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EXTRACTION OF FUEL FROM WASTE PLASTIC

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ABSTRACT

In the today's world due to increase in population, industrialization and use of automobiles and, there is increase in demand of fuel all around the world. Since today's non-renewable energy sources are not sufficient to meet those requirements. Therefore, it is required to explore alternative energy sources. Thus this energy can be obtained by the artificial fuel which can be extracted from waste plastic which is indispensable in the nature. Since, due to indispensable property of plastics, it cannot be decomposed in the environment naturally.

This paper deals with process of extraction of fuel from waste plastic by using pyrolysis process.

Keywords: Pyrolysis, Waste Plastic, Fuel, etc.

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I. INTRODUCTION

In India, on the basis of the survey carried out by Central Pollution Control Board (CPCB), about 5 million tons of waste plastic is generated per year, out of which about 50 % of plastic can be recycled. But left of the plastics dumped in dump yard and some of it is thrown into water resources such as rivers, oceans, etc. Due to uneven management of such plastic waste, dumping of plastic on land can lead to make the land infertile due to its toxic and harmful properties. Also the discarded bottles and other plastic materials may harm aquatic animals, sea birds and other living organisms. Now a day, many techniques are implemented to extract the fuel from waste plastic.

Pyrolysis process is one of the best process which extracts the fuel from the plastic as well as dispose off the waste plastic which is harmful to environmental health.

Pyrolysis is chemical reaction which involves molecular breakdown of larger molecules into smaller molecules in presence of heat and oxygen free environment. Products of pyrolysis process are vapors and liquid which a1re termed as biofuel and remaining product of the process is carbon content called as char.

Prajakta Sontakke[1],issued a paper in 2014 on "Fuels From Plastic Wastes". This research paper focuses on improvisation of technique of process of conversion of process of conversion of waste plastic into fuel with the hope of lowering of fuel prices in the future.

Manish Chand Sharma[2],issued a paper in 2013 on."Production of alternative fuel from waste oil and comparison with fresh diesel ". This research paper compares with blend of fresh diesel and diesel obtained from pyrolysis of used engine oils with conventional diesel oil.

II. PARTS OF SETUP

We need following parts to for setup of unit to extract fuel from plastic waste

Table No. 1

Sr. No.	Part Name	Material Used	Quantity
1	Frame	M.S.	1
2	Heating Chamber	M.S.	1
3	Insulator Sheet	Stainless Steel	1
4	Condenser	Stainless Steel	1
5	Top Plate	M.S.	1
6	Reducer	Galvanized Iron	1
7	Copper Coil	Copper	1
8	Coil Holder	Ceramic	1
9	Heating Element	Nichrome	1
10	Vessel Insulation	Fibre Glass Wool	1

11	Nut Bolt Washer	Steel	8
12	Gasket	Asbestos	1

Fig.-1: Proposed assembly of setup

Pyrolysis Process:

Pyrolysis is the chemical process in which the plastic is heated in non oxygen environment where it is melted at about 400°C and the process results in formation of vapors and liquid in the heating chamber.

The plastic loaded heating chamber is heated for about 45 minutes by employing heating element which is hold into ceramic coil holder made up of ceramic. Then the vapors produced in heating chamber are passed into copper coil to condenser through reducer. In condenser high temperature vapors is condensed. This condensed liquid have the properties nearly similar to standard properties of crude oil. It is collected in the fuel collector after condensation.

Fig.-2: Experimental Setup

III. DESIGN

Mild Steel (C45) has certain desirable properties such as good welding ability and is capable to withstand for higher temperature (i.e. up to 1500˚C).Therefore, this metal is selected to design the component such as Heating Chamber, Top Plate, Nut, Bolt etc.

Design for heating chamber:

According to heater face dimension,

Diameter of coil holder=190mm.

For more heat transfer from coil to heating chamber allowing , the internal diameter of heating chamber to extent by 20mm.

Inner diameter of heating chamber=210mm.

Material for shell selected=C45=0.45%carbon.

Design pressure, Pi=4bar=0.4 N/mm^2.

Operating temp=400˚C

$\sigma ut = 320\ N/mm^2$……. [for Mild Steel]

Take factor of safety

F.O.S=4

Tensile Stress,

$$\sigma t = \frac{\sigma ut}{F.O.S} = \frac{320}{4} = 80\frac{N}{mm^2}.$$

Shear Stress,

$$\sigma s = \frac{\sigma t}{2} = \frac{80}{2} = 40\frac{N}{mm^2}.$$

Also, joint efficiency of fillet welding (Higher)

$\eta t = 80\%$

According to Hooke's Law,

By, circumferential stress criteria,

Thickness,

t= (Pi*Di) / (2*$\sigma t * \eta t$)

t= (0.4*210) / (2*80*0.8)

t=0.66mm

Adding, corrosion allowance=1.5 mm , we get,

t=0.66+1.5=2.16mm.

t $\approx$ 3mm [say]

But, we are using 5mm thick cylinder. So, our design is safe.

t=5mm.

Outer diameter of heating chamber= 220 mm .

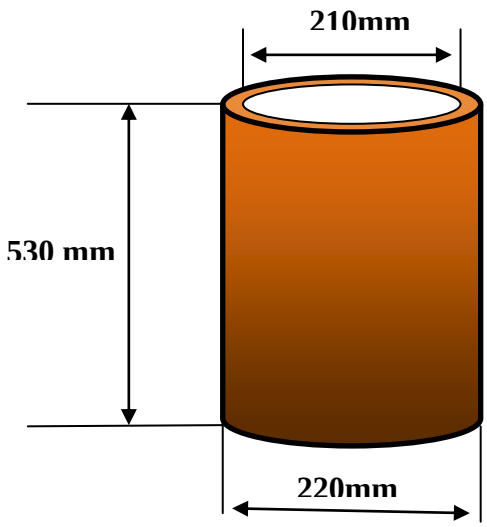

Fig.-3: Heating Chamber

IV. RESULT

For experimentation on above setup we obtain the following results,

Amount of plastic loaded	Amount of fuel extracted
2kg	1300ml

Therefore, we get about 75% fuel quantity from the plastic.

V. CONCLUSION

This paper provides the solution for extraction of fuel from waste plastic by pyrolysis process. Implementation of this process can effectively reduce the hazardous effect of the plastic on the environment. The properties of liquid obtained from the setup are nearly equal to commercial fuel.

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