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Design and Fabrication of System to Convert Waste plastic into Crude oil

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Abstract- The study focus on the design and fabrication of System to convert plastic into oil as an effort in finding environment-friendly means of waste recycling by means of pyrolysis. It is an alternative solution to increasing problem of waste disposal. Pyrolysis keeps an added fuels such as petrol, kerosene, and diesel. Our Project deals with the extraction of oil from the waste plastics termed as plastic pyrolyzed oil which cuberunning without oxygen and in high temperature of around 250°C for which reactor is manufactured to give the expected temperature to theresponse. The waste plastics are subjected to depolymerization, pyrolysis, catalytic cracking and fractional distillation to obtain different value marketed at much cheaper rates compared to that present in the market. As we know that both Plastics and Petroleum derived fuels are Hydrocarbons that contain the elements of Carbon & Hydrogen.

Keywords- Plastics,Pyrolysis.

1. INTRODUCTION

Plastics are one of the most commonly used materials in our daily life and offer remarkable contribution to the society. They are widely used in packaging and manufacture of products includingelectronic, automotive, etc. Plastics are light weight and can be simply formed. They show non-corrosive behavior. They are reusable and conserve natural resources. Resultantly, there has been a quick development in plastic utilization and plastics have been utilized as substitution to wood and metals.Plastic was invented by Alexander Parkes in 1860 and has high molecular mass. They are synthetic organic materials produced by polymerization. They may contain other substances besides polymers to reduce costs and to improve performance. Desired shape can be given to these polymers by molding or by extrusion Pyrolysis involves the heating and degradation of the polymeric materials at temperatures between 250°C and 350°C without oxygen bringing about the arrangement of a carbonized singe (strong deposits) and an unpredictable division which might be isolated into condensable hydrocarbon oil and a non-condensable high caloric esteem gas. Scheirs expressed that gases framed amid the pyrolysis of natural material incorporate carbon monoxide, hydrogen, methane, carbon dioxide, water, and hydrocarbons, similar to ethane, ethane, propane, propane, butane, and so forth. The temperature and heating rates can be controlled to produce desired solid, gas and liquid products because they have considerable influence in the pyrolysis process. Yin have considered pyrolysis of waste plastic as one of the most feasible large-scale methods of energy regeneration. This is because waste plastic is a valuable source of liquid and gas fuels as well as chemicals

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2. OBJECTIVES

- Studying different types plastics and to find out environmental effects by plastics.
- To develop and fabricate the machine to convert plastic material into crude oil.

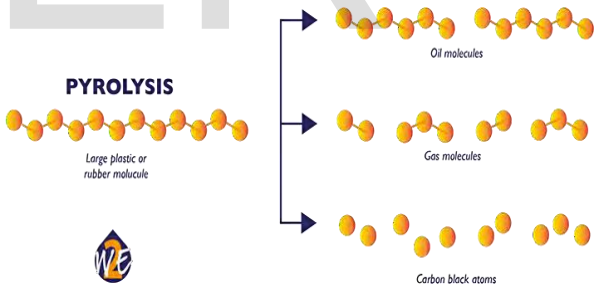
Polyethylene terephthalate(PET):
PET has become the great choice for plastic packaging for various food products, mainly beverages such as mineral water, soft drink bottle and fruit juice containers. This is due to its intrinsic properties that are very suitable for large-capacity, lightweight and pressure-resistant containers. Different utilizations of PET incorporate electrical protection, printing sheets, attractive tapes, X-ray and other photographic film.

High-density polyethyleneHDPE):
HDPE is characterized as a long linear polymer chain with high degree of crystallinity and low branching which leads to high strength properties. Because of its high quality properties, HDPE is generally utilized as a part of assembling of drain bottles, cleanser bottles, oil compartments, toys and the sky is the limit from there.

Mixedplastics:
As already said, pyrolysis process has an additionalfavorable position over the reusing procedure since it needn't bother with an extreme arranging process. In recycling process, most plastics are not compatible with each other to be processed together during recycling. For example, a slight measure of PVC contaminant introduce in PET reuse stream will debase the entire PET gum by getting to be yellowish and weak that requires reprocessing .This shows that recycling process is very sensitive to contaminants that it requires all plastics to be sorted based on type of resins, colors and transparency. However, pyrolysis process seems to be more sustainable since liquid oil still can be produced from the mixed plastics in the feedstock. This has been encountered by several researchers who conducted studies of mixed plasticspyrolysis.

Fig:PYROLYSISPROCESS

Pyrolysis is the thermal decomposition of materials at higher temperatures in the absence of oxygen (or an inert atmosphere).It is a chemical reaction process which involves molecular breakdown of larger molecules into smaller molecules in the presence of heat.It includes the difference in concoction arrangement and the procedure is irreversible. The word pyrolysis is begat from the Greek-determined components pyro which signifies "fire" and lysis which signifies "isolating".



The most common application of pyrolysis is applied to the treatment of organic materials. It is one of the processes involved in charring wood, starting at temperature range of 250°C–350°C. During pyrolysis of organic substances, it produces volatile products and leaves a solid residue which is rich in carbon, char. Extreme pyrolysis leaves mostly carbon as the residue which

is calledcarbonization

3. PYROLYSIS OF PLASTIC

Production of fuel from waste plastic involves pyrolysis process. In this process, plastic is rapidly heated to 250^{o}-350°C in a reactor in the absence of oxygen. The temperature required depends on the types of plastics used. Once the melting point is reached, the plastics melts and the vapour rise up and is collected in the condensing unit. Water is used to condense the vapour. The condensed vapour is collected above the water due to the density difference of the oil and water. Finally, the oil is poured out of the condensing unit through the tap provided. The pyrolysis of plastic gives out the mixture of fuel, gases and solid char. Variation of the pyrolysis process, type of plastic used and the temperature will produce the varying percentage of these threeproducts

Fig: Collection of plastic

Fig:Condensing process

Fig:Experimental setup

4. PROPERTIES OF PLASTIC PYROLYSIS OIL

Density: -

Density of fuel at different temperatures was measured by a standard 25 ml marked flask. Weight of the fixed volume of fuel (25 ml) was measured at different temperatures by an electronic balance which measures up to 0.0001

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gm. The density values are reported in kg/m3.

Calorific value: -

The calorific value of a fuel is the quantity of heat produced by its combustion at constant pressure and under normal conditions. Calorific value determined by using bomb calorimeter.

Viscosity: -

Viscosity is an important property fuel and it is fluid's resistance to the flow (shear stress) at a given temperature. Fuel viscosity is specified in the standard for diesel fuel within a fairly narrow range. Hydrocarbon fuels in the diesel boiling range easily meet this viscosity requirement. The viscosity range for typical fuels overlaps the diesel fuel range with some fuels having viscosities above the limit. If fuel viscosity is extremely excessive, there will be a degradation of the spray in the cylinder causing poor atomization, contamination of the lubricating oil, and the production of black smoke. Kinematic viscosity takes into account the fluid density and centistokes is the engineering unit used to express the **Comparison of Properties of the Waste plastic fuel and Diesel Fuel**

Sl. No	Properties	Plastic Fuel	Diesel fuel
1	Density (kg/m^3)	818	812
2	Calorific Value	44,080	43,000
3	Kinematic Viscosity	2.3	3.10
4	Flash Point (c)	-	69
	Fire Point (c)	41	78

5. CONCLUSION

Plastic bears a major threat to the current scenario and the environment. Millions of tonnes of plastics are produced on the daily basis and only few percentage of the waste plastic are being successfully recycled. Since, plastic takes long years to decompose, some alternative to plastic should be developed. Also, the world is facing the problem of shortage of petroleum.

Therefore, conversion of waste plastic into fuel can provide a better solution to the disposal problem of waste plastic as well as act as an alternative to fossil fuel. From the experiments and trials, we also found that by using pyrolysis method we were able to get recover 80-85% oil for polypropylene plastic (Type-5). However, the output varies depending on the type of plastic used. Also, the plastic fuel showed properties similar to that of diesel fuel

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