DESIGN & FABRICATION OF MACHINE TO EXTRACT BASE OIL FROM PLASTIC

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ABSTRACT

The study focused on the design and fabrication of a machine to extract base oil from waste plastic as an effort in finding environment-friendly means of waste recycling. This is the basic idea behind the paper. Beside helping to remove a lot of plastic waste generated thus creating a neat and tidy environment. It also helps to generate fuel which when converted to convenient form can be used as a source of energy The Pyrolysis process was the basis in the design and fabrication of the equipment. It is a prototype/laboratory scale model that will serve as baseline in developing technology for energy recovery from waste plastics. The main components were the reactor assembly, condensing chamber, vapor line assembly, and the waste water collecting unit. The conversion of waste plastics into fuel is depend upon the type of the plastic that to be used for the conversion

.**Keyword :** Pyrolysis ,Reactor ,condenser,etc

1. INTRODUCTION

This paper will be prepared based upon the properties of plastics. The crude oil will be prepared based upon the types of plastics and its properties. The conversion process of the crude oil will be determined by the pretreatment process. Based on the various conversion techniques the crude oil will be extracted from the wastage of plastics. Although the impact of waste plastic to our health and environment may not always cause noticeable harm or destruction, research indicates that plastic waste in landfill and in badly managed recycling systems could be having an impact from the chemicals contained in the plastic. Plastic is generally derived from petroleum and when placed in landfills becomes carbon sink and if incinerated it increases carbon emissions. It is the process of conversion of plastic to mixed oil in an inert atmosphere or oxygen free atmosphere at elevated temperature. It is used to produce liquid fuel similar to diesel with a higher cetane value and lower sulphur content than traditional diesel6. The advantage of pyrolysis over landfill and incineration is in terms of environmental protection because it reduces the risk of air, water and soil pollution. In pyrolysis, the possibility of recycling is improved, because the resulting product such as gas and liquid can be used as combustible fuel to substitute fossil fuels.

2. PYROLYSIS

It is the process of conversion of plastic to mixed oil in an inert atmosphere or oxygen free atmosphere at elevated temperature. It is used to produce liquid fuel similar to diesel with a higher cetane value and lower sulphur content than traditional diesel6.

2.1 PHYSICAL PROCESS INVOLVED

Performing pyrolysis process the plastic starts melting and after melting process gaseous phase occur. The mixture of gases formed are again converted into liquid by condensation process. After the condensation process, layer of oil is appeared above water.

2.2 CHEMICAL PROCESS INVOLVED

Conversion of plastic into fuel involves thermal depolymerisation or catalytic thermal depolymerisation process. By increasing temperature the vibration amplitude of plastic's molecules increases and at an optimum temperature bond of plastic molecule is cleaved and converted into gaseous form. The above process can also be referred as Random thermal depolymerisation process, because the bond is breaking randomly.

2.2.1 THERMAL DEPOLYMERISATION PROCESS

In this process only high temperature pyrolysis is employed in order to increase entropy (randomness) of plastic molecules. The Pyrolysis Oil obtained from this process is crude oil having major quantity of heavy oil .According to the Japanese Blest company temperature range between 400 to 450 degree Celsius is suitable for the production of lighter mixed oil in which diesel and heavy oil etc are major constituents7,8. But by increasing temperature beyond 500 degree Celsius heavy oil constituent increases and quantity of oil decreases. However quantity of gaseous components increases due to the formation of non condensable gases of small chain length. But this gas is equivalent to the LPG (may require refining).

Above mentioned temperature is suitable for PE, PP and PS and not for PET bottles and PVC pipes. Through this process mixed oil is obtained which needs refining process for better output. According to the Japanese blest company the oil is obtained after refining process has following composition8.

Averagely,

Kerosene equivalent: 20-30%

Gasoline equivalent: 15-20%

Diesel oil equivalent: 20-30%

Heavy oil equivalent: Remains.

But above composition also depends upon the composition of plastic used.

3. . DESIGN OF MACHINE

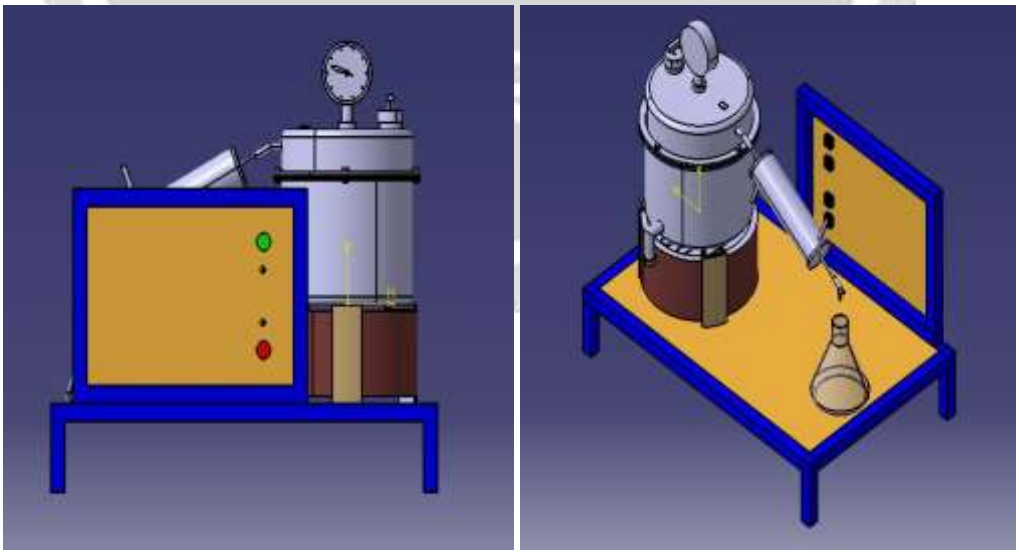
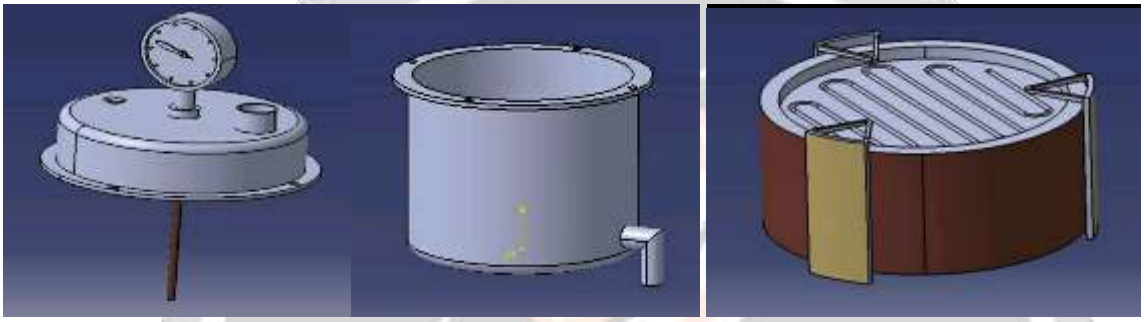


Fig.1. This is design (CAD) of machine.

Waste plastic is raw material for this machine (Fig.1.), it converts waste plastic into mixture of gases by providing heat from electric heater in a closed container. These gases are again converted into crude oil by condensation process with the help of water at room temperature and the non condensable gases can be collected into another chamber for further uses. The pyrolysis oil can be recovered from machine by opening upper tap. Design of this machine is also suitable for experimentation.

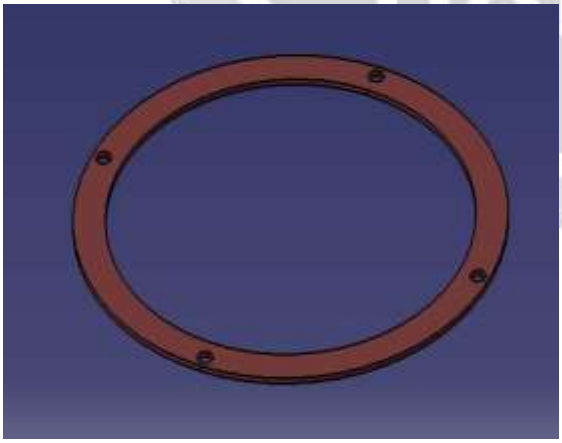
4. SPECIFICATION OF EACH PART OF THIS MACHINE

4.1 REACTOR PARTS



A Container or apparatus in which substance are made to react chemically. The Reactor has a wall thickness of 5 mm and is made up of ALUMINIUM ALLOY. The reactor has 2-heaters with 2 KW capacities each.

4.2 GASKET



Minimum Contact Pressure, Pc=Pi×[(G/4b)+m]

Gasket is used to provide mechanical seal and it also fills the space between two surfaces.

4.3 CONDENSOR

Condenser is a device or unit which is used to condense vapour into liquid. The Condenser has a wall thickness of 4 mm and is made up of mild steel, which is surrounded by a water jacket. The condenser has pre- installed copper tubes running inside in a coiled fashion. The copper tubes consist of a vapour coming from the reactor and is surrounded by water from all sides. Continuous flow of water is made inside the condenser by connecting the pipe from tap. The condenser contains a outlet copper tube at bottom , from where we can extract the plastic oil.

4.4 HEATER

These heaters are used for plastic molding, extrusion and molding presses or any application where there is a need to apply heat to a cylindrical surface.The capacity of heater is 2kw. The maximum the heater can heat is up to 600˚C.

4.5 TYPE OF PLASTIC USED IN MACHINE

Polyethylene (HDPE, LDPE, LLDPE), polypropylene and polystyrene are the types of plastic which can be converted into oil, whereas PVC and PET bottles are non convertible by this machine because both require temperature more than 500 degree Celsius and PVC cracking is not preferable in the fuel product because chloride is not desirable in the fuels.12

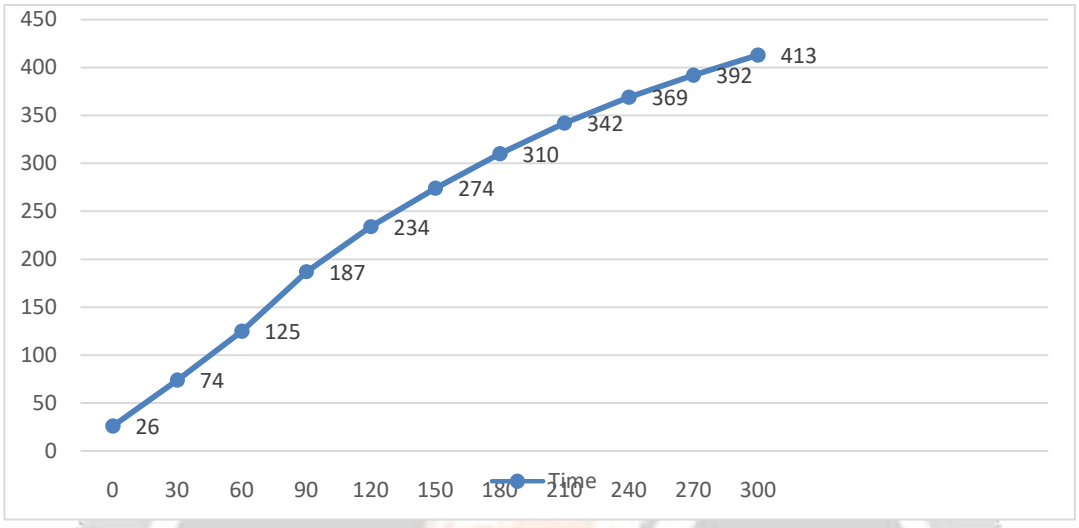
5. RESULT & CONCLUSION

The output products of this machine are pyrolysis oil, hydrocarbon gas and carbon black charcoal. Hydrocarbon gas is very less emitted, after condensation it can also be used for daily domestic purpose. Obtained oil can be used in stove, generator or other daily domestic purpose, but for commercial purpose obtained oil needs refining and after refining process this oil is equivalent to diesel and petrol. physical properties of petrol and diesel obtained after the distillation of mixed oil or pyrolysis oil14.

5.1 READINGS:-

Parameters	Trial				Average
	1	2	3	Total	
Weight of Plastic (Kg)	3	3	3	9	3
Duration of Experiment	5 Hr 10 min	5 Hr 20 min	5 Hr 23 min	15 Hr 53 min	5 Hr 17 min
Volume of Oil (ml)	1200	1180	1250	3630	1210
Weight of Charcoal (gm)	630	590	510	1730	1390

5.2 GRAPH:-



6. ACKNOWLEDGEMENT

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