

Synthesis and characterization of Fe₂O₃/CaO derived from Anadara Granosa for methyl ester production

ABSTRACT

In this study, the iron (III) oxide (Fe₂O₃) doped on natural CaO catalyst (Fe₂O₃/CaO) was prepared and utilized in biodiesel production from used frying oil by a single-step reaction process. The heterogeneous Fe₂O₃/CaO catalyst was synthesized using impregnation method; followed by calcination at 500 °C. The catalyst was characterized in detail by both qualitative and quantitative methods such as X-ray fluorescence (XRF), X-ray diffraction (XRD), scanning electron microscope (SEM), thermal gravimetric analysis (TGA), ammonia and carbon dioxide-temperature programmed desorption (NH₃-TPD and CO₂-TPD), and Brunauer-Emmett-Teller (BET) analyses. The operating parameters such as molar ratio of methanol, catalyst amount and reaction time were investigated in order to optimize the reaction condition for the biodiesel production. As a result, the optimum reaction parameters found were 15:1 methanol-to-oil molar ratio, 65 °C reaction temperature, 3 h of reaction time and 1 wt.% of the Fe₂O₃/CaO. The reported results revealed suggestively high potential of the heterogeneous Fe₂O₃/CaO catalyst for direct conversion of used frying oil to biodiesel-with the possibility to reuse at least 5 reaction cycles without any reactivation process.

Keyword: Fe₂O₃/CaO catalyst; Used frying oil; Biodiesel; Characterization; Transesterification