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RESEARCH ARTICLE

EFFICACY OF MICROBES IN BIOREMEDIATION OF TANNERY EFFLUENT

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ABSTRACT

The present research work has been carried out to analyze the physico-chemical characteristics of tannery effluent and to reduce the load of BOD and COD by the process of bioremediation using microorganisms. Among the physical chemical parameters analyzed TDS, TSS, BOD and COD were found to be very high. One bacterium, *Bacillus cereus* and one fungal species, *Aspergillus niger* were identified and isolated and used in the reduction of BOD and COD in the tannery effluent. Four different concentrations of untreated tannery effluents (control, 25, 50, 75 and 100%) were prepared. The experiment was carried out for 72 hrs (3 days). It is inferred from the results that *Aspergillus niger* found to be more effective in reducing BOD and COD than the bacterium, *Bacillus* sp. in the untreated tannery effluents.

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INTRODUCTION

Industrial revolution has generated unprecedented disturbances in the environment due to the introduction of anthropogenic pollutants such as organic, inorganic and xenobiotic chemicals in the form of untreated industrial waste water. With increasing population and industrial expansion, the need for the treatment and disposal of the waste has grown. The tannery effluent waste are ranked as high pollutants among all other industrial wastes (Eye and Lawrence 1971). Tannery industrial waste water is a serious consequence from the pollution point of view for streams, Freshwater and land used for agriculture. The lack of awareness in the modern industrial practice has resulted in the discharge of tannery effluents which exhibit very high value for Cr, Sulphide, and chloride, TDS, TSS, BOD and COD in the water stream or land. In the course of the last two decades a wide variety of technologies had been developed for cleanup operations of contaminated sites. Bioremediation has evolved as the most promising one because of its economical safety and environmental features, since organic contaminants become actually transferred and some of them are fully mineralized. Bioremediation of tannery effluents is an attractive environment friendly, safe and cost effective alternative technology to conventional methods. Microbes in the environment play an important role in cycling and destroying them through bio-degradation. The present investigation essentially deals with the characterization tannery effluents and to biodegrade certain important parameters viz. BOD and COD using microbes like fungus, *Aspergillus niger* and bacterium, *Bacillus cereus* in the untreated tannery effluents.

MATERIAL AND METHODS

In the present study, effluent was collected from a tannery at Sembattu in Tiruchirappalli District, Tamil Nadu, India. The effluent samples were collected raw as well as from final discharge point where in effluent from all the stages of processing are released together. The effluent was collected in polythene containers [1 litres capacity] and were brought to the laboratory with due care and stored at 20°C.

The physico-chemical parameters such as pH, Electrical conductivity (EC), Total dissolved solids (TDS), Total suspended solids (TSS), Biological oxygen demand (BOD), Chemical oxygen demand (COD), Oil and grease (OG) and Chloride (Cl) and sulphate of the effluent were analyzed following standard methods outlined by APHA (1989). The isolation of bacteria from the tannery effluent was done by serial dilution technique. (Charurvedi, 1992). After identification of the bacteria, culture was carried out in the laboratory to be used for biotreatment of the tannery effluent. Bacterium such as *Bacillus* sp. was used for the treatment of tannery effluent. Tannery effluents collected were used for the analysis of Mycoflora. The fungi were isolated using dilution plating method. The fungi were mounted in lactophenol cotton blue and observed through light microscope. They were identified using standard manuals. (Gilman, 1967; Subramanian, 1971, Ellis, 1971; Barnett and Hunter, 1972). After identification of the fungi, culture was carried out in the laboratory to be used for biotreatment of the tannery effluent. Fungi such as *Aspergillus niger*, was separately used for the treatment of tannery effluent.

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Table 1. Water quality parameters of Tannery effluent at two different units

Parameters	Inlet. (Raw)	Outlet – Final (Treated)
pH	10.4	6.9
Electrical Conductivity (dsm ⁻¹)	3.90	2.90
TSS (mg/l)	1600	100
TDS (mg/l)	2510	1480
Chloride	1600	1450
Sulphate	570	110
BOD	947	230
COD	2277	520
Oil & Grease	0.61	0.02

Table 2. BOD of tannery of effluent before (control) and after biodegradation (72 hrs) using fungus and bacterium

Parameters	Concentration of the effluent	Mean + SD & % Reduction	Control	<i>Aspergillus niger</i>	<i>Bacillus cereus</i>
BOD	100%	Mean ± SD	947.5 ± 42.98	904.16 ± 29.73	921.7 ± 35.30
		% Reduction		-4.57%	-0.63%
	75%	Mean ± SD	834.16 ± 27.28	620 ± 50.49	658.3 ± 44.45
		% Reduction		-25.67%	-21.08%
	50%	Mean ± SD	635.83 ± 26.72	481.33 ± 23.47	528.3 ± 44.00
		% Reduction		-24.29%	-16.92%
	25%	Mean ± SD	311.66 ± 58.70	252 ± 59.74	280.8 ± 26.53
		% Reduction		-19.14%	-9.91%

Table 3. COD of tannery of effluent before (control) and after biodegradation (72 hrs) using fungi and bacteria

Parameters	Concentration of the effluent	Mean + SD & % Reduction	Control	<i>Aspergillus niger</i>	<i>Bacillus cereus</i>
COD	100%	Mean ± SD	2277.83 ± 72.47	1835.5 ± 39.97	1938.3 ± 32.62
		% Reduction		-19.42%	-14.91%
	75%	Mean ± SD	1772 ± 42.66	1576.7 ± 31.25	1676.6 ± 29.26
		% Reduction		-11.02%	-5.38%
	50%	Mean ± SD	1452.5 ± 30.12	1362 ± 22.36	1404.16 ± 22.22
		% Reduction		-6.64%	-3.33%
	25%	Mean ± SD	1355 ± 64.18	1117.5 ± 33.27	1216.6 ± 31.57
		% Reduction		-17.53%	-10.22%

Fig. 1. BOD of the tannery effluent before (control) and after biodegradation (72hrs) using fungi and bacteria.**Fig. 2. COD of the tannery effluent before (control) and after biodegradation (72hrs) using fungus and bacterium**

Bioremediation of Tannery Effluent Using Fungus and Bacterium

Approximately 10 g (fresh weight) of mycelia of *Aspergillus niger*, and 10 ml (fresh weight) of *Bacillus sp.* were transferred to experimental jars containing 1000 ml of different concentrations (25%, 50%, 75% and 100%) of tannery effluent. They were kept in an orbit shaker for 72 hrs and maintained at 28 ± 2°C. Two important physicochemical parameters such as BOD and COD were estimated before and after 72 hrs (3 days) to check the degradation process by the fungus and the bacterium.

RESULTS

The water quality parameters of the tannery effluent were analyzed and its results are presented in the Table 1. The results of the analysis showed that the tannery effluent was grey coloured with a disagreeable odour, acidic pH, with high organic and inorganic load indicating high EC, BOD, COD, TSS, TDS, chloride and sulphate. Based upon the dominant fungus and bacterium, *Aspergillus niger* and *Bacillus cereus* were individually used to reduce the BOD and COD in the effluent. Laboratory scale biodegradation of

tannery in different concentrations (viz 25%, 50%,75% and 100%) using above fungus and bacterium. Two important physicochemical parameters namely BOD and COD were analyzed in the biotreated tannery effluent after 72 hours of incubation. Results of the tannery effluent treated with the fungi *Aspergillus niger* and Bacterium *Bacillus cereus* at different concentration (25%, 50%, 75% and 100%) for 72 hrs is shown in the Table 2 & 3. The BOD of tannery effluent before (control) and after bioremediation (72 hrs) by individual fungus and bacteria is shown in Table 2. The COD of tannery effluent before (control) and after biodegradation (72 hrs) by individual fungus and bacteria is shown in Table 3. In all the concentrations of tannery effluent *Aspergillus niger* was found to reduce BOD and COD to maximum extent followed by the bacterium *Bacillus cereus*. The decrease in BOD and COD values in the biotreated effluent is statistically significant $P < 0.001$.

DISCUSSION

Recent developments in biotechnology now offers opportunities to modify organisms so that their basic biological processes are more efficient and can degrade more complex chemicals and higher volumes of waste materials. Notable accomplishments of the environmental biotechnology include the cleanup of waste water especially from tanneries and other industries. Bioremediation is addressed as one example of an environmental biotechnology. Due to its comparatively low cost and generally benign environmental impact, bioremediation offers an attractive alternative and/or supplement to more conventional clean-up technologies. Use of microbes to concentrate pollutants is an emerging research area. Microorganisms, bacteria and fungi are nature's original recyclers. Their capability to transform natural and synthetic chemicals into sources of energy and raw materials for their own growth suggests that expensive chemical or physical remediation processes might be replaced or supplemented with biological processes that are lower in cost and more environmentally benign.

The present study on tannery effluent from Tiruchirappalli is aimed at analyzing the characteristics to tannery effluent and to reduce certain parameters that pose threat to the environment. In the present investigation, the physico-chemical characteristics of the untreated effluent have revealed that it is acidic with high BOD and COD, organic matter, unpleasant odour and colour. The present study has revealed that high levels of BOD in the tannery effluents indicating high organic load. Present investigation is in agreement with the studies on tannery effluent. (Kulkarni, 1992).

Further the presence of organic matter will promote anaerobic action leading to the accumulation of toxic compounds in the water bodies (Goel, 2000). In the present investigation, high level of COD in the tannery is recorded. Raj *et al.*, 1996 have recorded higher values of COD from the tannery effluent of Chrompet. Further high COD may be due to high amount of inorganic compounds which are not affected by the bacterial decomposition (Nagarajan and Ramachandramoorthy, 2002).

Microbes in the environment play an important role in the cycling and fate of organic chemicals and can destroy them through bioremediation. The present study reveals that *Bacillus cereus* and *Aspergillus niger* are able to reduce the BOD and COD in all concentrations of the tannery effluent. Studies also reveal that *Aspergillus niger* was more efficient and has high degrading ability to reduce BOD and COD than *Bacillus* sp. Hence it may be suggested that fungus will be beneficial for bioremediation and purification of effluents.

REFERENCES

- APHA, 1989. Standard methods for the examination of water and waste water. American Public Health Association, Washington, 17th Edition. D.C. pp.1193.
- Barnett, H.L. and Hunter, B.B. 1972, Illustrated genera of imperfect fungi. III edition, Burgers publishing company. Minneapolis, Minnesota.
- Ellis, M.B. 1971. Dematiaceous Hyphomycetes, common wealth mycologists institute, kew, Surrey, England.
- Eye, J.D. and Lawrence, L. 1971. Treatment of wastw from a sole leather industry. *J.Wat. pollut. Cont. Fed.*, 43:2291-2302.
- Gilman, J.C. 1967. A manual of soil fungi, oxford and IBH Pub. Co. Calcutta.
- Goel, P.K. 2000. Water pollution causes, effects and control. New Age International (P) Ltd., Publ. New Delhi, 269
- Jackson, M.C. 1958. Soil chemical analysis, Prentice Halls Inc., Englewood cliffs, New Jersey : 498.
- Kulkarni, T.T. 1992. Source and characteristic of dairy wastes from a medium size effluent on microorganisms plant growth and their microbial change. *Life.Sci.Adv.*, 3:26-78
- Raj, E.M., Sankaran, D.P Sreenath, S.K . Kumaran, S. and Mohan, M. 1996. Studies on the treated effluent characteristics of a few tanneries at Chrompet, Madras. *Ind. J. Environ.Prot.*, 6: 252-254
- Subramanian, C.V. 1971. Hyphomycetes (An account of Indian species, except cercosporae) ICAR, New Delhi.
