Preparation of Na2O supported CNTs nanocatalyst for efficient biodiesel production from waste-oil

ABSTRACT

The present work demonstrated the preparation of sodium oxide impregnated on carbon nanotubes (CNTs) and its application as a heterogeneous catalyst for transesterification of waste cooking oil. The catalyst was prepared by impregnation of metal oxide such as sodium oxide, Na2O on the CNTs by calcination at 500 °C for 3 h. It was assumed that the positive metal ion which is Na+ (cations) possess Lewis acidity, whereby, high negativity of oxygen ions can acts as the Brønsted bases, which could enhance the activity of the catalyst. The characterization of synthesized Na2O impregnated-CNTs nanocatalyst was performed using Temperature-programmed desorption of carbon dioxide (TPD-CO2), X-ray diffraction (XRD), infrared spectroscopy and Field emission scanning electron microscope (FESEM). Herein, the mechanism of the transesterification process assisted by the Lewis acidic metal oxide on carbon support was proposed and explained. Series of reactions were carried out to determine the performance of the catalyst. It was found that the prepared Na2O(20 wt%)/CNTs catalysts yielded above 97% of FAME yield at 65 °C assisted by 3 wt% of catalyst amount and 20:1 of methanol-to-oil molar ratio in 3 h of reaction time. Moreover, the results on catalyst's reusability indicated that the catalyst could last for 3 subsequent reaction cycles due to deactivation of the catalyst caused by leaching of metal oxides and poisioning effect on the active sites. It can be concluded that the prepared Lewis acidic carbon catalyst has a potential to catalyse the production of biodiesel from waste cooking oil (WCO).

Keyword: Heterogeneous catalyst; Na2O/CNTs; Biodiesel; Waste cooking oil; One-step process; Transesterification