ISSN: 0976-3031

Available Online at http://www.recentscientific.com

International Journal of Recent Scientific Research
Vol. 4, Issue, 8, pp.1198- 1200, August, 2013

International Journal of Recent Scientific Research

RESEARCH ARTICLE

MICROBIAL DECOLORIZATION OF TEXTILE EFFLUENT UNDER AEROBIC CONDITIONS

***Umamaheswari. S. and Padmanaban. A. M**

Department of Zoology, Sri Vasavi College, Erode – 638 316. Tamil Nadu, India.

ARTICLE INFO

Article History:

Received 14th, July, 2013
Received in revised form 26th, July, 2013
Accepted 11th, August, 2013
Published online 30th August, 2013

Key words:
Textile effluent, Bacterial strain, Bioremediation, Incubation and Decolourization.

ABSTRACT

The assessment of effluent generated from textile industries. The effluent was analyzed for Biological Oxygen(BOD), Chemical Oxygen Demand(COD), total solid, suspended solid, dissolved solid, colour and odour prior to biological treatment with bacterial culture of M1, M2, and M3. The product of biological treatment was analyzed after two days of treatment. The result revealed that the effluent was initially high BOD, COD, TS, DS, and SS and colour intensity. The bioremediation method used in this work has significantly reduced COD to well below 150 mg/l and BOD 25 ml/l which are the upper limit for disposal. The result indicated remarkable overall COD reduction from 870 mg/l to 150 mg/l, BOD 375 mg/l to 25 mg/l and 89% decolorization. High effectiveness was attained within 24 hours and 48 hours of incubation at room temperature at neutral pH. Optimum decolorization took place strictly under aerobic conditions.

INTRODUCTION

Effluents are waste water, unwanted fluids and chemical in liquid forms that are discharged as industrial waste. Large amounts of chemically different dyes are employed for various industrial applications including dyeing. Colour is the first contaminant to be recognized in the dyeing effluents and to be removed before discharging into the water stream. Aesthetic merit and water transparencies are affected by the presence of dyes even in small amount. The removal of colour from waste water has been rated to be relatively more important than the removal of soluble colorless substances, which usually contribute the major fraction of Biochemical Oxygen Demand. Azo dyes are the largest group of man-made chemicals used in the textile and paper-printing industries, and they are usually recalcitrant to conventional wastewater treatment. Several methods are used to treat textile effluents to achieve decolourization. These include physicochemical methods such as filtration, coagulation, carbon activated and chemical flocculation. These methods are effective but they are expensive and involve the formation of a concentrated sludge that creates a secondary disposal problem. In recent years, new biological processes, including aerobic and anaerobic bacteria and fungi, for dye degradation and wastewater reutilization have been developed.

This work aims to

(a) Isolate and identify azo dye degrading bacteria,

(b) Study the potential of these isolates in azo dye degradation.

The present study aims at assessing the level of environmental pollution due to effluent from textile industries before and after the effluent has been treated biologically. Hence, the objective of this study was to assess the potential of the unknown microorganism to decolorize textile waste water under aerobic conditions. Such potential of the microorganism will definitely prove cost effective in waste water treatment.

MATERIALS AND METHODS

Sources of The Sample

The effluent was collected form textile industries nearby Erode. The characteristics of the dye house effluent were Chemical Oxygen Demand (COD) 870 mgl^{-1}, Biochemical Oxygen Demand (BOD) 375 mgl^{-1} and pH 9 ± 0.1 (APHA 1998). The colour of the effluent was red due to the presence of dyes. The effluent was refrigerated at 4˚C and used with any preliminary treatment.

Determination of Colour Intensity

The colour intensity of the sample was determined with the aid of comparator by matching the colour of the sample with standards (APHA 1998).

Determination of Odour

The effluent was filled half way into the wide-mouth glass stopper bottle and vigorous shaking for 2 or 3 seconds. The stopper was removed and odour was quickly observed (APHA 1998).

Determination of Total Solids (Ts)

A clean dish was dried of suitable size at 102-105˚C in an oven to constant weight. 100-200 ml of thoroughly mixed effluent was accurately pipette into a dish, weighed and evaporated to dryness on a steam bath. The residue was dried in an oven for about 1 hour at 103-105˚C and re-weighed after cooling to room temperature. The cooling was done until the weight of the dish plus residue was constant to within 0.05 mg. the

* Corresponding author: Umamaheswari . S
Department of Zoology, Sri Vasavi College, Erode – 638 316. Tamil Nadu, India.

weight of the dish was subtracted to obtain the weight of the total solid (APHA 1998).

Determination of Suspended Solids (Ss)

100 ml of effluent was withdrawn in to a conical flask with a pipette. It was filtered in funnel fitted with filter paper which has been pre-dried at 103-105˚C. The filter paper was carefully removed from the funnel and dried to a constant weight at 103-105˚C and the weight subtracted from the weight of the filter paper to obtain the weight of the suspended solids (APHA 1998).

Determination of Dissolved Solids (Ds)

Dissolved solid was obtained by difference between total solids and suspended solids (APHA 1998).

Determination Of Chemical Oxygen Demand (COD)

The untreated effluent was first analyzed for COD immediately after collection. The biologically treated sample was also analyzed for COD as earlier reported (APHA 1998).

Determination of Biological Oxygen Demand (BOD_5)

The untreated effluent was first analyzed for BOD_5 immediately after collection. The biologically treated sample was also analyzed for BOD_5 as earlier reported (APHA 1998).

Microbial Isolates

Effluent contaminated soil was collected from the sites. Bacterial colonies were obtained on separate petriplates containing Nutrient Agar media (Himedia) by serially diluting respective sample from contaminated soil. Sample was serially diluted in sterile distilled water and plated into an agar medium. Selected strains isolates were further purified and sub-cultured. Discrete bacterial colonies that developed on agar plates were then incubated at 30˚C for 48 hours and colony with most distinct morphology and repeatability was picked up, purifies and it is named as M1, M2, M3. Fresh cultures were used for all experiments performed. The pure cultures were identified based on their biochemical activity and by Bergey's Manual of determinative Bacteriology.

Biological Treatment

Isolated bacterial culture were occurred during microbial isolation were grown in slant for 48 h at 30˚C. 10ml of each of the medium containing mixed with bacterial inoculum was added to 200ml of the effluent in a 250 ml conical flask and inorganic nutrient was done using the mineral composition of agar medium. The final pH was adjusted to 7 and incubated at 30˚C in a static condition. COD, BOD, TSS, DS, SSS, colour and pH levels of the effluent are measured after a time 24 h.

Analysis Of Decolourization Rate

The decolourization rate was monitored by spectrometer. The absorbance was monitored at 528nm, after incubation 5ml culture was taken from the flask and centrifuged using bench top centrifuge. All experiments were carried out in triplicates and the mean value was taken. Medium without effluent and inoculum was used as blank. Medium with effluent but with inoculum was used as control. The Decolorizing activity (%) was calculated by the formula,

$$\%\,\textbf{decolourization}=\frac{Initial\ Absorbance-Final\ Absorbance}{Initial\ absorbanc}\times 100$$

RESULTS AND DISCUSSION

Isolation of Dye Decolourizing Bacteria

Isolated from contaminated soil samples were carried out by the enrichment culture technique using source of carbon and energy. But we were not successful in isolating bacteria capable of decolourizing and utilizing only dyes as a source of carbon and energy. So we were supplementing the agar medium for isolate and screening the bacterial strains. Three different bacterial strains were isolated from the soil. Among them two bacterial strains showed higher decolourization and it was used for further study **(Table-1).**

Table 1 decolourization study with isolated bacteria

S.No	Organisms isolates from soil	% DECOLOURIZATION UNDER STATIC CONDITION		
		Hours		
		0	24	48
1.	M1	0	55.26	89.47
2.	M2	0	55.26	73.68
3.	M3	0	65.78	86.84

The results obtained after treatment indicate a very good decolourization by M1, M2, and M3 in 24 hours and 48 hours. This result is correlation with Moturi *et.al.,* (2009) who reported the decolourization of effluent very effective in the dye. Kodam *et.al.,*(2005) were reported her study showed higher decolourization and decolourizing rate was considerably increased and decolourization time also reduced to adding supplementing the carbon and nitrogen source. But the following authors are interprets the result against the static conditions Chimezie (2008) *et.al.,* reported effected colour removal activity under agitation condition, poor decolourization for the three days obtained under static conditions.

Table 2 Textile Effluent Initial and Final (Treated) Parameters

Parameter	pH	Odour	TS (mg/l)	SS (mg/l)	DS (mg/l)	COD (mg/l)	BOD (mg/L)
Initial	9.00	pungent	5000	2000	3000	870	375
Final	7.00	odourless	270	150	120	150	75

Franciscon (2009) *et.al.* resulted 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. And as also observed Ngwasiri (2011) *et.al.,* with higher growth in shaking condition for all the consortiums, there was a corresponding higher decolourization rate in shaking condition than static conditions for textile effluents. The **Table-2** represent the result obtained at the initial characterization of the textile effluent .the result indicated the mean values of COD, BOD, TS, SS, DS, pH, and odour of 870 mg/l, 375 mg/l, 5000 mg/l, 2000 mg/l, 3000 mg/l, 9, brown and pungent respectively. If this effluent is not treated before being discharged into the receiving the river or soil, it can pose ecological threat. The effluents from textile dyeing industries have high COD and pH. Wafaa *et.al*. (2010) reported that the effluents from industries had high values of COD, BOD, pH and other parameters. A high BOD and COD values show that the effluents have highly oxygen demanding waste Babu *et.al*. (2010) which cause the depletion of DO which is fundamental requirement for aquatic life. The results obtained after treatment indicate very good correlation with Ajao *et.al,*(2011)

who reported the reduction of COD load of the effluent below the upper limit of 25 mg/l. the COD was reduced from 870 mg/l to 150 mg/l after treatment. BOD and other physicochemical parameters such as TS, SS, and DS were also reduced considerably.

CONCLUSION

After assessing the result of the present study and other aspects involved in removal of BOD, COD and TSS, there is a need to appreciate the efficacy of the degradation. The result obtained from the work had revealed that effluent from industries like textile contain toxic and harmful components. The removal efficiency in the level of BOD, COD, TS, DS, SS, odour and pH have reduced by the bacterial strains which were used. It is evidently cleared in this work efforts are in progress to extend the work to the effluent and also determine the trace elements in the effluents that may toxic or harmful to the environment.

Acknowledgement

We are deeply grateful to Dr. K. Nagarajan, Former H.O.D of Sri Vasavi College, Erode, who provided guidance, literature and also helped in improving the ability.

Reference

Ajao.A.T,Adebayo.G.B andYakubu.S.E. 2011. Bioremediation of Textile Industrial Effluent using mixed culture of Psudomonas aeruginosa and Bacillus subtilis immobilized on agar-agar in a bioreactor. Journal of Microbiology and Biotechnology. Res., 1(3): 50-56.

APHA 1995. Standard methods for the Examination of water and waste water. 19th ed.,American Public Health Association, Washington DC.

Babu B.V Effluent treatment: Basics and a case study.http://discovery.bitspilani.ac.in/discipline/chemical /BVb/

Chimezie and Thomas sawidis., 2011. Bioremediation and Detoxification of synthetic Wastewater containing Triarylmethane Dyes by A.hydrophila Isolated from Industrial Effluent. Journal of Biotechnology Research International Volume 2011 Article ID 967925, 11 pages.

Franciscon Elisangela, Cacaco-Paulo artur., 2009. Biodegradation of textile azo dyes by a Facultative S.arlettae strain VN-11 Using a sequential micro aerophilic/aerobic process. International Biodeterioration and Biodegradation 63 280-288.

Kodam K.M, I. Soojhawon, P.D. Lokhande and K.R. Gawai Microbial decolorization of reactive azo dyes under aerobic conditions. World Journal of Microbiology & Biotechnology (2005) 21: 367–370.

Moturi.B and singara charya.M.A Decolourisation of crystal violet and Malachite green by fungi. Science world Journal Vol4 (No4), 28-33 (2009)

Ngwasiri Pride Ndasi, Mbawala Augustin, Tchatchuery Jean Bosco 2011. Biodecolourization of Textile dyes by local microbial consortia isolated from dye polluted soils in ngaoundere (Cameroon) International Journal of environmental Science Vol 1, No.7, 1403-1419

Wafaa. M. Abd El-Rahim and Hassan Moawad. Testing the performance of small scale bioremediation unit designed for Bioremoval/Enzymatic Biodegradation of Textile Azo Dyes Residues. Biodegradation of Textile Azo Dyes Residues, New York science Journal. 3(3), 77-92.

****