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## CHARACTERIZATION OF SLUDGE GENERATED FROM AUTOMOBILE INDUSTRY

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### ABSTRACT

In the present study sludge was collected from different units in Effluent Treatment Plant (ETP) of an automotive manufacturing industry located at Nagpur, Maharashtra, India. In view of hazardous nature of the sludge generated from ETP of automotive industry. It was decided to work out characterization of paint sludge, biological sludge and dried sludge on sludge drying bed from four sampling points of the ETP. The pertinent parameters viz. moisture content, bulk density, ash, pH, Oil & Grease, Nitrogen, Phosphorus and Potassium, Chloride, Iron, Lead, Chromium, It was observed that moisture content range 50 -70%, bulk density 60-70 g/cc, Ash 33.2 to 58.9, pH 7.2-8.2, oil & grease 12.4-18.6mg/l. Also sludge was found to be strong in N,P,K values Nitrogen 1.21-4.86 g/kg, Phosphorus 2.1-3.5 g/kg and Potassium 1.93-3.54g/kg. due to strong N,P,K values it can be used as a soil conditioner.



**KEYWORDS-** Automobile industry, Characteristics, ETP, Sludge Management, Generation.

### INTRODUCTION :

In Turkey there were 13 manufacturing plant producing over 573 million vehicles in 2002 (Mayyas et.al,2012). The production of global vehicles was 89.75 million in year 2014 as compared to year 2013 (OICA, 2015). The India the automobile manufacturing plant producing largest amount of car in 2014-15 (Shrutakirti et.al, 2016). Tata leading automotive manufacturing industry in India produced 1 million vehicles per year (ISPAT,2014) also it produces sludge which would be treated.

As per NEERI Manual all industrial units in Maharashtra have to operate within the jurisdiction of Maharashtra Pollution Control Board (MPCB). Those unit which uses water likely to generate wastewater.MPCB gives consent to operate the industry only if (a) sewage & industrial waste are segregated (b) their properly treated to meet effluent standards as per IS 2490.Ministry of Environmental forest and Climate Culture ( MOEF & CC) Govt. of India has categorized sludge from effluent water treatment plant as "hazardous". Therefore Hazardous wastes (Management & Handling Rules, 1989) applicable to ensure proper management of sludge generated.

Industrial effluent contains matter. The wastewater analysis of effluent generated from automotive vehicles from washing in Sweden also content high organic pollutants (Somnath et.al.,2011). Therefore it is essential to treat not only wastewater but also sludge properly so as to meet disposal standards. Sludge quantity

and its nature depend on quality of effluent generated from industry. Quantity of sludge depends on the efficiencies of unit processes being used in an ETP. Wastewater reuse and recycling is helpful for the agriculture purpose and conserving the plant nutrients (Parmeshwari et.al.,2013).

Wastewater Treatment is carried out satisfactory only if the impurities in solid form are concentrated and separated from liquid this concentration of solid which is called "sludge" which contains many objectionable materials. Sludge is semisolid residue from industrial processes and treatment of sewage. It is soft thick material that is produced in various industrial processes (Viet,et.al.,2013).In biological treatment system dissolved organic materials is converted into biomass depending on the biological conversion, therefore biological sludge is generated.

Due to proper management it is possible not to lose the nutrients in the sludge and to dispose off it efficiently and sustainably. The sludge generated at different units of ETP needs to be dewatered so as to reduce disposal cost by about 40%. (Salihoglu, et al. 2015).The effluent generated from automobile industry, if not properly managed and discharged that can have a great impact on the environment (Gopalkrishna, et.al., 2016).

Industrial activity is a function of demand of a product. Waste generation, liquid or solid depend on production.

Hence, it was decided to work out quantification and characterization of the sludge generated from automotive industry for the parameters viz. moisture content, bulk density, ash, pH, Oil & Grease, Nitrogen, Phosphorus and Potassium.

## 2. METHODOLOGY

Present study was conducted for management of sludge generated from ETP of automobile manufacturing industry in MIDC area, Hingna, Nagpur. This industry was operational from the past three decades. Besides installation of production unit this multinational unit has taken precaution to provide a well-designed industrial wastewater treatment plant (ETP). In addition to this ETP, industry has provided a separate Sewage Treatment Plant (STP). It may be stated that Maharashtra pollution control state board (MPCB) does not permit mixing of sewage with industrial wastewater for combined treatment. As a result there was separate drainage for carrying process and sanitary wastewater /sewage.

This study required collection of representative samples, preservation of sample and estimation of various parameters. It was necessary to clean glassware, rinsed with de-mineralized water. Chemicals and reagents required for the analysis were of analytical reagent grade. Analysis were done with standard methods for analysis of sludge

In the present study, representative samples were collected for the analysis of sludge management in an automobile industry from four sampling points as shown in Fig 2.1. To analyze for characteristics of dried sludge on sludge drying bed for following parameter like moisture content, bulk density, volatile solids, ash, pH, Oil & Grease, Nitrogen, Phosphorus, potassium, Chloride, Sulphate, Iron, Calcium, Magnesium ions & heavy metals viz. Chromium, zinc. During the study, the samples were collected in the period of about six month of September - 2016 to January - 2017. The sludge samples were collected from the different units like primary clarifier, aeration tank, sludge drying bed (1) Dried sludge were collected about 1 kg in plastic bag by the method of quartering (2) Biological sludge were collected from 5 litres plastic cane with the help of depth sampler that cane were washed with DM water. Proper labeling was done at the site only. Time was noted down on the site. Samples were transported to the laboratory were analyzed in the laboratory.

Study of existing ETP at automobile industry revealed that there are three types of sludges like Paint sludge, Biological sludge and Chemical sludge.

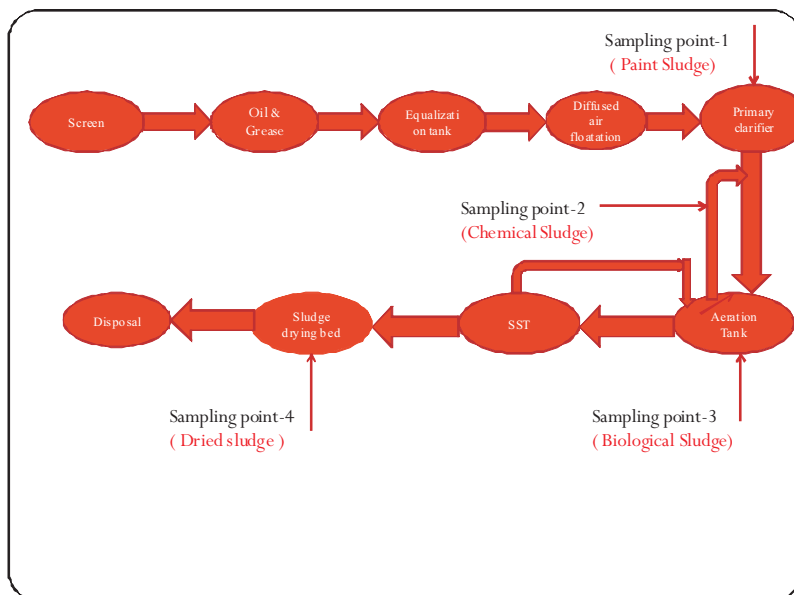


Fig.2.1: Flow sheet of ETP in Automobile industry along with sampling points

3. RESULTS AND DISCUSSION

There are three types of sludge characteristics given below.(1)Paint Sludge (2) Biological Sludge (3) Sludge Drying Bed.

Table 3.1: Characteristics of Paint Sludge from month September 2016 to February 2017

Parameter	Unit	Sept. 16	Oct. 16	Nov. 16	Dec. 16	Jan. 17	Feb. 17
pH	-	8.2	7.2	7.6	7.3	7.7	7.4
Moisture Content	%	53.69	74.97	59.8	50.6	57.2	50.9
Organic Matter	%	72.15	74.92	71.2	67.2	63.8	67.3
Ash	%	27.85	25.08	33.6	32.8	30.4	30.9
Bulk Density	%	0.75	1.07	0.64	0.67	0.61	0.72
Iron	g/cc	1.2	1.4	3.1	3.2	2.7	4.8
Oil & Grease	mg/l	15.5	12.3	18.6	17.1	16.4	12.4
Lead	mg/kg	1012	1001	1163	1386	1206	1106
Chromium	mg/kg	3.85	10.4	3.2	4.3	3.9	5.2

Table 3.1 showed characteristics of the paint sludge from month September 2016 to February 2017 for the parameters analyzed. It was observed that pH was in the range of 7.2-8.2, Moisture Content was high in the month of November because collect the sample on primary clarifier, Organic Matter also high content of this month, Ash within the range of 27.8 to 33.9, Bulk Density also high in November month because if it is well wet sludge, bulk density become high. Iron was in the range of 1.2 to 4.8, Oil & Grease value was high because paint sludge content emulsified oil.

Lead was in the range of 1012 to 1386 within the permissible limit, Chromium also content in the range of 3.2 to 10.4 mg/kg.

**Table 3.2: Characteristics of biological Sludge from month September 2016 to February 2017**

Parameter	Unit	(1) Sept.16	(2) Oct. 16	(3) Nov. 16	(4) Dec. 16	(5) Jan. 17	(6) Feb. 17
pH		8.4	8.1	8.7	8.6	8.2	8.6
Total Solid	Mg/l	11975	11719	10896	12798	12327	13739
Total Dissolved Solid	Mg/l	1220	1312	1184	1098	1174	1248
Total Suspended Solid	-	10755	10407	9712	11700	1115	12491
Total Solid(I)	-	7770	7642	6350	7948	6890	8471
Total Dissolved Solid (I)	-	950	840	864	938	859	920
Total Inorganic Suspended Solid	-	6820	6802	5486	7010	6031	7557
Total Volatile Solid	-	4205	4077	4546	4850	5437	5268
Total Dissolved Volatile Solid	Mg/l	270	472	320	160	315	328
Total Suspended Volatile Solid	Mg/l	3935	3605	4226	4690	5122	4940

Table 3.2 showed characteristics of the paint sludge from month September 2016 to February 2017 for the parameters was analyzed It was observed that pH was in the range of 8.1-8.7.

The biological of different parameter high content of value because this is extended aeration system provided which maintain the MLSS, content of Solids ,Semisolids, organic and inorganic matter, concentration high within the permissible limit.

**Table 3.3: Characteristics of Dried Sludge on Sludge Drying Bed Sludge from month September 2016 to February 2017**

Parameter	Unit	(1) Sept.16	(2) Oct. 16	(3) Nov. 16	(4) Dec. 16	(5) Jan. 17	(6) Feb. 17
Ph	-	6.8	7.0	6.9	7.2	7.0	7.3
Moisture Content	%	26	26.2	87.32	20.8	23.4	21.6
Organic Matter	%	63.09	66.8	41.10	63.1	62.4	64.1
Ash	mg/kg	36.91	33.2	58.9	36.2	37.6	35.9
Bulk Density	g/cc	0.602	019	0.87	0.45	0.17	0.18
Ca <sup>++</sup>	Mg/kg	368	37	40	308	32	41
Mg <sup>++</sup>	Mg/kg	106	63	9.6	100	58	66
Chloride	Mg/kg	219	381	724	201	424	391
Sulphate	-	706	532	300	510	556	557
Iron	-	12	15.4	9.4	10	14.3	14.8
Oil & Grease	Mg/l	4.8	7.2	8.1	3.2	6.8	8.1
Nitrogen	g/kg	4.86	2.1	3.7	1.0	3.3	4.3
Phosphorous	g/kg	2.03	2.1	2.4	1.8	2.1	3.5
Potassium	Mg/kg	3.54	1.93	1.68	3.1	3.5	2.5
Lead	Mg/kg	Nil	BDL	BDL	BDL	BDL	BDL

Table 3.3 showed characteristics of the paint sludge from month September 2016 to February 2017 for the parameters was analyzed. It was observed that pH was in the range of 7.2-8.2 sludge parameter on sludge drying bed pH was low as compared other two parameter because anaerobic digestion, extract the sludge for one day.

Moisture Content was high in the month of November because collect the fresh sample after disposed on the sludge drying bed, Organic Matter 41 to 66.9, Ash was in the range of 33.2 to 37.91, Bulk Density the value was high because if it is well wet sludge, bulk density become high Iron within the range of 12 to 15.4 Oil & Grease also within the range of 3.2 to 8.1 Lead and Chromium was below detectable limit.

## CONCLUSIONS

- 1) Proper sludge management is an important operation in effluent treatment plants. The paint sludge has hazardous cannot be use or recycle it it can be disposed on landfilling and incineration.
- 2) Dried sludge on sludge drying bed there is no hazardous, strong N,P,K Value these are the plant nutrients, so it can be use as soil conditioner or composting. Which is beneficial to the plant.

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