Waste Plastic Pyrolysis

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***Abstract*:- The increased demand and high price for energy sources are driving efforts to convert organic compounds into useful hydrocarbon fuels. Although much of this work has focused on biomass, there are strong benefits to deriving fuels from waste plastic material. Waste plastic is abundant and its disposal creates large problems for the environment. Plastic does not break down in landfills, it is not easily recycled and degrades in quality during the recycling process, and it can produce waste ash, heavy metals, and potentially harmful gas emissions if incinerated at high temperatures. However, thermal processes can be used to convert plastics into hydrocarbon fuels such as gasoline, diesel, aviation / jet fuel, which have unlimited applications in airline industries, helicopter, heavy transportation, and electricity generation. The method and principal of the production / process will be discussed.**

1.INTRODUCTION

Plastic waste is regarded as a potentially cheap source of chemicals and energy. Lots of us have encountered a variety of products that use plastic materials today. As a result of the increasing level of private consumption of these plastic materials huge amount of wastes are discharged to the environment.

Plastic materials are a type of material that cannot be decomposed easily in a short period of time. Substantial quantities of plastic have accumulated in the natural environment and in landfills. Those wastes can be classified according to their origins. They are

- Industrial
- Municipal

These groups have different qualities and properties and are subjected to different management strategies. Huge amounts of plastic wastes arise as a by-product or defective product in industry and agriculture.

The main components of municipal solid waste (MSW) are food waste, wood, paper, cardboard, plastics, rubbers, fabrics, and metals. On the other words, more than half of the municipal solid waste components are organic species mainly thermoplastics, which can be used as energy sources.

The traditional MSW disposal method is landfill. Because of the longevity of plastics, disposal to landfill may simply be storing problems for the future. For example, plasticizers and other additive chemicals have been shown to leach from landfills. The extent of varies accordingly, particularly pH and organic content.

Recently, the conception of energy recovery from MSW has been a very hot topic. It is also undesirable to dispose of waste plastics by landfill due to poor biodegradability.

An alternative strategy is that of chemical recycling, known as feedstock recycling or tertiary recycling, which has attracted much interest recently with the aim of converting waste plastics into basic petrochemicals to be used as chemical feedstock or fuels for a variety of downstream processes.

2. SELECTION OF WASTE PLASTICS

Waste plastics are one of the most promising resources for fuel production because of its high heat of combustion and due to the increasing availability in local communities. Unlike paper and wood, plastics do not absorb much moisture and the water content of plastics is far lower than the water content of biomass such as crops and kitchen wastes. The conversion methods of waste plastics into fuel depend on the types of plastics to be targeted and the properties of other wastes that might be used in the process. Additionally the effective conversion requires technologies to be selected according to local economic, environmental, social and technical characteristics In general, the conversion of waste plastic into fuel requires feedstock which are non-hazardous and combustible. In particular each type of waste plastic conversion method has its own suitable feedstock. The composition of the plastics used as feedstock may be very different and sonic plastic articles might contain undesirable substances (e.g. additives such as flame-retardants containing bromine and antimony compounds or plastics containing nitrogen, halogens, sulfur or any other hazardous substances) which pose potential risks to humans and to the environment. The types of plastics and their composition will condition the conversion process and will determine the pretreatment requirements, the combustion temperature for the conversion and therefore the energy consumption required, the fuel quality output, the flue gas composition (e.g. formation of hazardous flue gases such as NOx and HO), the fly ash and bottom ash composition, and the potential of chemical corrosion of the equipment.

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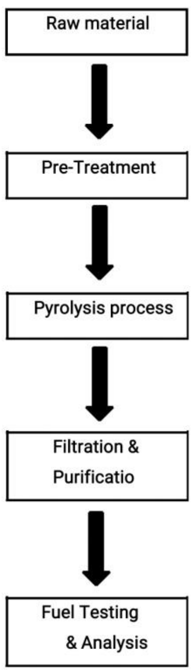
3. PYROLYSI

The description and classification of pyrolysis reactors are given in Section of this thesis and the existing commercial pyrolysis plants use various types of the reactors. Continuous pyrolysis process is applied on most commercial plants with capability to use catalysts in which the plastic retention time is relatively short. Very few of the commercial plants use high pressure operation condition and most of the plants operate at or slightly above atmospheric pressure. The operating temperature in the reactors varies largely from 250 ºC (Mazda fixedbed catalytic process in Japan) up to 800 ºC (Compact Power fixed-bed pyrolysis in United Kingdom) but most of the pyrolysis reactors operate between 400 ºC and 550 ºC. It must be noted that if the operation temperature is above 800 ºC, the process becomes gasification and the products are mainly short chain hydrocarbons which remains as gases under room temperature and atmospheric pressure. All of the commercial plants are fast or flash pyrolysis. Three types of reactors including fixed-bed, fluidized-bed, and rotary kiln can be found in the literature review

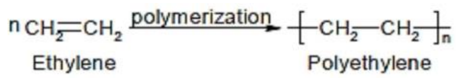
The products from the plastic pyrolysis are mainly combustible gases and liquids. The liquids can be either combusted for power generation or for further refining to produce high quality fuels. Diesel range products can then be distilled out as in an oil refinery process. The non-condensable gases are mainly made of hydrocarbons, and a minor amount of hydrogen and carbon monoxide. The gases can be liquefied as fuels, or used as fuels to heat the pyrolysis reactor, or if the amount is insignificant, the non-condensable gases are sent to an incinerator flaring off with the air

4. PROCESS



5. CHEMICAL COMPOSITION

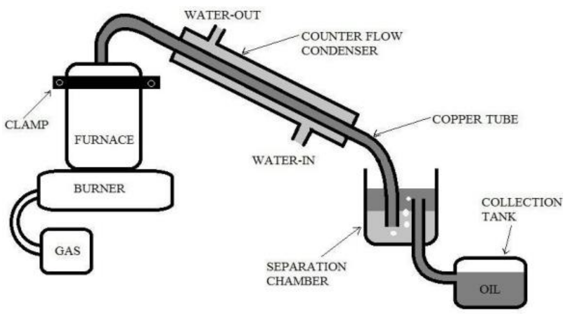
The pyrolysis products are directly related to the chemical composition and chemical structure of the plastics to be pyrolyzed.In addition, the chemical composition of the feedstock also affects the pyrolysis processes. In reality, waste plastics are possibly contaminated before recycling which could also have effects on the pyrolysis process and products.PE, PP and PS are most commonly used polymerichydrocarbons and were selected as the investigated materials in this study. Polyethylene is formed from ethylene through chain polymerization which is shown in Formula



6. SCHEMATIC DIAGRAM

Gravity seperation is the basic process. In this process the impure fluid is poured in a container in which the bottom part is like a funnel. So when the fluid is poured, the most denser liquid will settle down below. Most probably the water was found.Then the waxy and greesy substance which was pale greenish yellow was found immediately above the water. Finally, most of the polypropylene oil is seen above in the topmost layer. So by opening the valve at the bottom, all the unwanted substance are removed. Remaining oil is processed further.In filteration process, the substances which are in colloidal state can be removed. The filter paper will allow the molecules which are smaller than its pores. So the various size of smaller pores will give more clean fuel.Thus the collected samples are to be tested by appropriate methods.

7. PHOTOGRAPHY



8. CONCLUSION

Pyrolysis of hydrocarbon polymers is a very complex process, which consists of hundreds of reactions and products. Several factors have significant effects on the reactions and the products. Based on previous research, this chapter investigated the fundamental plastic processes and reactions. With temperature increasing, plastic will go through glassy state, rubbery state, liquid state, and decomposition. Decomposition of plastic in an inert environment into liquid is called pyrolysis. There are four stages of reactions during the plastic pyrolysis process: initiation, propagation, hydrogen transfer, and termination reactions. It was found that heavy molecular weight hydrocarbons produced from primary cracking can be further cracked into light molecular weight products through a secondary cracking process. This secondary cracking process has significantly influence on the distribution of the product. This process converts heavy hydrocarbons into gas or light liquid product.

9. REFERENCE

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