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Transesterification of Waste Cooking Oil for Biodiesel Production Using Modified Clinoptilolite Zeolite as a Heterogeneous Catalyst

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Abstract : Reduction of fossil fuels sources, increasing of pollution gases emission, and global warming effects increase the demand of renewable fuels. One of the main candidates of alternative fuels is biodiesel. Biodiesel limits greenhouse gas effects due to the closed CO₂ cycle. Biodiesel has more biodegradability, lower combustion emissions such as CO, SO_x, HC, PM and lower toxicity than petro diesel. However, biodiesel has high production cost due to high price of plant oils as raw material. So, the utilization of waste cooking oils (WCOs) as feedstock, due to their low price and disposal problems reduce biodiesel production cost. In this study, production of biodiesel by transesterification of methanol and WCO using modified sodic potassic (SP) clinoptilolite zeolite and sodic potassic calcic (SPC) clinoptilolite zeolite as heterogeneous catalysts have been investigated. These natural clinoptilolite zeolites were modified by KOH solution to increase the site activity. The optimum biodiesel yields for SP clinoptilolite and SPC clinoptilolite were 95.8% and 94.8%, respectively. Produced biodiesel were analyzed and compared with petro diesel and ASTM limits. The properties of produced biodiesel confirm well with ASTM limits. The density, kinematic viscosity, cetane index, flash point, cloud point, and pour point of produced biodiesel were all higher than petro diesel but its acid value was lower than petro diesel. Finally, the reusability and regeneration of catalysts were investigated. The results indicated that the spent zeolites cannot be reused directly for the transesterification, but they can be regenerated easily and can obtain high activity.

Keywords : biodiesel, renewable fuel, transesterification, waste cooking oil
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