

Biodiesel synthesis over millimetric γ -Al₂O₃/KI catalyst

ABSTRACT

The use of spherical millimetric gamma-alumina (γ -Al₂O₃) as a catalyst support for the production of biodiesel from palm oil was demonstrated. The catalyst support was produced using dripping method, and KI catalyst was loaded on the support using impregnation method. The highest FAME (fatty acid methyl ester) yield of 98% was obtained when the reaction was carried out under the conditions of catalyst to oil ratio of 0.6 g (4wt.%, gcat./goil) using 0.24gKI/g γ -Al₂O₃ of catalyst loading, reaction time of 4 h, temperature of 60 °C and methanol to palm oil molar ratio of 14:1. XRD (X-ray diffraction) analysis showed the formation of K₂O and KAlO₂ phases on the KI/ γ -Al₂O₃ catalyst which were possibly the active sites for the transesterification reaction. The highest number and strength of basic sites generated from the solid phase reaction of the KI/ γ -Al₂O₃ catalyst loaded with 0.24 g KI/g γ -Al₂O₃ were confirmed by temperature programmed desorption of CO₂ (CO₂-TPD) analysis. The nitrogen adsorption-desorption isotherms was revealed a mesoporous structure of the catalysts. The leaching of potassium species in reused catalysts was observed, as verified by XRF (X-ray fluorescence). KI/ γ -Al₂O₃ had a long life time and maintained sustained activity even after being repeatedly used for 11 cycles. The biodiesel yield was comparable to that produced from smaller catalysts. Thus, the catalyst could be potential for industrial use, as they can be handled safely, easily separated from the process fluid and used in fixed bed reactor to minimize pressure drop.

Keyword: Sológel; γ -alumina; Calcination; Transesterification; Biodiesel