Design and Fabrication of Extraction Of Fuel From Waste Plastic Using Pyrolysis

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ABSTRACT

There is an increase in the production and consumption of plastics as the day goes by. All plastics need to be disposed after their usefulness, as waste. The needs to manage this waste from plastic become more apparent. This leads to pyrolysis, which is a way of making to become very useful to us by recycling them to produce fuel oil. In this study, plastic wastes (polyethylene) were used for the pyrolysis to get fuel oil that has the same physical properties as the fuel used in aviation industry (JP-4). The experiment was carried out in such a way on, thermal pyrolysis (without the aid of a catalyst). Some of the plastics wastes that are suitable for pyrolysis are: HDPF (high density polyethylene). LDPF (low density polyethylene), polypropylene, polystyrene, polyvinyl alcohol, polyoxymethylene, polyamide, polyurethane, polyphenylene, polyvinyl chloride etc Pyrolysis runs without oxygen and in high temperature of about 430℃.Thus the problems faced by the increasing in plastic waste and the increasing fuel crisis can be eliminated by making a system which can decrease the pollution due to plastic and increasing the availability of the alternative fuel. This was made by converting the waste plastic into useful alternative oil by means of pyrolysis process.

Keyword: - *Polyamide, high density polyethylene, low density polyethylene, pyrolysis , fuel oil.*

1. INTRODUCTION

Plastics are polymeric materials, a material built up from long repeating chains of molecules. Polymers such as rubber occur naturally, but it wasn't until the development of synthetic polymers around 1910 that the polymers tailored to the needs of the engineer first started to appear. One of the first commercial plastics developed was Bakelite and was used for the casting of early radios. Because the early plastics were not completely chemically stable, they gained a reputation for being cheap and unreliable. However, advances in plastic technology since then, mean that plastics are a very important and reliable class of materials for product design. Plastic is a marvel of polymer chemistry, plastics have become an indispensable part of our daily life. But repeated reprocessing of plastic waste, and its disposal cause environmental problems, pose health hazards, in addition to being a public nuisance. The biggest current threat to the conventional plastics industry is likely to be environmental concerns, including the release of toxic pollutants, greenhouse gas and non-bio degrable landfill impact as a result of the production and disposal of petroleum based plastics. Municipal solid wastes which consist of plastics has become indispensable in our society today and the world at large. Due to their light weight, durability, energy efficiency, coupled with a faster rate of production and design flexibility, these plastics are employed in entire gamut of industrial and domestic area. It is mostly used in the production of sachet water bags and the way of controlling its wastes has been very difficult, thus lead to pyrolysis which makes these wastes very useful in the production of hydrocarbons (fuel). pyrolysis is the thermo chemical decomposition of organic rnaterial elevated temperatures in the absence of oxygen' It occurs under pressure and operating temperatures above 430oC (800oF). pyrolysis also requires the use of catalyst to enhance the reaction process. In this study silica-alumina was used as a catalyst**.**

2. LITERATURE REVIEW

The literature towards the design methodologies proposed by different authors is collected and presented in the subsequent paragraphs.

M.F.Ali

Reported that the yield of liquid fuels in the boiling range 100ºC-400ºC and gases were obtained along with a small amount of heavy oils and insoluble materials such as gums and coke. The results obtained on the co-processing Of polypropylene with coal and petroleum residues are very encouraging as this method appears to be quite feasible to convert plastic material into liquefied coal products and to upgrade the petroleum residues and waste plastics.

Miskolczi

Investigated the pyrolysis of real waste plastics (high-density polyethylene and polypropylene) in a pilot scale horizontal tube reactor at 520 °C temperature in the presence and absence of ZSM-5 catalyst. It was found that the yields of gases, gasoline and light oil could be increased in the presence of catalyst. They also concluded that the plastic wastes could be converted into gasoline and light oil with yields of 20–48% and 17–36% respectively depending on the used parameters.

F murfyk

From the recent literature, it is evident that the process of converting waste plastic to reusable oil is a current research topic, preparation of blends of diesel with varying proportions of waste plastic oil produced from the thermal pyrolysis and the analysis of viscosity and density of these blends is presented. The feasibility of the waste plastic oils derived from PVC plastics as an alternate fuel for transportation is also checked by conducting performance test on a single cylinder Kirlosker diesel engine equipped with electrical loading at 50% of the engine maximum load i.e., at 3.7 kW.

3. PLASTICS

A material consisting of very large molecules characterized by light weight, high corrosion resistance, high strength-to-weight ratios, and low melting points. Most plastics are easily shaped or formed.

3.1 Low Density Polyethylene

It is not reactive at room temperature, except by strong oxidizing agents and some solvents causing swelling. It can withstand temperatures of 80ºC continuously and 95ºC for a short time. LDPE is used for manufacturing various containers, dispensing bottles, wash bottles, tubing, plastic bags for computer, and its common use is in plastic bags.

3.2 Reactor

This is a stainless steel tube of length 145mm, internal diameter 37mm, outer diameter 41mm sealed at one end and an outlet tube at the other end. The reactor is to be placed inside the furnace for external heating with the raw material inside for internal heating. The reactor is heated by electrical heating to temperature of about 500ºC and more.

3.3 Condenser

It cools all the heated vapour coming out of the reactor. It has an inlet and outlet for cold water to run through its outer area. This is used for cooling the vapour. The gaseous hydrocarbons at a temperature of about 35OoC are condensed to about 30-35^{o}C.

3.4 Furnace

The furnace provides the heat the reactor needs for pyrolysis to take place, it has a thermocouple to control the temperature.

4. DESIGN OF HEATER SPECIFICATION

1. Coil wounded electric heater
2. Coating: Ceramic coated
3. Temperature: 400-500 deg Celsius
4. Watts: 4000watts
5. Voltage: 230v AC
6. SINGLE PHASE AC

4. WORKING PRINCIPLE

In our experiments, commercialize available shredded plastics were procured and washed before pyrolysis. One of the most favorable and effective disposing method is pyrolysis, which is environmental friendly and efficient way. Pyrolysis is the thermal degradation of solid wastes at high temperatures (300-900nC) in the absence of air (and oxygen). As the structure of products and their yields can be considerably modified by catalysts, results of pyrolysis in the absence of catalyst were presented in this article Pyrolysis of waste plastics was carried out in an indigenously designed and fabricated reactor. Fig shows the scheme of the process involved in the experiments and the photograph of the experimental set up respectively. Waste plastics had been procured form the commercial source and stored in a raw material storage unit. Raw material was then fed in the reactor and heated by means of electrical energy. The yield commenced at a temperature of 350^0C. The gaseous products resulting from the pyrolysis of the plastic wastes is supplied through the copper tube. Then the burned plastic gas condensed in a water cooled condenser to liquid fuel and collected for experiments.

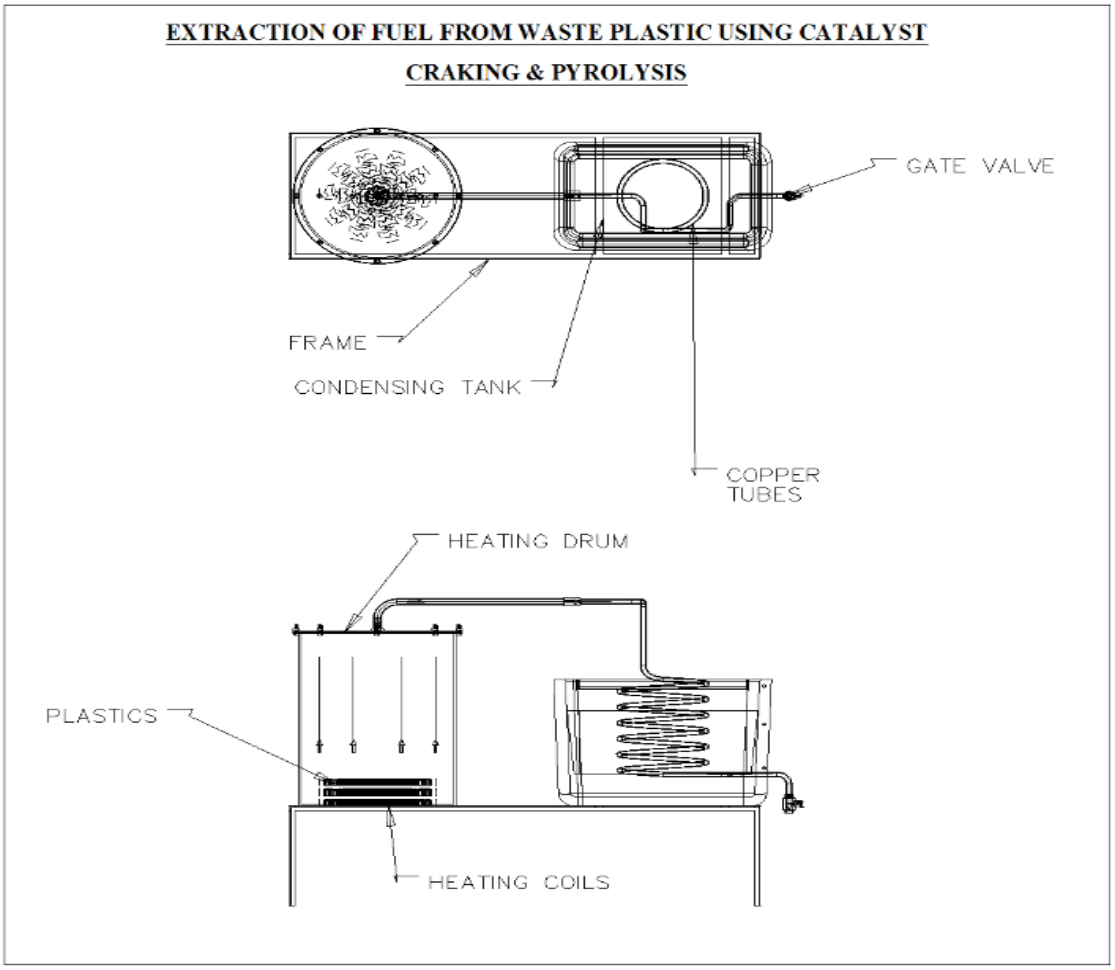

Fig-1:Top view and front view of pyrolysis setup

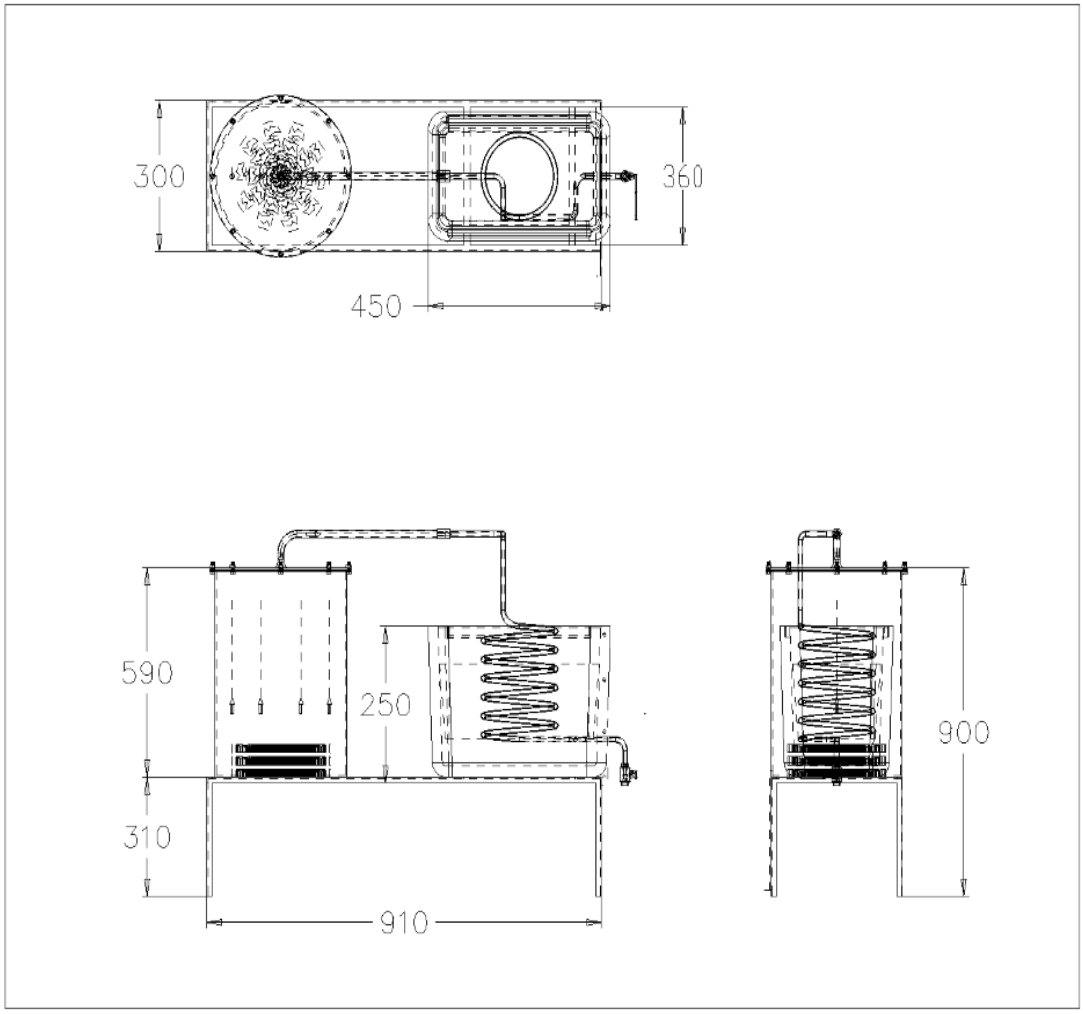

Fig-2: Top view, front view and side view of pyrolysis setup

5. CONCLUSION

A strong multidiscipline team with a good engineering base is necessary for the Development and refinement of advanced computer programming, editing techniques, diagnostic Software, algorithms for the dynamic exchange of informational different levels of hierarchy.This project work has provided us an excellent opportunity and experience, to use our limited knowledge. We gained a lot of practical knowledge regarding, planning, purchasing, assembling and machining while doing this project work.We are proud that we have completed the work with the limited time successfully. The **"EXTRACTION OF FUEL FROM WASTE PLASTIC USING PYROLYSIS"** is working with satisfactory conditions. We are able to understand the difficulties in maintaining the tolerances and also quality.We have done to our ability and skill making maximum use of available facilities. In conclusion remarks of our project work. Thus we have developed a **"EXTRACTION OF FUEL FROM WASTE PLASTIC USING PYROLYSIS"**. By using more techniques, they can be modified and developed according to the applications.

6. REFERENCES

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