Current World Environment Vol. **3**(1), 93-96 (2008)

A study of heavy metals in sludge, sewage and industrial waste water of different districts of Haryana

S. MAHESHWARI[1], P.K. JOSHI[1], R. KUMAR[2] and N. SINGH[2]

[1]Soil and Crop Management Division, Central Soil Salinity Research Institute, Karnal - 132 001 (India)
[2]Department of Bio and Nano Technology, Guru Jambheswar University of Science and Technology, Hisar - 125 001 (India)

(Received: April 10, 2008; Accepted: May 28, 2008)

ABSTRACT

Several electroplating industry including agricultural sector industries, sewage treatment and mining operations all combine to generate hazardous waste water containing enormous amounts of toxic heavy metals. The accumulation of toxic heavy metals in human beings and animals cause many metabolic disorders. Heavy metal concentration was estimated in sewage, sludge and electroplating wastewater collected from Karnal, Panipat, and Sonepat districts of Haryana. Heavy metals were estimated by Atomic Absorption Spectrophotometer. The results showed that Cd, Cr, Pb and Ni were found in the industrial effluent, sludge, and sewage samples of Karnal, Panipat and Sonepat. The soluble heavy metals ranged from: Cd (0.015 - 0.451 mg/L), Cr (0.015 - 0.248 mg/L), Pb (0.014 - 0.351 mg/L) and Ni (0.023 - 0.624 mg/L). Similarly total heavy metals ranged from: Cd (0.2 – 6.5 mg/L), Cr (0.1- 180 mg/L), Pb (0.1 - 180 mg/L) and Ni (0.3 – 125 mg/L).

Key words: Electroplating, accumulation, Wastewater, Cadmium, Chromium, Nickel, Lead.

INTRODUCTION

Metal bearing wastewater may be of known and predictable composition if derived from a single industry, e.g. electroplating wastewaters[1]. The approach by many governmental regulators is now to prevent further deterioration of the environment by intercepting toxic metals before they are discharged. It is recognized that new, hopefully more cost-effective, technologies are needed to replace those borrowed primarily from the unit operations of the chemical industry which rely on a mixture of physical and chemical process to render the contaminants less toxic or more easily handled [2]. The heavy metals are one of the main problems associated with human activities. One of the effects is the increase in heavy metal solubility, which results in the elements in the environment[3]. Effect of enrichment of Dindigulr town's sewage sludge with different levels of cadmium, on the nutrient content of sorghum plants has been investigated. The Cd enriched sewage sludge to the soil increases the uptake of the essential micronutrients by sorghum plants and the safe level of Cd content of Dindigul sewage sludge for very good growth of sorghum is 5.0 ppm[4]. Sewage water samples collected from different locations revealed a wide variation in their physico-chemical characteristics, concentrations of essential plant nutrients. All the toxic metals were present in sewage waters. The variation in macro and toxic elements concentration of sewer waters may be attributed to their sources of industrial effluents[5]. Heavy metal contamination in Kolar water at different sampling station. The results show that Kolar water quality is severely affected by various effluents heavy metal[6]. The estimated concentrations of five heavy metals namely Cu, Cd, Cr, Fe, and Pb were studied in the river Ganga at Varanasi from the University ghat (the most upstream point) to Rajghat (the most downstream point)[7]. Levels of all the heavy metals were highest during the summer season and lowest during the rainy season. Study on Wastewater samples from different disposals of Amritsar city was analyzed for heavy metals. The heavy metals from different disposals have varied concentration due to variable nature of contributing sources[8]. The effect of summer and winter seasons on metals concentration has also been studied. In this study, samples of sewage and sludge collected from Karnal, Panipat and Sonepat districts of Haryana. The total and dissolved heavy metals were estimated using Atomic Absorption Spectrophotometer (AAS, GBC 932 and Semi-automatic)

MATERIAL AND METHODS

Sample collection

Heavy metals contaminated wastewater, sewage water, sludge, and industrial effluents were collected from the various wastewater treatment plants Karnal, Panipat, Sonepat, districts of Haryana (India). All glassware used for storing stock and working metal solutions was cleaned by leaching in 6M HCl at 80 °C for 12 hour, and then rinsed thoroughly with de-ionized H_2O (dH_2O). All plasticware used for experiments was pretreated for 1 h in 1 M HCl to leach any metals, and then rinsed three times in dH_2O before air drying. Wastewater collected in autoclaved bottle and stored at 4°C till for further analysis.

Estimation of heavy metals

The heavy metals in sewage, sludge, and industrial effluents were analyzed by the method known as wet-dry ashing[9]. By this method before estimation in Atomic Absorption Spectrophotometer, sample was allowed to settle down for at least 18 hours before the liquid phase was decanted for subsequent analysis. The industrial wastewater, sewage, sludge sample were filtered by Whatman Filter paper No. 42 for estimation of environment available heavy metal and meanwhile 50 ml of each industrial wastewater, sewage and sludge sample 1g (air dried) were digested in 250 ml conical flask with Nitric acid and Perchloric acid in 3:1 ratio. After proper digestion white fume produced in samples then diluted with de-ionized water to leach all metals, and then rinsed three times in dH_2O. Filtered with

Table 1: Concentration of heavy metal (Cd, Cr, Pb, Ni) in sewage water, sludge, and industrial effluents

Sample	Cd (ppm)		Cr (ppm)		Pb (ppm)		Ni (ppm)	
	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved
Tap water	0.2	0.024	0.1	0.015	0.1	0.014	0.3	0.023
Sewage STP,	2.8	0.15	0.3	0.015	3.5	0.268	4.5	0.413
Sludge STP, Karnal	3.7	0.268	10	0.015	180	0.324	120	0.224
Sewage CSSRI, Karnal	2.5	0.205	2.5	0.175	5.6	0.45	2.5	0.241
Sludge CSSRI, Karnal	1.2	0.115	180	0.248	125	0.152	75	0.150
Wastewater, Panipat	2.5	0.175	0.9	0.026	4.6	0.351	3.3	0.332
Sewage STP, Panipat	2.5	0.243	1	0.035	3.2	0.235	4.5	0.352
Sludge STP, Panipat	3.5	0.267	75	0.099	90	0.246	125	0.231
Industrial effluent, Sonipat	6.5	0.451	1.7	0.154	1.5	0.254	6.5	0.624

*Concentration of wastewater sample in ppm (microgram/ ml) was estimated in AAS in Central Laboratory. CSSRI, Karnal

Whatman Filter paper No. 42, and then volume was made up to 50 ml in volumetric flask. Heavy metal was estimated by Atomic Absorption Spectroscopy (AAS, GBC 932 and Semi-automatic).

RESULT AND DISCUSSION

Heavy metal estimation from wastewater, sewage water, sludge, industrial effluents using atomic absorption spectrophotometers (AAS):

The heavy metals in samples of sewage, sludge, and industrial effluents of Karnal, Panipat and Sonepat districts of Haryan were estimated using Atomic Absorption Spectrophotometer (Table 1). The heavy metals Cd, Cr, Pb and Ni were estimated in wastewater, sewage water, sludge, industrial effluents (Table 1). The total concentration of Cd ranged from 0.2 ppm to 6.5 ppm and dissolved concentration of Cd ranged from 0.024 ppm to 0.451ppm (Table 1). The total (6.5 ppm) and dissolved (0.451 ppm) concentration of Cd was found higher in industrial wastewater of Sonepat. Similarly, total concentration of Cr ranged from 0.1 ppm to 180 ppm and dissolved concentration of Cr ranged from 0.015 ppm to 0.248 ppm (Table 1). The total (180 ppm) and dissolved (0.248 ppm) concentration of Cr was found higher in sludge and wastewater of CSSRI, Karnal. Similarly, total concentration of Pb ranged from 0.1 ppm to 180 ppm and dissolved concentration of Pb ranged from 0.014 ppm to 0.351 ppm (Table 1). The total (180 ppm) and dissolved (0.351 ppm) concentration of Pb was found higher in sludge of STP, Karnal and wastewater of open drain Panipat. The total concentration of Ni ranged from 0.3 ppm to 125 ppm and dissolved concentration of Ni ranged from 0.023 ppm to 0.624 ppm (Table 1)[10]. The total (125 ppm) and dissolved (0.624 ppm) concentration of Pb was found higher in sludge of STP, Karnal and industrial wastewater of Sonepat[11,12.13].

The higher concentration of Cd in industrial effluent of Panipat was due to presence of electroplating industry. The higher concentration of Cr in sludge of CSSRI, Karnal was due to its accumulation from laboratory wastewater. The higher concentration of Pb and Ni in sludge of in STP Karnal and STP Panipat respectively was due to accumulation of these heavy metals from wastewater of industrial effluents. Higher concentration of heavy metals in wastewater of electroplating industry and sludge from wastewater of industrial origin has been reported by earlier findings[14]. However, this is accepted that the determination of total elements does not give an accurate estimation of the environmental impact. So, it is necessary to apply soluble or environmental available heavy metal to obtain suitable information about their bioavailability or toxicity through food chain. In relation to current international legislation WHO for the use of sludge for agricultural purposes none of metal concentrations exceeded maximum permitted levels. In most of the metal elements under considerations, results showed heavy metal concentration in industrial effluent and sewage was found more than desirable range with reference to above the standard limit recommended by IS: 10500 -1991 for heavy metal Cd, Cr, Pb and Ni[15,16]. In sludge total heavy metal concentration found very high due to settling of heavy metal from effluent of industrial area of district of Haryana. Heavy metals contaminated wastewater, sewage, sludge, and industrial effluents of esteemed sampling site containing heavy metal in abundant amount are not useful for agriculture purpose.

REFERENCES

1. Silva M.A., Mater L., Souza-Sierra M.M., Correa A.X., Sperb R. and Radetski C.M., J. Hazard. Mater., **147**: 986 (2007).
2. Alvarez E. A., Mochon C.M.· , Sanchez J.C. and Rodriguez M.T., Chemosphere, **47**: 765 (2002).
3. Ledin M. and Pedersen K., Earth.Sci. Rev., **41**: 108 (1996).
4. Kumar N., Raqmamurthy K., Rajarajan A. S. and Savarimuthu E., J. Polln. Res., **18**: 301 (1999).
5. Singh, K.K., Rao A.K., Kumar R. and Basit

A., J. Nature Conserv., **10**: 15 (1998).
6. Jain P. and Shreivastava R., J. Nature Conserve., **10**: 93 (1998).
7. Dwivedi S. and Tewari I.C., *Indian J. Eniviron. Prot.,* **17**: 281(1997).
8. Venkata R., Singh M. and Singh G., J. Indl. Polln. Cont., **10**: 83 (2000).
9. Greenberg A.E., Trussell R.R., Clesceri L.S. and Franson M.A., Standard Methods for the Examination of Water and Wastewater, Amer. Public Health Assoc., Washington DC, USA, 149 (1985).
10. Singh V. and Singh C.P., *J. Environ. Sci. Eng.,* **48**: 103 (2006).
11. Singh .V.K., Singh K.P.and Mohan D., Environ. Monit. Assess., **105**: 43 (2005).
12. Tuna A.L., Yilmaz F., Demirak A. and Ozdemir N., Environ. Monit. Assess., **125**: 47 (2005).
13. Samecka C. A., Kempers A.J., *Arch. Environ. Contam. Toxicol*., **53**: 198 (2007).
14. Jain C.K., Singhal D.C. and Sharma M.K., Environ. Monit. Assess., **105**: 193 (2005).
15. Standard of water quality: Indian standard Drinking water quality specification Bureau of Indian Standard: SI 50010-1991.
16. Standard for sludge use in agriculture: World Health Organization http://www.who.int.html