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**Research Article**

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# Assessment studies on waste water pollution by Textile and Mat Industry

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**ABSTRACT**

*Textile effluents & Mat effluents samples were collected from Karur and vadugappatti near Musiri respectively. Both the industries were characterized for their pollution potential. In the present study, we have analyzed physical parameters such as Color Odour, Turbidity, Temperature and Chemical parameters such as pH, Total Dissolved Solids, Biological oxygen demand, Chemical oxygen demand, Electric conductivity, Carbonate, Bicarbonate, Calcium, magnesium, Chloride, Potassium, Sodium, Phosphate, Nitrite, Nitrate, Zinc, Iron, Copper in the collected effluents. All the physical and chemical parameters showed high level to the IS Tolerance limit standards for effluents discharge. Both the industrial effluents are threat to the environment. Hence, we suggest that the suitable treatment is needed for the effluents before discharging in water ways.*

**Key words:** Textile effluent; Mat effluent; Chemical oxygen demand; pH; Biochemical oxygen demand.

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## INTRODUCTION

The industries whose effluents contribute to aquatic pollution in India are pulp and paper, textile, tanneries, sugar, distilleries, coal washeries, petrochemicals etc., [1]. In India, textile industry is one of the major industries that pollute fresh water bodies by the discharge of their untreated effluents [2].Textile industry effluents has a wide variety of dyes and other chemicals like acids, bases, detergents, bleaching agents, wetting agents, oxidants, mercerizing and finishing chemicals and printing pastes, gums and resins, salts of metals used as mortants and fixing agents which are not retained in the final product [3],[20]. The physico-chemical characteristics of effluent from textile wet finishing operations processing denim and other textile fabrics were evaluated.

Mat industry in Mat weaving is an important traditional handicraft of Tamil nadu which is famous for its Korai-grass mats. Tamil nadu produces nearly 90% of all the woven grass mats made in India. It is more than 250 years old. Mats made with korai/sedge grass are extremely delicate and highly valued. Mats are made in numerous color (green, orange, red, violet, blue and yellow) and designs, [23], [4]. The present study was conducted in two effluents were characterized in Textile industries and Mat industries.

## EXPERIMENTAL SECTION

The samples were collected in dry plastic tank and used for physicochemical examination. The collected samples were analyzed for various parameters such as Odour, Turbidity, Temperature and Chemical parameter were pH measured using a hand held ELICO LI120 pH meter, Total Dissolved Solids BY Gravimetric method a Trivedy and Goel, 1984, Biological oxygen demand and Chemical oxygen demand using Titration method , Electric conductivity using Elico conductivity bridge[5], Carbonate and Bicarbonate using Titrimetric method, Calcium and magnesium were estimated by the EDTA Titrimetric method. [22]. Chloride was estimated by Argen metric method [22]. Potassium and Sodium estimated using Digital Photometer (Model –Elico CL 22d) by adopting the method of Manivasakam, [6]. Phosphates Stannous Chloride method described by American Public Health Association, Nitrite and Nitrate was estimated by adopting the method described by American Public Health Association [19], Zinc, Iron, Copper and Manganese using Atomic Absorption Spectrophotometer for the Textile and Mat industry effluent respectively .

## RESULTS AND DISCUSSION

The physical characteristics of the textile and mat effluents were depicted in Table 1.

**Color**
The textile effluent was intensely pink colored and mat industry was in blue color. It was due to the presence of large amounts of different colored dyes used in the dyeing process.

**Odour**
The textile effluent had a pungent smell and mat industry was unpleasant smell which might be due to the excessive amount of bleaching agents discharged in the effluent.

**Turbidity**
The effluents were highly turbid Both Textile and mat effluents. This might be due to the presence of suspended particles like cotton fibers and insoluble and colloidal particles.

**Temperature**
The temperature of the textile effluent was found to be 45 °C and mat effluent was 47°C. The higher temperature noted in the effluent was due to the scouring process that involved steam boiling of the fabrics.

**Chemical Characteristics**
The chemical constituents of textile and mat effluents were given Table 2.

**pH**
Table 2 represents the pH value of the textile effluents. The pH of both the effluents was suitable for the tolerance limits. The alkalinities of the effluents were due to the limited use of sodium hydroxide and sodium carbonate in textile processing and mat industries [7].

**Electric Conductivity**
Table 2 gives the mean electric conductivity (EC) of the effluents. The EC prescribed by IS for inland surface polluted water is 2.25 mmhos $cm^{-1}$ [8].The increased EC values of the textile effluents and mat effluent in the present study might be due to the high concentration of soluble salts in the effluents.

**Biochemical Oxygen Demand**
From the values prescribed in Table 2 it is evident that the biochemical oxygen demand (BOD) of the textile effluents was very higher than the tolerance limit. BOD values are indicators of biodegradable organic pollution load [9]. The high BOD value of the textile effluents compared to the tolerance limit indicates higher concentrations of biologically oxidisable organic matter in hydrolysed products of starch from sizing and desizing processes and soap, organic solvents like tetrapol and monopol, mordants like acetates and organic dyes in dyeing processes and thickening agents like gums used in printing [10]. Mat effluent was higher than the tolerance limit.

**Chemical oxygen Demand**
The level of chemical oxygen demand (COD) of the textile effluent is depicted in Table 2. It is observed from the values that the COD of the effluent was raised when compared to the IS tolerance limit. A mat effluent was slightly above the IS tolerance limit. The very high COD value indicates the highly elevated levels of biodegradable and non biodegradable organic compounds in the discharged textile effluents.

**Total Dissolved Solids**
From the values presented in Table 2 it is seen that the total dissolved solids (TDS) of the Textile effluent was higher than the IS tolerance limit. Mat effluent was slightly richer compare to the IS tolerance limit. The wide range of organic and inorganic chemicals, solvents, dyes, mordants, printing pastes, soluble detergents, bleaching agents, thickening and wetting agents used in the different textile processes and discharged in the effluent, account for the high level of total dissolved solids. The dissolved substances in the effluents might alter the chemical status of the soil and water which might adversely affect plant growth [11].

**Carbonate and Bicarbonate**
The carbonate and bicarbonate values of the textile effluents were showed in Table 2. From the table values the textile effluent (Carbonate-1.2 mg $l^{-1}$and Bicarbonate -1.2 mg $l^{-1}$) & Mat effluents (Carbonate – 0.8 mg $l^{-1}$ and Bicarbonate –289mg $l^{-1}$) were very low when compared to paper mill effluent (Carbonate – 436 mg $l^{-1}$ and Bicarbonate – 106 mg $l^{-1}$) reported by [12] and dyeing industry effluents (Carbonate – 120 mg $l^{-1}$ and Bicarbonate – 85.4 mg $l^{-1}$ recorded by [13]

**Calcium and Magnesium**
The levels of calcium and magnesium in the textile effluents were presented in Table 2. From the table, Calcium values of both the textile and Mat effluent was (689 mg $l^{-1}$ and 548 mg $l^{-1}$ respectively) higher than that of reported sewage water (28 mg $l^{-1}$) by[14] and tannery effluent (140 mg $l^{-1}$) by [15]. This is due to the excessive use of lime and bleaching powder in bleaching process.

The Magnesium content of the textile effluents and Mat effluent was (289 mg $l^{-1}$ and 178 mg $l^{-1}$ respectively) higher than that of reported Paper mill effluents (92.3mg $l^{-1}$) by [13] .This is due to the not excessive level use of magnesium compounds used in both units.

**Sodium and Potassium**
The sodium and potassium values of the textile effluents were given in Table 2. It is seen from the values that the sodium level is very high while the potassium level is low. Sodium and Potassium level were low in Mat effluent. Employment of bulk amounts of caustic soda, soda ash, sodium silicate, sodium peroxide, sodium hypochlorite, sodium chloride, sodium nitrite and sodium hydrosulfite in designing, souring, bleaching, mercerizing, dyeing and printing units accounts for the high sodium level in the textile effluent. Potassium levels in the effluents were comparatively low because potassium compounds are of limited use in textile processing.

**Phosphate and Chloride**
It is evident from Table 2 that the phosphate content (4.8 mg $l^{-1}$) of the textile effluents was within the IS tolerance limit of 5 mg $l^{-1}$.The presence of Phosphate in textile effluents is due to the use of trisodium phosphate as one of the common wetting agents in scouring process. It is found from the values presented in Table 2 that the chloride content of the both textile and mat effluents were lower compared to the IS tolerance limit. This is due to the fact that chloride compound (alkaline hypochlorite, chlorine, sodium chloride) are not extensively used in bleaching and dyeing processing.

**Nitrite and Nitrate**
The levels of Nitrite and Nitrate in the textile effluent and mat effluent were presented in Table 2. The table values showed that the level of Nitrite in both the effluent (0.05 mg $l^{-1}$ and 0.03 mg $l^{-1}$) was lower than that of dyeing factory effluent (140 mg $l^{-1}$) reported by [13], Protein industry effluent (15.2mg $l^{-1}$) reported by [12].

The Nitrate value (0.03 mg $l^{-1}$ and 0.03 mg $l^{-1}$) was observed lower than that of paper mill effluent (1679 mg $l^{-1}$) reported by[12], and protein industry effluent (74.4 mg$l^{-1}$) reported by [16].The salts of nitrites and nitrates and nitrogenous compounds like certain thickening agents, mordants and a wide range of dyes used in textile industry and mat industry account for the presence of nitrites in the textile effluent.

**Zinc, Iron, Copper and Manganese**

The level of zinc, iron, copper and manganese in the textile effluents and mat effluents were shown in Table 2. It is evident from the values given in Table 2 that the zinc level of the effluent was lower than the tolerance limit while copper level were also lower value compared to the tolerance limit. The manganese content of the textile effluent was observed as 2.28 mg $l^{-1}$And the Mat effluent was recorded as 0.24 mg $l^{-1}$. Most of the direct dyes used in dyeing processes are copper salt. These metallic salts would have been discharged in the spent waste of textile process. Hence the discharge of textile effluent and mat effluents into water system without treatment would be hazardous.

**Physical characteristics**

**Table 1 PHYSICAL CHARATERISTICS OF THE TEXTILE AND MAT EFFLUENTS**

| Characteristic | textile effluent | Mat effluent | IS Tolerance Limit IS: 2490-1981 (Part 1) |
|---|---|---|---|
| Colour | Pink Colored | Blue colored | Colourless |
| Odour | Pungent smell | Unpleasant smell | Odourless |
| Turbidity | Highly turbid | Highly turbid | Clear |
| Temperature (°C) | 45 | 47 | Less than 40 |

***** *Tolerance limits for industrial effluent discharge in to Inland surface waters prescribed by Bureau of Indian Standards*

**Table 2 CHEMICAL CONSTITUENTS OF THE TEXTILE UNIT EFFLUENTS**

| Constituent | Textile effluents | Mat effluent | IS Tolerance Limit IS: 2490-1981 (Part 1) |
|---|---|---|---|
| pH | 8.26 | 8.0 | 5.5 – 9.0 |
| Electrical Conductivity (mmhos $cm^{-1}$) | 4.56 | 3.56 | 2.25 |
| BOD(mg $l^{-1}$) | 4500 | 1589 | 30 |
| COD(mg $l^{-1}$) | 2200 | 983 | 250 |
| Total Dissolved Solids (mg $l^{-1}$) | 2918 | 2280 | 2,100 |
| Carbonate(mg $l^{-1}$) | 1.2 | 0.8 | NM |
| Bicarbonate (mg $l^{-1}$) | 1.214 | 289 | NM |
| Calcium (mg $l^{-1}$) | 689 | 289 | NM |
| Magnesium (mg $l^{-1}$) | 548 | 178 | NM |
| Chloride (mg $l^{-1}$) | 893 | 459 | 1,000 |
| Potassium (mg $l^{-1}$) | 1.56 | 0.38 | NM |
| Phosphate (mg $l^{-1}$) | 1.26 | 0.12 | 5.0 |
| Sodium (mg $l^{-1}$) | 1245 | 896 | NM |
| Nitrite (mg $l^{-1}$) | 0.05 | 0.03 | NM |
| Nitrate (mg $l^{-1}$) | 0.58 | 0.16 | NM |
| Zinc (mg $l^{-1}$) | 1.56 | 0.28 | 5.0 |
| Iron (mg $l^{-1}$) | 0.50 | 0.25 | NM |
| Copper (mg $l^{-1}$) | 0.85 | 0.16 | 3.0 |
| Manganese (mg $l^{-1}$) | 2.28 | 0.24 | NM |

* *Tolerance limits for industrial effluent discharge in to Inland surface waters prescribed by Bureau of Indian Standards*
*NM - Not Mentioned*

## CONCLUSION

Water with high level physical and chemical parameter values are unsuitable for irrigation. This study revealed that the effluent from textile and mat industries were highly polluted. There is a need to adapt adequate effluent treatment methods before discharging waste water to water bodies for reducing potential environmental hazards.

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