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Physico-Chemical Characterization of Effluents of Local Textile Industries of Faisalabad–Pakistan

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ABSTRACT

Fifteen samples were collected from different textile mills and analyzed for various physico-chemical parameters such as pH, electrical conductivity (EC), chloride, sulphate, phenols, total dissolved solids (TDS), biochemical oxygen demand (BOD) and chemical oxygen demand (COD). demand (COD). The results indicated that all samples had high values of pH, EC, chloride, phenols, BOD and COD. Only sulphate contents were found to be present with in the permissible limits. It was therefore, concluded that textile effluents were highly polluted.

Key Words: Textile effluents; Total dissolved solids; Electrical conductivity; Biochemical; Chemical oxygen demand; pH; Chloride

INTRODUCTION

The textile industry actually represents a range of industries with operations and processes as diverse as its products. It is almost impossible to describe a "typical" textile effluent because of such diversity. Fabrics, after its manufacturing, are subjected to several wet processes collectively known as "finishing" and it is in these finishing operations that the major waste effluents are produced (Abo-Elela *et al.,* 1988).

In Faisalabad, more than 40 textile units are working at present. Almost all of them have no proper discharge system. The effluents come through open channels in the city and it is common to find stagnant pools of colored and foul water in the industrial areas deteriorating water and soil, Keeping in view the significance of water pollution, the present project has been undertaken to check the contribution of textile effluents in water pollution.

MATERIALS AND METHODS

Fifteen samples were collected from five different textile mills at the point of their discharge. These samples were collected from different sections like bleaching, dying, printing etc. The samples were analyzed for various physicochemical parameters like pH, electrical conductivity (EC), total dissolved solids (TDS). Biochemical oxygen demand (BOD), chemical oxygen demand (COD), phenols, sulphate and chloride contents. pH was determined by using pH meter (Jenco digital pH meter, model-671-p) while EC was determined by conductivity meter (Jenvway EC meter, model-4070). Evaporation method was employed for determination of BOD was determined by DO meter while COD by COD apparatus directly (Greenberg *et al.,* 1992). Chloride and sulphate contents were determined by titrimetric and turbidity method, respectively (Rump & Krist, 1992). While phenolic compound were determined by photometric method (Greenberg *et al.,* 1992).

RESULTS AND DISCUSSION

The results pertaining to various physico-chemical characteristics of textile effluents are shown in Table I. pH of different effluent samples appeared to lie between 8-14. It is obvious that only bleaching and printing samples have pH with in the permissible limit, while other samples have higher pH values especially mixed effluents. These results are in accordance with the results of Junkins (1982) who reported that the textile wastes are highly alkaline. pH of effluents affects physico-chemical properties of water which in turn adversely affects aquatic life, plants and humans. This also changes soil permeability which results in polluting underground resources of water (Rump & Kriot, 1992).

EC of textile effluents ranged from 3.6–10 μ S cm^{-1} which is within the permissible limits. Total dissolved

Table I. Physico-chemical analyses of effluents of textile industry at Faisalabad

No. of industries	pH				Ec (U-simens/cm)				TDS(mg/L)			
	Bleaching	Dying	Printing	Mixed	Bleaching	Dying	Printing	Mixed	Bleaching	Dying	Printing	Mixed
1	8.0	10.9	9.5	12.9	4.91	5.15	5.74	5.18	3331.7	2799.4	2891.0	3302.0
2	8.0	14.0	10.8	14.0	6.93	5.33	7.25	9.78	3847.1	3449.2	3781.0	3449.7
3	8.4	13.0	9.0	14.0	6.17	4.78	5.33	6.71	4231.0	3678.7	3497.3	3879.5
4	4.9	13.7	10.5	12.0	6.41	3.69	7.84	7.73	4111.0	4001.2	3567.0	4071.6
5	8.7	12.9	9.0	14.0	8.15	4.75	5.15	9.14	3274.0	3300.0	4101.7	4102.0

Table II. Chloride, sulphate and phenol contents of textile effluents

	Chloride (mg/L)				Sulphate (mg/L)				Phenol (mg/L)			
No. of industries	Bleaching	Dying	Printing	Mixed	Bleaching	Dying	Printing	Mixed	Bleaching	Dying	Printing	Mixed
1	2200	1300	1540	1520	479.5	294.4	806.7	605.03	0.432	0.199	0.110	0.070
2	1620	1200	1140	1450	212.2	257.6	292.2	380.0	0.067	0.061	0.197	0.299
3	2650	1834	1900	2010	340.2	371.09	339	402.68	0.055	0.110	0.166	0.270
4	2020	1780	1400	1621	478.5	249.09	877.7	687.7	0.4218	0.155	0.660	0.266
5	1644	1548	1440	1340	950.0	214.4	206.0	405.03	0.99	0.450	0.253	0.521

solids (TDS) values fell within the range 2700- 4250 ppm. TDS values of majority of the samples are much higher then the permissible limits which predicts the presence of excess of materials and dissolved matter in textile effluents. These values are very close to the findings of Junkins (1982) who reported a value of 2700 ppm in textile waste water. High TDS are one of the major sources of sediments which reduce the light penetration into water and ultimately decrease the photosynthesis. The decrease in photosynthetic rate reduces the DO level of waster water which results in decreased purification of waste water by micro-organisms (Tyagi & Mehra, 1990).

Table III. Biochemical/chemical oxygen demand measurements

	BOD (mg/L)				COD (mg/L)			
No. of industries	Bleaching	Dying	Printing	Mixed	Bleaching	Dying	Printing	Mixed
1	226.0	307.0	331.5	421.4	507.0	618.5	670.0	840.9
2	251.7	314.0	471.0	403.9	755.7	640.5	940.0	807.8
3	314.5	441.1	304.8	312.8	621.9	880.0	870.0	422.0
4	402.0	487.7	291.5	408.0	807.0	591.6	588.4	740.7
5	229.0	211.9	134.0	410.2	410.7	630.6	806.0	182.0

The chloride values varied between 1140-2650 ppm. All the textile effluents had alarmingly high values of chloride contents. High chloride contents are harmful for metallic pipes as well as for agricultural crops if such wastes containing high chlorides are used for irrigation purposes. Moreover, high chloride contents also kill some micro-organisms which are important in some food chains of aquatic life (Kumar, 1989). The concentration range of sulphate (SO_4^{2-}) ion in textile effluents was 200–950. It is obvious that majority of the samples have permissible limits of sulphate ions. Most of the textile effluents showed phenolic contents greater than 0.1 ppm which is permissible limit of the phenolic compounds these compounds are very toxic for fish even at every low concentration. Moreover phenols form polychlorinated compounds in bleaching effluents having high chloride contents are not easily biodegradable and are highly toxic (Agarwal, 1996).

COD value of textile effluents were found to be in the range of 220–490 mg/L and 180–940 mg/L respectively. The results indicate that almost all the effluent samples are highly polluted. These results are in the close agreement with the Randall and King (1980) and the Kertell and Hill (1982) who also reported a high BOD and COD values in the textile effluents. A high BOD and COD values show that the effluents have highly oxygen demanding waste (Kumar, 1989) which cause the depletion of DO which is a fundamental requirement for aquatic life. Moreover, high BOD and COD produce unaesthetic color, endanger water supplies and decrease recreational value of water ways (Tayagi & Mehra, 1990).

CONCLUSION

Textile effluents are highly polluted. Such polluted effluents must be treated properly before their discharge into the drainage channel to minimize the effect of various pollutants on the environment.

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