turbine can be calculated using the free software *Blade Calculator*.

3	Number of Blades	<input checked="" type="radio"/> SI
7	TSR	
0.4	Blade Efficiency	<input type="radio"/> Metric
1	Blade Radius (m)	
11	Wind Speed (m/s)	<input type="radio"/> Imperial
<input type="button" value="Solve Equations"/>		

Table 1 : Output obtained for the given parameters

Power	1.02 KW
-------	---------

Rotational speed	77 rad/sec
Torque	13.25 Nm

The program display three power. The first power is the power available in the wind for given wind speed and radius. The second power is the Betz Power. This is the maximum power can be extracted from the wind if there were no losses or inefficiencies in the system. Please note that it is very difficult to get the Betz power from any turbine. The last power which is labeled as Real Power is the power you can get from the turbine with the efficiency displayed in the screen. This kind turbines will have 0 efficiency for wind speeds above 25 m/s, meaning that turbine reached it is cut of speed and turned of to prevent damage to turbine.

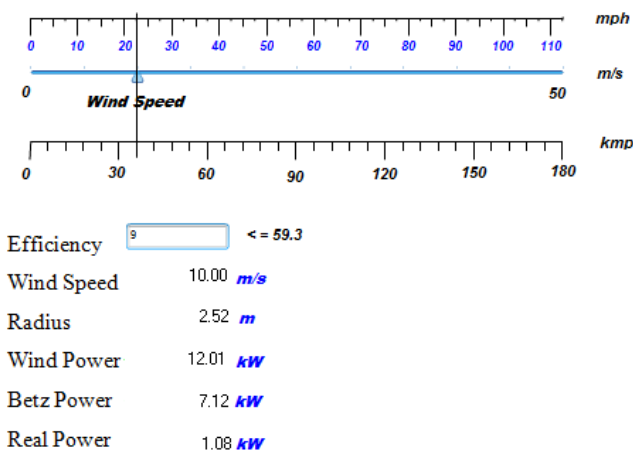


Figure 7 : Result obtained for a wind speed of 10m/s and turbine efficiency 9%.

VI. CALCULATION OF GENERATOR EFFICIENCY

The following conditions/status are assumed.

1. The 3 phases are isolated, and connected as 3 single phase outputs.
2. Each output is rectified to DC using a single phase bridge rectifier.

At 666rpm, generator voltage $V_s = 65$ Volts.

R_s = Resistance of each phase of the generator (5.6 Ohms), Voltage across $R_s = 65 - 48 = V_s = 17$ Volts, $V = IR$ and therefore $V/R = I$, Current into battery $= 17/5.6 = 3$ amps per phase, $P = VI$. Power into battery $= 48 \times 3 = 144$ watts per phase (432 watts for all 3 phases), $P = V^2/R$, Power Lost is $= 17^2/5.6 = 51.6$ per phase, Efficiency of generator $= 144/(144+51.6) = 73.6\%$ (Theoretical)

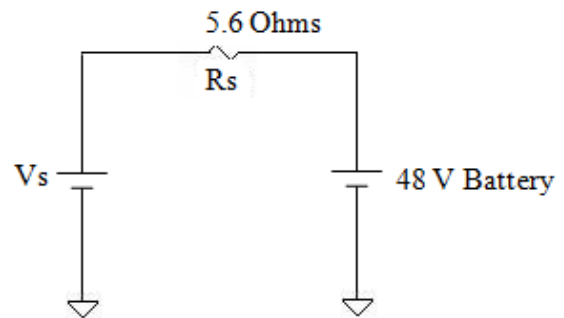


Figure 8 : One phase representation of generator

VII. MEASURED RESULTS

R_s is the resistance of the generator windings plus the power cable; 5.75 ohms and R_l is the resistance of the load; 6.6, 10, 15, 21.5 and 25 ohms.

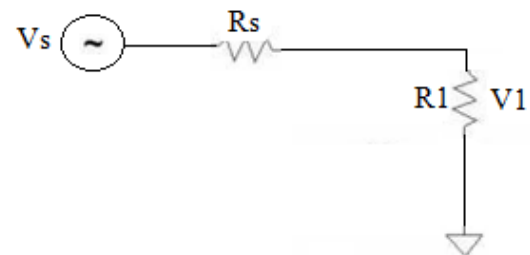


Figure 9 : Electrical analogy of wind turbine

Table 2 : Specification and result for 1kw generator

Parameter	Unit	Value
Rated power	W	1000
Rated speed	rpm	300
Rated frequency	Hz	40
Rated EMF (per coil)	V	33.6
Number of phases	-	3
Number of pole pairs	-	8
Number of armature coils	-	12
Generator diameter	mm	462
Generator length	mm	55

Table 3 : Rotational speed of turbine for different wind speed(rpm)

Wind Speed	25 ohms	21.5 ohms	15 ohms	10 ohms	6 ohms
30km/h	820	766	809	-	-
40km/h	1302	1363	851	645	-
50km/h	1753	1676	1489	1291	1105
60km/h	-	2365	2098	1744	1607

Table 4 : Power in Watts

Wind Speed	25 ohms	21.5 ohms	15 ohms	10 ohms	6 ohms
30km/h	208	205	300	-	-
40km/h	524	649	332	252	-
50km/h	950	981	1017	1008	940

60km/h	-	1953	2019	1837	1990
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Table 5 : Blade efficiency of turbine

Wind Speed	25 ohms	21.5 ohms	15 ohms	10 ohms	6 ohms
30km/h	0.23	0.23	-	-	-
40km/h	0.24	0.30	0.15	-	-
50km/h	0.22	0.23	0.24	0.24	-
60km/h	-	0.27	0.27	0.25	0.27

Table 6 : Tip speed (km/hour)

Wind Speed	25 ohms	21.5 ohms	15 ohms	10 ohms	6 ohms
30km/h	278	260	275	-	-
40km/h	441	463	289	218	-
50km/h	595	569	506	438	375
60km/h	-	803	712	592	546

Table 7 : Tip speed ratio

Wind Speed	25 ohms	21.5 ohms	15 ohms	10 ohms	6 ohms
30km/h	9.2	8.7	9.2	-	-
40km/h	11.0	11.6	7.2	5.5	-
50km/h	11.9	11.4	10.1	8.8	7.5
60km/h	-	16.1	14.2	11.8	10.9

Power generated by the blades was calculated by dividing by the efficiency of the generator. Once the blades have been characterized, a new generator will be designed. Powers generated by the blades are calculated by the following:

Voltage across the resistor load was measured V_L ,
 $V_s = V_L \times [(R_s + R_L) / R_L]$. Power produced by blades, and lost in generator, power cable and resistor load is given by;
 $P = V^2/R$
 $P = V_s^2 / (R_s + R_L)$

VIII. CONCLUSION AND FUTURE SCOPE

A 1kW @ 11m/s, 1 meter diameter wind turbine designed with the support of software. The wind turbine blades power and efficiency has been measured at different tip-speed-ratios as well as calculated using software tool. The wind turbine blades power and efficiency has been measured at different tip-speed-ratios and a maximum efficiency of 30% at a TSR of 11.6 was recorded, verifying the blade calculator's accuracy. The environmental factors like wind direction, corrosion, water vapour intrusion, thermal expansion, mechanical load, summer-winter climate change, ageing and component derating which degrades the performance can be considered for estimating a more practical and accurate design.

REFERENCES

- [1] Reliability of Wind Turbines Experiences of 15 years with 1,500 WT's Berthold Hahn, Michael Durstewitz, Kurt Rohrig, Institut für Solare Energieversorgungstechnik (ISET), Verein an der Universität Kassel e.V., 34119 Kassel, Germany.
- [2] SANDIA REPORT (2006), Unlimited Release, Printed March 2006 Wind Turbine Reliability: Understanding and Minimizing Wind Turbine Operation and Maintenance Costs - Christopher A. Walford Global Energy Concepts, Prepared by Sandia National Laboratories Albuquerque, New Mexico 87185 and Livermore, California 94550
- [3] http://www.flapturbine.com/hawt_power_change_efficiency.html
- [4] <http://warlock.com.au/030504.htm>
- [5] Modeling of Wind Power Plants for Short Circuit Analysis in the Transmission Network (2008), Nader Samaan, Member, Robert Zavadil, Member, J. Charles Smith, Senior Member, and Jose Conto,
- [6] Member, IEEE, 978-1-4244-1904-3/08/\$25.00 ©2008, IEEE.

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Acute *Streptococcus pneumoniae* meningitis causes Neurodegeneration in the Subregions of the Hippocampus in Wistar Rats

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Abstract- Background: Bacterial meningitis is known to cause neurodegenerations in the hippocampus, motor cortex and cerebellum. Aim of the present study was to investigate quantitatively the effect of pneumococcal meningitis on hippocampal sub regions in Wistar rats.

Materials and Methods: Thirty days old rats were divided into normal control (NC) and meningitis (M) groups. Rats in the meningitis group were infected with *Streptococcus pneumoniae* intracisternally on postnatal day 31. The concentration of the bacterial suspension in phosphate-buffered saline (PBS) was 1×10^6 cfu/ml (colony forming units/ml). The rats were kept under observation for 18 hrs for clinical symptoms of meningitis to develop. After 18-24 hrs of incubation, 10-50 μ l of the CSF sample was collected. Gram's staining of the CSF smear was done and observed under oil immersion objective (100X) for Gram positive, lanceolate diplococci. The rats were perfused transcardially with saline followed by 10% formalin. Brains were removed, processed for paraffin sectioning and stained with cresyl violet stain. Neurodegeneration in the hippocampal CA1, CA3 and dentate hilus were quantified.

Results: The hippocampal sub-regions showed neurodegeneration. Significant fractions of neurons in the above regions were darkly stained and were irregular in shape. There was 56-81% neuronal loss in these regions. The surviving neurons showed 34-45% decrease in cell diameter and 28-29% decrease in the cross-sectional area in the hippocampal sub regions.

Conclusion: Meningitis affects the hippocampal subregions equally and may be the neural basis of cognitive deficit. The mechanism of such neurodegeneration could have been due to necrosis or apoptosis.

Index Terms- Neurodegeneration, pneumococcal meningitis, hippocampus, CA1, CA3, Dentate hilus

I. INTRODUCTION

Pneumococcal meningitis (PM) is associated with high mortality and morbidity. Great majority of survivors are affected by neurological sequelae due to a wide spectrum of brain injury mainly affecting the cortex and hippocampus. Bacterial meningitis due to *Streptococcus pneumoniae* is associated with neurologic sequelae including sensory-motor deficits, seizures, and impairments of learning and memory. The histomorphological observations of these sequelae suggest a

pattern of brain damage characterized by necrotic tissue damage in the cerebral cortex and apoptosis of neurons in the hippocampal dentate gyrus [2,3,4,5]. The only mode of treatment for bacterial meningitis has been antibiotics [1]. Two-thirds of meningitis related deaths are due to miserable outcomes, primarily from central nervous system damage. Rest of the outcomes are due to systemic complications related to septic shock [6]. Spatial memory and learning deficits were reported in mice after experimental pneumococcal meningitis. It has been shown that inflammatory host responses still continue even after killing the bacteria with antibiotics. This inflammatory response of the host is said to be responsible for tissue damage in the central nervous system [7,8,9,10].

In bacterial meningitis neuronal injury or damage is a common feature, which occurs in the hippocampus due to apoptotic cell death pathways. Neuronal injury in bacterial meningitis is caused by hypoxia, neurotoxic bacterial products and inflammatory mediators of the host response. The final tissue damaging oxidants are the free radicals. These include reactive oxygen species, reactive nitrogen species and they directly affect the neurons [11]. Programmed cell death of the neurons in the granular layer of the hippocampal dentate gyrus and necrosis of the pyramidal neurons is seen in the hippocampus. The above pathways lead to severe neurological sequelae or even to death [12,13,14,15,16,17,18,19].

Magnetic resonance studies of survivors of bacterial meningitis have shown hippocampal atrophy²⁰. Long term bacterial meningitis leads to neuronal death, deafness, intellectual and cognitive impairments and behavioral problems and less commonly to epilepsy, spasticity or focal neurologic deficits [3,21,22,23,24,25].

Though there is ample literature on meningitis induced neuronal injury in the hippocampal region, none of them seem to address the neurodegeneration quantitatively in different subregions of the hippocampus. Hence the present study was performed to investigate neuronal injury quantitatively in the sub regions of the hippocampus, after experimentally inducing meningitis in Wistar rats.

II. MATERIALS AND METHODS

Animal ethical approval

Twelve one month-old Wistar rats were housed in the Central Animal Research Facility of Manipal University. The rats were housed in sanitized polypropylene cages containing sterile paddy husk as bedding. The animals were maintained under controlled

conditions of temperature ($23 \pm 2^\circ\text{C}$), humidity ($50 \pm 5\%$) and a 12-h light-dark cycle. All animals were allowed free access to water and were fed on a commercial diet. All the studies conducted were approved by the Institutional Animal Ethical Clearance Committee, Melaka Manipal medical college, Manipal, according to prescribed guidelines of Committee for the Purpose of Control and Supervision of Experiments on Animals (CPCSEA), Government of India

Experimental protocol

a. Isolation of *Streptococcus pneumoniae*:

Oxacillin sensitive *Streptococcus pneumoniae* ATCC 33400 obtained from Christian Medical College, Vellore, India was used for the study. The pneumococci were plated and isolated on chocolate agar. The alpha haemolytic colonies were subjected to Gram's staining for microscopical analysis. Gram positive, lanceolate-shaped diplococci were seen on examination at 100X magnification. The colonies were emulsified in Hiss's serum water for a further battery of biochemical tests for confirmation. The pneumococci were tested for the fermentation abilities with acid only, for sugars along with Inulin. The pneumococcal colonies were lyophilized and cryopreserved at -70°C for further use.

b. Experimental groups:

30 days old Wistar rats were divided into Normal control (NC) and Meningitis (M) groups ($n=6$ in each group). The normal control group of rats remained undisturbed in their home cages. Rats in the meningitis group were infected with *Streptococcus pneumoniae* intracisternally on postnatal day 31.

c. Induction of acute Pneumococcal meningitis in rats

The rats were anaesthetized with 3% vol/vol halothane and were fixed in the stereotaxic frame (Robert et al., 2003). 10 μl of the pneumococcal suspension was inoculated into the cisterna magna under steriotactic guidance. Skull was exposed through a skin incision and location of cisterna magna was identified. A burr hole was drilled and bacterial suspension was injected using 10 μl Hamilton syringe. The concentration of the bacterial suspension in phosphate buffered saline (PBS) was 1×10^6 cfu/ml (colony forming units/ml). The rats were kept under observation for every 6 hrs for clinical symptoms of meningitis. After 18-24 hrs of incubation, 10-50 μl of the CSF (cerebrospinal fluid) sample was collected through lumbar puncture, for further tests. Gram's staining of the CSF smear was done and observed under oil immersion objective (100X) for Gram positive, lanceolate diplococci. Culture was also done to assess the bacterial colonies. CSF samples suspended in 20 μl were fixed with methanol (20 μl) for 30 minutes, prior to Geimsa staining. The polymorphs were counted using a hemocytometer and assigned total cell count as cells/ml as defined for infection (Robert et al., 2003).

d. Tissue processing for histological study

After 18hrs of incubation, the rats in the meningitic group and the rats of the control group were euthanized and sacrificed on post natal day 31. The rats were perfused transcardially with 100 ml of saline, followed by 200 ml of 10% formalin. Brain was removed and post fixed for 48 hrs in the

same fixative. The tissue was processed for paraffin sectioning. Hippocampal tissue was selected for study. Tissue was dehydrated in the ascending grades of ethyl alcohol and then cleared with xylene. The tissue was further embedded in paraffin wax. Coronal sections of hippocampus were taken at 5 μm thickness in a rotory microtome. The sections were stained with 0.1% cresyl violet stain in distilled water. Briefly, the sections were deparaffinized in xylene, and hydrated in the descending grades of ethyl alcohol. The sections were then stained with cresyl violet stain at 60°C for 20 minutes. Sections were differentiated in 70% alcohol and then dehydrated with 90% alcohol and absolute alcohol. The sections were mounted with DPX mounting media.

e. Neuronal quantification

i. Neuronal cell counts:

Number of neurons in 250 μm length of CA1, CA3 and dentate hilus region were counted at 400X magnification. The neurons with clear cell boundary and nucleus were only counted and cells with irregular shapes and that which stained darkly were excluded from quantification. A total of 15 sections spaced 20 microns apart were selected for quantification. Number of neurons was expressed as Number/ 250 μm length of the given region.

ii. Cross sectional area and diameter of neurons:

The cross sectional area of the neurons and diameter were measured using the Scion image analysis software. The digital images were used for this purpose. From each animal five randomly selected fields with a minimum of 6 neurons were selected (From each animal a minimum of 30 neurons were analyzed).

f. Statistical analysis

Data was expressed as mean \pm Standard Error of Mean (SEM). Data was analysed by two tailed Student's t-test. P value less than 0.05 was considered as significant.

III. RESULTS

Behavioral observations and general histological changes

The rats infected with pneumococci were found to have symptoms of meningitis. They were sluggish, and showed decreased ambulatory movements. Their CSF showed Gram positive lanceolate diplococci. Gram's staining of the CSF culture also confirmed the same. The hippocampus of meningitis rats showed significant neurodegeneration. There was significant gliosis in all the sub regions of the hippocampus in the meningitis rat. The hippocampus was decreased significantly in its size and all the layers were decreased in their thickness in the meningitis induced rat brain compared to the normal control brain. The majority of the neurons showed degenerative features. The degenerating neurons were irregular in shape and were darkly stained

Effect of meningitis on hippocampal CA1 region

There were severe neurodegenerative changes in the hippocampal

CA1 region (Fig 1.)

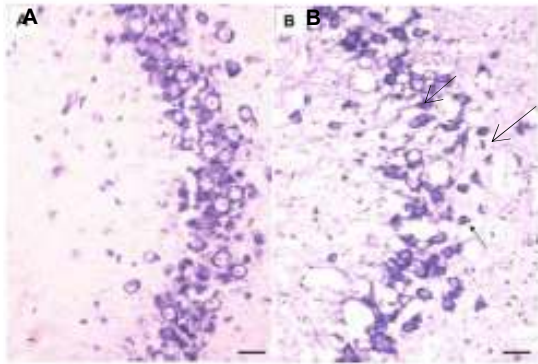


Fig 1: Photomicrographs of hippocampus: CA1 region of normal control (A) and Meningitis (B) rat brain. Note the degenerative changes (arrows in B) and decreased number of neurons in B. Cresyl violet stain, Scale bar = 25µm.

i. Neuronal cell density in CA1 region (Fig 2)

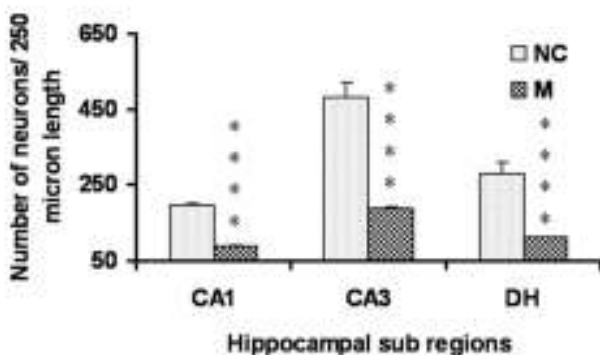


Fig 2: Graph showing the number of neurons in 250µm length of CA1, CA3 and dentate hilus of normal control (NC) and meningitis (M) groups. Each bar represents mean±SEM(n=6). Note there is a significant decrease in the number of neurons in meningitis group. NC Vs M, * $P < 0.0001$; Two tailed student t-test.

Number of neurons in CA1 region was decreased significantly (56%) in the meningitis group compared to normal control group, [198.16 ± 3.42 cells in 250µm length of CA1 region (Mean ± SEM) in control group, (n=6) Vs 86.83 ± 3.58 in meningitis group, (n=6), $P < 0.0001$, two tailed, Student's t-test].

ii. Diameter of CA1 neurons (Fig 3)

The diameter of CA1 neurons was decreased significantly (36%) in the meningitis group compared to normal control group (25.64 ± 0.96 in control group, (n=6) Vs 16.31 ± 0.67

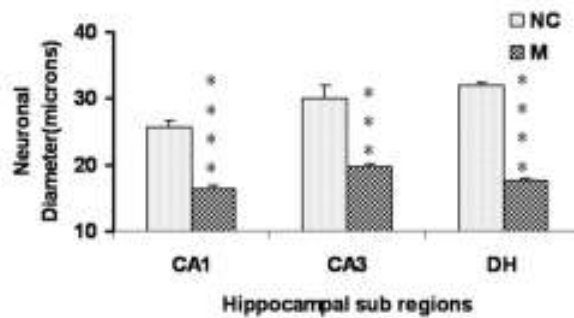


Fig 3: Graph showing the diameter hippocampal CA1, CA3 and dentate hilar neurons in normal control (NC) and meningitis (M) groups. Each bar represents mean ± SEM(n=6). Note there is a significant decrease in the diameter of the neurons in meningitis group. NC Vs M, *** $P < 0.001$; Two tailed student t-test.

in meningitis group, (n=6), $P < 0.0001$, two tailed, Student's t-test).

iii. Cross sectional area of CA1 neurons (Fig 4)

The cross sectional area of CA3 neurons was decreased significantly (28%) in the meningitis group compared to normal control group (181.10 ± 4.33 in control group, (n=6) Vs 130.10 ± 8.29 in meningitis group, (n=6), $P < 0.001$, two tailed, Student's t-test).

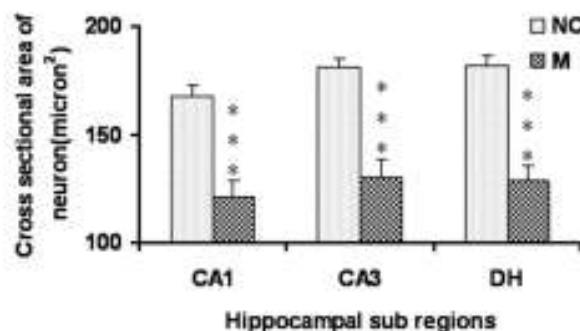


Fig 4: Graph showing the cross sectional area of hippocampal CA1, CA3 and dentate hilar neurons in normal control (NC) and meningitis (M) groups. Each bar represents mean ± SEM (n=6). Note there is a significant decrease in the cross sectional area of the neurons in meningitis group. NC Vs M, *** $P < 0.001$; Two tailed student t-test.

Effect of meningitis on hippocampal CA3 region

There were severe neurodegenerative changes in the hippocampal CA3 region (Fig 5)

i. Neuronal cell density in CA3 region (Figure 2)

Number of neurons in CA3 region was decreased significantly (81%) in the meningitis group compared to normal control group (481.5 ± 37.46 cell in 250µm length of CA3 region in control group, (n=6) Vs 188.00 ± 3.96 in meningitis group, (n=6),

$P < 0.0001$, two tailed, Student's t-test)

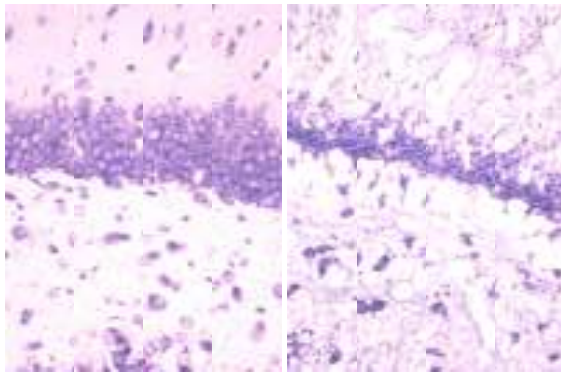


Fig 5: Photomicrographs of hippocampal CA3 region in normal control (A) and Meningitis (B) rat brains. Note the degenerative changes in hippocampal CA3 neurons (arrows in B) and decreased number of neurons in meningitis group. Cresyl violet stain, Scale bar = 25µm.

ii. Diameter of CA3 neurons (Figure 3)

The diameter of CA3 neurons was decreased significantly (34%) in the meningitis group compared to normal control group (29.96 ± 2.02 in control group, (n=6) Vs 19.64 ± 0.50 in meningitis group, (n=6), $P < 0.001$, two tailed, Student's t-test).

iii. Cross sectional area of CA3 neurons (Fig 4)

The cross sectional area of CA3 neurons was decreased significantly (28%) in the meningitis group compared to normal control group (181.10 ± 4.33 in control group, (n=6) Vs 130.10 ± 8.29 in meningitis group, (n=6), $P < 0.001$, two tailed, Student's t-test).

Effect of meningitis on dentate hilus region

There were severe neurodegenerative changes in the hippocampal CA1 region (Figure 6.)

i. Neuronal cell density in dentate hilus region (Fig 2)

Number of neurons in dentate hilus was decreased significantly (60%) in the meningitis group compared to normal control group (281.5 ± 27.75 cell in 250µm length of dentate hilus region in control group, (n=6) Vs 113.00 ± 2.01 in meningitis group, (n=6), $P < 0.0001$, two tailed, Student's t-test).

ii. Diameter of dentate hilar neurons (Fig 3)

The diameter of dentate hilar neuron was decreased significantly (45%) in the meningitis group compared to normal control group (31.96 ± 0.48 in control group (n=6) Vs 17.62 ± 0.41 in meningitis group (n=6), $P < 0.0001$, two tailed, Student's t-test).

iii. Cross sectional area dentate hilar neurons (Figure 4)

The cross sectional area of dentate hilar neurons was decreased significantly (29%) in the meningitis group

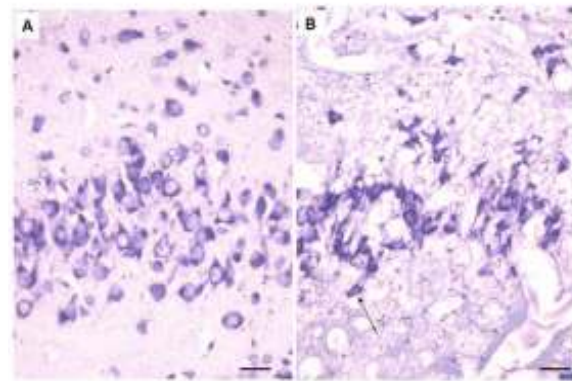


Fig 6: Photomicrographs of dentate hilus region of the hippocampus in normal control (A) and Meningitis (B) rat brains. Note the degenerative changes (arrows in B) and decreased number of neurons in B. Cresyl violet stain, Scale bar=25µm

compared to normal control group (181.1 ± 5.20 in control group, (n=6) Vs 128.76 ± 6.55 in meningitis group, (n=6), $P < 0.001$, two tailed, Student's t-test)

IV. DISCUSSION

The results of the present experiment revealed that pneumococcal meningitis will lead to extensive lesion in the sub regions of the hippocampus, the part of the brain concerned with cognitive functions. Hippocampus on the whole has been attributed to spatial memory and long term potentiation (LTP) and LTP is widely believed to be one of the main neural mechanisms by which memory is stored in the brain. Some neuroscientists no longer believe that the concept of a unified "limbic system" is valid, though[35]. However, the hippocampus with the areas of the CA1 to CA4 along with the dentate gyrus, is anatomically connected to parts of the brain that are involved with emotional behavior-the septum, the hypothalamic mammillary body, and the anterior nuclear complex in the thalamus so it's role as a limbic structure cannot be completely dismissed. The hippocampus is especially vulnerable to damage caused by metabolic dysregulation and in the present study the dysregulation being brought about by septic meningitis mediated by the gram positive pneumococci. However distinct sub-regions within the hippocampus differ by their relative susceptibility to such damage. Region CA1 pyramidal neurons are most sensitive to metabolic perturbations while region CA3 pyramidal neurons show more resistance, and these unique profiles of susceptibility are but one example that differentiates CA1/CA3 neurons[36]. However, despite the importance of hippocampus in learning, memory and cognitive deficits, little information is available about the integrity of hippocampal neurons during acute pneumococcal meningitis. Thus, we have investigated the effects

of meningitis on the hippocampal morphology in a rat model of intracisternal inoculation inducing pneumococcal meningitis and our results revealed neuronal damage which was very severe in all sub regions of hippocampus as revealed by our quantitative data. In the case of CA1, CA3 and dentate hilus regions, 56-81% neuronal loss was documented. Further more there was 34-45% decrease in the diameter and 28-29% decrease in the cross sectional area was observed in the surviving neurons in the hippocampal sub regions. The neurons also showed shrunken and darkly stained cytoplasm with clear nuclei that showed no sign of death signifying that there was no DNA damage. This is in line with the works done by Kafa et al. during sepsis where they also show that a significantly higher neuronal density together with widespread dark, shrunken neurons with dense cytoplasm and irregular membrane boundaries in the CA1 and CA3 areas of the hippocampus in faecal peritonitis group as compared to the sham and unoperated groups [37]. One possible explanation for the decreased neuronal cell volumes is that it could be due to a more condensed alignment of neurons within these areas that could significantly lower nuclear diameter of healthy looking pyramidal neurons of CA1 area. The dark, shrunken neurons frequently observed in these regions in the present study may represent an early stage of a neuronal degeneration. The presence of such neurons have also been reported previously in different brain areas including hippocampus after studies of ischemia, trauma and other brain insults as brought out by Gallays et al. and Messaris et al.

Although, the pathophysiological basis of these changes (shrunken size with slightly condensed chromatin and darkly stained neurons) is not entirely described they may be regarded as an early sign of programmed cell death (Ito *et al.*, 2007). There is compelling evidence to support this assumption. Increased apoptosis is reported in neurons of CA1 regions of the hippocampus, in choroid plexus and in purkinje cells of the cerebellum in models of sepsis.

Hippocampal neuronal death reported here could be the result of apoptosis or as an inflammatory response [26]. Alternatively it could also have been an excitotoxic injury. Indeed studies implicate an important role of monocytic inflammatory cells in bacterial meningitis by the release of glutamate, which may contribute to neuronal cell death. Animals treated with kynurenic acid showed significantly less neuronal injury ($P < .03$) in the cortex and the hippocampus than did untreated controls. These results suggest an important contribution of glutamate to neurotoxicity in the animal model of neonatal meningitis [27].

The observed neuronal injury may also be the consequence of axonal injury as reported in the human studies [28]. Infarction in chronic meningitis may be another factor causing the neuronal injury [29,30]. The neuronal degeneration could take the necrotic pathway or the apoptotic pathway. It has been demonstrated that genetic inactivation of inducible nitric oxide synthase (iNOS) results in a marked reduction of caspase-3-mediated neuronal damage in experimental murine pneumococcal meningitis [26]. It has been demonstrated that the broad-spectrum caspase inhibitor N-benzyloxycarbonyl-Val-Ala-Asp-

fluoromethyl-ketone(z-VAD-fmk) prevented hippocampal neuronal cell death and white blood cell influx into the cerebrospinal fluid compartment in experimental pneumococcal meningitis³¹. Further more gene expression studies in cortex and hippocampus during acute pneumococcal meningitis have shown the upregulation of the cell death/survival genes in hippocampus [32].

Experimental analysis during the acute phase of pneumococcal meningitis showed the localisation of Galectin-3 to polymorphonuclear neutrophils, microglia, monocytes and macrophages, suggesting an involvement of galectin-3 in the neuroinflammatory processes leading to brain damage in pneumococcal meningitis [33]. In the late phase of acute PM, a significant transcriptional upregulation of kynurenine-3-hydroxylase and an accumulation of the neurotoxic metabolites 3-hydroxykynurenine (3-HKYN) and 3-hydroxyanthranilic acid in cortex and hippocampus has been reported. The positive correlation between the concentration of 3-HKYN and the extent of hippocampal apoptosis adds support to the concept that 3-HKYN contributes to brain injury in PM [33].

Another mechanism of neuronal injury in the hippocampus could be due to the down regulation of neurotrophic factor secretion during meningitis insult. The experimental BDNF infusion has shown to protect a large number of neurons in cerebral cortex and hippocampus from inflammatory brain injury in bacterial meningitis [34].

Furthermore the morphological changes associated with cell shrinkage and density decrease could also precipitate dysfunction in synaptic integrity of the regions of the hippocampus that are connected with each other through pathways. Many neurons in the rat and mouse hippocampus respond as place cells: that is, they fire bursts of action potentials when the animal passes through a specific part of its environment. Hippocampal place cells interact extensively with head direction cells, whose activity acts as an inertial compass, and with grid cells in the neighboring entorhinal cortex. In particular, the extensive excitatory recurrent connections of region CA3 have been proposed to play a role in encoding and retrieval of associations, including autoassociative completion of a single pattern, or associative retrieval of the next pattern in a sequence. Lee and Kessner et al in their work on lesions to selective regions of the hippocampus have brought out significant functions attributed to the CA1, CA3 and the dentate gyrus regions of the hippocampus. They show that selective lesions of the dentate gyrus or region CA3 impair the detection of novel locations of familiar items, beyond the effect of CA1 lesions. Control rats showed a normal increase in exploration when a familiar object was moved to an unfamiliar location, whereas rats with CA3 lesions did not show this enhanced exploration. The authors interpret this finding as indicating a role of region CA3 in detecting the mismatch between the memory for the spatial context of each item and the current sensory input about the spatial position of the item. They contrast this with a more modest change in mismatch detection found in rats with lesions of region CA1, which has traditionally been proposed as the region that computes mismatch. They also find a reduction of exploration with dentate gyrus lesions, which they interpret as impairment in the capacity to create the distinct

representations of spatial context necessary for detection of the mismatch[38]. The results for the present study highlight the complexity of the changes that could be brought about by acute pneumococcal meningitis causing the dysfunction of synaptic integrity which could be effected as an early sign for neuronal degeneration and this could very well explain the pattern of neurodegeneration associated with metabolic dysfunction that could lead to impairment of spatial memory, acquisition and short-term/LTP associated with the hippocampal regions of CA1, CA3 and the dentate hilus as a whole. Hence this study could well be helpful in curtailing the effects of neurodegeneration via conjunctive therapy targeted against neuroinflammation, free radical damage of the neuronal mass due to apoptosis and necrosis and several signal transduction pathways involving Brain derived neurotrophic factor (BDNF) that can directly or indirectly control neurogenesis to replace the damage done to the various regions in the brain

V. CONCLUSION

The consequences of the observed neurodegeneration in the different sub regions of the hippocampus from our study lines up with the facts published by Wellmer et al ²⁸, that state that the result of untreated pneumococcal meningitis may result in cognitive deficit . These findings may well be the neuronal basis for the reported cognitive deficit reported in the human survivors of meningitis, especially in children ^{20, 3}. This study could pave avenues for research into therapeutic modalities that could thwart the process of neurodegeneration through pathways that could trigger salvage of the destroyed neurons; as the study indicates only early signs of neuronal damage but not DNA damage.

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REFERENCES

- [1] Quagliarello VJ, and Scheld WM. Treatment of bacterial meningitis. *N. Engl. J. Med.* 1997;336:708-16
- [2] Arditi ME, Mason O, Bradley JS, Tan TQ, Barson WJ, Schutze GE, Wald ER, Givner LB, Kim KS, Yogev R, and Kaplan SL. Three year multicentre surveillance of pneumococcal meningitis in children: clinical characteristics, and outcome related to penicillin susceptibility and dexamethasone use. *Pediatrics.* 1998;102:1087-1097
- [3] Baraff LJ, Lee SI, and Scriger DL. Outcome of bacterial meningitis in children: a meta-analysis. *Pediatr. Infect. Dis. J.* 1993;12:389-394
- [4] Erickson L, and De Wals P. Complications and sequelae of meningococcal disease in Quebec, Canada. *Clin. Infect. Dis.* 1998;41:275-279
- [5] Grimwood K, Anderson P, Anderson V, Tan L, and Nolan P. Twelve year outcomes following bacterial meningitis: further evidence for persisting effects. *Arch. Dis. Child.* 2000;83:111-116
- [6] Pfister HW, Feiden W, and Einhaupl KM. Cerebrovascular complications of bacterial meningitis in adults. *Neurology.* 1992;42:1497-1504

- [7] Lorenzo S, Koedel U, Frei K, Bernatowicz A, Fontana A, and Pfister HW. Protective effect of a 21-aminosteroid during experimental pneumococcal meningitis. *J. Infect. Dis.* 1995;172:113-118
- [8] Mertsola J, Kennedy WA, Waagner D, Saez-Llorens X, Olsen K, Hansen EJ, and McCracken Jr, GH. Endotoxin concentrations in cerebrospinal fluid correlate with clinical severity and neurologic outcome of Haemophilus influenzae type B meningitis. *Am. J. Dis. Child.* 1991;45:1099-1103
- [9] Mustafa MM, Ramilo O, Syrragionopoulos GA, Olsen KD, McCracken Jr, GH, and Hansen EJ. Induction of meningeal inflammation by outer membrane vesicles of Haemophilus influenzae type B. *J. Infect. Dis.* 1989;159:917-922
- [10] Schneider O, Michel U, Zysk G, Dubuis O, and Nau R. Clinical outcome in pneumococcal meningitis correlates with CSF lipoteichoic acid concentration. *Neurology.* 1999;53:1584-1587
- [11] Kastenbauer S, Koedel U and Pfister HW. Oxidative stress in bacterial meningitis in humans. *Neurology.* 2002;58:186-191
- [12] Koedel U, Sheld WM and Pfister HW. Pathogenesis and pathophysiology of pneumococcal meningitis. *Lancet Infect. Dis.* 2002;2:721-736
- [13] Leib SL and Tauber MG. Pathogenesis of bacterial meningitis. *Infect. Dis. Clin. North Am.* 1999;13:527-548
- [14] Quagliarello V and Scheld WM. Bacterial meningitis: pathogenesis, pathophysiology and progress. *N. Eng. J Med.* 1992;327:864-872
- [15] Leib SL and Tauber MG. In search of strategies for preventing brain damage as a sequelae of bacterial meningitis. *Schweiz. Med. Wochenschr.* 2000;130:928-935
- [16] Nau R and Bruck W. Neuronal injury in bacterial meningitis: mechanisms and implications for therapy. *Trends Neurosci.* 2002;25:38-45
- [17] Pfister HW, Fontana A, Tauber MG, Tomasz A and Scheld WM. Mechanisms of brain injury in bacterial meningitis: workshop summary. *Clin. Infect. Dis.* 1994;19:463-479
- [18] Townsend GC and Scheld WM. Adjunctive therapy for bacterial meningitis: rationale for use, current status, and prospects for the future. *Clin. Infect. Dis.* 1993;17(Suppl. 2):S537-549
- [19] Tuomanen E. Partner drugs: a new outlook for bacterial meningitis. *Ann. Intern. Med.* 1998;109:690-692
- [20] Free SL, Li LM, Fish DR, Shroven SD and Stevens JM. Bilateral hippocampal volume loss in patients with a history of encephalitis or meningitis. *Epilepsia.* 1996;37:400-405
- [21] Berg S, Trollfors B, Hugosson S, Fernell E and Svensson E. Long-term follow-up of children with bacterial meningitis with emphasis on behavioral characteristics. *Eur. J. Pediatr.* 2002;161:330-336
- [22] Bohr V, Paulson OB and Rasmussen N. Pneumococcal meningitis. Late neurologic sequelae and features of prognostic impact. *Arch. Neurol.* 1984;41:1045-1049
- [23] De Beek DD, Schmand B, De Gans J, Weistfelt M, Vaessen H, Dankert J and Vermuelen M. Cognitive impairment in adults with good recovery after bacterial meningitis. *J. Infect. Dis.* 2002;186:1047-1052
- [24] Grimwood K, Anderson P, Anderson V, Tan L and Nolan T. Twelve year outcomes following bacterial meningitis: further evidence for persisting effects. *Arch. Dis. Child.* 83:111-116
- [25] Schuchat A, Robinson K, Wenger JD, Harrison LH, Farley M, Reingold AL, Lefkowitz L and Perkins BA. Bacterial meningitis in the United States in 1995. Active Surveillance Team. *N. Engl. J. Med.* 1995;337:970-976
- [26] Braun JS. Neuroprotection by a caspase inhibitor in acute bacterial meningitis. *Nature. Med.* 1999;5:298-302
- [27] Leib SL and Tauber MG. Pathogenesis of bacterial meningitis. *Infect. Dis. Clin. North Am.* 1999;13:527-548
- [28] Gerber J, Raivich G, Wellmer A, Noeske C, Kunst T, Werner A, Brück W, Nau R. A mouse model of Streptococcus pneumoniae meningitis mimicking several features of human disease. *Acta Neuropathol.* 2001;101(5), 499-508.
- [29] Floret D, Delmas MC, Cochat P. Cerebellar infarction as a complication of pneumococcus meningitis. *Pediatr Infect Dis J.* 1989;8(1),57-8
- [30] Lan SH, Chang WN, Lu CH, Lui CC, Chang HW. Cerebral infarction in chronic meningitis: a comparison of tuberculous meningitis and cryptococcal meningitis. *QJM.* 2001;94(5), 247-53.
- [31] Braun J. Inducible nitric oxide synthase mediates hippocampal caspase-3 activation in pneumococcal meningitis. *Int J Neurosci.* 2009;119(4), 455-9

- [32] Coimbra RS, Voisin V, de Saizieu AB, Lindberg RL, Wittwer M, Leppert D, Leib SL. Gene expression in cortex and hippocampus during acute pneumococcal meningitis. *BMC Biol.* 2006;(2)4:15.
- [33] Bellac CL, Coimbra RS, Christen S, Leib SL. Pneumococcal meningitis causes accumulation of neurotoxic kynurenine metabolites in brain regions prone to injury. *Neurobiol Dis.* 2006. 24(2), 395-402.
- [34] Li L, Shui QX, Liang K, Ren H. Brain-derived neurotrophic factor rescues neurons from bacterial meningitis. *Pediatr Neurol.* 2007;36(5),324-9.
- [35] Köster R, Stephan KE. Useless or helpful? The "limbic system" concept. *Rev Neurosci* 1997;8(2),139-45.
- [36] Travis CJ and Thomas CF. regional health and function in the hippocampus: Evolutionary compromises for a critical brain region. *Biosci Hypoth.* 2009;2(4),245-251
- [37] Kafa IM, Ari I and Kurt MA. Morphometric investigation of neurons in the hippocampal CA1, CA3 areas and dentate gyrus in a rat model of sepsis. *Int. J. Morphol.* 2010;28(1),183-192
- [38] Michael EH. The Role of Hippocampal Regions CA3 and CA1 in Matching Entorhinal Input with Retrieval of Associations between Objects and Context: Theoretical Comment on Lee et al. *Behav Neurosci.* 2005;119(1),342-345.

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