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Bioremediation of Automobile Effluent Using Cyanobacterium

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Automobile wastewater is an important land and water pollutant that is becoming a major nuisance especially in the metropolitan cities and towns. Presence of oil and grease in the water is highly undesirable as it inhibits diffusion of oxygen and reaeration as they spread over the surface of water and it creates aesthetic problems. It is found that the amount of oil and grease in the sample tested showed well above the prescribed limits by (BIS, 1993). This wastewater is dumped into the drainage systems without any treatment. If the present scenario is going to be a continuous one, the consequences may be very hazardous. The present paper deals with the bioremediation of wastewater from automobile workshop using cyanobacteria. Cyanobacteria can be employed in the bioremediation process for reducing automobile wastewater pollutants. The results from the present investigation are encouraging and attempts will be made to take up this lab trial to field level.

Key words: Bioremediation, Automobile Effluent, Cyanobacteria.

In recent years, increasing industrialization, urbanization and development activities to cope up with the population explosion have brought inevitable waste crisis (Rao *et al*., 1998). Studies on water quality are getting increasing importance in our country. Oil contamination of water is a widespread problem now a day. Keeping this in mind, many attempts have been made to isolate Cyanobacteria from natural environment where the accumulation of petroleum hydrocarbon and detergents were more due to discharge of automobile wastewater. Biological reclamation using Cyanobacteria such as *Oscillatoria* sp provides possibility to degrade the pollutant in the contaminated water (Cernigilia, 1992). Recent studies show that microbiological cleanup of the contaminants are being simpler, economical and eco friendly (Blackbrun *et al*.,1993).

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MATERIAL AND METHODS

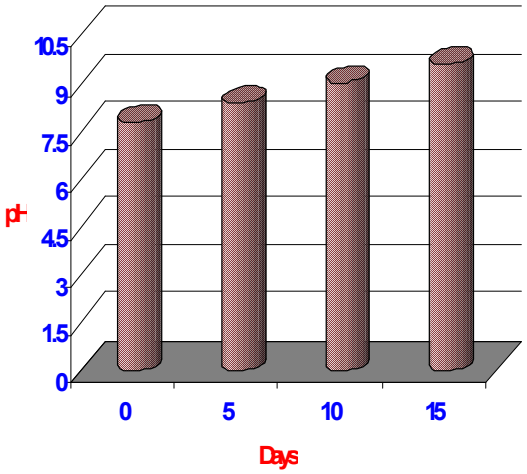
The sample collected from an automobile workshop, Chennai, was used in all the

experiments. Cyanobacterial populations were collected at different places from where the effluent was collected; isolated and identified by using the standard manual (Desikachary, 1959) and were maintained in CFTRI medium (1985). To study the role of *Oscillatoria* sp in automobile effluent, the following treatments were employed. i) Effluent treated with *Oscillatoria* sp and ii) Effluent without *Oscillatoria* sp was held as control. Two ml of uniform suspension of *Oscillatoria sp* was inoculated as initial inoculums in each of the treatment flasks. The effluent was periodically (every 5th day) analyzed for various physico-chemical parameters using standard methods (APHA, 2000). Standards have been laid down by the Central Pollution Control Board for determining water quality for various uses.

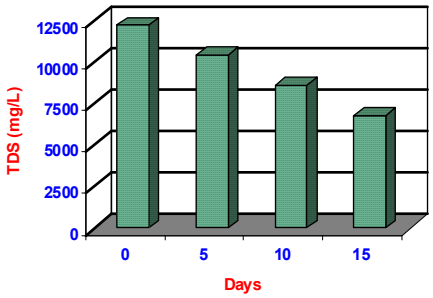
RESULTS AND DISCUSSION

Physico-chemical parameters of untreated and treated automobile wastewater are depicted in Table 1. The automobile wastewater was black in colour with unpleasant odour, which was due to the presence of high amount of oil and grease and the presence of large variety of contaminants released from automobiles Anjaneyulu, (1997).

In the present study, pH increased in automobile effluent from 5th day (8.4) onwards (Fig. 1a). The pH of the automobile effluent with *Oscillatoria sp* continued to remain higher than the controls. Manoharan and



(a)



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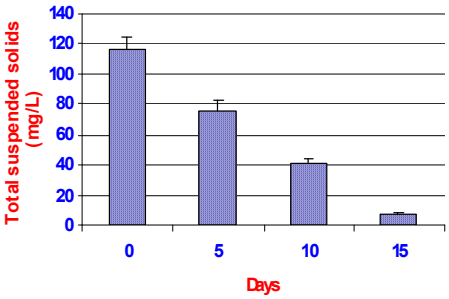
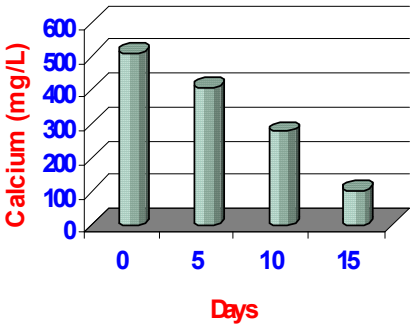


(c)



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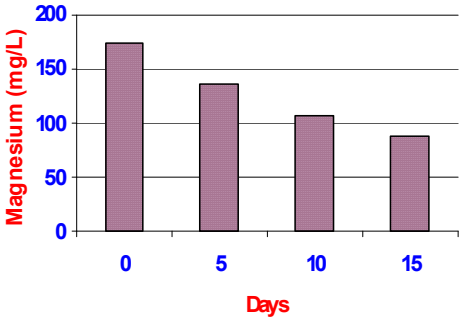

(e)

Fig.1. TDS Fig.1 a) Growth of *Oscillatoria* b) Increase of pH b b) Reduction in pollution load Total dissolved solids c) Total suspended solids d) Calcium and e) magnesium

Subramanian (1993) found a rise in pH value up to 10th day growth in paper mills waste water effluent inoculated with blue green algae. The typical capacity of *Oscillatoria* sp to bring about changes in the pH value to suit their requirement was evident in this study..

The automobile wastewater recorded high level of TDS (6684 mg/L).Total dissolved solids in the present study was reduced to71.88 percent when the effluent was treated with *Oscillatoria* sp (Fig.1b).

Due to the accumulation of particulate matter there was an increase in the total suspended solids. Total suspended solids in the present study were reduced to 93.10 percent when the effluent was treated with *Oscillatoria* sp (Fig. 1c).

The total hardness of the automobile wastewater was higher due to the increased amounts of calcium and magnesium ions. In the present study calcium and magnesium in the effluent was found to be reduced to 80.00 (Fig.1d) and 53 % (Fig.1e) respectively when the effluent was treated with *Oscillatoria* sp.

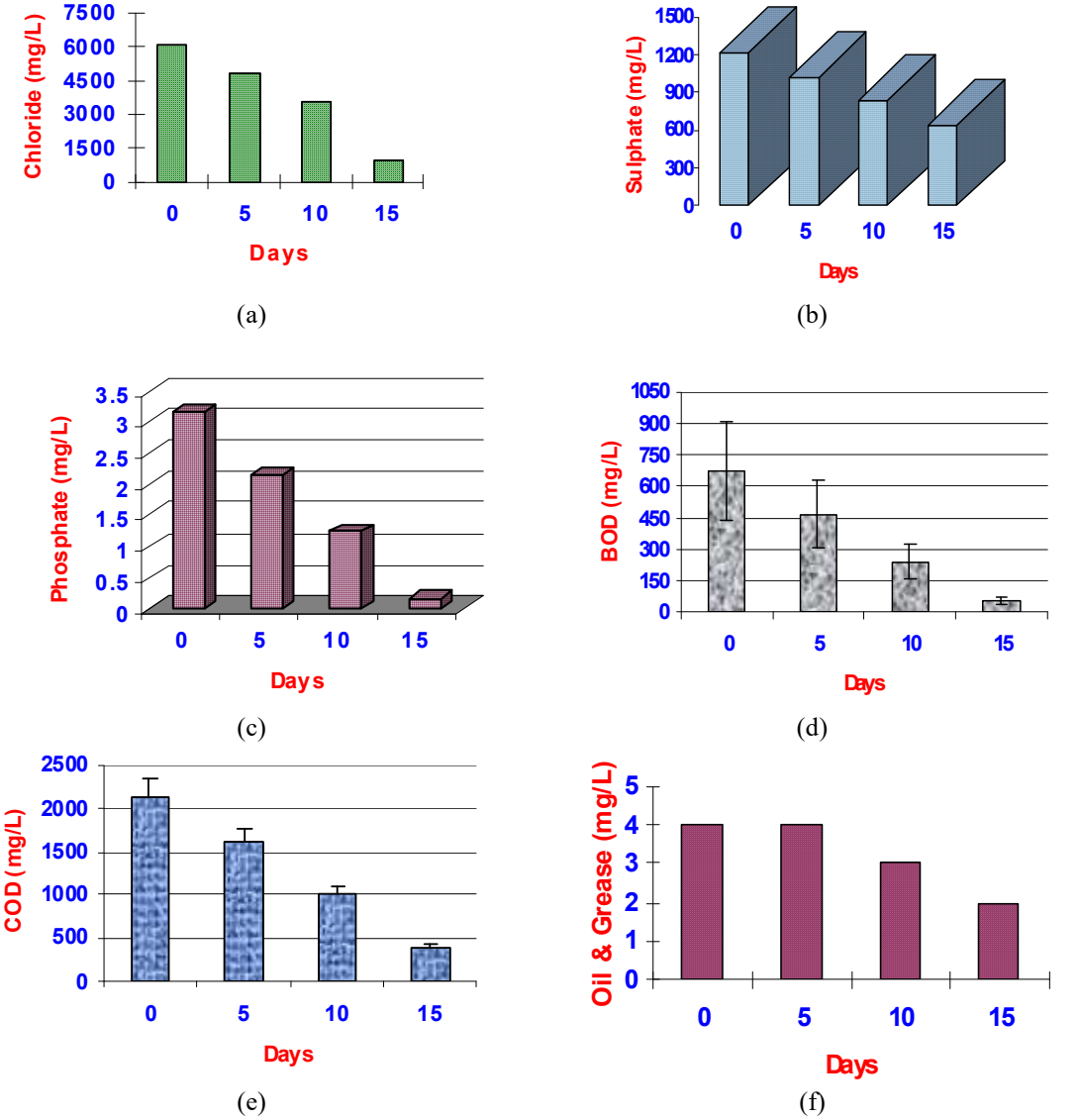

Fig. 2. Reduction in pollution load a) chloride b) sulphate c) phosphate d) BOD e) COD and f) Oil and grease

Chloride and sulphate level beyond the tolerance limit causes corrosion, non - potability of water and gastro intestinal irritation. In the present study chloride and sulphate in the effluent was found to be reduced to 62 % (Fig.2a) and 47% (Fig.2b) respectively. Vijayakumar *et al*., (2005) reported 40% reduction of chloride in dye effluent, when treated with *Oscillatoria sp.*

In the present study phosphate content in the effluent was found to be reduced to 95 % (Fig.2c). The removal of phosphate with all carbon sources was appreciably high at lower NH_4+-N concentrations in the waste, but it was quite low at higher concentrations. Doran and Boyle (1979) reported that 90%of phosphorus removal by activated algae was due to chemical precipitation.

The BOD and COD of automobile wastewater were found to be higher in untreated effluent. Due to the presence of excess of organic matter, the BOD level increases and causes eutrophication. The BOD values in the effluent were found to be reduced to 91.70 percent (Fig.2d) when the effluent was treated with *Oscillatoria*. The COD levels in automobile wastewater were greater than the tolerance limits (250 mg/L). The level of COD was reduced to 81% (Fig.2e) when the effluent was treated with *Oscillatoria* sp. The BOD and COD load were high that caused low DO level in the effluent and capable of affecting

Table 1. Physico-chemical parameters of *Oscillatoria* sp treated and untreated automobile wastewater.

S. No	Parameters (mg/L^{-1})	0 day	5^{h} day	10th day	15th day	% Reduction (Over 0 day)
1	Colour	Black	Black	Pale green	Green	-
2	pH	7.8	8.4	9.0	9.6	+18.75
3	Total dissolved solids	6684	4986	3378	1879	-71.88
4	Total suspended solids	116	76	41	8	-93.10
5	Calcium	510	401	279	102	-80.00
6	Magnesium	174	146	127	82	-52.87
7	Chloride	6095	4331	2955	998	-62.21
8	Sulphate	1221	1028	838	646	-47.09
9	Phosphate	3.1	2.15	1.22	0.15	-95.16
10	BOD	675	469	254	56	-91.70
11	COD	2134	1602	1063	400	-81.25
12	Oil & Grease	4	4	3	2	-50.00

water quality of receiving wetland. This observation was in conformity with Baruah *et al.,* (1996). Amudha and Mahalingam (1997) and Kumar *et al*., (2001) in different industrial effluents.

High amount of oil and grease obstruct the interaction to increase DO level as well as oxygen supplement for oxidation process in the effluent. In the present study oil and grease was reduced to 50 percent (Fig.2f) when the effluent was treated with *Oscillatoria* sp, which was due to the presence of the surface-active agents in automobile wastewater.

The physico-chemical analyses of the wastewater shows that the water is very toxic and if discharged, can cause serious environmental problems and harmful effects on human beings, animals and aquatic organisms. However, bioremediation using cyanobacteria *Oscillatoria* sp can be versatile, inexpensive and can potentially transform toxic pollutants into harmless end products.

The automobile wastewater upon degradation by cyanobacterium *Oscillatoria* sp can be used for irrigation purpose and the cyanobacteria are of immense importance in the maintenance of soil fertility and are greatly influenced by soil nutrients.

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