Conversion of Low Density Polyethylene (LDPE) Plastic Waste Into Liquid Fuel Via Pyrolysis

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Abstract- *The present rate of economic growth is unsustainable without saving of fossil energy like crude oil, natural gas, or coal. There are many alternatives to fossil energy such as biomass, biodiesel, alcohol, LPG, CNG. Also, suitable waste management strategy is another important aspect. Development and modernization have brought about a huge increase in the production of all kinds of commodities, which indirectly generate waste. Plastics have been one of the materials because of their wide range of applications due to versatility, relatively low cost, and light in weight. Plastic to added strength made up with different combinations of polymer which leads problem in recycling. The plastic wastes usually good in recycling and getting fuel by plastic pyrolysis method. The aim of this review is focused on which method is suitable for convert the waste plastic into fuel.*

Keywords- Plastic Waste, Plastic Fuel, LDPE, Pyrolysis.

I. INTRODUCTION

Due to the fossil fuel crisis in past decade, mankind has to focus on developing the alternate energy sources such as biomass, hydropower, geothermal energy, wind energy, solar energy, and nuclear energy. The developing of alternative-fuel technologies are investigated to deliver the replacement of fossil fuel. The focused technologies are bio-ethanol, bio-diesel lipid derived bio-fuel, waste oil recycling, pyrolysis, gasification, dimethyl ether, and biogas. On the other hand, appropriate waste management strategy is another important aspect of sustainable development since waste problem is concerned in every city.

Plastic have been essential material and their applications in industrial field are continuously increasing. Plastic production and consumption is increasing day by day at faster rates with increase of human population, rapid economic growth, and change in life style. The global plastic production was estimated around 350 million tons per year and continuously increasing every year. The world's annual production of plastic materials has been steadily increasing at a rate of nearly 5% over the past 20yrs due to economic growth and the change of consumption and production patterns. Recovery and recycling, however, remain insufficient, and millions of tons of plastics end up in landfills and oceans each year. Waste plastic is causing problem to the environment. India consumes Approximately 16.5 Million tones plastic every year. Plastic is non-biodegradable that remains as a hazardous material for more than centuries. Recycling of waste plastics is expected to become the most effective way of regenerating and utilizing. Plastic pyrolysis has great potential to convert plastic waste into oil to achieve maximum economics and environmental benefits.

Fig.1: Plastic Products

Different Methods are used for plastic waste Management

1. Ocean Dumping
2. Sanitary Landfills
3. Open Dumping
4. Recycling-Pyrolysis.

II. LITERATURE REVIEW

B. PHANISANKAR, et.al [2020] Studied about the certain intention of the analyzing and fetch further the catalytic conversion of waste and standard plastic into liquid hydrocarbon fuel. A number of industrial methods are used for this experimentation, like pyrolysis, catalytic pyrolysis, Hydrocracking, Thermal Cracking etc. through which Catalytic Cracking is the best suitable method found, because the temperature required for this process is less than pyrolysis process. (22°C-390°C). Another result found as coil condenser was an excellent helper in hydrocarbon vapors condensation.

R. SINGH, et.al [2020] They have concluded that, pyrolysis of mixed plastic waste at 450°C produces a high-quality fuel having physical properties similar to conventional fuels like diesel and petrol represents an excellent alternative to be used as fuel in diesel engines. The utilization of crude PPO with diesel blends up to 50% can be utilized in diesel engines with a minor loss in efficiency and with a small increase in exhaust emission when compared to 100% diesel fuel characteristics.

N. Ahmad. et.al [2020] they have converted polystyrene waste plastic into liquid fuel using thermal liquefaction process in the presence of ethanol as a solvent. Furthermore, GC-MS analysis identified the presence of aromatics, alkenes, and alkyls compounds in the oil making it potential fuel source. The liquefaction of polystyrene was also performed using water as a solvent under same operation conditions for comparative study. Similarly, the pyrolysis of polystyrene was also conducted at 500°C for comparative study showed that liquefaction process and the use of ethanol as a solvent is more feasible for the production of better quality and quantity of Oil.

S. Tulashiea, et.al[2019] they proven that the pyrolysis technology can be used in converting the mixture waste plastics into an alternative energy source. It was observed that the oil contained more of aliphatic compounds, which is good for fuel in motor engines. Moreover, the fuel after characterization was observed to be in the diesel fuel range. The pyrolysis of plastic waste studied here presents an efficient, clean and very effective means of removing plastic debris that are left in the environment over the last several decades. The benefit of pyrolysis of mixture of plastic waste (recovery of energy and reduction of environmental problems) though will exist only as long as the waste plastics last it will surely provide a strong platform for us to build on a sustainable, clean and green future.

V. Mangesh, et.al [2019]they were adopted Experimental methods to find the suitability of PSW pyrolysis oil for conversion to diesel. The selected waste plastics for pyrolysis are HDPE, LDPE, PP, and styrene as these four materials 65% of the plastics in use. PPO had physicochemical properties closer to diesel values. PPO blended with diesel showed higher peal pressure and HRR (Heat Release Rate) than diesel. The CO, NOx and HC emissions of blended oil were significantly higher than pure diesel.

T. Anup, et.al [2014] they have performedthe experimentation on both the C.I & S.I Engine and concluded that petrol Engine was able to run with 100% waste plastic oil. Engine fuelled with waste plastic pyrolysis oil exhibits higher thermal efficiency up to 50% of the rated power for petrol engine. Engine fuelled with waste pyrolysis oil exhibits higher thermal efficiency up to 75% of the rated power for diesel engine. The NOx emission in waste plastic oil varies from 55ppm to 91 ppm for petrol grade fuel of plastic oil, and for diesel grade fuel of plastic varies from 192ppm to 1268ppm, CO emission increased by 5% in waste plastic oil compared to diesel operation.

C. Cleetus, et.al [2014] concluded that petroleum based fuel has been produced from waste plastic (polythene). In the performance analysis in engine, even though the plastic oil shows inferior results as compared to diesel, the lower blends percentage oils shows results close with that of diesel (B10, B20, and B 30). This makes it a strong competitor in the area of alternate fuels. Also the blend B20 has low CO emissions than for diesel. However, the NOx emissions are higher for B20.

M. Mani, et.al [2010] concluded that, WPO (Waste Pyrolysis oil) exhibits a higher cylinder peak pressure compared to diesel because of evaporation of WPO inside the cylinder by absorbing heat from the combustion chamber. The heat release rate with WPO is higher compared to Diesel due to better combustion. With an increase in percentage of WPO, NOx increases due to higher heat release rate and combustion temperature. Hydrocarbon is higher for WPO due to higher quantity of fuel admission. Smoke for WPO increases by about 35%, 40% throughout the load spectrum compared to diesel. Engine with WPO result in better performance than blend of WPO and diesel.

III. WRITE DOWN YOUR STUDIES AND FINDINGS

From the above study it has been found that availability of waste plastic and is more in the environment. Due to its non-biodegradable nature, the plastic waste contributes significantly to the problem of waste management. No study has been done on the combustion analysis of a LDPE type of waste plastic fuel. From the Previous work one thing is clear that work has been done on the waste plastic fuel and its analysis only in the terms of performance and emission. According to study one more thing is clear that Pyrolysis is the best Suitable technique used to produce fuel from plastic waste by considering its time, temperature range and cracking of hydrocarbon bonds.Now it is the time to articulate the research work with ideas gathered in above steps by adopting a suitable approach.

IV. PROBLEM STATEMENT

Plasticpollutioncanunfavorablyaffectlands,waterways andoceans.Livingorganisms, particularly marine animals, can

also be affected through entanglement, direct ingestion of plastic waste, or through exposure to chemicals within plastics that cause interruptions in biological functions. Humans are also affected by plastic pollution, such as through the disruption of the thyroid hormone axis or hormone levels. Fuel is essential need to run vehicles and also in day-to-day life of humans but limited. The plastic is also difficult to dispose it can't degrade up to thousands of years. When we burnt the plastic, the harmful toxic gases are produced which are harmful to human life.

Sources of diesel are limited available and emission coming out by burning diesel is affecting negatively on environment. Hence, it is necessary to search for an alternative fuel which can be used in available Internal Combustion Engine without any major modification. It is very necessary to search for an more alternative fuel for an engine as considering fossil fuel crisis.

V. CONCLUSION

From the review paper study we conclude the following,

1) Pyrolysis method is the best suitable method for production of fuel from plastic waste.
2) It is necessary to Search for an more and more alternative fuels for an engine without any changes in available Internal Combustion Engine.

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