THERMAL CATALYTIC PYROLYSIS PROCESS STUDIES FOR POST CONSUMER POLYETHYLENE WASTE CONVERSION

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Abstract
Catalytic pyrolysis is a process of thermal decomposition for plastics at elevated temperatures, in presence of a catalyst and complete absence of oxygen. Plastics are converted into gas and oil fuels that have high calorific values similar to those of liquefied petroleum gas, petrol and diesel. Catalytic pyrolysis is thus an important technology for plastic waste recycling into fuels. The aim of this study was to assess the effect of using catalyst in the plastic pyrolysis process. From the previous findings on effect of temperature and reaction rates, high density polyethylene gave the highest yields of crude oil. It was therefore the preferred plastic in this experiment. The catalysts used were aluminum oxide, iron II oxide and manganese oxide. The process was conducted in a locally assembled bunch pyrolysis reactor using temperature ranges of 200 ºC – 350 ºC and 350 ºC – 450 ºC with heating rates of 5 ºC -10 ºC per minute. Plastic waste materials were collected from the open dumpsites, washed, sun-dried, sorted according to resin codes, sliced and pelletized into small pieces of dimensions of 2 mm. Plastic samples in batches of 500 g were mixed with catalyst in the ratio of 10:1 and fed into a preheated reactor for conversion. Fuel gas, crude oil, solid residue and wax yields obtained while using iron II oxide, aluminum oxide and manganese oxide. Fuel gas yields obtained during thermal and catalytic pyrolysis were significantly different ($P > 0.05$) for paired T-test. The catalyst significantly lowered the cracking temperatures and reaction times thus lowering the cost of operation during recycling large amounts of plastic waste.

Key words: Catalytic pyrolysis, plastic waste to energy