International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 07 Issue: 04 | Apr 2020 www.irjet.net p-ISSN: 2395-0072

Fuel from Plastic Waste

Rashid MP [1], Harikrishnan KP [2], Hashim Fayis PM[3], Hasil Rahman CK[4], Javid Rahman V[5], Nishil Jacob[6], Sabirmon[7]

[1]Lecturer, Department Of Mechanical Engineering, Orphanage Polytechnic College, Edavanna, Kerala, India.
[2,3,4,5,6,7]Diploma students, Department Of Mechanical Engineering, Orphanage Polytechnic College, Edavanna, Kerala, India

---

Abstract - Plastics have woven their way into our daily lives and now pose a tremendous threat to the environment. Over a 100million tones of plastics are produced annually worldwide, and the used products have become a common feature at over flowing bins and landfills. Though work has been done to make futuristic biodegradable plastics, there have not been many conclusive steps towards cleaning up the existing problem. Here, the process of converting waste plastic into value added fuels is explained as a viable solution for recycling of plastics. Thus two universal problems such as problems of waste plastic and problems of fuel shortage are being tackled simultaneously. In this project, plastic wastes (low density polyethylene)were used for the pyrolysis to get fuel oil that has the same physical properties as the fuels like petrol, diesel etc. Pyrolysis runs without oxygen and in high temperature of about 300°C which is why a reactor was fabricated to provide the required temperature for the reaction. The waste plastics are subjected to depolymerisation, pyrolysis, thermal cracking and distillation to obtain different value added fuels such as petrol, kerosene, and diesel, lube oil etc.

***Key Words*:** Waste plastic, Pyrolysis, condensation, petrol oil.

INTRODUCTION

Plastic waste production and consumption is increasing at an alarming rate, with the increase of human population. Over1.3 billion metric ton of plastic is being manufactured every year to meet demands of modern world. Plastic is material consisting of any of a wide range of synthetic or semi-synthetic.so can be molded into solid objects. In the world of total 100 million tons of plastic is manufactured to meet global demand this much production consumption of plastic is a threat to environment. Right now, many other process is used to decompose the plastic and to recycle also like land filling, mechanical recycling, biological recycling which takes several years. So, alternatives with more benefits are needed to increase the decomposition of plastic waste into a needed product or something. So, a recycling process is found and worked on to decompose waste plastic into value added product that is fuel. The process is known as Pyrolysis. Pyrolysis is the thermal decomposition of plastic at high temperatures in an inert atmosphere. It involves a change of chemical composition of plastic to hydrocarbon compounds and is irreversible. Applications of pyrolysis are waste plastics back into usable oil, or waste into safely disposable substances. The growing of plastics demand affects the petroleum resources availability as non-renewable fossil fuel since plastics were the petroleum-based material. The objective of our project is the production, characterization and evaluation of alternative plastic fuel from pyrolysis of Polyethylene, Polypropylene. The subject of the project is the conversion of plastic waste into fuels.

PROCESS INVOLVED

1. Raw materials: The Raw material used for extracting oil by the process of Pyrolysis is Polypropylene (PP).

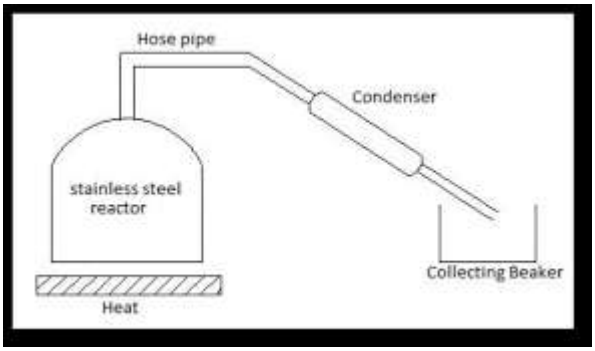
2. Heat treatment: The waste plastic that are collected is heated in a air tight oil tin can.

3. Pyrolysis: A recycling process is found and worked on to decompose waste plastic into value added product that is fuel. The process is known as Pyrolysis. Pyrolysis is the thermal decomposition of plastic at high temperatures in an inert atmosphere.

4. Filteration and purification: The obtained plastic fuel is not a perfect fuel so, this fuel is filtered and purified for getting pure fuel.

5. Fuel testing and Analysis: The purified fuel is to be tested to find out its characteristics. In order to interpret the quality and properties of fuel, various tests were carried out in the laborotary under various testing conditions. The tests performed were: Colour, Density, Viscosity, Calorific Value, Flash Point, Ash Content and fire point.

SYSTEM LEVEL AND COMPONETS DESIGN



1-Plastic waste
2-Copper pipe
3-Condenser
4-Supporting stand

PRINCIPLE INVOLVED

All plastics are polymers mostly containing carbon and hydrogen and few other elements like chlorine, nitrogen, etc. Polymers are made up of small molecules, called monomers, which combine together and form large molecules, called polymers. When this long chains of polymers break at certain points, or when lower molecular weight fractions are formed, this is termed as degradation of polymers. This is reverse of polymerization or de-polymerization. If such breaking of long polymeric chain or scission of bonds occurs randomly, it is called Random depolymerisations. Here the polymer degrades to lower molecular fragments. In the process of conversion of waste plastics into fuels, random depolymerisation is carried out in a specially designed reactor in the absence of oxygen and in the presence of coal and certain catalytic additives. The maximum reaction temperature is 350oC. There is total conversion of waste plastics into value-added fuel products.

RESULT AND TESTING

The plastic waste is converted into fuel by the various process.

The characteristics such as colour, flash point, fire point, density, viscosity, ash content and calorific value are compared with obtained plastic fuel and diesel.

CONTENT	PLASTIC PETROL	DIESEL
Colour	Reddish orange	Bright yellow
Flash point	27◦C	42◦C
Fire point	36◦C	52◦C
Density	835Kg/cm^3	980Kg/cm^3
Viscosity	5.8cm^2/s	2.23cm^2/s
Ash content	Nil	0.1
Calorific value	49150 KJ/Kg	45000 KJ/Kg

Table-1: Testing of plastic petrol and diesel.

ADVANTAGES AND DISADVANTAGES

The main advantages of plastic petrol from plastic wastes are reduce pollution, helps in plastic degradation, cheaper quality fuel, raw material is readily available, simple process, no machinery is used, helps to clean our cities and reduce global warming. The disadvantages of plastic petrol from plastic are unsafe, unhygienic ,it produces unpleasant smell, problems to respiratory organs, large amount of plastic wastes are required to produce fuel and high temperature is also required for heating.

CONCLUSIONS

Plastics present a major threat to today's society and environment. Over 14 million tons of plastics are dumped into the oceans annually, killing about 1,000,000 species of oceanic life. Though mankind has awoken to this threat and responded with developments in creating degradable bio-plastics, there is still no conclusive effort done to repair the damage already caused. In this regard, the catalytic Pyrolysis studied here presents an efficient, clean and very effective means of removing the debris that we have left behind over the last several decades. By converting plastics to fuel, we solve two issues, one of the large plastic seas, and the other of the fuel shortage. This dual benefit, though will exist only as long as the waste plastics last, but will surely provide a strong platform for us to build on a sustainable, clean and green future. By taking into account the financial benefits of such a project, it would be a great boon to our economy. So, from this project we can conclude that the properties of the fuel obtained from plastics are similar to that of petrol and further studies on this field can yield better results.

ACKNOWLEDGEMENT

We extend our deep sense of gratitude to our project guide Mr. Rashid. MP, Lecturer, Department of Mechanical Engineering for providing us with valuable guidance and whole hearted encouragement throughout the project. We express our sincere thanks to Mr. Mansoor Ali PP Principal, Orphanage Polytechnic College Edavanna for the support and constant encouragement. We express our sincere gratitude to Mr. Binu. KK, Head of Department, Department of Mechanical Engineering for the support and constant encouragement. We thank all the teaching and non-teaching staffs, our classmates and friends for sharing their knowledge and valuable suggestions.

REFERENCES

[1] Yuan, X., Converting Waste Plastics into Liquid Fuel by Pyrolysis: Developments in China, in Feedstock Recycling and Pyrolysis of Waste Plastics, J. Scheirs and W. Kaminsky, Editors. 2006, John Wiley & Sons, Ltd: Changsha, P.R. China.

[2] Material Safety Data Sheet Polypropylene (PP) Indian Oil Corporation Ltd.

[3] Ciliz, N.K., E. Ekinci, and C.E. Snape, Pyrolysis of virgin and waste polypropylene and its mixtures with waste polyethylene and polystyrene. Waste Management, 2004.

[4] Aguado, J., D.P. Serrano, and J.M. Escola, Catalytic Upgrading of Plastic Wastes, in Feedstock Recycling and Pyrolysis of Waste Plastics, J. Scheirs and W. Kaminsky, Editors. 2006, John Wiley & Sons, Ltd: Mostoles, Spain.

[5] Williams, P.T., J. Scheirs and W. Kaminsky, Editors. 2006, John Wiley & Sons, Ltd: Leeds. Yield and composition of gases and oils/waxes from the feedstock recycling of waste plastic.

BIOGRAPHIES

Rashid MP
Lecturer
Dept.of mechanical engineering
O.P.T.C edavanna
Malappuram, kerala

Hari Krishnan K.P
Neeharam(H)
Pathiriyal (p.o)
Malappuram, kerala

Hashim Fayis PM
Podiyattu Madathil(H)
Pathappiriyam (p.o)
Malappuram, kerala
fayis0451@gmail.com

Hasil Rahman CK
Kandappan (H)
Pookkottumpadam (po)
Malappuram, kerala

Javid Rahman.V
Vazhayil (H)
Vadapuram (po)
Malappuram, kerala

Nishil Jacob
Vattukulathil (H)
Manimooly(po)
Malappuram, kerala

Sabirmon
Thankayath (H)
Chungathara (po)
Malappuram, kerala