J. Env. Bio-sci. Vol. 23 (1) : 29-31, 2009

ASSESSMENT OF HEAVY METALS STATUS IN EFFLUENT OF A TEXTILE INDUSTRY AT HARDWAR

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In the present study an attempt was made to assess the heavy metal concentrations in untreated and treated samples of textile industry effluent in Bahadarabad, Hardwar. It revealed that the chromium concentration found to have increased from the recommended norms[1] of textile effluent discharged on ground while the concentration of Cd, Fe, Mn and Cu were found with in the prescribed limits. The values of metals namely Cr, Cd, Fe, Mn and Cu were noted to decrease by 78.43%, 66.66%, 54.11%, 39.82% and 100%, respectively, after treatment, than untreated effluent samples.

Heavy metal contamination occurs in aqueous waste of many industries such as electroplating industries, paint industries, textile manufacturing industries, leather tanning industries, iron and steel industries and metal finishing industries etc and ultimately disposed to land or in to water courses. Hence water has to be treated to prevent any injury to aquatic life on receiving water[2]. Metals in textile industrial effluent are produced during dyeing process, which usually contributes chromium, lead, zinc and copper to wastewater. Although heavy metals may be discharged in highly diluted form but these can reach to human beings in a concentrated form through simple food chain, with much bio-magnification, if are absorbed and retained by plants or animals[3]. Heavy metals produce undesirable effects and toxicity even if they are present in extremely minute quantities, on human and animals' life[4]. Since most of the heavy metals are non-degradable into non-toxic end-products, therefore their concentrations must be reduced to acceptable levels before discharging them into the environment.

MATERIALS AND METHODS

Effluent samples were collected using polyethylene bottles from effluent treatment plant. One untreated sample collected from reservoir and second treated, from clarifier. Samples were preserved using conc. HNO_3 and transferred immediately to the laboratory for analysis. Both samples were stored at 4^{o}C in a refrigerator. Samples were filtered through Whatman No. 42 filter paper. Following metals were estimated in filters as Pb, Cd, Ni, Mn, Fe, Cu and Cr (VI). Pb, Cd, Ni, Mn, Fe and Cu were determined by using Atomic Absorption Spectrometer (Perkin Elmer model 3110). Hexavalent chromium was analysed by diphenyl carbazide (DPC) method with the help of UV spectrophotometer (model Spectronic 21 D) [5,6].

RESULTS AND DISCUSSION

In the present study the values of chromium metal were recorded 2.383 ± 0.0045 mg/l for untreated and 0.514 ± 0.005 mg/l for treated effluent (table-1). Chromium is essential for plant and animal metabolism. However, when accumulated in high level it can cause lung cancer, as the concentration reaches 0.1 mg/g of body weight, when it becomes lethal. Chromium VI is more toxic from for bacteria, plants and animals[7]. The concentrations of chromium in treated effluent were found to be 78.43% less as compared to untreated effluent (Table-1). Similar values of Cr metal of 0.255 to 0.149 mg/l were reported in the effluent samples collected from textile industries in

Iiupeju in Lagos Metropolis, Nigeria[8]. Lower values of Cr 0.06±0.01 mg/l in wastewater collected from cluster of small scale cotton textile industries[3]. However, no concentration of Cr was found in all collected samples from textile mills effluent of Kaduna, Nigeria[9].On the other hand, the higher concentration of chromium of 2.0 mg/l to 4.0 mg/l was found in a textile industry effluent in Pakistan[10]. Chromium is only metal which is present in the solution of the organic form (CrO_4^{2-}). More ever, it is highly toxic in its oxidation state of Cr^{6+} when compared to that of Cr^{3+}[11].

Most of the textile effluents contain Cr metal in excess amount than other metals. Out of the various matters of concern, heavy metal accumulation (i.e. Cr VI) receives high importance. The sources of chromium happen to be the discharge of industrial effluent from electroplating and allied process, petroleum refining, tanning, dye manufacturing, chemical manufacturing, metal process and photographic process etc[12]. It is significant that the values of Pb were not detected in all the samples collected before and after the treatment (Table-1). While lower values of Pb (0.18-0.59 mg/l) were observed in the effluent of textile industry, collected from Panipat district of Haryana[13]. Similar values of lead were also reported[3,8]. The values of Cd were noted 66.66% higher in untreated effluent than treated effluent. Before treatment of effluent, the value of Cd was noted 0.018 ± 4.472mg/l; while after treatment the value was 0.006 ± 0.017mg/l. Relatively, similar value of 0.0 to 0.02 mg/l for Cd were reported in dye house effluent of Panipat district, Haryana[13]. On the other hand, a similar study carried out for textile industries effluents in Iiupeju in Lagos Metropolis, Nigeria[8] and Cd was not detected in all of their effluent samples. Further, Ni was not detected in the effluent samples collected, in the present study. On the contrary, the concentration of Ni was 0.13 mg/l in the wastewater collected from cluster of small scale cotton textile industries[3].

The values of Iron metal were recorded 1.70 ± 0.017 mg/l in untreated effluent samples and 0.78 ± 0.03 mg/l in treated effluent samples. These observed values showed a sharp fall by 54.11%, after treatment (Table-1). Similar observation was also made [13]. They reported the values of 0.03 to 0.30 mg/l for Fe in textile industry effluent collected from Panipat district of Haryana. Relatively higher values of 0.45 to 2.14 mg/l for iron in the

Table- 1. Observed values of some physico-chemical parameters of textile industry effluents (All values are mean±SD and range for four samples each).

S.No.	Metals (mg/l)	Untreated effluent (Reservoir)	Treated effluent (Clarifier)	Average changes (%) after treatment
1.	Cr	2.383 ± 0.005 (2.379 - 2.389)	0.514 ± 0.005 (0.509 - 0.521)	(-) 78.43%
2.	Pb	ND	ND	ND
3.	Cd	0.018 ± 4.472 (0.012 – 0.022)	0.006 ± 0.002 (0.002 – 0.009)	(-) 66.66%
4.	Ni	ND	ND	ND
5.	Fe	1.70 ± 0.017 (1.65 – 1.74)	0.780±0.03 (0.75 – 0.82)	(-) 54.11%
6.	Mn	0.570 ± 0.005 (0.564 – 0.576)	0.343 ± 0.0067 (0.335 – 0.350)	(-) 39.82%
7.	Cu	0.011 ± 0.004 (0.007 – 0.015)	ND	(-) 100%

effluent samples was reported taken from textile industries of Iiupeju in Lagos Metropolis, Nigeria[9]. While, slightly higher values of 4.39 ± 0.09 mg/l was observed in the wastewater samples collected from common effluent treatment plant[3]. The distribution of Mn was reported 0.570 ± 0.005 mg/l and 0.343 ± 0.0067 mg/l for untreated and treated effluent samples, respectively. The concentration of Mn was found to have decreased by 39.82% in the treated effluent as compared to untreated. A similar value of 0.11± 0.01 mg/l for Mn was recorded[3]; while slightly higher values of 0.3 to 1.65 mg/l9 of Mn were observed.

The value of copper was found 0.011 ± 0.0035 mg/l for untreated effluent sample, but was nil in the treated sample. It indicates 100% reduction/ removal, in copper contents after treatment. On the other hand, much higher concentrations of Cu were reported which ranged between 1.16 to 5.14 mg/l and 2.0 to 4.0 mg/l, respectively[9,10]. This makes it clear if effluent treatment plant work effectively, then the effluent can be turned safer in most of the heavy metals, provided specific removal methods are followed for different metals.

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