ISSN : 0974 - 7451 Volume 12 Issue 4

Environmental Science
An Indian Journal
Current Research Paper

ESAIJ, 12(4), 2016 [133-136]

Heavy metals content in inlet water, treated and untreated waste water of garments industries at Gazipur, Bangladesh

Ahasanur M.Rabbi[1]*, Mehedi M.Hasan[2], Ayesha Akhter[1]
[1]Bangladesh Council of Scientific & Industrial Research Laboratories, Rajshahi-6206, (BANGLADESH)
[2]Department of Chemistry, University of Rajshahi, (BANGLADESH)
E-mail: rabbi_chem@yahoo.com

ABSTRACT

Ready–Made Garments (RMG) is the biggest sector in Bangladesh where a large amount of waste streams or effluents is produced. The presence of heavy metals in industrial waste water is one of the main causes of water and soil pollution in Bangladesh. The present research was carried out on eight garments industries of Gazipur region that are using Effluent Treatment Plant (ETP) for the waste water management. In this investigation the heavy metal (Cd, Pb, Hg, Ni, As, Cr, Cu, Zn, Mn, Sb and Co) contents in the 24 samples of different garment industry's inlet water and waste water (before and after treatment) were determined. In most of the cases the Cd, Pb, Hg, Ni, As, Cr, Sb and Co content are not too high in the waste water and can be reduce to tolerable range with the ETP, whereas the textile manufacturing process discharge huge amount of Cu, Zn and Mn to the waste water and these metals content in the waste water even after treatment are beyond the tolerable range.

KEYWORDS

RMG;
Effluents;
Heavy metal;
Waste-water;
Inlet water;
ETP;
Gazipur.

INTRODUCTION

Rapid growth in the industrial sector is playing a vital role in the economy of Bangladesh. In recent years, the Ready–Made Garments (RMG) sector of Bangladesh has emerged as the biggest earner of foreign currency. The sector contributes significantly to the GDP of Bangladesh. It also provides employment to around 2 million Bangladeshis. From the environmental concern these textile and dyeing industries now viewed as a major environmental threat in the industrial area of Bangladesh[1]. The textile manufacturing process is characterized by the high consumption of resources like water, fuel and a variety of chemicals in a long process sequence that generates a significant amount of waste. Slashing, bleaching, mercerizing, and dyeing are the major water consumption activities as well as waste water generation processes. During each stage different type of chemicals are used such as strong acids, strong alkalis, inorganic chlorinated compounds, hypochlorite of sodium, organic compound such as dye stuff, bleaching agent, finishing chemicals, starch, thickening agent, surface active chemicals, wetting and dispensing agents and salts of metals[2]. The main environmental problems associated with textile in-

dustry are typically those associated with water body pollution caused by the discharge of untreated effluents. In Bangladesh many medium and small RMG industries discharge wastewater into the rivers and ponds indiscriminately without any treatment. Those who have the waste water treatment plant (ETP), contribute huge amounts of sludge in waste water treatment processes. Although characteristics of sludge depend on the waste water treatment process and sludge stabilization methods, it contains substantial amounts of toxic heavy metals[3]. Heavy metals are important environmental pollutants, particularly in areas with high anthropogenic sources[4]. Toxic heavy metals in air, soil, and water are global problem that is a growing threat to humanity. These pollutants are extremely persistent in the environment, nonbiodegradable, nonthermodegradable, therefore could readily accumulate to toxic levels[5,6]. Generally, humans are exposed to these metals by ingestion (drinking or eating) or inhalation (breathing). These heavy metals have carcinogenic or toxic effects on human beings and environment[7, 8]. Working in or living near an industrial site which utilizes these metals and their compounds increases ones risk of exposure, as does living near a site where these metals have been improperly disposed.

Gazipur is an industrial area of Bangladesh. The waste waters of eight RMG industries that have the ETPs were investigated for heavy metal content. The eleven heavy metal concentrations in the inlet water, waste water before treatment and waste water after treatment were studied in this investigation.

MATERIALS & METHOD

The concentrations of eleven heavy metals in inlet water, before treatment and after treatment waste water were measured for each garments industry.

Sample collection: The samples were collected in one liter plastic bottle from the eight garments industries at Gazipur region in mid-August, 2015. All of the industries under consideration have the ETPs. The industries were selected at different zones namely Kaliakoier, Shreepur, Vabanipur, Zirani Bazar and Tongi of Gazipur district. Name of the eight RMG industries are expressed as G-1, G-2, G-3, G-4, G-5, G-6, G-7 and G-8. Among these eight industries G-1 and G-2 are at Kaliakoir, G-3 and G-4 at Vabanipur, G-5 and G-6 at Sreepur, G-7 at Jarani Bazar and G-8 at Tongi region of Gazipur District. The collected samples were stored into separate plastic container and stored at ambient temperature prior to treatment.

Digestion of Sample: 100 mL of the each sample was taken in a 400mL beaker. 5 mL of concentrated HNO_3 was added to each sample. The sample was evaporated to 5 mL, cooled and filtered through 41 membrane filter paper in 25mL volumetric flask. Then the each sample was made up 25 mL by DI water. Finally each sample was analyzed by ICP-OES, Agilent 700 Series. Average values of three replicates were taken for each determination. Analytical Grade (Merck) regents were used in all cases and standard were of High purity & Accu Standadard.

RESULTS & DISCUSSION

The eight garments industries under investigation are 100% export oriented and all have the ETPs. The concentrations of Cd, Pb, Hg, Ni, As, Cr, Cu, Zn, Mn, Sb and Co in inlet water, waste water before treatment and after treatment ware given in TABLE-1. In all cases the Cd, Pb, Hg, Ni, As, Cr and Co concentrations were less than the detection limit. Those RMG mainly discharge Cu, Zn and Mn to the waste water. In two waste water samples Sb was found. The highest Cu concentration before and after treatment were found to be 772.49 and 82.50 μg/L respectively for G-1. The highest Zn concentration before and after treatment were found to be 399.04 and 186.58 μg/L respectively for G-3. The highest Mn concentration before and after treatment were found to be 414.67 and 318.92 μg/L for G-1. The Mn content in inlet water of G-1 was 298.50 μg/L. The reason of high Mn content in inlet water might be due to the other industries at Kaliakoier who have no ETP.

The textile & textile processing industries at Gazipur generate large amount of waste water on a regular basis which are being directly discharged

TABLE 1 : Heavy metal contents in inlet water, waste water before and after treatment

Industry	Water Quality	Heavy Metal Concentration (µg/L)										
		Cd	Pb	Hg	Ni	As	Cr	Cu	Zn	Mn	Sb	Co
	Inlet Water	<0.1	<1	<0.05	<1	<1	<1	<1	29.64	298.50	<1	<1
G-1	Before treatment	<0.1	7.55	<0.05	<1	<1	<1	772.49	70.83	414.67	<1	<1
	After Treatment	<0.1	<1	<0.05	<1	<1	<1	82.50	17.44	318.92	<1	<1
	Inlet Water	<0.1	<1	<0.05	<1	<1	<1	22.0	<1	7	<1	<1
G-2	Before treatment	<0.1	<1	<0.05	<1	<1	<1	72.0	210.0	53.0	<1	<1
	After Treatment	<0.1	<1	<0.05	<1	<1	<1	29.0	14.0	16.0	<1	<1
	Inlet Water	<0.1	<1	<0.05	<1	<1	<1	<1	37.09	<1	<1	<1
G-3	Before treatment	<0.1	<1	<0.05	<1	<1	<1	<1	399.04	115.0	<1	<1
	After Treatment	<0.1	<1	<0.05	<1	<1	<1	<1	186.58	35.30	<1	<1
	Inlet Water	<0.1	<1	<0.05	<1	<1	<1	<1	<1	<1	<1	<1
G-4	Before treatment	<0.1	<1	<0.05	<1	<1	<1	<1	58.31	28.66	<1	<1
	After Treatment	<0.1	<1	<0.05	<1	<1	<1	<1	7.33	10.29	<1	<1
	Inlet Water	<0.1	<1	<0.05	<1	<1	<1	<1	8.65	<1	<1	<1
G-5	Before treatment	<0.1	<1	<0.05	<1	<1	<1	<1	105.71	37.49	51.19	<1
	After Treatment	<0.1	<1	<0.05	<1	<1	<1	<1	9.52	11.73	19.75	<1
	Inlet Water	<0.1	<1	<0.05	<1	<1	<1	19.57	<1	<1	<1	<1
G-6	Before treatment	<0.1	<1	<0.05	<1	<1	<1	71.17	57.92	9.03	<1	<1
	After Treatment	<0.1	<1	<0.05	<1	<1	<1	53.08	21.49	<1	<1	<1
	Inlet Water	<0.1	<1	<0.05	<1	<1	<1	<1	<1	8	<1	<1
G-7	Before treatment	<0.1	<1	<0.05	<1	<1	<1	<1	162.0	57.0	20	<1
	After Treatment	<0.1	<1	<0.05	<1	<1	<1	<1	20	24.0	<1	<1
	Inlet Water	<0.1	<1	<0.05	<1	<1	<1	<1	23.0	41.0	<1	<1
G-8	Before treatment	<0.1	<1	<0.05	<1	<1	<1	<1	49.0	65.0	<1	<1
	After Treatment	<0.1	<1	<0.05	<1	<1	<1	<1	37.0	58.0	<1	<1

into the surrounding channel, agricultural fields, irrigation channels, surface water and these finally enter into Turag river[9]. Turag is badly affected by those industries and losing its flow day by day. So the possibility of excessive accumulation of heavy metals in agricultural soils through waste water irrigation increases day by day. This may not only result in soil contamination, but also affect food quality and safety[10].

CONCLUSION

Most of the cases Cu, Zn and Mn content on the waste water after treatment were found beyond the safety level. So the Cu, Zn and Mn concentrations will gradually increases on the surface water in this region. ETP can't control the Cu, Zn and Mn totally and discharge them in the environment. Consequently those heavy metals were found in the inlet water of the industries. However the ETP plays a very crucial role to control the heavy metal contamination. In Bangladesh total number of dyeing and textile processing units is around 3500 where 1200 of them are 100% export oriented. Among them, only 900 have ETPs. Out of those 900 about 60% ETPs were found to be in use by the owners. The rest of the ETPs were either turned off deliberately to save operating cost or were out of order. This investigation suggest the implementation of ETPs in all the dyeing and textile processing industries and the efficiency of the ETPs should be increased simultaneously maintaining the continuous operation, strong monitoring & stimulus support from the government is required. Central ETP may be a good solution so that all the small and medium industries can be taken under the coverage of central ETP.

REFERENCES

[1] M.M.Karim, A.K.Das, S.H.Lee; Anal.Chimica.Acta., **576**, 37 **(2006)**.

[2] Shuchismita Dey, Ashraful Islam; Resources and Environment, **5**, 15 **(2015)**.

[3] Y.Chen, C.Wang, Z.Wang; Environ.Int., **31**, 778 **(2005)**.

[4] I.Ejazul, Y.Xiao-e, Zhen H.Li, M.Qaisar; JZUS-B, **8**, 1 **(2007)**.

[5] Kumar R.Sharma, M.Agrawal, F.Marshall; Ecotox Environ Safe, **66**, 258 **(2007)**.

[6] C.Micó, L.Recatalá, M.Peris, J.Sánchez; Chemosphere, **65**, 863 **(2006)**.

[7] D.Trichopoulos; Epidemiology of Cancer., Philadelphia, 231 **(2001)**.

[8] M.K.Turkdogan, F.Kilicel, K.Kara, I.Tuncer, I.Uygan; Environ.Toxicol.Pharmacol, **13**, 175 **(2002)**.

[9] A.Munnaf, M.S.Islam, T.R.Tusher, M.H.Kibria, M.A.H.Molla; J.Environ.Sci.& Natural Resources, **7**, 257 **(2014)**.

[10] M.Muchuweti, J.W.Birkett, E.Chinyanga, R.Zvauya, M.D.Scrimshaw, J.N.Lester; Agric.Ecosyst.Environ., **112**, 41 **(2006)**.