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STUDIES ON CHARACTERIZATION OF TEXTILE INDUSTRIAL WASTE WATER IN SOLAPUR CITY

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ABSTRACT

Six textile industries have been selected in East region of Solapur city based on field analysis and characterization studies. Textile effluent from these selected industries is collected and characterized for major pollution indicator parameters namely BOD, COD, TDS, sulphide, sulphate, chloride, hardness, alkalinity, calcium and magnesium.

The effluent is dark colored with alkaline pH. The values of BOD and COD are found to be higher than Central Pollution Control Board, Government of India and also ratio of BOD : COD lies between 0.2 – 0.35 indicates that effluent contains large proportion of non-biodegradable matter. The concentration of total dissolved solid are observed to be higher than 5000 mg/L. The effluent also contains high concentration of sulphate, sulphide, chloride, calcium and magnesium, which are responsible for higher hardness of waste water. The results showed that, the textile industries under study area emanate effluent containing pollution indicator parameters considerably higher than standards stipulated by Central Pollution Control Board. Based on these characteristics, it is suggested that the effluent is not be suitable for discharge into environment without treatment.

Key words: Textile effluent, Pollution load, Characterization, Standards.

INTRODUCTION

Environmental pollution due to different types of industries is one of the vital problem presently facing the India and all over the world. Textile industries are major sources of Environmental pollution[1]. As the textile industries consume large quantities of water and generates waste water in proportionate order[2,3]. Moreover the dyes used in textile industry are important sources of environmental pollution. It poses serious problems because

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of its strong color, high COD, BOD and low biodegradability[4]. These effluents usually contain indigo dyes and non-biodegradable dyes, which causes aesthetic problem[5].

All the textile industries under study area are raw cotton based. The water consumption and waste water generation from textile industry depends upon the processing operations employed during the conversion of fiber to textile fabric. On the basis of waste generation the textile industries can be classified into two groups viz dry and wet fabric industry[6]. In dry fabric industries, solid wastes are generated and in wet fabric industries, liquid wastes are generated. All textile industry under study area is of second type. Wet fabric processing industry includes, desizing, scouring, bleaching, mercerizing, dying, printing and finishing stages. During each stage different type of chemicals are used such as strong acids, strong alkalis, inorganic chlorinated compounds, hypochlorite of sodium, organic compound such as dyestuff, bleaching agent, finishing chemicals, starch, thickening agent, surface active chemicals, wetting and dispersing agents and salts of metals[7]. Various dyes are used during dying stage for coloring purpose; multicolor are used to improve beauty of products. The main products of textile industries in Solapur are raw cotton based like pullout, towels, napkins and power looms. The processing steps involved and pollutants emanated are show in schematic Fig. 1.

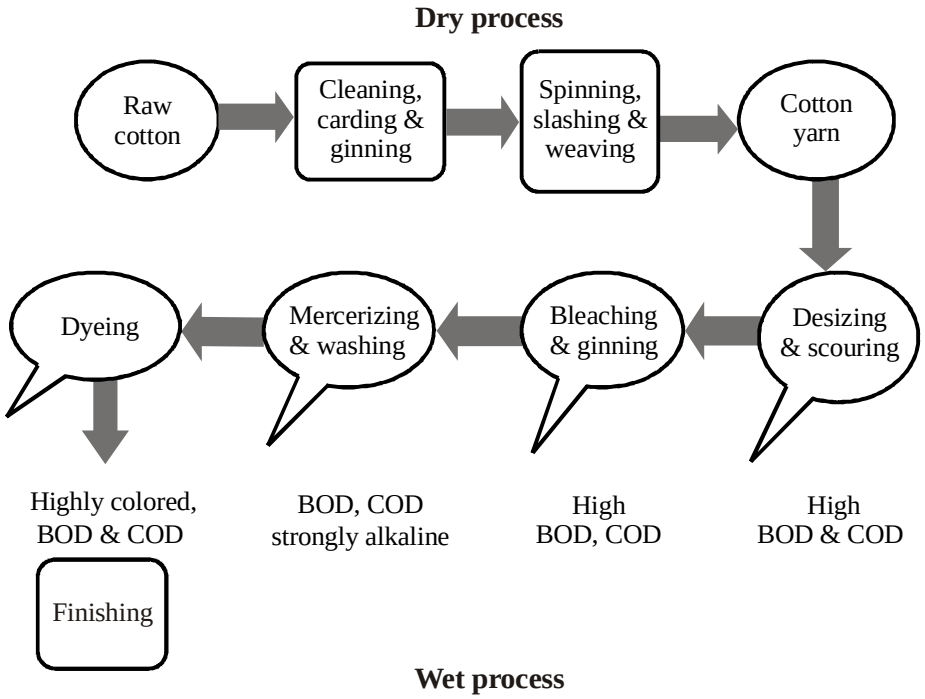


Fig. 1: Cotton fabric production and associated water pollutants

Textile industry is one of the important and largest industrial sector in Solapur city and also important for the economy of Solapur. The climatic condition of Solapur city is dry and hot. This weather is typically suitable for the textile processing and ultimately for the growth of textile industries. The growth of textile industry is also due to availability of cheap labor from nearby area. There are 3515 small and medium scale textile industries in Solapur. Out of total industries in MIDC Solapur about 70% are textile units. It is seen that these industries discharges huge amount of effluent directly into public drain and on open space.

The present research work is aimed at characterization of waste water with the help of important pollution indicator parameters like pH, BOD, COD, TDS, sulphide, sulphate, hardness, alkalinity, calcium and magnesium. It is also aimed to assess the pollution potential due to effluent discharged by textile industries in Solapur city.

EXPERIMENTAL

Material and methods

Study area selected is MIDC situated at East region of Solapur city. Six textile industries are selected at different places in MIDC. Waste water from these industries is collected.

Sampling of effluent

The representative effluent samples are collected separately with one hour interval in working period of each industry i.e. 9.00 am to 5.00 pm. Samples are collected from each industry are mixed separately. These samples are considered as composite sample and used for characterization study. Flow measurements are carried out during sampling and average flow rate is computed.

Preservation of sample

Samples are preserved by refrigeration at 4^{o}C without chemical addition. All the parameters are determined soon after sampling.

Sample analysis

The physico-chemical and biological parameters are analyzed as per the method described in Standard Methods for the examination of water and waste water[8]. pH is determined potentiometrically, biochemical oxygen demand (BOD) is determined at 20^{o}C

for 5 days by dilution method, chemical oxygen demand (COD) by closed refluxed method, total dissolved solid (TDS) by gravimetric method, sulphide by titration method, sulphate is determined by turbidometric method, chloride is determined by argentometric method. Total hardness, alkalinity, calcium and magnesium are determined titrimatrically.

RESULTS AND DISCUSSION

The average characteristics of effluent from six different textile industries and limits prescribed by CPCB are given in Table 1 and the variation of concentration of various parameters of industrial effluent are given in Fig. 2.

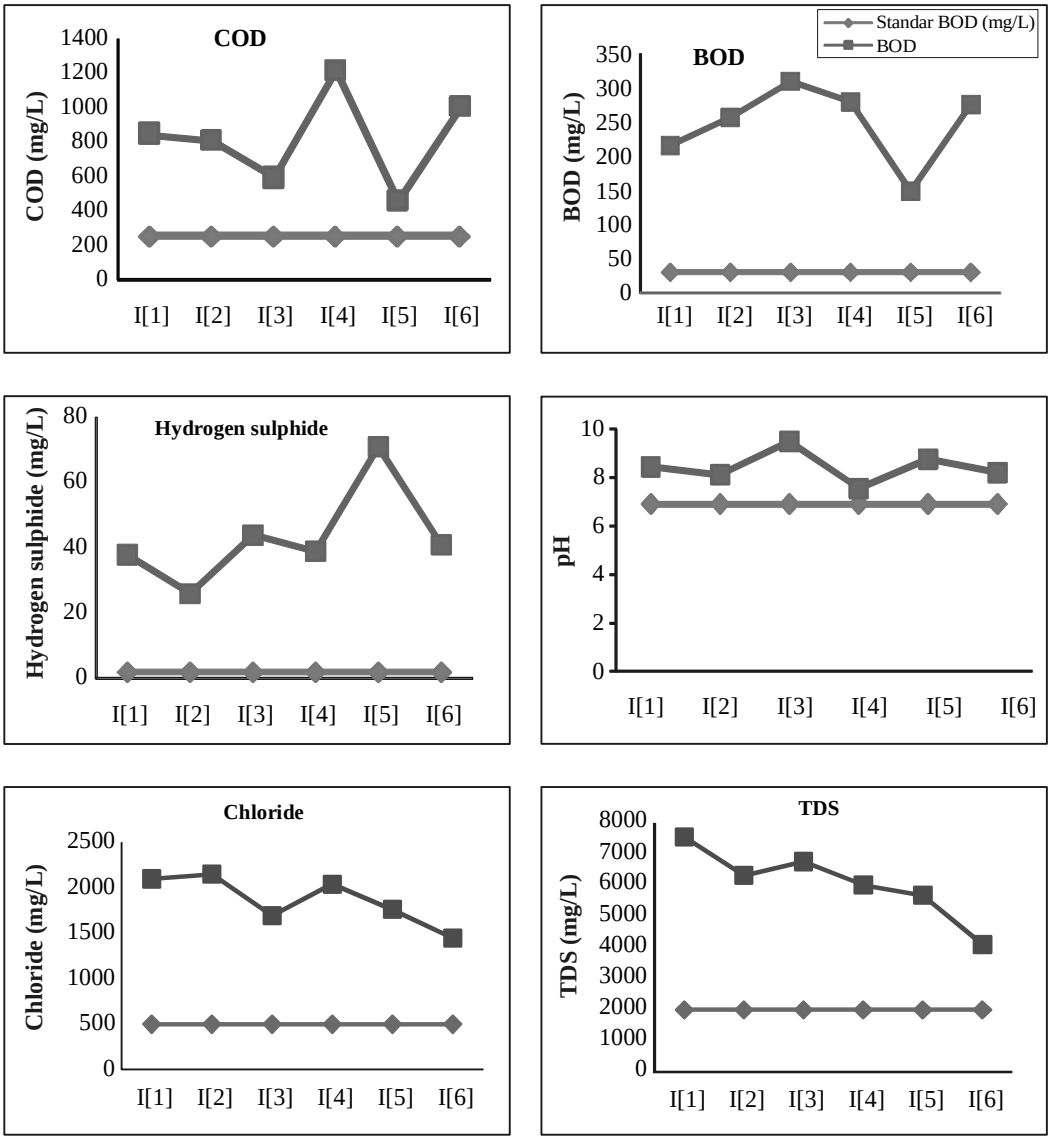
Table 1: Characterization of the effluents from six textile industries

Para-meters	Industry -1	Industry -2	Industry -3	Industry -4	Industry -5	Industry -6	Bore-well sample	CPCB Standard
pH	7.69	7.71	9.59	7.54	7.86	8.20	7.58	**6.9**
DO	Nil	Nil	Nil	Nil	Nil	Nil	Nil	
BOD	170	200	280	500	130	450	Nil	**30**
COD	490	571	816	1548	381	1349	-	**250**
TDS	3896	4312	7072	5336	5752	2264	-	**2000**
Sulphide	18	32	36	30	79	12	16	**2**
Sulphate	440	560	620	912	850	545	-	**NA**
Chloride	1700	1255	2750	1550	2100	950	-	**500**
Total Hardness	1050	550	470	780	500	1001	700	**NA**
Alkalinity	300	430	280	440	310	500	380	**NA**
Calcium	276	172	212	325	404	128	276	**75**
Magnesium	110	78	88	134	210	93	110	**50**
Phosphate	3.91	1.39	1.6	3.9	4.5	10.45	nil	**NA**

All the values except pH are in mg/L

NA-Not Available

Highly colored liquid effluents are observed under study area. The pH of the effluents is varied from 7.59 to 9.49. This shows that the effluents from textile industries under study area are alkaline in nature. The pH variation is primarily caused by different kinds of chemicals used during processing steps in six textile industries. The values are observed to be higher than the standard prescribed by Central Pollution Control Board (CPCB) of effluent discharge. Higher pH is due to use of chemicals like NaOCl, NaOH, surfactants and sodium phosphate.



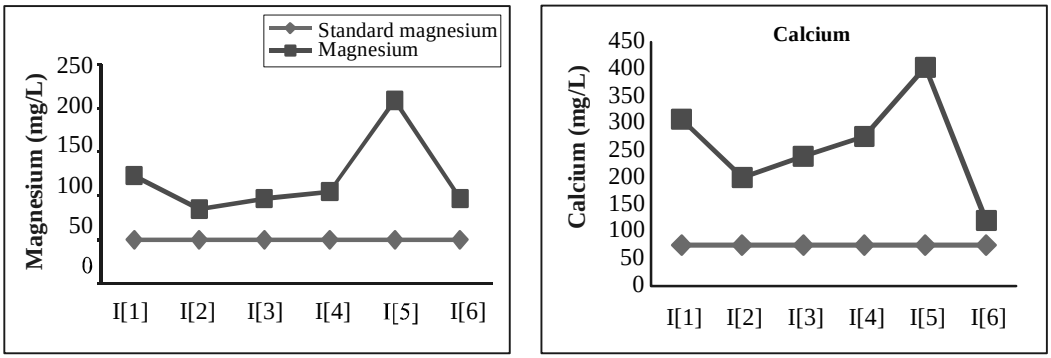


Fig. 2: The variation of the concentration of various parameters of industrial effluent. The solid straight line represents the standard value of the parameters recommended by CPCB

Concentration of organic pollutant indicator

All the six textile industrial effluents contain BOD value between 170 to 450 mg/L and average value is found to be 348 mg/L, this value is higher than prescribed standards stipulated by CPCB. The value of COD of given textile effluent ranging from 455 to 1349 mg/L and average value is 817 mg/L, which is also higher than CPCB standards. The higher value of COD is due to especially from dying section of textile processing industry because of nature of chemicals employed. The ratio of BOD : COD is also studied and if the BOD : COD ratio is less than 0.5, it indicates that the effluent contains a large proportion of non-biodegradable matter[9]. The ratio of the BOD : COD obtained from the results of present study is ranging from 0.2 to 0.35. This indicates that the effluent contains a large portion of non-biodegradable matter.

Total dissolved solid of given textile effluent is in between 2264 and 5752 mg/L and average value is 4071 mg/L, which is higher than CPCB standards of effluent discharge. In all, the effluents sulphate concentration varied from 545 to 912 mg/L. The average value was found to be 710 mg/L. Sulphate is an important anion imparting hardness of water. It may undergo transformation to sulphur or hydrogen sulphide depending largely upon the redox potential of water. In present investigation, the concentration of sulphide is in the ranges from 22 to 79 mg/L and average value is found to be 49 mg/L, which is about 25 times higher than CPCB standards. Hydrogen sulphide is commonly originates in water owning to the decomposition of organic matter or bacterial reduction of sulphate under anaerobic condition[10].

The chloride levels are more than the limits of CPCB, values lies between 950 to 2750 mg/L, higher chloride concentration is responsible for increase in total dissolved solids. The values of total hardness and alkalinity are ranging from 280 to 1050 mg/L and 280 to 600 mg/L. The level of calcium and magnesium in the effluent are quite high. The amount of calcium and magnesium are 210 mg/L and 119 mg/L. It is higher than CPCB standards.

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