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Monitoring of Heavy Metal in Textile Waste Water of Sanganer, Jaipur (Rajasthan)

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Abstract- The textile industry represents a range of industries with operations and processes as diverse as its products. Textile industry effluents account for several point sources of water pollution thus posing negative effects on aquatic lives and human health. The paper contains results of a study carried out in agricultural fields of Sanganer town. This paper contains results of physico-chemical analysis of waste water collected from Sanganer town. The town is situated about 20 kms away from the city center, Jaipur. In the study area (Amanishah Nalla Sanganer ,Jaipur) vegetables are grown in the fields receiving sewerage and textile waste water. Random samples were collected during different periods of the year Amanishah nallah and analyzed for various physic-chemical parameters such as Ph, Electrical Conductvity, Total Solids, chloride, Total Hardness ,Ca Hardness, and heavy metals such as Cr, Cu, Pb, Zn, Fe, Ni and Cd.This waste water is used in several nearby located agricultural fields. Results revealed that pH of the waste water ranges between 7.45 to 9.43 and Electrical Conductivity between 0.97 to 1.25 umho/cm and total solids from 965.8 to 1562 mg/L .Calcium and Magnesium ranges between 54.76 to 123.24mg/L and 466.23 to 941.64mg/L respectively. The total Hardness ranges between 568 to 1138mg/L. Chloride and D.O. values ranges between 295 to 578.3 mg/L and 17.1 to 36.20 mg/L respectively. Heavy metals were also analysed. This waste water contains Pb 1.098,mg/L, Fe 0.191mg/L, Cu 4.66 mg/L, Cd 1.98 mg/L, Zn 3.29 mg/L, Ni 0.076 mg/L and Cr 3.96 mg/L.

Index Terms- Sanganer, textile industries, Physico-chemical, Waste water.

I. Introduction

Cleaner production has spread to almost every industrial sector and many researchers have devoted themselves to the development of clean technologies in the textile printing industry. Cleaner production, which has beendeveloped in recent years as a tool for environmental protection and for higher efficiency, has shown its ability to decrease environmental pollution, preserve natural resources from excessive depletion and generally to limit the adverse environmental impact of economic activities(Li et al. 2011). The current problem with polluted industrial waters indeveloping nations is the absence of treatment prior to environmental discharge, combined with the formation of large amounts of wastes when treatment is processed. Indeed, whether the treatment method uses chemical, biologicalor electrical means, large amounts of sludge are produced which are difficult to handle and dispose of (El Quardi et al 2009). Industrial progress and development of global population have led to an excessive contamination of ecosystems ,particularly marine environment, by metals over the last three decades (Franca et al. 2005). Environmental pollution has become a worldwide phenomenon .Pollution of water bodies is a phenomenon of concern in the developing countries of the world including India (Awomeso et al; 2010). Industrial effluents urban runoff, direct disposal of wastes into the water bodies agricultural fertilizer and animal wastes remain the major water contaminants .It is also reported that textile and dyeing industry pose a major environmental threat because of the large amounts of water and dyes involved in the manufacturing process .Large amount of chemically different dyes are employed for various industrial applications including textile dyeing(Pal and Brijmohan1990).Textile and dying industry in the world pose a major environmental threat because of the large amounts of water and dyes involved in the manufacturing process(Abd El Rahim et al 2008).Large amount of chemically different dyes are employed for various industrial applications including textile dyeing(Pal and Brijmohan1990).The waste water contains heavy metals because the water comes from the printing industries. The dye used in these industries contain synthetic chemicals, which are generally metal based .Many of the metals are harmful for human body above permissible limits (Orebiyi et al.2010).Metals occur naturally in our environment, especially in the Earth's crusts where they contribute to the balance of the planet. However, as a result of human activities they are distributed, concentrated and chemically modified, which may increase their toxicity (Mihaly et al. 2005).). Environmental pollution and continuous exposure of human beings to toxic heavy metals such as Hg, Cd, and Pb is serious growing problem throughout the world (Yusuf and Sonibare 2004).Textile industries contribute significantly toward the economy of developing countries such as India, but they also pollute the aquatic environment through wastewaters released at various steps of dyeing and printing. Textile wastewater is a mixture of colorants (dyes and pigments) and various organic compounds used as cleaning solvents, plasticizers, etc. It also contains high concentrations of heavy metals, total dissolved solids, and has high chemical and biological oxygen demand. The major metal pollutants such as copper, zinc, chromium, etc. come mainly from the metal complex dyes and chromium salts used in wool dyeing or as oxidizing agents in sulfur dyeing (Chavan 2001). In India, textile printing and dyeing industries have expanded rapidly in recent years. Their effluents are discharged either directly (mostly untreated/partially treated) or along with domestic wastewater. The application of such wastewaters to agricultural fields is quite common in rural India, which has led to biomagnifications of heavy metals in vegetables and cereals (Sharma et al. 2001). The toxicity of dyes has mostly been investigated with vertebrates, mostly fish, whereas the effects on invertebrates and plants are least explored (Sharma et al. 2005) Industrial waste and effluents are undesirable by-products of economic development and environment and when these products handled and disposed improperly, they cause serious threat to human health and environment. Such as use of dye stuffs in textile paper, paint and printing industries and improper disposal of these stuffs into the water sources cause serious problem of pollution and health hazards due to presence of heavy metals above permissible limits (Khan et al. 2001). Amanishah Nala which is of great importance to Jaipur city particularly Sanganer area has effluent water (polluted water) from textile industries. The ground water is used in the cottage industries (Khan et al. 2003).Waste water effluents from textile dyeing and printing industries from Sanganer which contains dyes, bleaching agents, salts, acids and heavy metals like Cr, Cu, Pb, Zn, Fe are discharged continuously without any treatment into Amanishah Nala. The effluent water takes the dissolved toxicants to crop plants and its consumers (Khan et al. 2009). Azo dyes and Cu are the most common pollutants in the textile wastewater of Sanganer, Jaipur (Sharma et al. 1999). This waste water cause many problems including ground water pollution and adverse effects on agricultural products, animals and health of the people.

II. STUDY AREA

Sanganer town is situated nearly 20 km away from the main city of Jaipur. Sanganer town lies between 26^{o} 49' to 26^{o}51'N latitude and 75^{o}46' to 75^{o}51'E longitude. The total area of Sanganer is about 635.5 sq km. various industries discharge untreated waste water in Amanishah Nala.Sanganer is famous for its textile hand printing work.Mainly Chhipas community is engaged in dyeing and printing of textile as small scale industry.Sanganer is very famous for a special type of printing known as 'Sanganer Printing'.This type of printing requires water based process for color fixation and it creates water pollution. The chipas either wash clothes at their wells in the city or bring the cloth on wells dug on bank of Amanishah Nallah.The Amanishah Nallah gets polluted due to discharge of trade effluent into it and due to inflowing domestic waste water of Jaipur city.

III. MATERIAL AND METHODS

The sample were collected from different location of Amanishah Nallah. These samples were collected periodically from April 2012 to January 2013.Water samples were collected in different glass bottles. Physico-chemical parameters for the collected samples were studied by standard methods.

Heavy Metal Analysis By Atomic Absorption Spectrophotometer.

Atomic absorption Spectrophotometer (AAS Model GBC 932) was used for analysis of heavy metals in water. The 25ml of the sample was digested in di acid mixture of HNO3 and per chloric acid in the ratio of (10:1). The digestion was performed in 100 ml conical flasks and to facilitate complete digestion the samples in di acid mixture were kept overnight at room temperature .These flasks containing samples and di acid mixture were heated at hot plate until a clear solution was obtained .This was followed by a slow but complete evaporation of acids. Then, the volume of the digested samples was made up to 100 ml with the help of the double distilled water .Finally these solutions were analyzed by Atomic Absorption Spectrophotometer.

IV. RESULT AND DISCUSSION

Textile industry effluents collected from several point sources of water pollution. The results related to physico-chemical characteristics of textile effluents are given in the table no.1. In the present study pH was found to be maximum in July. The results indicated that pH values range between *7.45±0.02to 9.44±0.10* Minimum pH (7.45) was found in January 2012 and maximum pH (9.44) was in July 2013. E.C. ranged between *0.67±0.05 to1.26±0.06* mmhos its maximum concentration i.e. 1.26 was found in July 2013 and minimum in January 2012 i.e. 0.67. Total solids ranged from *937.8±9.59* mg/L was found in January 2012 and maximum *1852±22.33* mg/L in July 2013. Similarly Chloride values ranged between *276.6±16.21* mg/L in April 2012 and *572±27.5* mg/L was maximum in July 2013. Calcium and Magnesium hardness ranged between *42.46±5.19* was minimum in January 2013 and *124.2±24.25* mg/L was maximum in July 2012 and *540.72±2.28* mg/L minimum in. January 2013 to *1165.94±2.16*mg/L Maximum in July 2013. The Total Hardness was between *583.18±17.38 to1251.8±22.55* mg/L .In the present study the maximum concentration 1.107 ±0.034 mg/L of lead was recorded from textile waste water maximum permissible limits of lead is 0.1 mg/L. Desirable limits of lead is .05 mg/L beyond this limit water becomes toxic. Average concentration of copper 4.794 ±0.17 mg/L found in the textile water samples is more than the permissible limits. Average concentration of cadmium 2.058±0.16 mg/L cadmium level was found high in industrial area. Average concentration of ferrous 0.152±0.017 mg/L found in textile water samples is more than permissible limits. Chromium metal was found 3.64 ±0.22 mg/L it was higher than permissible limits. The permissible limit for Cr is 0.05 mg/L. Average concentration of zinc and nickel was 3.264 ±0.07 mg/L to 0.078 ± 0.01 mg/L.

RECOMMENDATION

There is a need of treating effluent water by central effluent treatment plant and removing heavy metals before utilizing this water for crop plants.

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Analysis of Textile Waste Water Samples from Amanishah Nallah(Sanganer

Parameter s	*2012*				*2013*				
	April	*July*	*October*	*January*	*April*	*July*	*October*	*January*	
PH Hydrogen ion concentration	*8.53±0.26*	*9.27±0.15*	*8.21±0.14*	*7.45±0.02*	*8.79±0.07*	*9.44±0.10*	*8.29±0.09*	*7.60±0.16*	
Electrical Conductivity m mhos / cm	*0.95±0.07*	*1.13±0.05*	*0.82±0.07*	*0.67±0.05*	*1.04±0.08*	*1.26±0.06*	*0.86±0.04*	*0.79±0.06*	
Total solids mg/L	*960.5±8.66*	*1774.4±18.95*	*1518.8±21.18*	*937.8±9.59*	*1486.2±14.34*	*1852±22.33*	*1560±24.977*	*1166.2±16.15*	
Chloride mg/L	*276.6±16.21*	*538.42±8.24*	*385.2±28.58*	*326±25.4*	*299.2±16.35*	*572±27.5*	*391±26.48*	*360.34±16.48*	
D.O. Mg/L	*24.32±1.13*	*39.76±1.53*	*21.86±2.04*	*19.7±1.51*	*22.64±2.48*	*35.28±1.48*	*20.32±0.74*	*16.8±1.013*	
Ca –H mg/L	*77.22±12.32*	*124.2±24.25*	*62.66±10.65*	*46.96±6.81*	*66.94±7.40*	*85.86±8.6*	*57.6±11.01*	*42.46±5.19*	
Mg-H mg/L	*1109.38±3.72*	*1119.2±3.49*	*723.94±1.32*	*567.64±2.32*	*849.02±2.21*	*1165.94±2.16*	*714±2.99*	*540.72±2.28*	
Total Hardness mg/L	*1186.6±21.57*	*1243.4±8.04*	*786.6±22.81*	*614.6±21.37*	*915.96±10.31*	*1251.8±22.55*	*771.6±24.88*	*583.18±17.38*	

(Mean ± SEM of 5 values)
Ca-H – Calcium Hardness
Mg-H – Magnesium Hardness

Analysis of Textile Waste Water Samples from Amanishah Nallah(Sanganer)

	Pb (mg/L)	**Fe(mg/L)**	**Cu(mg/L)**	**Cd(mg/L)**	**Zn(mg/L)**	**Ni(mg/L)**	**Cr(mg/L)**
*	1.107 ±0.034	0.152±0.017	4.794 ±0.17	2.058±0.16	3.264 ±0.07	0.078 ± 0.01	3.64 ±0.22
**	0.1	0.3	1	0.05	5	-	0.05

(Mean ± SEM of 5 values)
*Showing analysed value of heavy metals concentration in water sample from textile effluent discharging sites of Amanishah Nalla.
** Showing maximum permissible limit of WHO for particular metal.

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