



e-ISSN: 2319-8753 | p-ISSN: 2320-6710

# IJRSET

International Journal of Innovative Research in  
**SCIENCE | ENGINEERING | TECHNOLOGY**

# INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN SCIENCE | ENGINEERING | TECHNOLOGY

Volume 9, Issue 11, November 2020

**ISSN** INTERNATIONAL  
STANDARD  
SERIAL  
NUMBER  
INDIA

**Impact Factor: 7.512**

9940 572 462

6381 907 438

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# A Case Study on Wastewater from Automobile Service Stations in Madurai City, India

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**ABSTRACT:** The automobile industry in India is fourth largest in the world and one of the fastest growing around the globe. At the same time automobile service stations/repair shops are increasing in rapid face and vehicle wash facilities create a great deal of wastewater that can have a great impact on the environment, if not properly managed and discharged. An interesting statistical survey of automobile service station is conducted and found that 99 stations were existing in Madurai, the second largest city in Tamil Nadu, India. The service stations are divided into 9 categories based on type of service availability and found that a few stations only having treatment facilities in all categories. The quantity of water estimated per vehicle cleaning (in average) according to survey is 30 litres/two wheeler, 100 litres/three wheeler, 250 litres/four wheeler, and 500 litres/six wheeler. The characterisation of wastewater from few automobile service stations is also conducted. Various parameters are found that pH, temperature, total solids, total dissolved solids, total suspended solids, sulphates, chlorides, BOD<sub>5</sub>, COD and oil and grease concentration in the range of 7.4-8.5 pH scale, 27-30 °C, 1010-1382 mg/L, 852-950 2mg/L, 50-518, 86-136 mg/L, 118-317 mg/L, 4.1- 7.8 mg/L, 37- 282 mg/L, and 0-185 mg/L respectively. The characterization of wastewater from two automobile service stations found that COD, suspended solids and oil and grease are above the tolerance limits for industrial effluent discharged into inland surface water.

**KEYWORDS:** Automobile service station, Oily wastewater, Treatment process, Characterization, Madurai

## I. INTRODUCTION

The Indian automobile industry is the fourth largest in the world and is expected to be in top 3 by 2021, with an annual production of approximately 26.36 million vehicles (<https://www.ibef.org/industry/india-automobiles.aspx>, 2020). It is involved in design, development, manufacture, marketing, and sale of motor vehicles. There are a number of global automotive giants that are upbeat about the expansion plans and collaboration with domestic companies to produce automobiles in India. The major car manufacturers in India are MarutiUdyog, Hyundai Motors India Ltd., General Motors India Pvt. Ltd., Honda SIEL Cars India Ltd., Toyota Kirloskar Motor Ltd., Hindustan Motors etc. The two-wheeler manufacturers in India are Honda Motorcycle & Scooter India (Pvt.) Ltd., TVS, Hero Honda, Yamaha, Bajaj, etc. The heavy motors including buses, trucks, auto rickshaws and multi-utility vehicles are manufactured by Tata-Telco, Eicher Motors, Bajaj, Mahindra and Mahindra, etc.

At the same time automobile service stations/repair shops are increasing in rapid face and vehicle wash facilities create a great deal of wastewater that can have a great impact on the environment, if not properly managed and discharged. The service station is a place where the automobile vehicles are repairing or maintaining, servicing, washing or cleaning by under heavy pressure. The contaminants in wash wastewater include the following: (i) Oil and grease, which contain hazardous materials such as benzene, lead, zinc, chromium, arsenic, pesticides, herbicides, nitrates, and other metals (ii) Detergents, including biodegradable detergents, that can be poisonous to fish (iii) Phosphates, which are plant nutrients and can cause excessive growth of nuisance plants in water bodies (iv) Chemicals, such as hydrofluoric acid and ammonium bifluoride products (ABF), and solvent-based solutions that are harmful to living organisms (v) Chemicals and oils used for the maintenance of cleaning machinery (for automatic systems) (vi) Debris that can clog storm sewer inlets and grates and thereby prevent storm water drainage to the sewer (<http://www.epa.state.il.us/small-business/car-wash>). The automobile wash wastewater can be harmful to humans, plants, and animals if released untreated to surface water bodies. Additionally, allowing wash wastewater to soak into the ground can be harmful because the wastewater may contaminate soil and

groundwater. So on-site automobile wash wastewater treatment is essential and a prospective direction towards the reduction of pollution load to the municipal or combined urban wastewater (Mazumder and Mukherjee, 2011).

## II. EXPERIMENTAL SECTION

### 2.1 SURVEY REPORT (Balamurugan et al., 2002)

An interesting statistical survey of automobile service station is conducted and found that 99 stations are existing in Madurai, the second largest city in Tamil Nadu, India. Most of the service stations are located on the outskirts of Madurai city, mainly on bye-pass road, Alagarkoil road etc. It has been found that most of the service stations serve all the categories of vehicles. Some service stations are attached with petrol bunks. In Madurai city many dealers of two wheelers and four wheelers do their sales and services as the automobile service stations are attached with their show rooms. Many mechanical workshops are also attached with small service stations.

The service stations are divided into 9 categories based on type of service available. Category-I for two wheeler only, Category-II for three wheelers only, Category-III for four wheelers only (LMV), Category-IV for six wheeler only (HMV), Category-V for two wheeler and three wheeler, Category-VI for two wheeler, three wheeler and four wheeler only, Category-VII for two wheeler and four wheeler only, Category-VIII for two wheeler and six wheeler only, Category-IX for three wheeler and four wheeler only. There are 43 service stations available in category-1 among only 16 stations are having treatment facilities like sand removal, oil separator. Only one service station (without treatment facility) is available under category-II. There are 24 service stations are available under category-III, among 22 stations are having treatment facilities like sand removal, oil separator. Under category-IV & V have one & two service stations respectively with treatment facility available. There are 4(3), 11(7), and 12(11) service stations (with treatment) available under category of VI, VII and VIII respectively. Under category IX, only one service station without treatment plant available. Among 99 service stations 66 have treatment facility like sand removal-oil separator and remaining 37 does not have any facilities. The quantity of water estimated per vehicle cleaning (in average) according to survey is 30 litres/two wheeler, 100 litres/three wheeler, 250 litres/four wheeler, and 500 litres/six wheeler.

General study about two dealers of automobile in Madurai city

i. Kodai Automobiles: It is situated in bye pass road at 5 km away from bus stand of Madurai city. They are dealers in Mahindra range of vehicles Jeep, Van & Tractors etc. Based on survey an average 6500 litres of (4 wheeler, 10 vehicles x 300 l/vehicle=3000 l plus 6 wheeler, 5 vehicles x 700 l/vehicle=3500 l) wash wastewater produced per day.

The operational process and treatment process are given by the following flow charts shown in Fig.1 and Fig. 2 respectively.

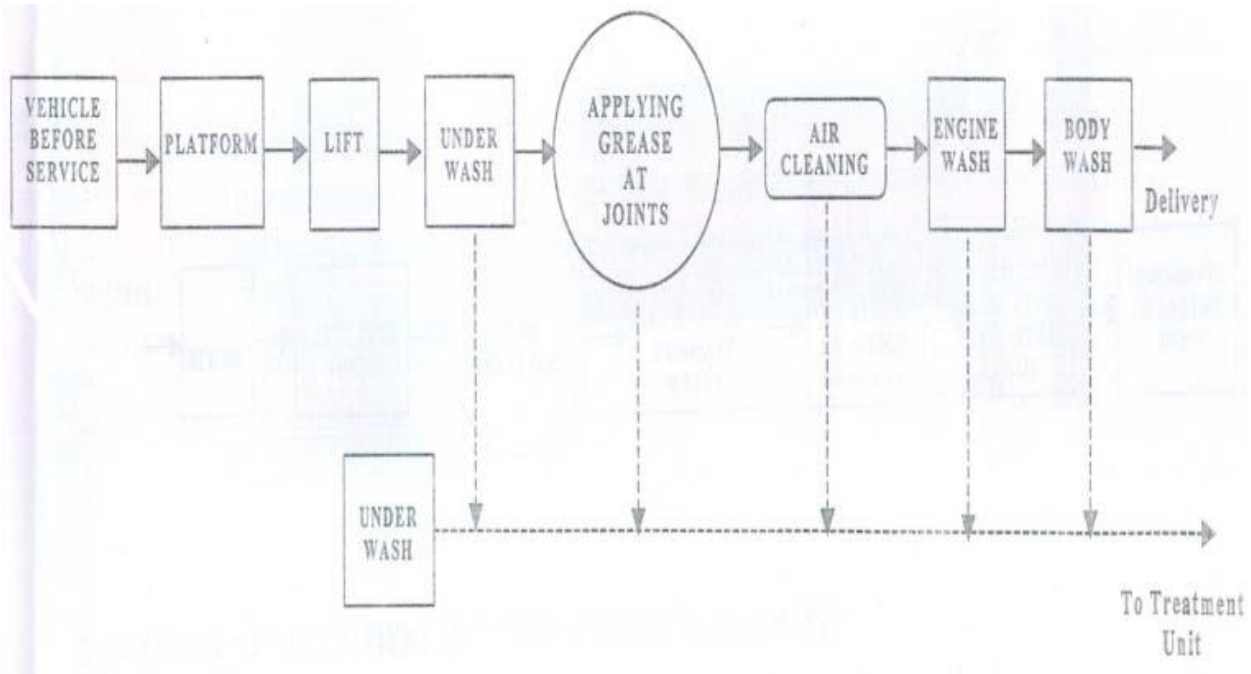


Fig. 1 Operational process in Kodai automobiles service station.



Fig. 2 Treatment process in Kodai automobiles service station.

ii. Susee Corporation: It is also situated in Theni road at 5 km away from bus stand of Madurai city. They are dealers in Hyundai range of vehicles & Eicher. Based on survey an average 4800 litres of (4 wheeler, 10 vehicles x 300 l/vehicle=3000 l plus 6 wheeler, 3 vehicles x 600 l/vehicle=1800 l) wash wastewater produced per day. The operational process and treatment process are given by the following flow charts shown in Fig.3 and Fig. 4 respectively.



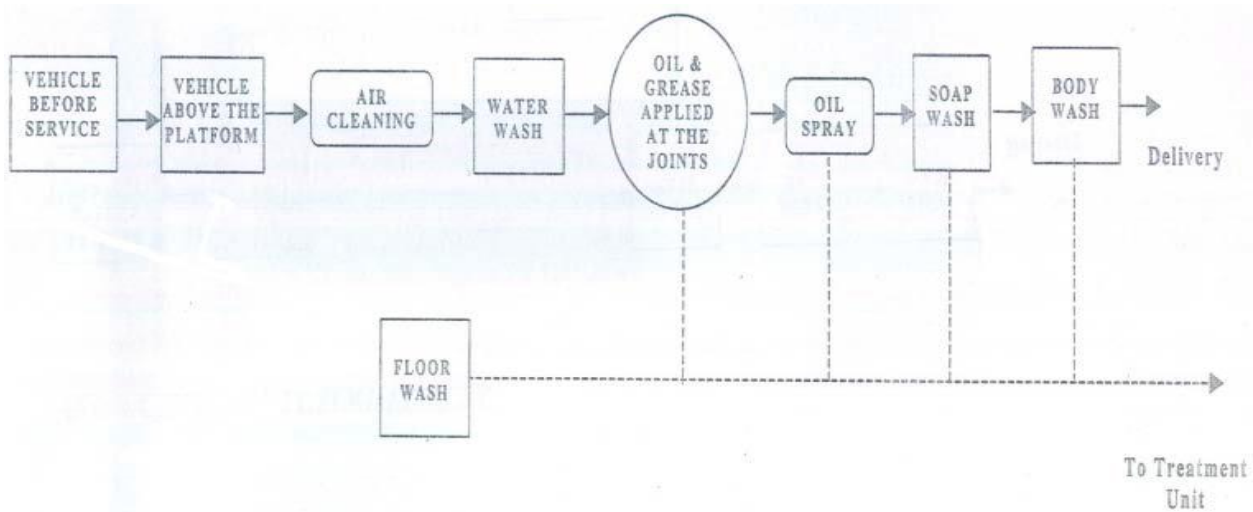


Fig. 3 Operational process in Susee corporation service station

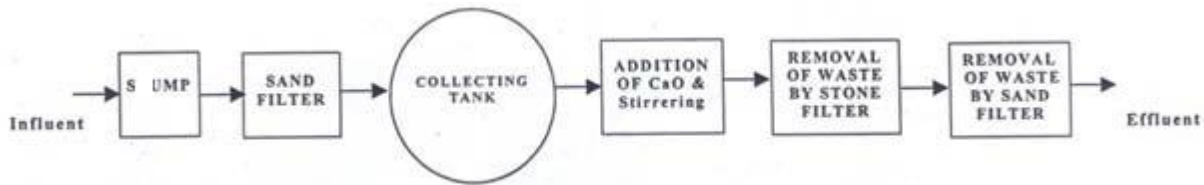


Fig. 4 Treatment process in Susee corporation service station

## 2.2 Wastewater survey

The wastewater is mainly generated from above two service stations are washing of different type of vehicle. The washing is done by spraying high pressure water jets through nozzle guided by compressor motor assembly. Grease gun is used to trigger lubricants to different parts of the vehicles as a routine procedure. Each garage unit is facilitated with one washing bay. For washing purpose, vehicles are aligned on the bay and high pressure water jet is sprayed on the vehicles (Fig. 1 & 3). The washed wastewater is then drained to treatment units as shown in Fig. 2 & 4.

The investigation was carried out by collecting grab samples from each automobile service station once in 15 days. Two consecutive samples were collected and analysis was carried out in Regional Testing Lab., Madurai and PWD, Geology division, Madurai. Different parameters like pH, total solids, fixed and volatile solids, sulphates, chlorides, oil and grease of the samples were analyzed as outlined in the standard methods for the examination of water and wastewater (APHA, 1998). The results of characterization of wash wastewater from Kodai automobiles and Susee Corporation shown in Table 1 & 2 respectively. A table shows average values of parameters with tolerance limits for industrial effluent discharged into inland surface water (IS: 2490) part I, 1980.

Table.1 Analysis of wastewater from Kodai automobiles service station.

S.No.	Parameters	Mean Sample	Tolerance Limit	Unit
1.	pH	7.65	5.5 to 9	--
2.	Temperature	30	40° at the point of discharge	°C
3.	Total Solids	1012	--	PPM
4.	Fixed Solids	758	--	PPM
5.	Volatile Solids	254	--	PPM
6.	Suspended Solids	54	100	PPM
7.	Dissolved Solids	949.5	--	PPM
8.	Sulphates (SO <sub>4</sub> )	88.5	1000	PPM
9.	Chlorides (Cl)	124	600	PPM
10.	Oil and Grease	179.5	10	PPM
11.	Dissolved Oxygen	NIL	--	--
12.	Biochemical Oxygen Demand (BOD)	7.65	30	PPM
13.	Chemical Oxygen Demand (COD)	40	250	PPM
14.	Phenolic Compounds	NIL	1.0	--

Table 2 Analysis of wastewater from Susee corporation service station

S.No.	Parameters	Mean Sample	Tolerance Limit	Unit
1.	pH	8.4	5.5 to 9	--
2.	Temperature	28	40° at the point of discharge	°C
3.	Total Solids	1380	--	PPM
4.	Fixed Solids	1110	--	PPM
5.	Volatile Solids	270	--	PPM
6.	Suspended Solids	511	100	PPM
7.	Dissolved Solids	856	--	PPM
8.	Sulphates (SO <sub>4</sub> )	134.5	1000	PPM
9.	Chlorides (Cl)	315	600	PPM
10.	Oil and Grease	NIL	10	--
11.	Dissolved Oxygen	NIL	--	--
12.	Biochemical Oxygen Demand (BOD)	4.4	30	PPM
13.	Chemical Oxygen Demand (COD)	281	250	PPM
14.	Phenolic Compounds	NIL	1.0	--

### III.RESULTS AND DISCUSSION

In the above study of two automobile service station wastewater, various parameters are found that pH, temperature, total solids, total dissolved solids, total suspended solids, sulphates, chlorides, BOD<sub>5</sub>, COD and oil and grease concentration in the range of 7.4-8.5, 27-30, 1010-1382 mg/L, 852-950 mg/L, 50-518, 86-136 mg/L, 118-317 mg/L, 4.1- 7.8 mg/L, 37- 282 mg/L, and 0-185 mg/L respectively. The Kodai service station wastewater contains more quantity of oil and grease than tolerance limit. The Susee service station wastewater contains more quantity of suspended solids and COD than the tolerance limits. Kurian and Natarajan (1997) studied 40 samples from 10 automobile service stations and found that total suspended solids, COD, BOD<sub>5</sub> and oil and grease concentration in the range of 610-4950 mg/L, 270-1640 mg/L, 75-570 mg/L and 14-420 mg/L respectively. Mazumder and Mukherjee (2011) found that COD, Total solids and Oil and grease are in the range of 227-445 mg/L, 800-6000 mg/L and 150-800 mg/L respectively from Kolkata municipal corporation garage yard wash wastewater. The variations in values of various parameters noted by different authors are attributed due to difference in number of vehicles and type of vehicles washed in each service station.



#### **IV. CONCLUSIONS**

The statistical survey of automobile service stations found that 99 are existing in Madurai, the second largest city in Tamil Nadu, India. The service stations are divided into 9 categories based on type of service availability and found that a few stations only having treatment facilities in all categories. The quantity of water estimated per vehicle cleaning (in average) according to survey is 30 litres/two wheeler, 100 litres/three wheeler, 250 litres/four wheeler, and 500 litres/six wheeler. The characterisation of wastewater from two automobile service stations is conducted and found that COD, suspended solids and oil and grease are above the tolerance limits for industrial effluent discharged into inland surface water.

#### **ACKNOWLEDGEMENTS**

The study was conducted as part of a final year student project in Bachelor of Civil Engineering in Civil Engineering Department, P.S.N.A. College of Engineering & Technology, Dindigul, Tamil Nadu (INDIA)). The author grateful to Balamurugan, M., Nivas, R., Periyar Lenin, R who worked under his supervision and established the basis of field sampling and data collection.

#### **REFERENCES**

- 1) APHA, AWWA, WEF. 1998. Standard Methods for the Examination of Water and Wastewater. 20th ed., American Public Health Association, Washington, DC, USA.
- 2) Balamurugan, M. Nivas, R. Periyar Lenin, R. (2002). Automobile service station effluent analysis and design of a common treatment plant in Madurai city. B.Tech. Project report submitted to Department of Civil Engineering, P.S.N.A. College of Engineering & Technology, Dindigul-624 622 Tamil Nadu (INDIA) of Madurai Kamaraj University, Madurai (TN).
- 3) IS: 2490 (part-I), 1980. Tolerance Limits for industrial effluents discharged into Inland Surface Waters. Bureau of Indian Standards. New Delhi.
- 4) Kurian, Joseph and Natarajan, K. (1997). Studies on Wastewater from Automobile Service Stations. Indian Journal of Environmental Health; 39(1), pp. 37 - 43.
- 5) Mazumdar, D and Mukherjee, S (2011). Treatment of automobile service station wastewater by coagulation and activated sludge process. International Journal of Science and Development, 2(1), pp. 64-69.





**INNO**  **SPACE**  
SJIF Scientific Journal Impact Factor

**Impact Factor:  
7.512**

**ISSN** INTERNATIONAL  
STANDARD  
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NUMBER  
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