Characteristics Analysis of Extracted Oil from Plastic Materials

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ABSTRACT: Around the world today, we produce about 400 million tons of plastic waste every year, but less than 10 per cent are only being recycled. The plastic waste is not a scrap, but it is having abundant opportunity to make wealth. So, systematic change is needed to extract the wealth dumped in the plastic waste. Here we have proposed a new method to recycle waste plastic. In this method oil is extracted from the waste plastic through pyrolysis process. The work carried out at a wide range of temperature, and the effective temperature to extract the maximum percentage of oil is between 370^0 C to 380^0 C. The characteristic of this oil is very close to diesel oil. The extracted oil is blended with diesel in different ratio, and tested in a four stroke diesel engine with varied engine loads. The results of engine performance confirmed that the oil extracted from the plastic waste through pyrolysis process can be a replacement for diesel in diesel engine.

KEYWORDS: Plastic Waste Oil, Oil Extraction, Pyrolysis Process, Alternative fuel, Performance.

I. INTRODUCTION

Plastics have become an indispensable part in today's world, due to their lightweight, durability, and energy efficiency, coupled with a faster rate of production and design flexibility. These plastics are employed in entire gamut of industrial and domestic areas. Hence, plastics have become essential materials and their applications in the industrial field are continually increasing. At the same time, waste plastics have created a very serious environmental challenge because of their huge quantities and their disposal problems.

The use of plastics has been associated with significant environmental problems due to their continuous accumulation in landfills, as plastic waste does not degrade or degrades at a very low pace. On average, 50% of the waste plastic generated in Europe is recovered, while the rest is sent to landfills. In 2015, global plastic production reached 322 million tonnes, a dramatic increase compared to the 279 million tonnes produced in 2011. According to the World Bank, plastic waste accounts for 8–12% of the total municipal solid waste (MSW) worldwide, while it is estimated to increase to 9–13% of the MSW by 2025.

The increasing availability of such waste material in local communities, coupled with the high energy density, render waste plastics one of the most promising resources for fuel production. The pyrolysis of plastics and other MSW (end-of-life tires, organic wastes, etc.) for fuel production is practiced by several small-size companies worldwide, especially those of emerging economies, where industries such as cement, glass, and other energy-intensive sectors represent the reference market this type of fuel (diesel-range hydrocarbons produced via the pyrolysis of plastics and MSW). The pyrolysis of plastics yields on average 45–50% of oil, 35–40% of gases, and 10–20% of tar, depending on the pyrolysis technology.

Most studies are carried out in beds or batch processes where all products are collected as a single sample, and subsequently analyzed. Often focus of the studies is effect of experimental conditions(reaction temperature and time) on product yield and composition, but others are focused on characterization of obtained products.

II. RELATED WORK

Chanashetty and Patil [1] have investigated fuel from waste plastic; they used condenser and reactor for pyrolysis process. They found this method is suitable for large plastic seas problems and helping fuel storage by means of products as diesel, kerosene, and lubricant oil. In this investigation, they used the waste plastic as rigid film, sheet plastic, and expanded foam materials. Karad and Havalammanavar [2] investigated waste plastic to fuel, petrol, diesel, and kerosene by pyrolysis method on the temperature range 350–500 °C and waste plastic bags, food wrap, vegetable oil bottles, automotive parts garments bags, some carpets refrigerated containers, and they concluded that it saves 1000000 species of oceanic life and green future. Due to eco-friendly, it is involved in Swachh Bharat. Arunkumar and Nataraj [3] explored change of waste plastic into fuel oil within the sight of

bentonite as an impetus and utilized materials condenser, reactor strategy is pyrolysis. It gives us outputs that are petrol, diesel, and fuel oil and inputs are PET bottles, shopping bags, plastic packages. They concluded that it provides perfect and green future and fuel efficiency, control of nitrogen, halogen, sulfur which is hazardous for human beings. Mathur et al. [4] investigated extraction of pyrolysis oil from waste plastic where pyrolysis process is using, and the waste plastic inlet is all the types of plastic and outputs are waste oil and diesel fuel. It concludes that the process is carried out grade 5 types of plastic materials, 1.65 l of oil is obtained by using 1.5 kg of plastic.

III. METHODOLOGY

Pyrolysis is generally defined as the controlled heating of a material in the absence of oxygen. In plastics Pyrolysis, the macromolecular structures of polymers are broken down into smaller molecules or oligomers and sometimes monomer units. Further degradation of these subsequent molecules depends on a number of different conditions including (and not limited to) temperature, residence time, presence of catalysts and other process conditions. The Pyrolysis reaction can be carried out with or without the presence of catalyst. Accordingly, the reaction will be thermal and catalytic Pyrolysis.

The pyrolysis is a simple process in which the organic matter is subjected to higher temperature about 300ºC to 500ºC in order to promote thermal cracking of the organic matter so as to obtain the end products in the form of – liquid, char and gas in absence of oxygen.

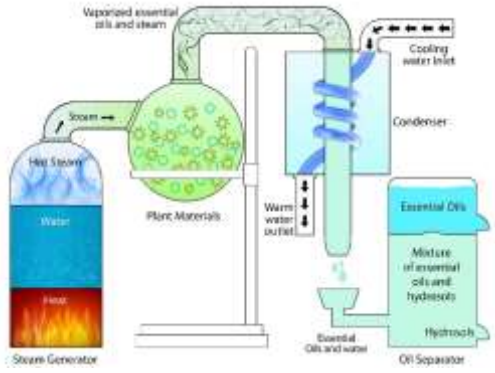
IV. EXPERIMENTAL RESULTS

Experimental investigations were carried out at various loads with a 10% blend of waste tyre oil. The combustion duration was increased by up to 1.16% with a reduction in co emissions and the brake thermal efficiency increased by 3.2% for a 10% blend. The plastic pyrolysis oils from mixed plastic wastes were obtained by the thermal depolymerization method. the performance, combustion, and emission characteristics were much closer to diesel fuel at lower (below 25%) loads.

V. CONCLUSION

It is very difficult to find out alternative of plastic. Even plastic´s demand is increasing every day as well as their waste. This project analysis has observed the use of waste plastics, a factory planning and its feasibility in Metropolitan City. It is easily assumed that, when the use of waste plastic will increase then the solid waste management will search more ways to find out to collect them. The implementation of this project can develop so many opportunities in the city. It can be a solution to control waste plastic, develop a new technique or idea, and detect the source of diesel for the country. Bangladesh is such a country where this kind of project could be very promising and effective in the future.

The use of plastic pyrolysis oil in diesel engine in the aspect of technical and economical is compared and found that oil is able to replace the diesel oil. Though the plastic pyrolysis oil offers lower engine performance, the plastic waste amount is enormous and it needed to be process to reduce the environmental problems. Moreover, the engine can be modify follow the combustion condition of plastic pyrolysis oil. The waste plastic used in the process must be PE or PP or LDPE in order to protect the contamination of chlorine in the oil.



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