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ANALYSIS AND BIOTREATMENT OF TEXTILE EFFLUENT

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ABSTRACT

Economical and bio-friendly approaches are needed to remedy the wastewater from textile and other industries. Present study has adopted bacterial strain capable of decolourizing textile effluent within 12h, 24h and 48hours with the colour removal range of 55.26% to 86.84% respectively. The microbes function in an optimal condition obtained for decolourization of textile effluent pH, temperature and culture was maintained static and agitated conditions. Effective colour removal in textile effluent was achieved in 48 hours.

KEY WORDS: Textile Effluent, Bacterial strain, Decolourization.

INTRODUCTION

Effluents are waste waters with chemicals in liquid form that are discharged as industrial effluents. Textile dye waste water has become one of the main sources of severe pollution problem in and around area. Due to greater demand for textile products and the proportional increase in production, so the applications of synthetics dyes usage have increased. The textile dyes and their effluents are toxic and they affect the environment and play an important role in ecological balance. Various physiochemical methods, such as adsorption, electro coagulation, flocculation, ion exchange, ozonation, membrane filtration and reverse osmosis have been used for decolourization of dyes in textile effluents. All these methods have serious restriction as economically feasible methods for decolorize textile effluent waste water such as high cost and form of unwanted by-products. On contrast, bioremediation processes provide a low cost, environmentally benign, efficient alternative for the treatment of textile effluent waste waters. The objective of the present study is the induction of potential activity of bacterial strain to decolorize the textile effluent. The present study is also

designed to assess the quality of textile waste water and its treatment by using microbial strains.

MATERIALS AND METHODS

Sampling and analysis of effluent

Erode is one of the most industrialized towns in Tamil Nadu, India. It also has several textile units. The effluent was collected from the middle point of the effluent let out of one such textile processing unit. Standard procedures (Spot and Grab) were followed during sampling. The temperature and pH were determined at the sampling site itself. The pH was determined by using pH meter and temperature with a mercury thermometer. The physicochemical parameters such as colour, electrical conductivity (EC), Biological Oxidation Demand (BOD), Chemical Oxygen Demand (COD) were determined as soon as the sample was brought to the laboratory using standards methods of APHA (1998).

Isolation

Effluent collected from textile mill was screened for the isolation of potential decolorizing bacterial strains. Sample was serially diluted with distilled water and plated into an agar medium. Discrete bacterial colonies that developed on agar plates were initially grouped on the basis of pigmentation, colony, morphology followed by gram staining and motility. Selected isolated strains were further purified and sub-cultured **(Pic-I, Pic-II).**

Decolorization

Three strains isolated from the textile effluent (M1, M2, and M3) were found to possess the ability to decolorize the textile effluent. The screening for the bacterial isolates was carried out on the screening medium with the agar **(Pic-III)**. A loop full of culture from the slant was inoculated into 100 ml of sterilized screening medium in 250 ml conical flask supplemented with filter sterilized effluent and incubated on agitation and static conditions at different pH, temperature for 48hours. At 24 hrs and 48 hrs sample were collected to determine the percentage of decolourization **(Pic-IV and Pic-V)**.

Percentage Of Decolourization

The decolorizing activity was expressed in terms of percentage decolorization and was determined by monitoring the decrease in absorbance at absorption maxima of the effluent 650nm. The uninoculated medium supplemented with respective dye effluent was used as reference. Decolorizing activity (%) was calculated by the formula,

$$\%\text{decolourization} = \frac{\text{Initial Absorbance} - \text{Final Absorbance}}{\text{Initial absorbance}} \times 100$$

RESULT AND DISCUSSION

The effluent was dark violet in colour, with pungent smell and pH 9.5, which was with in the permissible limits of NEQS and Manivasakam (2003). The temperature of the effluent was high (40˚C), Electrical conductivity of the effluent was 2.99mS. There was a high load of Chemical Oxygen Demand (998mgl^{-1}) and Biological Oxygen Demand (486.5mgl^{-1}) in the sample. These findings are in conformity with the reports of Arun Prasad *et.al.* (2010). A high value of BOD and COD would cause depletion of Dissolved Oxygen in water. The Total Hardness of effluent (890mgl^{-1}l) which is a combined effect of Calcium and Magnesium ions present in effluent was also found to be high. The chloride content was found to be remarkably high (2035mgl^{-1}) in the effluent **(Table 1)**. This is in accordance with the earlier findings of Bala Krishnan (2008) *et.al.,* and Irina *et.al.,*(2008). The percentage of M1 was found to be 89.47%, where as M2 and M3 exhibited about 73.68 and 84.47 respectively in 48 hours **(Table 2).** This finding corroborated with Ponraj (2011) *et.al.,* Bacterial species exhibited dye decolorizing activity only when incubated under the stationary condition, whereas, negligible decolourization (**65.78%**) was noted under the agitating condition. Stationary cultures exhibited apparently complete decolourization (**89.47%**) of textile dye effluent in 48 hours of incubation and further incubation did not improve decolourization. However Chimezie (2008) *et.al.,* reported effective colour removal activity was under agitation condition. Franciscon (2009) *et.al.,* reported that single reactor with a single bacterium only changing the agitation conditions, it was possible not only to decolourize the dyes but also to achieve a good degree of mineralization and low toxicity.

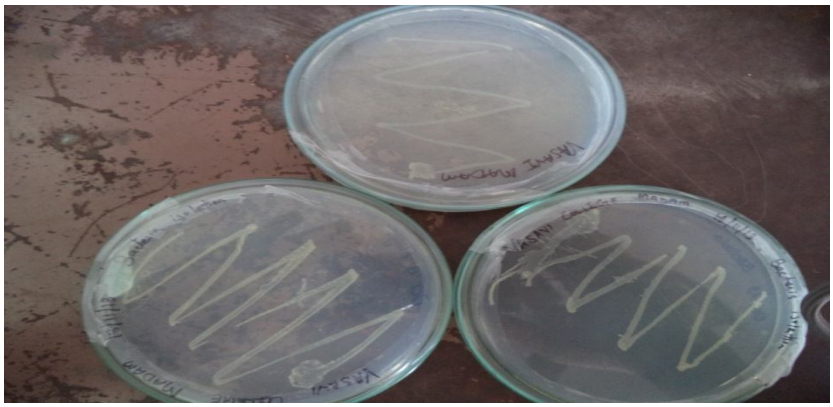
Table 1 Physico chemical characterization of the Textile Dye Effluent

S.No	Parameter	Units	Effluent Sample
1.	Colour	-	Dark red
2.	Smell	-	Pungent
3.	Temperature	˚C	40
4.	pH	-	9.5
5.	EC	mS	2.99
6.	COD	mgl^{-1}	998
7.	BOD	mgl^{-1}	486.5
8.	Ca	mgl^{-1}	279
9.	Mg	mgl^{-1}	67
10.	Cl^-	mgl^{-1}	2035
11.	Total Hardness	mgl^{-1}	890

Table 2 Percentage of Decolorization Of Textile Dye Effluent By Bacterial Isolates (Under Different Culture Conditions)

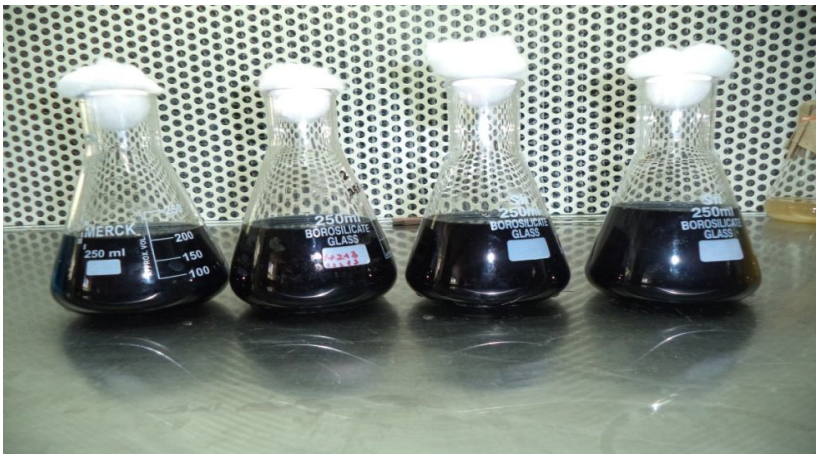
S.No.	Strains	% Decolourization					
		Under Agitated Condition			Under Static Condition		
		Hours			Hours		
		0	**24**	**48**	**0**	**24**	**48**
1.	M1	0	60.52	**73.68**	0	55.26	**89.47**
2.	M2	0	57.89	65.78	0	55.26	73.68
3.	M3	0	65.78	**84.47**	0	65.78	**86.84**

Picture –I Various Types of agar medium



Picture-II Isolation of M1, M2 and M3 cultures

Picture-III Ready to mix the inoculum into the textile Effluent



Picture-IV: Decolorization of Textile effluent By Bacterial Isolates

Picture-V: 48 Hours Decolourization of Textile Effluent

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