Int. J. Renew. Energy Environ., Vol. 1, No. 1, pp17-30 (2013)

NOVEL SOLID-ACID CATALYSTS FOR BIODIESEL PRODUCTION FROM WASTE COOKING OIL FEEDSTOCK

James O. Ugbomoiko, David E. Ogbeifun and Felix E. Okieimen*
University of Benin, Centre for Biomaterials Research, Benin City
**Corresponding author; Email: fexokieimen@yahoo.com*

Abstract

Development of domestic biofuels industry that increases the production of liquid fuels from renewable resources is priority energy policy objective of many countries. Biofuels are expected to reduce dependence on petroleum hydrocarbons and its associated political and economic vulnerability, reduce greenhouse gas emissions and other pollutants and revitalize the economy by increasing demand and prices of agricultural products. Although most attention appear to have been focused on bioethanol, interest in biodiesel, produced primary from vegetable oils, has increased over the years. The high cost element of vegetable oil to the overall cost of biodiesel production requires that effective method that permits minimizing the cost of feedstock be explored. Homogeneous catalysts (alkali and acid systems) although effective in the production of biodiesel, led to serious contamination problem that make essential the implementation of good separation and product purification protocols, which translate into higher production costs. The production of biodiesel from low-cost feedstocks, such as waste cooking oil, using novel solid-acid catalysts could provide a unique strategy for lowering the overall cost of biodiesel production. In this study, restaurant waste cooking oil (density 0.92±0.04 $g.ml^{-1}$; acid value 13.80±4.80 $mgKOH.g^{-1}$; peroxide value 20.00±4.00 $meq.kg^{-1}$; saponification value 160.10±11.90 $mgKOH.g^{-1}$, free fatty acid 6.80±1.00%; Wijs iodine value 38.00±7.00; kinematic viscosity at 30^{o}C 25.10±4.00 $mm^2.s^{-1}$, unsaponifiable matter 16.00±1.00 $g.kg^{-1}$) was used in the preparation of biodiesel using acid treated clay and oil palm fly ash catalysts. The physico-chemical and fuel properties of the biodiesel produced were determined in comparison with the properties produced using the conventional homogeneous catalysts. The methanolysis of waste cooking oil using the solid-acid catalysts appeared facile, with the fly ash appearing more efficient than the acid-treated clay in transforming the feedstock into biodiesel. The physico-chemical and fuel properties of the biodiesel samples produced compared favourably with the properties of biodiesel obtained from homogeneous catalysts and with Biodiesel Standards.