Paper ID: A416

Plastic-To-Fuel: Effect of nickel and cerium loading on oil palm fiber ash catalyst

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EXTENDED ABSTRACT

Investigation on converting waste including plastic waste; one of major waste compositions, via pyrolysis is recently explored by many researchers. One of the goal of the current researches is to develop a lower cost of catalyst. However, low yield and fuel quality are among major obstacles to scale up this process. The aim of this paper is to synthesis, characterize and study the performance of the catalysts with nickel or cerium metal loading on oil palm ash catalyst for plastic to fuel via catalytic pyrolysis. The High Density Polyethylene (HDPE) resin was used and thermally characterized with TGA. A 20 wt% of metal in nickel/ash or cerium/ash catalysts were synthesized via wet impregnation. The fresh catalysts were characterized via BET and SEM analysis. A 25g of HDPE was used. The weight ratio of HDPE resin to catalyst of 10:1 was tested in batch one liter borosilicate reactor at 450 °C for half an hour. The gas product compositions were identified by using GC-TCD while the liquid product compositions were identified by using GC-MS. The yield, calorific value, viscosity and clarity of the liquid were also determined. The nickel/ash catalyst was able to produce 75.32 wt% of liquid product and produced an equivalent quality fuel to commercial fuel. Meanwhile, the Ce/ash yielded 63.33 wt% of liquid fuel. About 70 wt% of liquid fuel was formed when solely ash as catalyst was used. The gas product that rich in CH4 was obtained when all catalysts were applied. It can be deduced that plastic pyrolysis by using nickel/ash catalyst showed the best performance and improve the fuel yield, fuel quality and reduce the cost of production.

Keywords: Plastics, liquid fuel, nickel, cerium, oil palm fiber ash