INVESTIGATION OF LIQUID AND GAS FUELS PRODUCTION FROM PLASTICS AND OILS WASTE

BY

KIMUTAI, STEPHEN KIBET

B.TECH. (HONS) MOI UNIVERSITY

A THESIS SUBMITTED IN PARTIAL FULFILLMENT
OF
THE REQUIREMENTS FOR THE
AWARD OF THE DEGREE OF
MASTER OF PHILOSOPHY
IN
PRODUCTION ENGINEERING
(MANUFACTURING OPTION)
OF MOI UNIVERSITY

NOVEMBER, 2010

ABSTRACT

The utility of plastics and engine oils is very important due to their wide application in the packaging and automotive industries respectively and as such their continued use has led to an in increase in plastics and oil waste. However, the huge amount of plastic and engine oil waste produced may be treated with thermal catalytic methods to produce fossil fuel substitutes.

In this research, the co-processing of polyethylene resin with waste petrol engine oil into high value hydrocarbons using thermal catalytic cracking (consisting of initial pyrolytic stage followed by a catalytic reforming stage) was investigated. Plastic resins and petrol engine oil were loaded in the thermal reactor and HZSM-5 zeolite catalyst placed in the catalytic chamber. The system was purged with nitrogen at temperatures between 400^{o}C and 520^{o}C. The resulting products were compared with those obtained in the absence of a catalyst.

At temperatures greater than 460^{o}C the conversion into liquid and gas fuels is above 70 wt%. At similar temperatures and in the absence of catalyst, thermal cracking of low density polyethylene generated majorly liquid products with a low calorific value. The use of HZSM-5 as a catalyst caused a significant increase in the proportion of gaseous hydrocarbons that consisted mainly light fraction olefins and liquid oil with calorific value of 43.9MJ/kg and also comparable to regular petrol fuel.

Depletion of non-renewable source of energy such as fossil fuel demands the improvement of this technique. This sets the future trends in plastics and oil waste thermal-catalytic recycling as an Industry.