

Biodiesel production via transesterification of palm oil by using CaO–CeO₂ mixed oxide catalysts

ABSTRACT

Solid base CaO–CeO₂ mixed oxide catalysts have been synthesized via wet impregnation method and characterized by X-ray diffraction (XRD), Brunauer–Emmett–Teller (BET) surface area analysis, temperature-programmed desorption of CO₂ (TPD-CO₂) and scanning electron microscopy (SEM). The catalytic activity was determined by transesterification of palm oil. Optimum biodiesel yield, 95%, was achieved by 50Ca–Ce catalyst under the reaction conditions of 5 wt.% of catalyst, methanol to oil molar ratio of 12:1, reaction temperature of 65 °C and reaction time of 4 h. The high catalytic activity (95%) of 50Ca–Ce catalyst may be due to strong basicity and high BET surface area, which indicate more number of active sites on the catalyst surface for transesterification process. Besides, 50Ca–Ce catalyst showed better reusability than the bulk CaO where it can be reused up to 6 times without a significant loss of catalytic activity (>80%). The lixiviation of CaO active phase was greatly reduced with the presence of strong synergic interaction between CaO and CeO₂. Deactivation of the catalyst was mainly due to the leaching of CaO active phase into the methanolic solution and pore-filling by fatty acid or glycerol.

Keyword: Biodiesel; Calcium oxide; Cerium oxide; Palm oil; Transesterification