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Original Research Paper

Physico-Chemical Analysis of Hazardous Effluents from Different Paper Industries

Asif Hanif Chaudhry*, Rehan ul Haq Siddiqui*, Tanveer Akhtar Malik, Kazi Muhammad Ashfaq**, Muhammad Shafiq***, Rashid Mahmood** and Ghazala Yaqub******

*Geoscience Advance Research Labs, GSP, Islamabad, Pakistan
**National Institute of Health, Islamabad, Pakistan
***Department of Chemistry, G.C. University, Faisalabad, Pakistan
****Department of Environmental Sciences, Kinnaird College for Women, Lahore, Pakistan

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ABSTRACT

Annual paper production is measure of the development of a country. Paper is made from cellulose based raw material, after their chemical and mechanical treatments. There treatment discharge waste water into the environment which is carried along the water channels like drains. The water form these drains is used by formers for irrigation purposes. If this drained water contains harmful effluents it can badly affect crops. To over come or minimize this damage present study was carried out. Various parameters were checked using standard procedure recommended by American Public Health Association and the results were compared with National Environmental Quality standards (NEQs) of Pakistan. The value of average temperature, pH, TDS and chloride was in harmony with NEQs, whereas the values of the other parameters like TSS, BOD5, COD, Copper and iron were above the NEQs limits for effluents. The violation of the parameters from NEQs suggest that it is time to take steps to check the discharge of unreacted or incomplete treatment effluents into these drains and distribution, so to ensure healthy environment for future generations.

INTRODUCTION

In the recent times there has been rapid industrialization and urbanization that has resulted in the stress on available water resources. Only small fraction of water used in industry is incorporated into its products or lost by evaporation. Most of the water is eventually discharged as spent water.

Pulp and paper industry has very important role in the development of country in all fields, is but also a major producer of water and solid pollution (Thompson 2001, Geng 2006, Murugesan 2000). For the production of 1 ton of the paper 273-450 m^3 of water is required. After paper processing, 60 to 300 m^3 of wastewater is discharged (Subramanium 1976). Most of the industries release wastes without pretreatment (Srivastava 1994). Untreated effluents discharged into water badly affects the quality of water and also imparts colour. Colour is responsible for the increase in temperature and slowing down the rate of photosynthesis, which will increase the oxygen demand (Kingstad 1984, Panesar 1999). Coloured effluents contain chlorinated phenols, dioxins, and other mutagenic and carcinogenic compounds, organic and inorganic compounds, chorolignin and lignin (Ingle 2000, Yadla 2002, Baruah 1996). Although low molecular weight chlorolignins are partially removed from the effluent by fungi but high molecular weight lignins remain unaffected and pass effluent treatment plants into receiving water bodies (Eriksson 1980). Slow decomposition of these compounds releases toxic compounds in waters (Kumar et al. 2000).

Present is study based on the physico-chemical study of wastewater effluents from the five paper mills located at Lahore, Punjab, Pakistan.

MATERIALS AND METHODS

Chemicals: All the solutions were prepared in doubly distilled water with AR grade chemicals. pH was determined by Cyber Scan pH meter, and conductivity by TOA CM conductivity meter CM-60S. COD was analysed according to the methods reported previously. Fe was determined by atomic absorption spectrophotometer (Prekin-Elmer Model Analyst-800). Remaining parameters were determined volumetrically/ titrimetrically by standard methods (APHA 1976, NCASI 1071, Manivasakam 1996, Trivedy & Goel 1986).

Collection of samples: Samples were collected in the sterilized plastic bottles. At the time of collection of samples temperature and pH were measured. Samples were stored in the controlled environment.

Table 1: Analysis of paper industry waste.

Sample No.	Packages Sample	Century Sample	Flying Sample	Mandialy Sample	Premier Sample
Temperature °C	30	32.3	32.7	33.5	36.4
pH	6.9	7	7.3	7.6	7.2
Electric Conductance (µS/cm)	740	1480	1057	1590	1540
TDS (ppm)	420	900	923	910	880
TSS (ppm)	122	1080	451	334	1440
Carbonate (ppm)	20	18	17	24	20
Bicarbonate (ppm)	10	9.5	9.2	12.5	9.5
Total Hardness (ppm)	800	900	828	910	790
Ca^{+2} Hardness (ppm)	5	7	11	3	9
BOD (ppm)	66	425	355	140	498
COD (ppm)	106	620	518	200	710
Chloride (ppm)	70	140	216	200	160
Iron (ppm)	0.156	0.147	0.175	0.143	0.158
Sulphate (ppm)	4.7	4.5	3.94	5.0	4.6
Nitrate (ppm)	0.4	0.5	0.61	0.67	0.85
Nitrite (ppm)	1.2	1.4	1.7	1.87	1.47

RESULTS

Parameters of each sample were tested under same conditions. The quality of the municipal and liquid industrial effluents was compared with the National Environmental Quality Standards (NEQS) of Pakistan Environment Protection Act 1997, revised by Pakistan Environment, Local Government and Rural Development on August 10, 2000 in Islamabad, through the Gazette of Pakistan Extraordinary (Table 2).

DISCUSSION

The normal temperature of water bodies in this part of the country ranges form 22-25°C, which means that the temperature of the drains is higher than normal. This can be attributed to pollutants in the drain water, which might trap heat that is generated due to different chemical reactions or due to heavy discharge of cooling water. Higher temperature favours the breakdown of the organic matter by microorganisms, which results in production of the organic acids and lowering of pH.

pH of the samples range between 6.8 and 8.0. Suspended solids badly affect the penetration of light through the water and thus, destroying the aquatic flora and fauna. The suspended solids serve as the transport mechanism for pesticides and other substances which are readily adsorbed on the clay particles. These values were much higher for the Century Paper Mill (1080 ppm). This is due to the fact that more and faster flow of water would not have allowed the settling of the suspended solids and kept them in suspended form.

Excess of dissolved solids imparts taste and odour to the water and renders it unit for use. TDS data show that all the samples had TDS value well below the permitted level. The highest value of TDS was for the sample No. F 1. The average value of TDS for all the samples was 949.26 ppm. The CO_3 values of these samples varied between 15 and 25 ppm. The HCO_3 values of the samples varied from 8 to 12 ppm. The total hardness of the samples varied between 800 and 900 ppm. For calcium hardness, values lie between 3 and 15 ppm. The NEQS permissible limit of BOD is 80 ppm whereas overall average value of BOD for all the samples was 359 ppm. Trend in COD was not different from that in BOD. The NEQS permissible limit of COD is 150 ppm, whereas the overall average value of COD for all the samples was 519 ppm. According to the data, the chlorides were well below the permissible limit of 1000 ppm. The overall average of the chlorides in all the samples was 210 ppm. Concentration of iron was found to be less than NEQS in sample No. 4, while all other samples had significantly higher concentrations. Concentration of sulphate varies between 4 and 5 ppm. Concentration of nitrate varies between 0.4 and 0.9 ppm, and nitrite between 1.2 and 2.0 ppm. Water treatment plant at the end point of industrial estates could be one option. But this will still expose the people and livestock from negative impacts of the large number of industries. Industrialist be asked to discharge the effluent only after proper treatment and the violators should be penalized strictly according to the Pakistan Environment Protection Act, 1997.

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Table 2: The national environmental quality standards (NEQS) of Pakistan.

Parameters	Existing Standards	Revised Standards	
		Into Inland Water	Into Sea
Temperature °C	40	≤ 30	≤ 30
pH	6-10	6-9	6-9
TSS (ppm)	150	200	200
TDS (ppm)	3500	3500	3500
COD (ppm)	150	150	400
BOD (ppm)	80	80	80
Chloride (ppm)	1000	1000	-
Copper (ppm)	1.0	1.0	1.0
Chromium (ppm)	0.1	0.1	0.1
Nickel (ppm)	1.0	1.0	1.0
Iron (ppm)	2.0	8.0	8.0

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