

Transesterification of Soybean Oil to Biodiesel Using Heterogeneous Catalysts

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ABSTRACT

In this work, an environmentally benign process for the transesterification of soybean oil to biodiesel using heterogeneous catalyst was developed. The Mg-Al hydrotalcite with Mg/Al molar ratio of 3.0 synthesized by co-precipitation method was used to catalyze the transesterification. The hydrotalcites calcined at various temperatures (450°C, 550°C, 650°C) were characterized by XRD, SEM, and surface area. The results indicated that the hydrotalcite calcined at 550°C showed excellent characteristics.

In order to investigate the effects of various reaction variables such as molar ratio of methanol to oil, calcination temperature, the catalyst loading and reaction time on the conversion of soybean oil, a series of transesterification of soybean oil was carried out at 60 °C with sodium hydroxide and hydrotalcite as catalyst. The experimental data showed that optimal conditions for hydrotalcite preparation and transesterification reactions are as follows: calcination temperature 550 °C, molar ratio of soybean oil to methanol of 6:1, reaction time 360 min, and catalyst dosage 5%. The yield of fatty acid methyl ester (biodiesel fuel) was 78%. Moreover, a study of the catalyst's recyclability indicated that the spent hydrotalcite cannot be directly reused for the transesterification. However, while the used catalyst was regenerated by calcinations at 550 °C for 3h, but the oil conversion ratio was decreased to 72%. Repeating the regeneration process, the oil conversion ratio was further decreased to 62%.

Keywords: Biodiesel, Heterogeneous catalyst, Transesterification