

Alumina supported/unsupported mixed oxides of Ca and Mg as heterogeneous catalysts for transesterification of *Nannochloropsis* sp. microalga's oil

Abstract

In this study, calcium magnesium (CaMgO) and alumina (Al₂O₃) supported CaMgO mixed oxide catalysts were prepared via pH-controlled co-precipitation (Na₂CO₃ and NaOH as a precipitant) for transesterification of crude *Nannochloropsis oculata* (*N. oculata*) oil with methanol. The catalysts were characterized by means of Thermogravimetric analyses (TGA), X-ray diffraction (XRD), Fourier transform-infrared (FTIR), Temperature programmed desorption of CO₂ (CO₂-TPD), Inductively coupled plasma–atomic emission spectrometer (ICP–AES) and Scanning electron microscopy (SEM) analysis. At optimization condition, CaMgO mixed oxide catalyst showed 75.2% of fatty acid methyl ester (FAME) yield with catalyst loading of 20 wt.% at 3 h. Meanwhile, the supported CaMgO mixed oxide catalyst gave a higher FAME yield of 85.3% with catalyst loading of 10 wt.% at same conditions. Besides, the reusability study of catalyst was performed to investigate the stability and durability of supported/unsupported catalysts. The high content of Ca²⁺ and Mg²⁺ precipitated on Al₂O₃ supported CaMgO mixed oxide catalyst tend to increase the total basicity and provide more active sites for transesterification reaction. Moreover, better moisture resistant on the Al₂O₃ supported CaMgO mixed oxide catalyst compared with CaMgO mixed oxide catalyst, which is favourable for transesterification reaction on high water content microalgae oil.

Keyword: Biodiesel; CaMgO; CaMgO/Al₂O₃; Heterogeneous; *Nannochloropsis oculata*; Transesterification