

Quality Assessment of Textile Effluents Discharged from Coloring Units in Jaspur Region of Uttarakhand

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Abstract The present study was carried out to collect the profile of dyeing and printing units in Jaspur region of Udham Singh Nagar, Uttarakhand where majority of dyeing and printing units of the state are located. They were disposing off their effluent whether liquid or solid form into the community disposal channels including open drains and garbage sites at Jaspur. In the present study, the liquid effluents were collected from community disposal channel from three different types of units namely, dyeing, printing and dyeing-cum-printing unit of Jaspur “to assess the physico-chemical characteristics viz.. temperature, pH, Dissolved Oxygen (DO), Biological Oxygen Demand (BOD), Chemical Oxygen Demand (COD), Total Solids (TS), Total Dissolved Solids (TDS) and Total Suspended Solids (TSS) of effluents (waste water) samples. The results show that mean values of physico-chemical characteristics of the effluent collected from dyeing units were lower than printing unit and dyeing-cum-printing unit. However all these parameters were found beyond the permissible limits of standards given by CPCB.

Keywords Dyeing, Printing, BOD, COD, TDS.

Introduction

Color is described as the property possessed by an object of producing different sensations on the eye as a result of the way it reflects or emits light. It always attaches with the emotions of human beings and makes them more aesthetic fascinating in the world. In textile, color affects its physical, social, psychological and marketing values. Dyeing and printing are the most commonly used techniques for adding colors to the textile products. In the ancient age, dyes were extracted from available natural resources such as blackberries, lichen, safflower, and indigo. Some of the well-known ancient dyes include madder, a red dye made from the roots of the *Rubia tinctorum* L., blue indigo from the leaves of *Indigofera tinctoria* L., yellow from the stigmas of the saffron plant (*Crocus sativus* L.) and from turmeric (*Curcuma longa* L.). But due to limitations with natural colors and discovery of synthetic dyes caused displacement of natural dyes owing to their durability, ease in application and availability of vibrant color shades. In India, the scale of dyeing and printing units ranges from tiny to large level where in the products are produced for domestic consumption as well as for export. These coloration units utilize varied types of colors, chemicals and auxiliaries to achieve bright and fast colors on the textiles. Majority of supplies of these units are pollution contributing substances. That is why the dyeing and printing units are identified as major culprits for excessive pollution of the areas of their location. 100% untreated textile effluents higher than the permissible limits of CPCB indicating the high pollution potential of the effluent, which caused biochemical depletion followed by car-

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bohydrates and protein in all the three organs i.e. gills, liver and muscle in fishes [1].

It was found that all the units in the state were being operated by SHGs comprising of 10 members belonging to Chhippi community. The soaking, dyeing, printing washing, drying, storage and packaging processes carried out in the units were utilizing very limited chemicals and auxiliaries, involving few equipment and mainly cotton based textile material. The materials prepared there were for different end uses like household textiles and apparel articles. The solid and liquid waste contents were being generated from all the units. None of the selected units were having the effluent treatment facilities. They were disposing off their waste material whether liquid or solid form into the community disposal channels including open drains and garbage sites at Jaspur.

Therefore present research work was carried out to analyze various physico-chemical characteristics of textile effluents generated from textile dyeing and printing units in Jaspur region of Udham Singh Nagar, Uttarakhand, where majority of dyeing and printing units of the state are located.

Materials and Methods

Selection of area

The study area selected was textile cluster units of Jaspur region. These clusters units have majority of dyeing and printing units of the state and use of water during these processes and then the untreated waste water from these units is directly discharged into open channels going from their houses which are then ultimately drained into community drains. In the present context of study, particular emphasis is made to find out physico-chemical characteristic of waste water to find out the status of pollution.

Method of sample collection

The sample was collected from community disposal channel in liquid form by using Grab sampling method from three different types of units viz., dyeing, printing and dyeing-cum-printing unit. The collected effluent samples were used to find out the relation be-

tween the types of unit and the effluent generated from them. Three liters of effluent samples were collected from each type of unit. The physico-chemical parameters for these collected samples were analyzed in the laboratory at GBPUAT, Pantnagar.

Assessment of physico-chemical characteristics

The following physico-chemical characteristics of effluent samples were assessed in the study: (a) Temperature : The temperature of effluent was measured by thermometer in degree centigrade ($^{\circ}\text{C}$) on the spot immediately after collecting the sample. (b) pH: the pH value of the effluent was measured by pH meter. (c) Dissolved Oxygen (DO) and Biochemical Oxygen Demand (BOD) : These two parameters were determined by using Azide Modification of Winkler method in mg/l. (d) Chemical oxygen Demand (COD) : It was determined by using COD digestion unit in mg/l. (e) Total Solids (TS) and Total Dissolved Solids (TDS) : These two parameters were measured by evaporation and weighing method in g/l. (f) Total; Suspended Solids (TSS) : It was calculated as the difference between the values of the Total Solids and the Total Dissolved Solids.

Statistical analysis

The collected data were analyzed by using statistical measures namely; percentage and one way ANOVA [2].

Results and Discussion

The results pertaining to various physico-chemical characteristics of effluents are shown in Table 1. pH of different effluent samples appeared to lie between 10.1-10.7. It was found that all the samples have higher pH values. This might be due to use of caustic soda in dyeing unit, have resulted in higher pH of the effluent streams in the region. These results are in accordance with [3], who reported that the textile wastes are highly alkaline in nature. Effluents of textile dyes industry showed similar pH trend, as seen in the present study, being alkaline in nature, pH of effluents affects physico-chemical properties of water which causes in turn adversely affects aquatic life, plants and humans [4].

Table 1. Mean of values of physico-chemical characteristics of different effluent samples.

Physico-chemical characteristics	Temperature (°C)	pH	DO (mg/l)	BOD (mg/l)	COD (mg/l)	TS (g/l)	TDS (g/l)	TSS (g/l)
Dyeing	28.2	10.2	2.3	61.7	349.3	1.8	1.3	0.5
Printing	29.2	10.1	2.6	76.7	349.3	6.4	5.4	1.0
Dyeing and Printing	28.8	10.7	2.8	63.3	366.7	4.3	2.7	1.6
Overall (Mean)	28.7	10.3	2.6	67.2	355.1	4.2	3.1	1.0
CD ($p=0.05$)	-	NS	NS	NS	NS	0.8	1.2	0.7
CPCB standard	shall not exceed 5 °C above the receiving water temperature	5.5-9.0	2.1	30.0	150.0	2.2	2.1	0.1

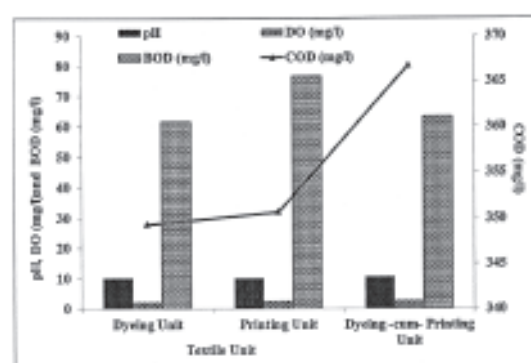
The mean values of other parameters of the effluents i.e. DO, BOD, COD, TS, TDS and TSS collected from printing units only and dyeing and printing composite units were higher than that of the effluent collected from dyeing units only. Patil and Sawant [5] also reported the similar findings from a case study for evaluation of dyeing and printing effluents at Surat. The higher mean values of these physico-chemical characteristics of effluent collected from printing units and from dyeing-cum-printing unit indicated higher pollution load. The higher pollution load may be due to the presence of thickening agent and dye content in the effluent stream. The thickening agent used was arrowroot, being cellulosic in nature it might had resulted in higher BOD, TS and TDS of the effluent stream. Besides this the use of salt and its release in effluent added towards higher TDS. The physico-chemical characteristics of collected effluents were beyond the permissible limits in term of all the parameters when compared with the standards given by CPCB [1]. This indicates that the dyeing and printing units located at Jaspur are causing high pollution in the region.

The polluting streams of the waste are being released in the community disposal system consisting of open drains that aggravates the pollution problems owing to the direct contact of the population with the drain silt that was removed and left at the edge of the drain. The pollution load of the units did not include pollution occur due to washing which was carried at bank of water body in the region. Thus pollution due the dyeing and printing units at Jaspur was affecting both the residential area as well as the farm lands which were being irrigated with the pol-

luted water of the local water bodies in the area. It is imperative to segregate the polluted streams at both the places for their treatment to reduce the pollution load resulting from these units' activities at Jaspur. Khopkar [6] had also stated that the textile waste is usually colored, alkaline with high BOD and suspended solids.

One-way ANOVA was applied to the mean values of physico-chemical characteristics of the effluent samples to compare the nature of the effluents collected from three different types of units. No any significant differences were found in pH, DO, BOD and COD of the effluents collected from different types of units, It showed that significant difference existed only in the case of TS, TDS and TSS of the effluents collected from three different types of units.

Figure. 1 reflects the non-significant relationship between the physico-chemical characteristics of ef-

**Fig. 1.** Mean values of pH, DO, BOD and COD of effluent samples collected from textile units.

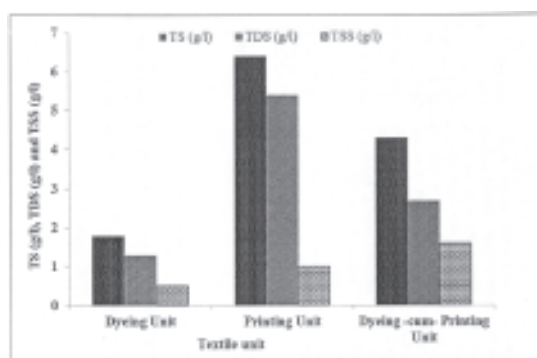


Fig. 2. Mean values TS, TDS and TSS of effluent samples collected from textile units.

fluents collected from selected units of Jaspur area and Figure 2 reflects the significant relationship between the physico-chemical characteristics of effluent collected from different units of Jaspur area.

Conclusion

The current study has shown that physico-chemical characteristics of effluents collected from different types of units were indicating highly polluting nature of the dyeing and printing units in Jaspur region and exceeds the CPCB limits, which might be due to the

use of synthetic dyes. It is therefore recommended that the effluent from the textile industry should be treated before being disposed into the water bodies. Further investigation is required on the quality of textile effluent and its impacts on human, livestock and agricultural health where it is used. Although, these may be discharged in diluted form but these can reach to living beings in a concentrated form and also affect the flora and fauna of that region. Thus, there is an urgent need for the proper management of textile dyeing and printing waste water of Jaspur region.

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