Management of Paint Sludge In A Tractor Plant

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Abstract- *The primary source of hazardous wastes at a tractor manufacturing plant is the waste paint generated during painting process, and this major waste fraction is "Paint sludge". According to Water Pollution Control Act paint or paint-sludge is categorized as " Hazardous Material " which has to be disposed of as per the rules, "The Hazardous Wastes [Management and Handling] Rules, 1989".The industry has to spend significant money for disposal of the generated paint sludge in the plant. Industry has desired that, the sludge be characterized properly namely for its quality and quantity. In this project, representative paint sludge sample will be collected and analyzed for its physico-chemical properties. This paper gives the process consists of drying the paint sludge for removal of water and organic solvents then pyrolizing the dried paint sludge in an inert atmosphere at temperature about 400 ^{0}C to 650 ^{0}C. The gaseous and liquid material further pyrolyzed for the recovery of some smart materials.*

Keywords- Hazardous, Inert, Organic, Physico-chemical, Pyrolyzed, Significant

I. INTRODUCTION

Industrial painting process generates waste paint during various painting operations. This waste paint washed with the help of circulating water and gets collected in a pit. This mixture of water with waste paint known as "Paint Sludge". This semi-solid lumpy material is classified as a hazardous waste – because if it is thrown freely anywhere on the ground it deteriorates the fertility of soil and lechates generated by it polluted the ground water sources. It is not only harmful for the agricultural land, but also it destroys the flora and fauna of the area wherever it is thrown or disposed off (D. Stephen, 2012).

Major routes for the disposal of the paint sludge are incineration as hazardous waste or combustion at cement kilns. Because of high dissolved organic carbon content of the paint, the paint sludge cannot be accepted by landfills according to European Union Legislations. More investigations are needed in the field of paint sludge recycling such as recycling it as a new paint or as other formulations, or making use of the sludge for the production of construction materials. Research on the applicability of the paint sludge in composting and bio gasification can also be useful (Salihoglu, et al, 2016).

Especially tough problems in the treatment of waste are found in the design of paint spray booth facilities where a large volume of paint sludge waste is generated. Paint sludge includes both organic and inorganic constituents. It is accordingly beneficial to provide a method and apparatus which effectively and economically treat the waste sludge from a painting operation. It is also desirable to provide a method and apparatus which reduce VOC (volatile organic content) emissions and minimize the weight and volume of waste paint sludge while substantially eliminating its hazardous characteristics (Johnson et al. 1990).There have been many attempts , to use paint sludge for creating various useful by products. Paint sludge can be reused as an ingredient in a fruitful process or recovery of a smart product feasibly. Processing of paint sludge is time consuming and costly. Pyrolysis is being suggested on basis of characterization of paint sludge with a purpose to verify and confirm its valorisation by a suitable process. It was also verified if sludge can be converted into activated char after Pyrolysis since resulting char can be used in paint booth water to capture paint and solvents from spray-booth air.

II. MATERIAL AND METHODS

2.1 Collection of Samples

Paint Sludge samples were collected from the industrial area of a Tractor Plant to carry out various testing on it. The sample generated in the plant was red in color i.e. in pure red oxide form.

Fig: Paint Sludge Sample

2.2 Physicochemical Characteristics of Paint sludge:

The characteristics of the paint sludge which mainly delegate the management route, are mainly determined by the type of application technique utilize, the paint used and the chemicals applied such as flocculants, detackifiers, pH boosters, as well as the dewatering techniques preferred. It has high dissolved organic carbon content; the paint sludge cannot be accepted by landfills according to European Union Legislations.

It is mandatory to analyze the paint sludge sample for its physico-chemical parameters for overall study of properties which helps to finalize the disposal method. Physical parameters tested were moisture content, calorific value, bulk density, ash content and organic matter. Paint sludge is considered as hazardous due to the presence of heavy metals and they were iron, chromium, nickel, copper, mercury, zinc, lead. Sample also tested for its total hardness and for pH to check is reactivity.

The two industry agree to same parameter analyze in 2000(Marlow, et.al.2000) HCMC city 30-40% organic matter content, volatile compound of sludge accounts 55-80% dry weight. Therefore, the sludge collection, transportation, treatment and reuse are difficult in 2013 Viet, et al. (2013). The physical and chemical parameters were chosen for the analysis as per Hazardous Waste Management and handling rules, 1989. The analytical procedure was done according to Toxicity Characteristics Leaching Process (TCLP) method.

2.3 Study of Pyrolysis

Ford Research Laboratory has intensively studied applications for paint sludge (Kim et al.1996) addressed the technical feasibility of converting paint sludge into activated char and reusing the char in paint spray booth water to capture paint solvents from spray booth air. They used Pyrolysis reactions to activate paint sludge and tested it as an adsorbent (Kim et al. 1997) developed a process by which water-soluble paint solvents are biologically degraded in an activated sludge reactor (Nakouzi et al.1998) described an alternative to landfill disposal whereby paint sludge is converted into ceramic composites that can be used as reinforcing materials. Pyrolysis is a possible way to make paint sludge become chemically inert. It can be generically defined as thermal degradation in the absence of or with a minimum amount of oxygen, with a sthe chemical industry and for the production of energy (Sodero et al., 1996).

III. RESULTS AND DISCUSSION

3.1 Study of Physical and Chemical Parameters of Paint Sludge Generated in a Tractor Plant

Table 3.1: Physical Characteristics are given below:

Sr. No	Parameters	Unit	Quantity
1	Moisture Content	%	40 – 60
2	Loss on Ignition	%	28 – 72
3	Calorific Value	kcal/Kg	5705
4	Bulk Density	gm/cc	0.78 – 0.93

Table 3.1 shows the physical parameters which plays the vital role in deciding the feasible disposal method for Paint Sludge. As calorific value is higher, the sludge can be pyrolysed easily without consuming much energy.

Table 3.2: Chemical Characteristics are given below:

Sr. No	Parameter	Unit	Value
1	pH	-	7.6
2	Total Hardness	mg/lit	90
3	Iron	mg/lit	0.025
4	Chromium	-	NIL
5	Copper	-	NIL
6	Nickel	mg/kg	0.19
7	Mercury	-	NIL
8	Zinc	mg/kg	0.12
9	Lead	-	NIL

Table 3.2 shows the chemical parameters including presence of heavy metal in the paint sludge. The quantity found is within the limits as per Hazardous Waste Management and Handling Rules, 1989 and it is obtained that there was no harmful effect of sludge on land if it is disposed by land filling also lechates were not formed.

This approach works the best in guidance of fellow researchers. In this the authors continuously receives or asks inputs from their fellows. It enriches the information pool of your paper with expert comments or up gradations. And the researcher feels confident about their work and takes a jump to start the paper writing.

3.3: Study of Pyrolysis Process

Literature survey shows that liquid phase collected during Pyrolysis can consist of benzene, toluene, xylene, and other hydrocarbons which are useful/commercial solvents. Reaction pathway Pyrolysis process is given in Figure 1.

Cost of Pyrolysis including labour and energy required can be reduced by resorting to heating @ 350^{0}C to 400^{0}C.

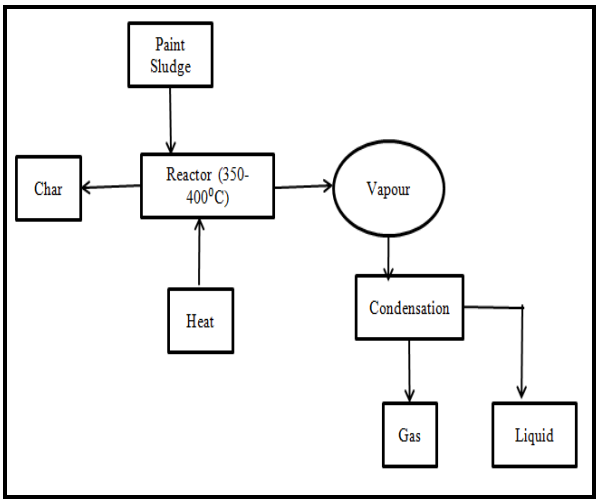

Fig 3.1 Reaction Pathway of Pyrolysis Process

IV. CONCLUSIONS

1. Physico-chemical parameters of paint-sludge were found within the permissible limits as per Hazardous Waste Management and Handling Rules 1989. Hence, no adverse effect on nearby environment.
2. By studying the properties of Paint Sludge, it is found that Land filling and Pyrolysis were feasible methods for disposal.
3. Calorific value of the sample is 5705 Kcal/kg. So it can be suitably disposed by the method of Pyrolysis.
4. After Pyrolysis the sludge can be converted into activated char which is used as moisture adsorbent. It is also used to capture solvents and paint from spray booth air.

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