# Physico-Chemical Analysis of Textile Dye Wastewater

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*Abstract*— Sample of textile industry wastewater was collected. The results of this analysis are compared with the waastewater effluent standards of CPCB. In this analysis the various physicochemical parameters such as pH, colour, odour, temperature, alkalinity, chloride, total dissolved solids (TDS), total suspended solid (TSS), sulphate, phosphate, nitrate, Oil& grease, COD and BOD, were determined using standard procedures from CPCB guideline. Textile industry is one of the most important and rapidly developing industrial sector in Vijayapur city Karnataka. It has a high importance in terms of its productivity, since it consumes considerably high amounts of processed water and produces highly polluted discharge water in large amounts. Result shows that some physic-chemical parameters are within permissible limit & some parameters are higher than permissible limit, so that a proper treatment is needed before discharge to avoid environmental problems.

***Key words:*** Physico-Chemical, Textile Dye, Wastewater

## I. INTRODUCTION

General: The textile dyeing industry consumes large quantities of water and produces large volumes of wastewater from different steps in the dyeing and finishing processes. Wastewater from printing and dyeing units is often rich in color, containing residues of reactive dyes and chemicals, and requires proper treatment before being released into the environment. The toxic effects of dyestuffs and other organic compounds, as well as acidic and alkaline contaminants, from industrial establishments on the general public are widely accepted. Increasing public concern about environmental issues has led to closure of several small-scale industries. Interest in ecologically friendly, wet-processing textile techniques has increased in recent years because of increased awareness of environmental issues throughout the world. Consumers in developed countries are demanding biodegradable and ecologically friendly textiles (Chavan, 2001). Cotton provides an ecologically friendly textile, but more than 50% of its production volume is dyed with reactive dyes. Unfortunately, dyes are unfavorable from an ecological point of view, because the effluents generated are heavily coloured, contain high concentrations of salts, and exhibit high biological oxygen demand/chemical oxygen demand (BOD/COD) values. In dyeing textiles, ecological standards are strictly applied throughout processing from raw material selection to the final product. The main challenge for the textile industry today is to modify production methods, so they are more ecologically friendly at a competitive price, by using safer dyes and chemicals and by reducing cost of effluent treatment/disposal. Recycling has become a necessary element, not because of the shortage of any item, but because of the need to control pollution. The present study deals with the collection of textile mill wastewater by grab sampling and characterization of the samples in order to find out the physic-chemical load put in by the effluent generated from textile industry, on the wastewater stream.

### A. Objective

- To find out Physico-chemical characteristics of textile wastewater.
- Comparing the treated effluent with CPCB Standard.

## II. METHODOLOGY

### A. Collection of sample

The grab sample used in this study is collected from Textile manufacturing industry in two polyethylene containers and stored with preservatives prior to its use and transported to laboratory. The grab effluent samples are collected and used for characterization study.

Testing Procedure for all the parameters are described from CPCB guidelines.

| SI No | Parameter | Method |
|---|---|---|
| 1 | Colour & odour | Visual observation |
| 2 | pH | Electrometric method |
| 3 | Chloride | Argentometric |
| 4 | Alkalinity | Titrimetric method |
| 5 | TS, TSS, TDS | Evaporation Method |
| 6 | BOD | Open reflux method |
| 7 | COD | Open reflux method |
| 8 | Phosphate | Stannous chloride method |
| 9 | Nitrate | (PDA) method |
| 10 | Sulphate | Turbidimetric method |
| 11 | Oil & Grease | Partition-gravimetric method |

Fig. 1: Physico-chemical analysis of effluent sample

## III. RESULT & DISCUSSION

### A. General:

In this chapter various physico-chemical parameters of textile wastewater are discussed.

### B. Colour and odour:

The colour of the effluent sample typically depends upon the different industrial processes. The measurement and removal of colour is essential part as it is unfit for recycling without proper treatment. Different colour of effluent may due to presence of dissolved salts. Untreated or incompletely treated textile wastewater can be harmful to both aquatic and terrestrial life by adversely affecting the natural ecosystem and causing long-term health effects. In the present investigation the colour & odour of effluents was 50 Hazen unit and disagreeable odour.

### C. pH

pH is the value expressed as the negative logarithm of the hydrogen ion concentration. pH of a effluent is very important in determination of water quality since it affects

 

other chemical reactions such as solubility and metal toxicity (Fakayode, 2005).In the present investigation the pH value of effluents is ranging between 8.5-12.0 that is beyond CPCB Standard.

*D. Alkalinity*

Alkalinity of water is acid-neutralizing capacity of the water to pre-designated pH. Alkalinity is the sum of all the titratable bases .Alkalinity in water is mainly due to carbonate, bicarbonate and hydroxide content. Borates, phosphates, silicates or other bases if present also contribute for alkalinity. (CPCB Standard: 200 to 600 mg/L; taste become unpleasant) In the present study, total methyl orange alkalinity of effluent was found 2496mg/L, that is higher than CPCB Standard.

*E. Biochemical Oxygen Demand*

BOD measures the amount of oxygen required by bacteria for breaking down to simpler substances from the decomposable organic matter present in any water or wastewater. In present study Value of BOD was found 2350mg/L, that is within CPCB standard.

*F. Chemical Oxygen Demand*

The result of chemical oxygen demand test indicates the amount of water - dissolved oxygen (expressed as parts per million or milligrams per liter of water) consumed by the contaminants, during two hours of decomposition from a solution of boiling potassium dichromate. The higher the chemical oxygen demand, the higher the amount of pollution in the test sample. COD test is useful in pinpointing toxic condition and presence of biological resistant substances (Chaurasia N.K.et al 2011).In present study Value of COD is 3069 mg/L, that is within permissible limit as CPCB Standard.

*G. Chlorides*

In present investigation concentration of chloride is 2019mg/L higher than CPCB Standard <600mg/L. High concentration of Chloride may due to use Chloride compounds, like Hydrochloric acid, Hypochloric acid, chlorine gas are used as a raw materials in various process. The fear of high level of chloride causing threat to all forms of biotic life. Its availability in small amount is beneficial to both plants and animals (Hodgson and Manus, 2006)

*H. Total Solid, Total Suspended Solid And Total Dissolved Solid:*

Total solid, Total suspended solid and Total dissolved solid is the measure of total inorganic salts and other substances that are dissolved in water. The effluents with high TDS value may cause salinity problem if discharged to irrigation water (A.S. Kolhe et al, 2011). In present study value of Total solid is 9000 mg/L, Total suspended solid 250 mg/L & Total dissolved solid 8500 mg/L that is higher than permissible limit of CPCB Standard of 8000mg/L.

*I. Phosphate*

Presence of phosphates in water and wastewater analysis has a great significance. Phosphate in small concentration is used in water supplies to reduce scale formation, to increase carrying capacity of mains. The presence of phosphate in large quantities in fresh waters indicates pollution through sewage and industrial wastes. Though phosphate possess problems in surface waters, its presence is necessary for biological degradation of wastewaters. Phosphorus is an essential nutrient for the growth of organisms and helps for the primary productivity of a body of water. In present study Value of phosphate is 27 mg/L,that is higher than permissible limit.

*J. Nitrate*

Nitrate is the most highly oxidised form of nitrogen compounds commonly present in natural waters. The growth stimulation of plants, especially of algae may cause objectionable eutrophication. The main cause of nitrate in textile industry is mainly due to high concentration of salts present in reactive dyeing effluent. Nitrate, sulphate, chloride and carbonate salts can all be used during reactive dyeing. In present study Value of Nitrate is found 8.5 mg/L, that is slightly higher than permissible limit as per CPCB Standard.

*K. Sulphate*

Sulphate ions usually occur in natural waters and existence of industrial wastes. Ingestion of water containing high concentration of sulphate can have a laxative effect, which is enhanced when sulphate is consumed in combination with magnesium. Sulphates cause scaling in water supplies, and problem of odour and corrosion in wastewater treatment due to its reduction to $H_2S$. In present study Value of Sulphate is found 272mg/L, that is slightly higher than permissible limit as per CPCB Standard.

*L. Oil & Grease*

Oil and grease is any material recovered as a substance soluble in petroleum ether, hexane or n-hexane. It includes other materials extracted by the solvent from an acidified sample such as sulphur compounds, certain organic dyes and chlorophyll. Oil and grease are defined by the method used for their determination. In present study Value of Oil & Grease is found 390mg/L,that is within permissible limit as per CPCB Standard.

| SI.No | Parameter | Unit | Permissible limit as per CPCB Standard. | Results |
|---|---|---|---|---|
| 1 | Color | Hazen | <30 | 50 |
| 2 | Odor | - | Pleasant | Disagreeable |
| 3 | pH | - | 8.5-12.0 | 12.84 |
| 4 | Chemical Oxygen Demand | mg/L | 5000 | 3069 |
| 5 | Biochemical Oxygen Demand | mg/L | 2500 | 2350 |
| 6 | Chloride | mg/L | <600 | 2019 |
| 7 | Total Solid | mg/L | 10000 | 9000 |
| 8 | Total Dissolved Solid | mg/L | 8000 | 9000 |
| 9 | Sulphate | mg/L | <100 | 272 |
| 10 | Oil & grease | mg/L | <500 | 390 |

 

| | | | | |
|---|---|---|---|---|
| 11 | Inorganic Phosphate | mg/L | <12 | 27 |
| 12 | Nitrate Nitrogen | mg/L | <4 | 8.5 |
| 13 | Alkalinity | mg/L | 200-600 | 2496 |

Table 2: Characteristics of Textile Wastewater

## IV. CONCLUSIONS

1) The analyzed parameters like pH, temperature, Biochemical oxygen Demand, Chemical oxygen, Oil & Grease lies within the maximum permissible limit prescribed by CPCB Standard.
2) But few parameter like Colour, Odour, Acidity, Alkilinity, Chloride, Total solid, Total Suspended Solid, Total Dissolved Solid, Phosphate, Nitrate and Sulphate, were reported with higher value than the permissible level.
3) So proper treatment is needed before discharge to avoid environmental problems.

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