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EFFECT OF PROCESS PARAMETERS ON WASTE PLASTIC PYROLYSIS IN A SEMI BATCH REACTOR

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Disposal of solid waste has become a major environmental issue in Sri Lanka. That is further aggravated by non-bio degradable solid waste like plastic and polythene because the polymer compounds used in plastic and polythene are hardly degradable in natural manner and causing numerous negative environmental impacts. Pyrolysis of plastic waste has gained increasing attention as a promising method for the treatment of mixed and contaminated plastic waste in environmental friendly manner. In the pyrolysis, plastics are thermally degraded to produce useful liqui d hydrocarbons, which can then either be added to existing fuel or solvent product, or returned to a refinery where they can be added to the feedstock. The objective of this research is to reduce environmental impacts and recover green alternative energy from waste plastics by converting them into hydrocarbon fuel using pyrolysis process.

A reactor system has been developed for the waste plastic pyrolysis process. The developed system which mainly consists of a semi batch reactor, a condenser and a liquid-gas separator, is capable of converting waste plastic (PE and PP) into hydrocarbon fuel at a maximum conversion rate of 99%. The maximum liquid and gas yields are 66% and 31% respectively.

The effects of pressure, batch size and set temperature on the waste plastic pyrolysis were experimentally analyzed. Optimum pressure was found to be near atmospheric slightly positive pressure (around 0.06 bar). Optimum batch size and set temperature were found to be, 3000 g and 425 0C respectively. Increasing pressure was found to increase reaction time and solid residue left in the reactor at an approximately same liquid yield. The small batch sizes were found to decrease both liquid yield and reaction time at an approximately same solid residue amount. The low set temperatures such as 400, 375 0C were found to drastically increase solid residue amount and reaction time at an approximately same liquid yield. The high set temperatures such as 450, 475 0C were found to decrease liquid yield and reaction time at an approximately same solid residue amount.

The waste plastic pyrolysis process is affected by many process parameters such as pressure, batch size, set temperature, heating rate, reactor design etc. The optimized process parameters lead to obtain high liquid yield at a minimum input energy in a comparatively small reaction time. Further, physical and chemical properties of the

fuel are affected by the process parameters. Therefore optimized process parameters are very important in pyrolysis of waste plastics in terms of obtaining usable fuel efficiently.

Keywords: Process parameters, Pyrolysis, Waste plastics, Semi batch reactor, Hydrocarbon fuel.