FUEL FROM WASTE PLASTIC

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ABSTRACT

There are many alternatives to fossil energy such as biomass, hydropower, and wind energy. 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.

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.

The waste to energy technology is investigated to process the potential materials in waste which are plastic, biomass and rubber tire to be oil. Pyrolysis process becomes an option of waste-to-energy technology to deliver bio-fuel to replace fossil fuel. Waste plastic and waste tire are investigated in this research as they are the available technology. The advantage of the pyrolysis process is its ability to handle un-sort and dirty plastic. The pre-treatment of the material is easy.

Tire is needed to be shredded while plastic is needed to be sorted and dried. Pyrolysis is also no toxic or environmental harmful emission unlike incineration

Economic growth and changing consumption and production patterns are resulting into rapid increase in generation of waste plastics in the world. For more than 50 years the global production of plastic has continued to rise.

SYNOPSIS

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, hydropower, and wind energy. 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 and relatively low cost.

Some 299 million tons of plastics were produced in 2013, representing a 4 percent increase over 2012. Recovery and recycling, however, remain insufficient, and millions of tons of plastics end up in landfills and oceans each yearApproximately 10–20 million tons of plastic end up in the oceans each year.

OBJECTIVES

The main objectives of this project are:

1. To establish the basis for the development and implementation of waste plastics recycling with the application of environmentally sound technologies (EST) to promote resource conservation and green house gases (GHG).

2. To raise awareness in developing countries like INDIA on plastic waste and its possible reuse for conversion into diesel or fuel, this could be generated and marketed at cheaper rates compared to that of the available diesel or oil in the market.
3. To reduce the dependency on gulf countries for fossil fuels, thereby contributing to the Economic growth of the country.

LITERATURE SURVEY

M.fAli reported that the high yields of liquid fuels in the boiling range 100°C–480°C and gases were obtained along with a small amount of heavy oils and insoluble material such as gums and coke. The results obtained on the co-processing of polypropylene with coal and petroleum residues are very encouraging as this method appears to be quite feasible to convert plastic materials into liquefied coal products and to upgrade the petroleum residues andwaste plastics.

Miskolczi 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 dependingon the used parameters.

F murfyk from the recent literature, it is evident that the process of converting waste plastic to reusable oil is a current research topic, preparation of blends of diesel with varying proportions of waste plastic oil produced from the thermal pyrolysis and the analysis of viscosity and density of these blends is presented. The feasibility of the waste plastic oils derived from PVC plastics as an alternate fuel for transportation is also checked by conducting performance test on a single cylinder Kirlosker diesel engine equipped with electrical loading at 50% of the engine maximum load i.e., at 3.7 kW.

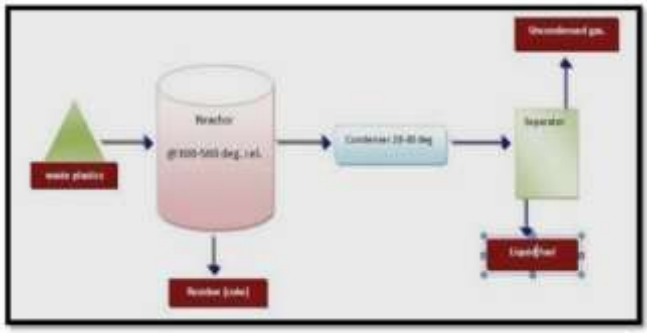
METHODOLOGY

1. Identification of waste plastics.
(PE/PP/PS/LDPE/HDPE)

2. Subjecting the waste plastic for pyrolysis process. Condensation of the gas to obtain raw fuel. Conversion of raw fuel into its pure form (diesel etc) by the process of distillation.

COLLECTION & IDENTIFICATION OF WASTE PLASTIC :

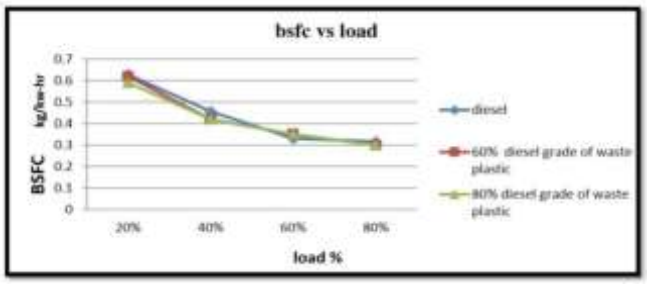
The collection of waste plastic is quite an easy task as compared to other wastes , the plastic wastes are abundant and can be obtained in large quantities from the households, roadsides, hospitals, hotels etc.



PERFORMANCE CHARACTERISTICS

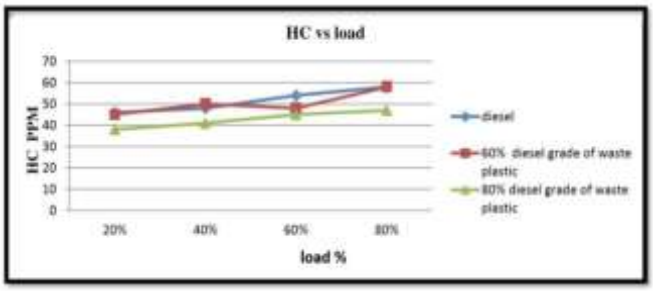
BRAKE SPECIFIC FUEL CONSUMPTION:

Brake specific fuel consumption measures how efficiently an engine is using the fuel supplied to produce work. It is inversely proportional to thermal efficiency as shown in the graph below.



Graph:1 Brake specific fuel consumption

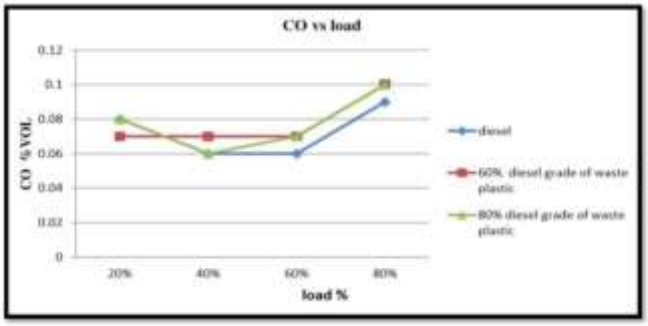
HYDROCARBON EMISSION:



Graph:2 Hydrocarbon emission

Above graph shows that an experimental study on diesel grade fuel of waste plastic oil shows that, unburned hydrocarbon varies from 36 ppm at low load to 58 ppm at full load, It is noticed that the concentration of the hydrocarbon of waste plastic oil is little higher than diesel; the reason behind increased unburned hydrocarbon in waste plastic oil may be due to higher fumigation rate and non-availability of oxygen relative to diesel.

CARBON MONOXIDE EMISSION:



Graph:3 Carbon monoxide emission

Graph shows that, CO2 varies from 2.40% vol. at low load to7.60 % vol. at full load for different blends,An experimental study on diesel grade fuel of waste plastic oil shows that, CO varies from 0.08% vol. at low load to 0.10 % vol. at full load for different blends.Here the CO emission of waste plastic oil is higher than diesel. The reason behind increased CO emission is incomplete combustion due to reduce in cylinder temperatures.

APPLICATION OF PROJECT & FUTURE WORK

The obtained fuel could be utilized in diesel generators, vehicles such as tractors and also passenger vehicles such as cars.

The fuel has to be refined at the industrial establishments, based on the results of which small scale industrycan be established.

As there is a high demand of crude oil and due to its sky reaching prices , we could take up this project to setup large or small scale industries and produce the fuel locally at much cheaper rates directly benefiting the National economy and also a step towards SWAACH BHARAT by recycling the waste plastic.

The application of this project could help in reducing the dependency on the gulf countries and promote a step towards innovation.

RESULTS AND DISCUSSIONS

Through our experimentation we concluded that about 600 to 750ml of diesel fuel could be obtained by burning 1Kg of plastic. Burning 1Kg of plastic in an open environment produces 3Kg of CO2, whereas by converting it into fuel and burning it reduces 80% of CO2 emissions , which results in to be quite environmentally friendly.

Lesser emission of unburnt HYDROCARBONS in waste plastic pyrolysis oil compared to that of diesel.

The diesel or oil thus obtained has a higher efficiency with around 30 to 40% low production cost compared to that available in the market

LIMITATIONS

High Carbon monoxide emissions compared to that of currently available diesel in the market.

High emissions at lesser loads compared to that of higher load working engines.

For efficient use of diesel grade fuel of waste plastic, blending it with normal diesel is necessary.

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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E-ISSN NO:2349-0721