

BIO-PHYSICO AND CHEMICAL ASSESSMENT OF AUTOMOBILE WASTEWATER

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ABSTRACT

Physico-chemical and microbiological studies of automobile wastewater in Nammakkal, Tamilnadu, India indicated that the values for pH, EC, TDS, TH, BOD, COD, Calcium, Chloride, Sulphate, Bicarbonate, Oil and Greases were on the higher side of permissible limits of BIS. Microbiological studies revealed the presence of bacteria such as *Pseudomonas aeruginosa*, *Bacillus subtilis*, *Micrococcus luteus*, *Klebsiella* sp. and fungal species such as *Rhizopus*, *Mucor*, *Fusarium*, *A.niger*, *A.terreus*, *Curvularia* and *Penicillium* sp, at high concentration and these organisms serves as indicators for pollutants. MPN test carried out with these samples were found to be positive.

INTRODUCTION

Water is the most ubiquitous material in nature and is the most vital and fascinating of all God's creation (Krishna, 1998). In recent years, increasing industrialization, urbanization and development activities to cope up with the population explosion have brought inevitable water crisis (Rao *et al.*, 1998). In India there are about 5000 industrial units, which generate lot of wastewater and effluents (Subrahmanya, 1996). Oil contamination of water is a wide spread problem now a days, which pose public health problem and also affects the aquatic and terrestrial system (Brown, 1997). Recent challenging advancement stated that microbiological cleanup of the contaminants are being simpler, economic and ecofriendly (Blackburn *et al.*, 1993).

MATERIAL AND METHOD

The samples were collected in pre-sterilized bottles from Namakkal district, Tamil Nadu, India. The collected samples were stored in a clean plastic

container at 4°C until analysis was done. The samples were analyzed for its physicochemical characteristics such as colour, pH, EC (Electrical Conductivity), TSS (Total Suspended Solids), TDS, TS, BOD, COD, TH (Total Hardness), Calcium, Magnesium, alkalinity, chloride, sulphate, phosphate, oil and greases (APHA, 1998).

The samples were also screened for the presence of microbes. The samples were plated onto nutrient agar medium by serial dilution technique. The plates were incubated at 37°C for 24h; well-grown colonies were picked and further purified by streaking. The isolated bacterial colonies were streaked onto nutrient agar plates and stored at 4°C. The bacterial colonies were identified based on Gram staining, motility and other biochemical characteristics (Sundarajan, 1995).

The samples were also plated onto Rose Bengal chloramphenicol agar medium by standard dilution technique. The plates were kept for incubation at room temperature. After a week the fungal colonies were observed and subjected to view the morphology by lactophenol cotton blue staining technique (Kannan, 1996).

RESULTS AND DISCUSSION

The results of different physicochemical parameters obtained after analysis of automobile wastewater samples are tabulated in Table 1. The results were compared with the Indian Standard Specifications for drinking water.

The amount of oil and greases made the physical nature of water turbid, unpleasant odour and imparts black color. The pH of the automobile wastewater was about 9.6, which was found to be above the tolerance limit (5.5-9.0). The EC of automobile wastewater was about 256mS, which was extremely high and detrimental to biotic growth. This may be due to the high concentration of dissolved ions in automobile wastewater. TDS and TSS were also found to be high compared to the tolerance limits prescribed by BIS. The total hardness of the automobile wastewater was higher due to the increased amounts of calcium and magnesium ions. When calcium level exceeds the desirable limits encrustation in water supply and the domestic use is adversely affected. Chloride and sulphate level beyond the tolerance limit causes corrosion, petability of water and gastro intestinal irritation respectively. The most common hazard caused by the high nitrate concentration is infant methaemoglobinemia (Todd, 1980). Due to the presence of excess organic matter the BOD level increases and causes eutrophication. Release of inorganic materials also increased the COD level. The presence of oil and grease was found to be 74 mg/L, which was due to the presence of surface-active agents in automobile wastewater.

Microbiological studies revealed the presence of bacterial and fungal population in automobile wastewater samples of the study area. The bacterial isolates were *Pseudomonas aeruginosa*, *Bacillus subtilis*, *Micrococcus luteus* and *Klebsiella* sp which are capable of degrading the pollutants (Table -2). The fungal isolates were *Rhizopus*, *Mucor*, *Fusarium*, *Aspergillus niger*, *A.terreus*, *Qirvularia* and *Pencillium* sp., which are capable of growing in higher con-

Table - 1
Physicochemical parameters of automobile waste water (all the values are expressed in mg/l except pH and electrical conductivity).

Biochemical parameters	Raw H ₂ O	Automobile waste water	BIS limits (IS-3371977)#
pH	8.0	9.6	5.5-9.0
EC	150	256	-
TSS	0.54	548	100
IDS	96.5	726	2100
TS	97.04	1274	2200
BOD	1.5	24.24	-
DO	4.5	3.2	-
COD	27	749	250
TH	16.5	937.9	-
Cations			
Ca	14.8	517.4	-
Mg	1.7	420.5	-
Alkalinity	36.5	212	-
Anionms			
Chloride	26	962	16.9
Sulphate	150	573	-
Phosphate	4	11	-
Oil and greases	2	74	-

Tolerance limits for industrial effluents discharged into the surface area prescribed by the Bureau of Indian Standards.

centration of calcium, potassium, bicarbonate and nitrates (Badiyala *et al*, 1990, Abu Backer *et al*, 1996, Iqbal and Mehta, 1996) and also constitute the set of indicator organisms for highly polluted soil or ground water. The MPN study reveals that higher counts of coliform bacterial population are present at a rate of 1100 cells/100 ml. The population of coliform bacteria increased significantly with increased level of BOD and inorganic salts. The automobile wastewater samples tested was found to have microbial population in large number. The automobile wastewater upon degradation by bacteria and fungi can be used for irrigation purpose and the water is unsuitable for human consumption. Microbes are of immense importance in the maintenance of soil fertility and are greatly influenced by soil nutrients. Majority of the people depend on ground water for their requirements, therefore it is very essential to protect these water resources from being polluted by automobile wastewater.

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Table - 2
Characterization of culture isolated from automobile wastewater

Biochemical characters	<i>Pseudomonas aeruginosa</i>	<i>Bacillus subtilis</i>	<i>Micrococcus luteus</i>	<i>Klebsiella</i>
Gram staining	-	+	+	-
Shape	R	R	C	R
Motility	+	+	+	-
Oxidase	+	D	-	-
Catalase	+	+	+	+
Acid fastness	-	-	-	-
Spores	-	-	-	-
Indole	-	-	-	-
Methyl red	-	D	-	-
Voges Proskauer	-	-	-	-
Citrate utilization	+	-	-	+
Nitrate reduction	+	+	D	+
Urease	-	-	+	+
Starch hydrolysis	-	-	-	-
Gelatin hydrolysis	+ (Rapid)	+ (Rapid)	+(Slow)	-
Glucose	A ⁺	A ⁺ G ⁻	-	A ⁺ G ⁺
Mannitol	-	-	-	A ⁺ G ⁺
Maltose	A ⁺ G ⁺	A ⁺ G ⁺	-	A ⁺ G ⁺
Sucrose	-	A-G-	-	A ⁺ G ⁺
Lactose	-	-	-	A ⁺ G ⁺

+/- = Positive/Negative, R= Rods, C= Cocci, A+/G+= Acid/ Gas Production
A-/G-= Acid/ Gas Production, D= 75- 95 % Positive.

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