International Journal of Geology, Earth and *Environmental Sciences ISSN: 2277-2081 (Online)*
An Open Access, Online International Journal Available at http://www.cibtech.org/jgee.htm
2014 Vol. 4 (1) January-April, pp.216-219/Jaishree and Khan
Research Article

PHYSICO-CHEMICAL ANALYSIS OF CONTAMINATED SOIL COLLECTED FROM DIFFERENT AREAS OF SANGANER TEXTILE INDUSTRIES JAIPUR (RAJASTHAN)

Jaishree and T.I. Khan
Indira Gandhi Centre for H.E.E.P.S. University of Rajasthan, Jaipur -302004
**Author for Correspondence*

ABSTRACT
Sanganer is famous for textile dyeing and printing industries. Water pollution caused by the textile industry is mainly by the release of wastewater coming out from the wet processing operations like bleaching, dyeing and printing etc The physico-chemical properties of soil of agricultural region and the water used for irrigation in Sanganer area of Jaipur were analyzed. A wide variation in the physico-chemical properties of soil of agricultural region and the water in Sanganer area were found in the present study. During the present study, the physico-chemical characteristics of the textile effluent contaminated soil samples of Sanganer region were analysed by standard methods and found to have great variation. The pH of the samples was alkaline in nature (7.8 – 9.4). The values of electrical conductivity ranged from 0.75-1.15 mmhos/cm. The amount of % organic matter and % organic carbon ranged from 0.41-0.72%and 0.24-0.42 % respectively. Heavy metals such as Zn, Mn, Fe and Cu were also analysed. This soil contains higher amount of heavy metals and exceed permissible limits. The effluent from the textile industry was the major source of pollution which will affect the flora and fauna existing in such environment. Thus, there is need for treatment of textile effluent before they are discharged into the environment.

Keywords: *Pollution, Textile Industry Effluent, Soil, Physicochemical Parameter, Sanganer*

INTRODUCTION
India's environment is becoming fragile and environmental pollution is one of the undesirable side effects of industrialization, urbanization, population growth and unconscious attitude towards the environment. Though industrialization and development in agriculture are necessary to meet the basic requirement of people, at the same time it is necessary to preserve the environment. With the rapid industrialization in the country, environment pollution by industrial waste has increased tremendously (Tiwari, 1994; Muthuswamy and Jayabalan, 2001; Noorjahan, 2011). The discharge of waste water from industries such as tanneries, pulp and paper, textile, petroleum, chemical industries etc. pollute water bodies (Mohan Rao, 1998).Textile is an important industry for Rajasthan, representing over 20 per cent of the investment made in the state. Rajasthan contributes over 7.5 per cent of India's production of cotton and blended yarn (235,000 tones in 2002-03) and over 5 per cent of fabrics (60 million m2). There are estimated to be around 500 block and screen printing units in Sanganer. A huge volume of mostly untreated textile dye wastewater (10,000 -15,000 kl/day) is discharged into various pools and drains adjoining the textile printing units. There are around 3000 families engaged in this Rajasthani art, and Sanganer is one of Rajasthan's most important centers of hand block printing. The main object of the present investigation was to assess the suitability of the waste water and dyes from Sanganer (Rajasthan). The coloured effluent of the textile mill industry has got much attention to their dual toxicity (Talware *et al.,* 2010**)**. A number of azo dyes (direct, reactive, rapid, mordant and premetalised etc) are used in textile printing industries at Sanganer. The quantities and characteristics of discharged effluent vary from industry to industry depending on the water consumption and average daily product (Joshi and Santani, 2012). Central Pollution Control Board has listed the dye and dye intermediates industry as one of the heavily polluting industries (CPCB, 1990). Most of the industrial wastewater is containing organic and inorganic matter and hazardous metals (Kumar and *et al.,* 2009). 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). These heavy metals and organic compounds affect quality of soil and ground water of the area (Bhattacharjee *et al.,* 2003). Heavy metals enter in the human body by different pathways and causes harmful effects (Gitimoni *et al.,* 2009). 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). The growing consciousness about sustainable agriculture and health risks associated with agrochemicalshas brought a major shift in people's preference towards safe and quality food. Prevention of heavy metal accumulation in soil has become one of the pre-requisites for sustainable agriculture (Witter, 1996). The aim of sustainable heavy metal management in agro-systems, in fact, is to ensure long-term protection of soil fertility along with the quality of agricultural produce (Moolennaar *et al.,* 1997) The contamination of soil by atmospheric deposition of toxic metals affects soil properties and further increase plant metal levels through root uptake. Lands under peri-urban agriculture are worst affected by this problem (Kaur and Rani, 2006). Soil is a dynamic natural body developed as a result of pedogenic processes through weathering of rocks, consisting of mineral and organic constituents, possessing definite chemical, physical, mineralogical and biological properties, having a variable depth over the surface of the earth, and providing a medium for plant growth (Thakre *et al.,* 2012). Soil formation is a constructive as well as destructive process. Destructive process predominates the physical and chemical breaking down of materials, plants and animal structures, which result in the partial loss of more soluble and volatile products. Constructive forces develop new chemical compounds, both mineral and organic that provides new distribution or association characteristics, structural properties as well as chemical compositions. These factors influence the plant growth in the soil (Pujar *et al.,* 2012). Soil is a complex natural medium and intensive soil physico-chemical testing is required to understand the behaviour of each soil type. Physiochemical characteristics of different soils vary in space and time due to variations in topography, climate, physical weathering processes, vegetation cover, microbial activities, and several other biotic and abiotic variables (Paudel and Sah, 2003). The properties of dry soil along with its type have a great importance in agriculture (Ahire *et al.,* 2013). Soil is not only important for agriculture but also have more useful for living organism. The differences in soil characteristics associated with landscape position are usually attributed to differences in the runoff, erosion and deposition processes that affect soil genesis (Dengđz, 2010)**.**

***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.

MATERIALS AND METHODS

The soil (adjoining the textile effluent) and water effluent samples were collected from three different sites of Sanganer region during different periods of the year. The collected samples have been analyzed to determine their physico-chemical characteristics. The water and soil samples were collected in morning time during August 2008 and May 2009. Temperature and *p*H was recorded on the field. Samples were collected in cleaned acid washed plastic bottles and sterilized plastic bags and stored at 4°C. The soil samples have been analyzed for various parameters as *p*H, electrical conductivity (EC); percent organic carbon (OC); nitrogen (N) and organic matter (OM); available phosphate (P) and potash (K). The effluent samples were analyzed for *p*H; electrical conductivity (EC); cations and anions. Physicochemical parameters of water and soil were done by standard methods (APHA, 1992).

RESULTS AND DISCUSSION

The soil samples adjoining the textile effluent, of agricultural region of Sanganer were also show great variation in the physico-chemical properties. The soil samples collected from Sanganer textile industrial region showed great variation in the physico-chemical properties. The soil samples were analysed for pH, conductivity, organic carbon, organic matter and chloride. The soil samples collected were brown to dark grey in colour. The pH of the soil samples ranged from 7.8 to 9.4 alkaline in nature and higher than that of

standard values. The values of electrical conductivity ranged from 0.75 to 1.15 mmhos/cm and were quite high. The high value of electrical conductivity might be due to the presence of high concentration of ions and dyes contributed by numerous printing houses located near the drain. The present investigations on high pH and high electrical conductivity values of the soil samples were in agreement with the results of the survey conducted by Gupta *et al.,* (1994) and Joshi and Kumar (2011). The amount of % organic matter and % organic carbon ranged from 0.41-0.72 % and 0.24-0.42% respectively. The amount of nitrogen ranged from 0.016-0.020%. The values of chloride ranged from 9 to 16.4 mg/L. The analysis of heavy metal ions (Zn, Fe, Cu and Mn) of the four soil samples revealed that the values are almost same for all four samples and higher than permissible limits prescribed by ISI for industrial effluents. Presence of heavy metal ions (Zn, Cu and Ni) arises from material used in the dyeing process, or in a considerable amount, from metal complex dyes. Long-term irrigation with textile industrial effluents can increases EC, organic carbon content and heavy metals accumulation in soil.

Table: Physicochemical characterization of textile effluent contaminated soil samples

Parameter	Sample 1	Sample 2	Sample 3	Sample 4	Permissible limits
pH	7.8	8.6	9.0	9.4	7-8.5
Electrical conductivity (mmhos/cm)	0.75	0.94	1.04	1.15	0-1.5
Organic carbon %	0.24	0.34	0.39	0.42	0.5-0.75
Organic matter %	0.41	0.58	0.62	0.72	0.8-1.29
Chloride Concentration(mg/L)	9.0	11.4	14.6	16.4	
Nitrogen %	0.016	0.015	0.017	0.020	0.0431-0.064

Heavy metals (ppm)	Sample 1	Sample 2	Sample 3	Sample 4	Permissible limits
Zn	1.20	1.52	1.37	1.75	0.6
Fe	3.20	4.65	3.98	4.73	4.5
Cu	0.46	0.36	0.29	0.54	0.2
Mn	3.67	3.98	2.98	4.6	2.0

Conclusion

This study has shown that textile mills effluent contaminated soil samples in Sanganer region were highly coloured, foul smelling and alkaline (pH 8.8) and contained trace metal ions at concentrations values which are not in compliance with standards. This study reveals that effluent from textile mill was highly polluted. There is urgent need to follow adequate effluent treatment methods before their discharge to surface water for reducing their potential environmental hazards.

ACKNOWLEDGEMENT

One of the author (Ms. Jaishree) is thankful to UGC for the award of Rajiv Gandhi National Senior Research Fellowship and the Dean Faculty of Science, University of Rajasthan, Jaipur for providing necessary facilities.

REFERENCES

Ahire DV, Chaudhari PR, Ahire VD and Patil AA (2013). Correlations of Electrical Conductivity and Dielectric Constant with Physico-Chemical Properties of Black Soils. *International Journal of Scientific and Research Publications* **3**(2) 1-16.

APHA (1992). *Standard Methods for the Examination of Water and Waste Water, American Public Health Association*, 18th edition (Academic Press, Washington D.C.) 214- 218.

Bhattacharjee KG, Choudhary SK and Sharma (2003). Physico chemical effect on pH and EC of soil with respect to Extent of degradation of petrolium hydrocarbon in soil under Natural Environment. *Research Journal Chemistry and Environment* **7** 28-34.

CPCB (Central Pollution Control Board) (1990). Minimal national standards: Dye and dye intermediate industry. *Comprehensive Industry Document Series*: COINDS / 34/1990(1990).

Dengđz O (2010). Morphology, Physico-Chemical Properties and Classification of Soils on Terraces of the Tigris River in the South-east Anatolia Region of Turkey. *Journal of Agricultural Science* **16**(206) 205-212.
Dinesh Kumar, Shekhawat GS and Ashu Chaudhari (2009). Assesment of the soil pollution parameters of the various soil samples collected from Sanganer town near pink city Jaipur, Rajasthan. *Asian Journal of Chemical and Environmental Research* **2**(3-4) 75-81.
Gitimoni Deka and Bhattacharjee KG (2009). Assesment of water quality in an area receiving effluent discharge from a textile mill. *Indian Journal of Environmental Protection* **29**(6) 539-543.
Gupta SK, Gupta RC and Seth AK (1994). Reversal of clinical and dental fluorosis. *Indian Pediatrics* **31**(4) 439.
Joshi N and Kumar A (2011). Physico-chemical Analysis of Soil and Industrial Effluents of Sanganer Region of Jaipur Rajasthan. *Research Journal of Agricultural Sciences* **2**(2) 354-356.
Joshi VJ and Santani DD (2012). Physicochemical Characterization and Heavy Metal Concentration in Effluent of Textile Industry. *Universal Journal of Environmental Research and Technology* **2(**2) 93-96.
Kaur R and Rani R (2006). Spatial characterization and prioritization of heavy metal contaminated soil—water resources in periurban areas of national capital territory (NCT), Delhi. *Environmental Monitoring and Assessment* **123** 233–247.
Mihaly-Cozmuta A, Mihaly-Cozmuta L, Viman V, Vatca G and Varga (2005). Spectrometric methods used to determine heavy metals and total cyanides in accidental polluted soils. *American Journal of Applied Sciences* **l2**(1) 358-362.
Moolennaar SW, Vander Zee SEATM and Lexmond Th M (1997). Indicators of the sustainability and heavy metal management in agro-ecosystem. *The Science of the Total Environment* **201** 155–196.
Paudel S and Sah JP (2003). Physiochemical characteristics of soil in tropical sal (*Shorea robusta* Gaertn.) forests in eastern Nepal. *Himalayan Journal of Sciences* **1**(2) 107-110.
Pujar KG, Hiremath SC, Pujar AS, Pujeri US and Yadawe MS (2012). Analysis of physico-chemical and heavy metal concentration in soil of bijapur taluka, karnataka. *Scientific Reviews and Chemical Communications* **2**(1) 76-79.
Thakre YG, Choudhary MD and Raut RD (2012). Physicochemical Characterization of Red and Black Soils of Wardha Region. *International Journal of Chemical and Physical Sciences* **1**(2) 60-66.
Tiwari PK (1994). An agenda for pollution control in dairy industry. *Indian Dairyman* **46**(10) 617-624.
Yusuf RO and Sonibare JA (2004). Characterization of textile industries effluents in Kaduna, Nigeria and Olayinka, Studies on industrial pollution in Nigeria. The effects of textile effluents on the quality of ground water in some parts of Lagos. *Nigerian Journal of Health and Biomedical Sciences* **3** 44-50.