International Journal of Latest Engineering Research and Applications (IJLERA) ISSN: 2455-7137

Volume –06, Issue – 07, July 2021, PP – 30-34

Artificial Fuel Production Technique using Plastics Materials

Sunil Kumar M[1], Navin Budha[2], Nissan Koirala[3], Upendra V[4], Sujan Subedi[5]

[1](Assistant Professor, Department of Mechanical Engineering, Bangalore Technological Institute, India)

[2](Mechanical Engineering, Bangalore Technological Institute, India)

[3](Mechanical Engineering, Bangalore Technological Institute, India)

[4](Mechanical Engineering, Bangalore Technological Institute, India)

[5](Mechanical Engineering, Bangalore Technological Institute, India)

Abstract: Plastic was invented by Alexander Parkes in 1860. Plastics have become a crucible part in today's world. Due to their light weight, durability, design flexibility, they are excessively used in industry as well as household and other fields The waste plastics are subjected to depolymerization, pyrolysis, catalytic cracking and fractional distillation to obtain different value-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 can be marketed at much cheaper rates compared to that present in the market

Pyrolysis process becomes an option of waste-to-energy technology to deliver bio-fuel to replace fossil fuel. The advantage of the pyrolysis process is its ability to handle unsort and dirty plastic. The pre-treatment of the material is easy. Plastic is needed to be sorted and dried. Pyrolysis is also nontoxic or non-environmental harmful emission unlike incineration. In this investigation, plastic waste (poly propylene) is utilized for pyrolysis to get fuel oil that has comparable physical properties as the energizes like petroleum, diesel and so on Converting waste plastics into fuel hold great promise for both the environmental and economic scenarios.

Keywords: Pyrolysis, Mixing, depolymerization, Converting, Pretreatment and Fossil- fuel.

I. 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 including electronic, 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 ring (strong deposits) and an unpredictable division which might be isolated into condensable hydrocarbon oil and a non-condensable high caloric esteem gas. SC heirs expressed those 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.

Mainly there are two types of plastics: thermoplastics and thermosetting plastic. If enough heat is supplied, thermoplastics can be softened and melted repeatedly. On cooling, they are hardened, so that they can be made into new plastics products. Examples are polyethylene terephthalate, polystyrene, polyvinyl chloride, high-density polyethylene, low-density polyethylene, poly propylene etc. They are recyclable. Thermosets or thermosetting plastics can be melted and shaped only once. It is not good to repeatedly heat treat such plastics; therefore, they remain in solid state after they have been solidified. Examples are epoxy resin, phenol formaldehyde and urea formaldehyde.

II. LITERATURE SURVEY

Achyut K. Panda, R.K. Singh, D.K. Mishra[1], "Thermolysis of waste plastics to liquid fuel". In this research projects he used wide range of old and new technologies for chemical recycling of waste plastic to liquid fuel.

Tiwari D.C., Ejaz Ahmad, Kumar Singh K.K [2], wrote on catalytic cracking process in which waste plastic is melted and cracked in the absence of oxygen and at very high temperature, the resulting gases were cooled by condensation and resulting crude oil was recovered. From this crude oil various products petrol, diesel and kerosene etc. can be obtained by distillation.

C. Wongkhorsub, N. Chindaprasert [3], Published a paper in July 2013 titled "A Comparison of the Use of Pyrolysis Oils in Diesel Engine". This research describes a comparison of the use of pyrolysis oils which are the plastic pyrolysis oil and diesel oil in the assessment of engine performance, and feasibility analysis. Pyrolysis oils and waste plastic are studied to apply with one-cylinder multipurpose agriculture diesel engine. Thus, a comparison between the two is studied.

Miskolczi [4], 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.

Yasha Shukla, Hemant Singh, ShiwangiSonkar and Deepak Kumar [5], The paper titled "Design of Viable Machine to Convert Waste Plastic into Mixed Oil for Domestic Purpose" states in the abstract that the aim of the article is to provide a more efficient design of machine to convert waste plastic into mixed oil for domestic purpose. In this machine daily domestic waste like polyethene, polypropylene or normal plastic carrying bag are converted to oil. This machine employs a closed container (stainless steel), temperature controlling electric heater and layers of insulating materials, these materials make machine more efficient and safer for use. For effective pyrolysis process the temperature of mild steel container (full of waste plastics) is raised by temperature controlling electric heater and for condensation process, water at room temperature is employed.

Manish Chand Sharma, NeeleshSoni [6], Issued a paper in 2013 on "Production of alternative fuel from waste oil and comparison with fresh diesel". This research paper compares the diesel obtained from pyrolysis of plastic oil with conventional diesel oil.

III. OBJECTIVES AND METHODOLOGY

3.1 Objectives

- To build up the reason for the improvement and execution of waste plastics reusing with the use of Environmentally Source Technologies (EST). To advance asset protection and ozone depleting substances.
- To raise awareness in developing countries on plastic waste and its possible reuse for conversion into diesel or fuel.
- To reduce the dependency on gulf countries for fossil fuels, thereby contributing to the economic growth of the country.
- To collect the household plastic waste from different places.
- To develop and fabricate the pyrolysis unit to produce liquid fuel from plastic waste.
- Conversion of household plastic waste in to liquid fuel.
- To purify the produced liquid fuel by water washing method.

3.2 Methodology

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^{o}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 called carbonization.

Pyrolysis process finds a heavy application in the chemical industry as well. For instance, it is utilized to deliver ethylene, numerous types of carbon, and different chemicals from oil, coal, to create coke from coal. Aspirational applications of pyrolysis would be to convert waste plastics back into usable oil, or waste into safely disposable substances.

Pyrolysis varies from other high temperature forms like ignition and hydrolysis. It as a rule does not include the expansion of different reagents, for example, oxygen (O_2, in burning) or water (in hydrolysis). However, in practice, it is often not practical to achieve a completely oxygen or water-free conditions, because some amount of oxygen is always present which cause oxidation **as**

Production of fuel from waste plastic involves pyrolysis process. In this process, plastic is rapidly heated to 250^0-350°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 vapor rise up and is collected in the condensing unit. Water is used to condense the vapor. The condensed vapor 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 three products.

Various technologies and methodologies can be used for the pyrolysis process such as batch reactor, semi batch reactor, fluidized bed reactor, fixed bed reactor etc. The process can be performed with or without the use of catalyst. The different types of catalyst that can be used for plastic pyrolysis are zeolite, alumina (Al_2O_3), silica (SiO_2), etc.

IV. WORKING PRINCIPLE

In Pyrolysis process plastic was cut into a number of small pieces. The plastic chips were washed, dried, and fed into a pyrolysis reactor unit. Fig. 1Shows the pyrolysis reactor Chamber used in this process is in cylindrical form. The reactor was placed inside the Burner. The Burner has a capacity of 3Kw. Fig. 2 Shows the indicator by means of high temperature outside the reactor vacuum was crated inside of reactor. Inside the Reactor thermocouple is used as a sensor which isconnectedwith temperatureindicator to indicate control the temperature of reactor. The process was carried out between the temperature ranges of 250^oC-350^oC outside of reactor for 1 hours and 30 minutes. The products of pyrolysis are in the form of vapor were send to a water-cooled condenser shown in Fig. 3 and the condensed liquid was collected as a fuel and we will get the fuel in the wax form. The main parts or components used in this project are listed below can be seen in Fig. 4.

1. Reactor unit
2. Artificial condenser
3. Thermocouple
4. Indicator
5. Storage tank
6. Condensing unit
7. Burner

V. FIGURES

Fig. 1 Air Filter

Fig. 2 Pressure Gauge

Fig. 3 Mixing Chamber

Fig. 4 Completed Project Model

VI. CONCLUSION ANDFUTURE SCOPE OF WORK

6.1 Conclusion

Plastic bears a major threat to the current scenario and the environment. Millions of tons of plastics are produced on the daily basis and only few percentages 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.

Hence, we can conclude that pyrolysis of plastic into fuel can solve both the problem of plastic waste management as well as shortage of fossil fuel if plant is set up at the commercial level.

6.2 Future Scope of Work

- It can replace the delegacy of fuel in diesel engines.
- We precisely going to terminate the problems of disposal and eco-friendly environment.
- The project will reduce the dependency of gulf country and will make the country economical.
- We will solve the energy crisis.
- If we replace the condenser by compressor, we can make the project more efficient.

REFERENCES

[1] **Achyut K. Panda, R.K. Singh, D.K. Mishra: -** Thermolysis of waste plastics to liquid fuel. A suitable method for plastic waste management and manufacture of value-added product A world prospective, 2009; 1-6: 10-11

[2] **Tiwari D.C., Ejaz Ahmad, Kumar Singh: -** K.K. International Journal of Chemical Research, ISSN: 0975-3699, Volume 1, Issue 2, 2009, pp-31-36

[3] **C.Wongkhorsub, N. Chindaprasert: -** "A Comparison of the Use of Pyrolysis Oils in Diesel Engine", Energy and Power Engineering, July2013).

[4] **N. Miskolczi**, Fuels by pyrolysis of waste plastics from agricultural and packaging sectors in a pilot scale reactor Fuel Processing Technology 90 (2009) 1032–104

[5] **Yasha Shukla, Hemant Singh, ShiwangiSonkar and Deepak Kumar: -** "Design of Viable Machine to Convert Waste Plastic into Mixed Oil for Domestic Purpose", International Journal of Engineering Research and Development, e-ISSN: 2278-067X, p-ISSN: 2278-800X, www.ijerd.com, Volume 12, Issue 4 (April 2016), PP.09-14

[6] **Manish Chand Sharma, NeeleshSoni: -**The International Journal of Engineering and Science (IJES), Volume-3 (54-58),2013, ISSN(e): 2319 – 1813 ISSN(p): 2319 –1805

