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Lithium Ion Supported on TiO2 Mixed Metal Oxides as a Heterogeneous Catalyst for Biodiesel Production from Canola Oil

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Abstract : Considering the environmental issues and the shortage in the conventional fossil fuel sources, biodiesel has gained a promising solution to shift away from fossil based fuel as one of the sustainable and renewable energy. It is synthesized by transesterification of vegetable oils or animal fats with alcohol (methanol or ethanol) in the presence of a catalyst. This study focuses on synthesizing a high efficient Li/TiO2 heterogeneous catalyst for biodiesel production from canola oil. In this work, lithium immobilized onto TiO2 by the simple impregnation method. The catalyst was evaluated by transesterification reaction in a batch reactor under moderate reaction conditions. To study the effect of Li concentrations, a series of LiNO3 concentrations (20, 30, 40 wt. %) at different calcination temperatures (450, 600, 750 ºC) were evaluated. The Li/TiO2 catalysts are characterized by several spectroscopic and analytical techniques such as XRD, FT-IR, BET, TG-DSC and FESEM. The optimum values of impregnated Lithium nitrate on TiO2 and calcination temperature are 30 wt. % and 600 ºC, respectively, along with a high conversion to be 98 %. The XRD study revealed that the insertion of Li improved the catalyst efficiency without any alteration in structure of TiO2 The best performance of the catalyst was achieved when using a methanol to oil ratio of 24:1, 5 wt. % of catalyst loading, at 65◦C reaction temperature for 3 hours of reaction time. Moreover, the experimental kinetic data were compatible with the pseudo-first order model and the activation energy was (39.366) kJ/mol. The synthesized catalyst Li/TiO2 was applied to trans- esterify used cooking oil and exhibited a 91.73% conversion. The prepared catalyst has shown a high catalytic activity to produce biodiesel from fresh and used oil within mild reaction conditions.

Keywords : biodiesel, canola oil, environment, heterogeneous catalyst, impregnation method, renewable energy, transesterification
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