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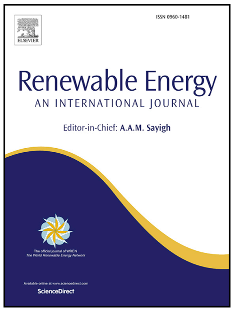

Preparation of biofuels with waste cooking oil by fluid catalytic cracking: The effect of catalyst performance on the products

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Preparation of biofuels with waste cooking oil by fluid catalytic cracking: the effect of catalyst performance on the products

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Abstract: Biofuels were produced with waste cooking oil by Fluid Catalytic Cracking (FCC). The catalytic reactions involved two catalysts of Endurance and CGP-1HN, which were characterized by Scanning Electron Microscopy (SEM), N_2 Adsorption-Desorption, X-ray Diffraction (XRD) and Pyridine Fourier Transform Infrared Spectroscopy (Py-FTIR). The results indicated that the structure and properties of Endurance and CGP-1HN were similar, and the most obvious difference between them was a different content of acid sites. The Lewis and Brönsted acid contents of Endurance were 189.39 and 341.69 μmol/g, respectively, and the Lewis and Brönsted acid contents of CGP-1HN were 21.53 and 258.23 μmol/g, respectively. The different acid sites resulted in different distributions of products under the same reaction conditions. A higher diesel yield (32.04 wt.%) was achieved using Endurance, and a higher Liquefied Petroleum Gas(LPG) yield (42.71 wt.%) was produced using CGP-1HN. The result shows that different type acid and acid contents effect on the product distribution.The Lewis acid sites decreases the catalytic cracking depth of waste cooking oil.

Keywords: Fluid catalytic cracking; Biofuels; Waste cooking oil; catalyst acidity ;

1. Introduction

In recent years, the domestic demand for energy was increasing due to the fast economic development. The energy demand will increase rapidly in the next few years, and the current energy structure cannot be satisfied for the sustainable development of society, including air pollution and energy short. To solve the energy crisis, the biofuels can be used as an alternative to the conventional petroleum supply.[1-3] Utilizing biomass to make biofuels has been the focus of much research in recent years.[4-5] Biofuels required an upgrading step before it could be used as a transport fuel. Although catalytic hydrogenation could convert biofuels into liquid hydrocarbons, it consumed a lot of hydrogen.[6,7] Catalytic esterification could reduce the corrosiveness of biofuels, but it makes less contribution to improve its heating value.[8,9] Emulsification could provide a homogeneous mixture with biofuels and petrochemical diesel, but the addition of biofuels made the emulsions corrosive[10,11]. Moreover, pyrolysis technique using microwave heating offers a promising approach for the conversion of biomass or bio-oil into biofuel products with improved properties, but the complicated equipments is not suitable for the industrial production.[12-15] Comparable to the techniques mentioned above, the FCC process consumes no hydrogen and has the potential of converting biomass into biofuels compatible with existing petroleum products, with the full-fledged industrial technique.[16,17]

The FCC is currently used in the petroleum and petrochemical industry to convert high molecular weight oil components to lower molecular weight ones which can be used directly or blended for use as fuel.[18] In this process, gasoline and diesel can be directly replaced with

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