

Full Length Research Paper

Characterization of certain Physico-chemical parameters of Textile Waste Water

Pavithra M and Hina Kousar***

**Research Scholar, Department of Post Graduate Studies and Research in Environmental Science, Kuvempu University, Jnana Sahyadri, Shankaraghatta-577 451, Karnataka, India.

*Assistant Professor, Department of Environmental Science, Kuvempu University, Jnana Sahyadri, Shankaraghatta-577 451, Karnataka, India.

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Corresponding Author:

Dr. Hina Kousar

Assistant Professor,

Department of

Environmental Science,

Kuvempu University,

Jnana Sahyadri,

Shankaraghatta-577

451, Karnataka, India..

Abstract

An attempt has been made to analyze the quality of the effluent from the textile industry. The effluent was collected from Shahi Exports Private Limited, Machenahalli, Shimoga District, Karnataka, India. In the present investigation, physico-chemical parameters such as colour, temperature, pH, total alkalinity, total hardness, biological oxygen demand (BOD) and chemical oxygen demand (COD) were determined using standard procedures. The results of the analysis were compared with the water quality standards of BIS (Bureau of Indian Standard). The effluent sample was pale grey in colour with objectionable odour. It showed high electrical conductivity, alkaline pH, high BOD and COD. It was observed that all the parameters studied exceeded the BIS limits except total hardness.

Keywords: Effluent, physico-chemical parameters, COD, BOD.

Introduction

Water is the most vital resource for all kinds of life, but it is being adversely affected both quantitatively and qualitatively. Today, most of the rivers receive millions of litre of sewage and industrial effluents containing varying characteristics from simple nutrients to highly toxic substances. The world's ever increasing population and progressive adoption of industry based lifestyle have inevitably led to an increased anthropogenic impact on the biosphere. With the increased demand for textile products, the textile industry and its wastewaters have been increasing proportionally, making it one of the main sources of severe pollution problems worldwide. The textile industry is one of the most important and rapidly developing industrial sectors in India (Husain and Husain, 2012) accounting for about 20% of the total industrial production. It consumes large quantities of water and produces large volumes of wastewater from different steps in the dyeing and finishing processes.

The diversity in composition of chemical reagents used in textile industry contributes to much of the water pollution (Mishra and Tripathy, 1993). The reagents range from inorganic compounds to polymers and organic products. Waste water generated by a textile mill has high p^H , temperature, detergents, oil, suspended and dissolved solids, dispersants, leveling agents, toxic and non-biodegradable matter, color and alkalinity. Important pollutants in textile effluent are mainly recalcitrant organics, color, toxicants and surfactants, chlorinated compounds (Kumar *et al.*, 2007). These wastes often contain a wide range of contaminants such as petroleum hydrocarbons, chlorinated hydrocarbons and heavy metals, various acids, alkalis, dyes and other chemicals which greatly change the physico-chemical properties of water.

The waste water thrown out from industries is either used for irrigation purposes or it runs off into natural sources of water (Ahlawat and Kumar, 2009). The surface water is the main source for disposal of industrial effluent. It is found that almost all rivers are polluted in most of the stretches by some industry or the other. Waste water from textile industries creates pollution problem due to the dye content. Color is the first contaminant to be recognized in wastewater and has to be removed before discharging into water bodies or on land.

Keeping in view the significance of dyes and their environmental problems, the current study was undertaken to analyze physico-chemical parameters of textile effluent released from Shahi Exports Private Limited, Machenahalli, Shimoga District, Karnataka. The comparison of the effluent characteristics with BIS (Bureau of Indian standards) limits. In addition, characterization of the effluent is important to determine its reuse as a safe option due to its high water consumption (Vigneshpriya and Shanthi, 2015).

Materials and Methods

Collection of samples

The samples for the analysis were collected from Shahi Exports Private Limited, Machenahalli, Shimoga District from the inlet of the effluent treatment plant. It was brought to the laboratory and analyzed for various physico-chemical parameters.

Physico-chemical Analyses: Standard methods (APHA, 2005) were used for analyses of various physico-chemical parameters of the effluent. The physico-chemical parameters analyzed were temperature, pH color, BOD, COD, Total hardness and conductivity.

Temperature: is a measure of heat in terms of a standardized unit. Temperature was noted at the site prior to its collection with a thermometer.

pH was measured by a pH meter [IS:3025(P 11)].

Chemical Oxygen Demand (COD) was determined by using closed reflux method (APHA 2009) before and after the treatment.

Biochemical Oxygen Demand (BOD) of the effluent was analyzed by incubating the sample at 20⁰ C for 5 days (IS: 3025 P44) before and after the effluent treatment.

Color: Concentration of the dye was analyzed using UV-visible spectrophotometer at λ max 600 nm (IS: 3025 P4).

Hardness: of the effluent was analyzed by titrimetric method using EDTA (IS 3025 P 21).

Conductivity: of the effluent was analyzed using conductivity meter (APHA 2009).

Result and Discussion

The present study was carried out to investigate the physico- chemical characteristics of textile effluent collected from Shahi Exports Private Limited, Machenahalli, Shimoga District, Karnataka. The results of the analysis are presented in Table-1.

Table 1: Physico- chemical characterization of textile effluent

Parameters	Observed Values	BIS Limits
Temperature (°C)	50 °C	Not exceed 40 ⁰ C
pH	9.11	5.5-9
Color (Pt-Co)	2600	25
BOD (mg/L)	330	100
COD (mg/L)	1290	250
Hardness as CaCO ₃ (mg/L)	173.4	500
Conductivity (μ mhos/cm)	6170	600

Discussion

Temperature of the effluent was found to be 50°C. Temperature affects chemical and biological reactions in water. It will also reduce the solubility of oxygen and amplify odor due to anaerobic reactions (Oke *et al* 2006). pH of the sample was found to be 9.11 which is alkaline. Many chemical reactions are controlled by the pH. At low pH, most of the metals become soluble in water and therefore could be hazardous to the environment. At high pH most of the metals become insoluble and accumulate in the sludge and sediments. Biological activities and some chemical treatment processes are usually restricted by pH.

The color units were found to be 2600 on Pt-Co scale. The effluent was highly colored indicating high content of different dyes. The high color may be the combined result of p^H, temperature and acidic conditions that do not allow the chromophore group of dye to degrade making the effluent highly colored.

BOD of the effluent was 330 ppm, much higher as compared to BIS limits indicating absence or less amount of oxygen for living organisms for utilizing organic matter.

COD of the effluent was found to be 1290 ppm, 5 times high as compared to limits set by BIS. High concentration of COD implies toxic conditions and the presence of biologically resistant organic substances. High COD concentration observed in the waste water might be due to the use of chemicals, which are organic, inorganic and diverse chemical structures that are highly oxygenic in nature.

Divalent metallic cations particularly Ca⁺², Mg⁺², Sr⁺², and Fe⁺² are responsible for hardness in textile effluents. According to BIS, the maximum permissible limit of hardness is 500 mg/L. Hardness of the effluent sample was found to be 173.4mg/L which is within the BIS limit.

The electrical conductivity of water is a measure of the ability of a solution to conduct an electric current; this ability depends upon the presence of ions, their total concentration, mobility and temperature of water. It is a useful indicator for salinity or total

salt content of waste water. In the present study, conductivity of the effluent was found to be 6170 $\mu\text{mhos/cm}$ which is much higher as compared to values prescribed by BIS (600 $\mu\text{mhos/cm}$).

The values determined for all the above parameters exceed the limits set by the BIS except total hardness, indicating that the effluent needs to be treated before its discharge into the receiving bodies.

Conclusion

The study addresses the physico-chemical characteristics of the textile effluent. From the results, it has been concluded that all the parameters are high in concentration compared to the standards prescribed by BIS. It is recommended that the disposal of industrial waste water without proper treatment should be discouraged and continuous monitoring of water quality is imperative to ensure the protection of water resources from further degradation.

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