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SYNTHESIZING FUEL FROM PLASTIC WASTE USING PYROLYSIS

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Abstract: The present work involves waste plastic-recycling-regeneration-and-utilization. In this process the waste plastic is recycled and converted as fuel. The waste plastic has to be recycled because it is non-disposable and has a series impact on environmental hazard. To overcome this effect, the work has to be focused to reduce the major issue of waste plastics by converting them into usable products such as fuel. As a feasible solution for plastic recycling, the pyrolysis is one of the process of transforming waste plastic into fuels. The synthesis of fuel using pyrolysis involves in degradation of the polymeric materials by heating them in the absence of oxygen and in the presence of a catalyst. In this process, different oil samples are produced using different catalyst under different reaction conditions from waste plastics. The synthesized oil samples are subjected to a parametric study based on the oil yield, selectivity of the oil, fuel properties, and reaction temperature. The performance analysis is based on chemical compositions of waste plastics and generated oil samples. These results obtained are to decrease the plastic waste and high calorific value of fuel which is obtained from the waste plastics by high heat combustion process. The fuel synthesis procedure based on selection of raw material, pre-treatment, pyrolysis-process, analysis, testing, filtration and purification.

Index Terms - Plastic waste, Pyrolysis, Fuel synthesis, Hydrocarbons

I. INTRODUCTION

The properties of plastic pyrolysis fuels are analyzed based on pyrolysis products from Polypropylene granules and are mainly hydrocarbons with molecular weights of non-condensable/ light liquid gases. The quality of the liquid fuels from pyrolysis of plastics will vary with the conditions of pyrolysis operational, pyrolysis reactor and its plastic feedstock, fixed/ fluidized bed, and rotary kiln. In [1] the process of feedstock recycling, pyrolysis of waste plastics and development process of a waste plastic mixture to fuel are discussed. In [2] the waste and virgin polypropylene plastics under slow pyrolysis conditions are discussed. In [3] operating variables of feedstock recycling and Pyrolysis process of Waste Plastics are discussed. In [4] the yielding and compositions of gases and oils are discussed. In [5] the functional groups of aviation, kerosene, jet category fuels and generation of conventional fuel of Polypropyleneares are discussed. In [6] the production processes of biodiesel were discussed and the effect of temperature on their viscosity and density was investigated. In [7] emissions from pure fossil diesel and mixtures with biodiesel and its proportions were discussed. In [8] the liquid fuels as an alternative to diesel and the production process of biodiesel from vegetable oils were discussed.

II. PRETREATMENT AND PELLET PRODUCTION METHODS

The solid fuel production process usually involves two steps, pretreatment and pellet production. The pretreatment production method is removal of non-combustible materials. The pellet production method comprises shredding and pelletization. Industrial waste plastics, which have been separated and collected in factories, are ideal to be used for solid fuel production. A fuel production facility consists of a waste unloading area, stockyard, pretreatment equipment, pelletizing equipment and solid fuel storage. The pretreatment process includes crushing and sorting for the removal of unsuitable materials from incoming wastes. After pretreatment, a suitable mixture of paper and plastics are further processed in a crusher and sorting process then the resulting mixture is pelletized to produce solid fuel.

III. PYROLYSIS PRODUCTION METHOD

In liquid fuel process the thermoplastics undergo thermal decomposition and yield as liquid hydrocarbons in the feedstock of the production. In addition to thermosetting plastics such as wood and paper format substance of carbons and amines in liquid products, the production method for the conversion of plastics to liquid fuel is based on the pyrolysis of the plastics and the condensation of the resulting hydrocarbons. After pyrolysis, the deposits are removed from the reactor to maintain the efficiency of heat conduction and are controlled by the operation conditions of the reactor, cracker and condenser. The liquid hydrocarbons are then collected in a storage tank through a receiver tank.

IV. FUEL SYNTHESIS PROCESS

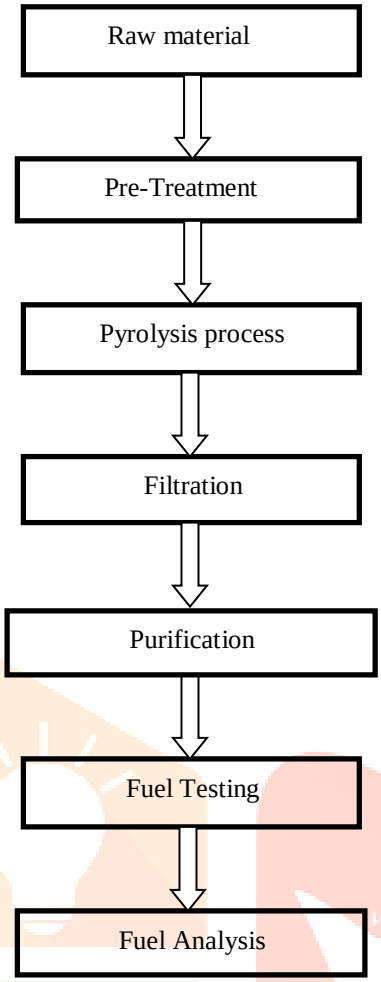

Fig. 1 Production of plastic fuel using pyrolysis

V. PRODUCTION OF PLASTIC FUEL USING PYROLYSIS

In this the raw material is feed in the furnace and closed with the clamped lid. After this process the melted plastics will evaporate and flow through the furnace outlet of the copper tube. The copper tube is cooled by the counter flow condenser vapor to liquid phase then the transition takes place during condensation process. The remaining uncondensed vapors coming from the reactor enters into the condenser where these vapors condenses to liquid hydrocarbon fuels and the stirrer is used to remove the carbons in the reactor and reactor acts as a heat insulator after this the liquid product of the pyrolysis is distilled. To remove the impurities of the fuel the gravity separation/filtration process are carried out in the collecting chamber. In gravity separation process the impure fluid is poured in a funnel container and the denser liquid will settle down below the funnel. Then the polypropylene oil has to be occupied on topmost layer by opening the valve at the bottom and all unwanted substance has to be removed. In filtration process, the colloidal state substances are to be removed and will give more clean fuel. Thus, the collected samples are to be tested by appropriate methods. 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 based on various conditions such as fuel color, density, viscosity, calorific value, and flash point and ash contents.

VI. CONCLUSION

In Pyrolysis process the generated hydrocarbons have significant effects on the reactions and the products. The plastic processes and reactions are based on temperature, by increasing temperature the plastic will go through glassy/ rubbery/ liquid states and decomposition of plastic into liquid state of pyrolysis. The stages of liquid state of pyrolysis are initiation, propagation, and termination. In cracking process, hydrocarbons converted as heavy molecular into light molecular such as gas or light liquid product this will influence on the distribution of the product. These light liquid fuels are used as feed stock refinery for further modification. The cause of environment imbalance is based on waste plastic which will reduce the processes on landfills and are alternative to fossil fuel.

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