



Quality Assessment of dye effluent from small scale textile units of Chinnalapatti, Dindigul district, TamilNadu, India

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ABSTRACT

Chinnalaptti a small village at Dindigul district of Tamil Nadu is famous for its Chungidi handloom sarees. Around 13 textile processing units are there in this village. This paper is an attempt to evaluate the physio-chemical characteristics of dye effluent such as Total Dissolved Solid (TDS), Chemical Oxygen Demand (COD), Biological Oxygen Demand (COD) Total Hardness, Sulphate, Sodium, Potassium, Calcium, Magnesium, Copper, Zinc and Nickel.

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Introduction

Wastewater from textile industries creates a great pollution problem due to the dye content. The inefficiency in dyeing processes has resulted in 10-15% of unused dyestuff entering the wastewater directly [1]. Colour present in dye effluent gives a straightforward indication of water polluted. Azo dyes constitute the largest group of synthetic dyes with great deal of structural and colour variety. They are extensively used in textile, leather, food, cosmetics, pharmaceutical and paper industries and eventually more than 7x10⁵ tones of these dyes are produced annually world wide[2]. Azo dyes have the same chromophore-N=N-and different auxochromes such as NH₂, OH and N(R)₂ groups. These dyes are recalcitrant even in conventional aerobic waste water treatment plants [3]. Azo dyes are potential mutagens and carcinogens which necessitate proper degradation and proper disposal [4]. Some of the azo dyes and their dissociated products are also strongly toxic and mutagenic to the living organisms [5]. The discharge of highly coloured dye effluent can result in serious environmental damage. Hence colour elimination in waste water is the principal problem concerning the textile industries since it is the first contaminant recognised in textile waste water and has to be removal before discharged into the receiving water bodies. In this study physico-chemical parameters and heavy metals of textile dye effluent were analysed and recorded.

Materials and methods

The effluent was collected from dye industries of small scale textile units of Chinnalapatti, Dindigul district, Tamil Nadu, India.

Sampling

Dye effluents samples were collected from different textile units in polypropylene cans with ice cubes; brought to the laboratory and stored in refrigerator (40 C) till analysed.

Physico- chemical analysis

Parameters such as Temperature, pH, Colour and Odour of the samples were recorded on the spot; Electrical Conductivity(EC), Total Dissolved Solid(TDS), Chemical Oxygen Demand (COD), Biological Oxygen Demand(COD),

Total Hardness, Sulphate, Sodium, Potassium, Calcium, Magnesium, Copper, Zinc and Nickel were carried out in the laboratory following standard methods[6], Atomic absorption Spectrophotometer(AS)[7] and Flame photometry[8].

Result and discussion

The physio-chemical parameters of textile dye effluents are given in Table: 1

The effluent was blue in colour; it may be due to the presence of unused dye; the odour of the effluent was fishy and the temperature of the effluent was 280C which is the below the recommended NEQS (400C) [9]. In the present study pH was recorded as 7.2+0.9. A similar result has also been reported and it was stated that the recommended pH range for irrigation is 6.5-8.5. The recorded pH may be due to excess use of carbonates, bicarbonates, hydrogen peroxide and sodium hydroxide during bleaching process [10].

Electrical conductivity is an important parameter that indicates salinity hazards. For irrigation, water conductivity value recommended was in the range of 250-750 μ for satisfactory crop growth.[11]. The primary effect of high EC in crop productivity is in the inability of the plant to compete with ions in the soil solution for water. The higher the EC the less water is available to plant even though the soil may appear to be wet. In the present study EC of the effluent was 2433 \pm 513.16 μ S/cm. Water with less than 250 μ mho/cm is considered good and that with greater than 750 μ mho/cm is unsuitable for irrigation.

In the present investigation TDS value was recorded as 1856 \pm 235mg/l this is more than desirable limit of 500mg/l. Agreeable limits of dissolved solid in freshwater is from 0-1000mg/l. The recorded TDS value might be due to type of cloths processed in textile industry[12]. Total Hardness of the water depends on the geological formations. Total Hardness in the collected sample was recorded as 328.8 \pm 23.6 where as the desirable limit is 300mg/l [12]. BOD, COD of the tested effluent were found to be 568 \pm 72.8mg/l, 6253 \pm 510 mg/l respectively. However the desirable limit of COD is in the range of 150-400mg/l and BOD is 80-250 mg/l respectively. High BOD and

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COD levels of the tested samples are the indicators of an increased load of organic pollutant in the effluent [13]. Sulphur is a major contributor for salinity. In high concentration it may interfere with uptake of other nutrients [7]. In the present study the sulphate content of the effluent was recorded as 255 ± 24.7 mg/l; normally water with sulphate values of below 192 mg/l are considered to be good for irrigation water.

Presence of Calcium, Sodium, Potassium, Magnesium were analyzed and accordingly they were 27.0 ± 6.11 mg/l, 13.2 ± 2.9 mg/l, 9.36 ± 1.0 mg/l, 11.27 ± 4.30 mg/l respectively. These values were found to be higher than the permissible limit under the NEQS [12]. Due to the usage of higher amount of the metal containing dye in dyeing process the effluent recorded heavy metal ion concentration such as Cu (1.0 ± 0.71 mg/l), Zn (1.56 ± 0.56 mg/l), Ni (0.92 ± 0.33 mg/l). The source of these metals in the effluent might be due to the dyes used in the textile industry [14] and about 10-15% of dyes are lost into the waste water during the dyeing process [15].

Conclusion

This study addresses the physicochemical characteristics of the effluent, warrants remedial measures to safeguard the atmosphere.

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Table: 1 Physio-chemical parameters of textile dye effluents

Parameters	Average	S.D ±	NEQS
Colour	Blue		Colourless
Odour	Fishy		Odourless
Temperature(°C)	28	1.0	40
Electrical Conductivity(µS/cm)	2433	513.16	
pH	7.2	0.9	6-9
Total Dissolved Solid (TDS) (mg/l)	1856	235	3500
Total Hardness (mg/l)	328.8	23.6	
Biological Oxygen Demand (BOD) (mg/l)	568	72.8	80-250
Chemical Oxygen Demand (COD) (mg/l)	6253	510	150-400
Sulphate (mg/l)	255	24.7	
Sodium (mg/l)	13.2	2.9	
Potassium (mg/l)	9.36	1.0	
Calcium (mg/l)	27.0	6.11	
Magnesium (mg/l)	11.27	4.30	
Copper (mg/l)	1.00	0.71	1.0
Zinc (mg/l)	1.56	0.56	5.0
Nickel (mg/l)	0.92	0.33	1.5