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HEAVYMETALCONCENTRATIONSIN INDUSTRIAL REGION OF SRIPERUMBUDUR, KANCHIPURAM DISTRICT, TAMIL NADU, INDIA

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ABSTRACT

In the present study on the heavy metals concentration in industrial effluents, soil and groundwater of the Sriperumbudur Region, Kanchipuram District, Tamilnadu, India during 2013–2014. Heavy metals were analyzed by using standard methods. Heavy metal concentration in effluents, soil and ground water was in following order AS > Cd > Cu > Cr > Fe > Pb > Mn > Hg > Ni > Zn. The high level of heavy metal (Chromium) was recorded from Tannary industry of soil sample and low level of heavy metal (Arsenic) was recorded in Textile industry of ground water sample.

Key words: Heavy metal concentration, Industrial effluents, soil, Ground water.

INTRODUCTION

In the recent years, heavy metal toxicity has grown up as a serious concern all over the world, as those heavy metals pose adverse effects on all forms of living organisms in the biosphere. These heavy metals are not readily degradable in the environment and accumulate in the animal and human bodies to a very high toxic levels leading to undesirable effects (Ugoji and Aboaba, 2004). Heavy metals are intrinsic, natural constituents of our environment. They are generally present in large amounts in industrial effluents. Contamination of the ground water by industrial effluents and agricultural activity is a serious problem faced by developing countries. The industrial waste water enters subsurface aquifers, resulting in the pollution of drinking water (Ata Shakeri *et al.,* 2009). Industrial waste water may also carry appreciable amounts of trace toxic metals and its long term application on agricultural lands contributes significantly to the build of evaluated concentration of toxic metals in irrigated soil (Sacther *et al.,* 1997). Heavy metals are important for proper functioning of biological systems but their deficiency (or) excess could lead to a number of disorders (Ward, 1995). Industrial effluents which discharged from the textile and tannery contain a higher amount of metals. These effluents released on the land as well as dumped into the surface water which ultimately leaches to groundwater and lead to contamination due to accumulation of toxic metallic components and resulted in a series of well documented problems in living beings because they cannot be completely degraded (Deepali and Gangwar, 2010).

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The present study was under taken to determine the concentration of heavy metals in textile and tannery effluents and associated soil and ground water from Sriperumbudur, Kanchipuram District, Tamil Nadu, India.

MATERIALS AND METHODS

Study area: Sriperumbudur is a city in the Indian state of Tamil Nadu located at 40 kilometers southwest of the of Chennai city. Geographical coordinate of the study area between 12.58ºN latitude and 79.56ºE longitudes.

Sample Collection and Analysis: Present study was carried out by systematic collection of effluents, soils and groundwater samples from textile and tannery industries around Sriperumbudur in Kanchipuram District during 2013 to 2014. The samples of effluent, soil and groundwater were collected from the vicinity of both industries and all the collected and all the collected samples were analyzed for Arsenic, Cadmium, Copper, Chromium, Iron, Lead, Manganese, Mercury, Nickel and Zinc. Standard methods were used for collection and analysis of effluents, ground water (APHA, 1995) and soil samples (Buckley and Cranston, 1993). Effluent and groundwater samples were collected and stored in a clean polythene bottles that has been pre–washed with 10% nitric acid and thoroughly rinsed with de–ionized water. Soil samples were collected in fresh polythene bags.

Metal in Effluent and Ground Water: Suitable volume of sample was taken, filtered through Whatman 42 filter paper and then acidified with concentrated HNO_3 to bring down the pH upto 2.0. 100 ml of sample was taken and added 5 ml concentrated HNO_3 and then digested was completed and

make up the volume to 100 ml with distilled water. Digested samples were analyzed for metal concentrations by atomic absorption spectrometer (Perkin Elmer 3110). The Cr concentrations in samples were determined colorimetrically by using spectrometer at 540nm by diphenyl carbazide (DPC) method (APHA, 1995).

Metal in Soil: 0.25gm soil was digested with 10ml HF acid and 1ml aquaregia i.e., HCl and HNO_3 in a ratio of 3:1 in a flask. Thereafter, 5.0 ml of $HClO_4$ was added and again heated on heating plate upto dryness and double distilled water was added to make up the volume to 100ml and filtered through Whatman no. 42 filter paper. Digested soil sample were analyzed for metal concentrations by atomic absorption spectrometer (Buckley and Cranston, 1993).

RESULTS

In the present study, heavy metal, concentration of industrial effluents associated with soil and groundwater are presented in Table. 1.

Heavy metals in effluents: The concentration of heavy metals in industrial effluents was in following order (Station–I & Station–II); Arsenic (0.032–0.037 µg/L) > Cadmium (0.47–0.59 µg/L) > Copper (0.62–0.88 µg/L) > Chromium (3.74–4.55 µg/L) > Iron (1.76–1.92 µg/L) > Lead (1.25–1.78 µg/L) > Manganese (0.81–0.96 µg/L) Mercury (1.48–1.87 µg/L) > Nickel (0.83–1.45 µg/L) > Zinc (1.35–1.64 µg/L).

Heavy metals in soil: The concentration of heavy metals in soil was in following order (Station–I: Textile industry and Station–II: Tannery Industry); Arsenic (0.040–0.047 µg/L) > Cadmium (86.29–90.95 µg/L) > Copper (69.07–74.34 µg/L) > Chromium (621.39–683.47 µg/L) > Iron (146.15–159.28 µg/L) Lead (130.17–142.21 µg/L) > Manganese (66.83–78.89 µg/L) > Mercury (1.92–1.97 µg/L) > Nickel (1.52–1.77 µg/L) > Zinc (1.74–1.92 µg/L).

Heavy metals in Groundwater: The concentration of heavy metals in groundwater was in following order (Station–I; Textile Industry; Station–II; Tannery industry); Arsenic (0.24–0.27 µg/L) > Cadmium (0.26–0.31 µg/L) > Copper (0.42–0.53 µg/L) > Chromium (1.54–1.88 µg/L) > Iron (3.18–4.36 µg/L) > Lead (0.23–0.41 µg/L) > Manganese (0.59–0.62 µg/L) > Mercury (0.57–0.75 µg/L) > Nickel (0.31–0.55 µg/L t) > Zinc (0.16–0.33 µg/L).

In the present study all the heavy metals the result were showed maximum concentration Station–II (Tannery effluents) and the minimum concentration of heavy metals were recorded in Station–I (Textile Industry) during 2013–2014.

DISCUSSION

In the present study heavy metals concentration in the effluents, soil and groundwater samples recorded the following order of AS > Cd > Cu > Cr > Fe > Pb > Mn > Hg > Ni > Zn respectively. In the effluents and soil samples were showed higher value of chromium and the lower value of arsenic concentrations. A similar finding was reported by (Dikshit and Shukla, 1989). In the groundwater samples showed higher value of iron and lower value of lead was recorded from Tannery and Textile industry. Similar work was reported by (Tanji and Valoppi, 1989). The high doses of copper and zinc were said to be toxic and carcinogenic. Over doses of copper may also lead to neurological complications, hyper tension, liver and kidney disfunctions. Higher contamination of zinc causes hematological disorders (Larocque and Rasmussen, 1998). The presence of lead reduces the enzymes activity of the biota and in consequence, incompletely decomposed organic material accumulates in the soil (Kumar, *et al.,* 1995).

The earlier reporters studied recites that the value of iron was maximum concentration in soil contaminated with tannery industry effluent, when compared to textile industry (Das and Borah, 1983). Davis *et al.* (2006) reported that high concentration of heavy metal present in the sediment than the water, because sediments accumulate more heavy metals. Prolonged consumption of unsafe concentrations of heavy metals through food stuffs may lead to the chronic accumulation of heavy metals in the kidney and liver of human causing disruption of numerous biochemical processes, leading to cardiovascular, nervous, kidney and bone diseases. Cadmium was considered potential carcinogens and was associated with etiology of a number of diseases, especially cardiovascular, kidney, nervous system, blood as well as bone diseases (Ping Zhuang, *et al.,* 2009). The deficiency of zinc manifests itself by retardation of growth, anorexia, lesions of the skin and appendages, impaired development and function of reproduction organ (Dara, 2004). Heavy metal concentrations were observed from three different samples like effluents, soil and groundwater of industrial area of Sriperumbudur in Kanchipuram District, Tamilnadu, India.

Table. 1. Concentration of heavy metals (µg/L.) analyzed from industrial effluents and its associated soil and ground water (2013 – 2014)

Heavy metals	Tannery Industry (Station –I)			Textile Industry (Station – II)		
	Effluents (µg/ µg/L)	Soil (µg/lit.)	Ground water (µg/lit.)	Effluents (µg/ µg/L)	Soil (µg/ µg/L)	Ground water (µg/ µg/L)
Arsenic	0.047± 0.001	0.066 ± 0.008	0.027±0.005	0.032 ± 0.008	0.040 ± 0.004	0.024±0.003
Cadmium	0.59 ± 0.02	90.95 ± 0.10	0.31 ± 0.05	0.47 ± 0.08	86.29 ± 0.39	0.26 ± 0.02
Copper	0.88 ± 0.02	74.34 ± 0.05	0.53 ± 0.05	0.62 ± 0.05	69.07 ± 0.08	0.42 ± 0.01
Chromium	4.55 ± 0.03	683.47 ± 1.63	1.88 ± 0.05	3.74 ± 0.07	621.39 ± 1.25	1.54 ± 0.03
Iron	1.92 ± 0.05	159.28 ± 0.14	4.36 ± 0.05	1.76 ± 0.06	146.15 ± 0.65	3.18 ± 0.04
Lead	1.78 ± 0.04	142.21 ± 0.61	0.41 ± 0.06	1.25 ± 0.05	130.17 ± 0.82	0.23 ± 0.03
Manganese	0.96 ± 0.05	78.89 ± 0.12	0.62 ± 0.08	0.81 ± 0.06	66.83 ± 0.10	0.59 ± 0.05
Mercury	1.87 ± 0.04	1.97 ± 0.12	0.75 ± 0.03	1.48 ± 0.06	1.92 ± 0.06	0.57 ± 0.09
Nickel	1.45 ± 0.04	1.77 ± 0.18	0.55 ± 0.05	0.83 ± 0.03	1.52 ± 0.04	0.31 ± 0.03
Zinc	1.64 ± 0.03	1.92 ± 0.05	0.33 ± 0.04	1.35 ± 0.03	1.74 ± 0.05	0.16 ± 0.02

The high levels of heavy metals were showed in tannery and textile industry. So the present study recommends to the regulatory agencies to control the heavy metals entry from the various non points to protect the aquatic environment and human health.

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