

Green nano-catalyst for methanolysis of non-edible Jatropha oil

Abstract

Non-edible feedstocks are regarded as a sustainable source of renewable energy. In order to find renewable, cheaper and easier methods to obtain energy, attention has been paid to develop potential green catalyst to produce renewable biodiesel. The catalyst was characterized by X-ray diffraction (XRD) results in combination with thermogravimetry–differential thermal analysis (TG–DTA), Brunauer–Emmer–Teller (BET), Fourier transform-infrared spectroscopy (FTIR), scanning electron microscopy (SEM) and transmission electron microscopy (TEM). TEM analysis depicted that calcium methoxide ($\text{Ca}(\text{OCH}_3)_2$) catalysts were in size of 34.7 nm. The reaction parameters namely; reaction time, methanol/oil molar ratio, catalyst dosage were investigated for fatty acid methyl ester (FAME) yield. The highest biodiesel yield (95%) was appraised under the optimum condition (i.e. catalyst amount of 2 wt.%; methanol/oil molar ratio of 15:1, reaction time of 90 min). The $\text{Ca}(\text{OCH}_3)_2$ phase of catalyst can be regarded as an active phase to get high yield of biodiesel which was confirmed from characterization study. Furthermore, important fuel properties were also investigated and satisfied the ASTM D6751 and European 14214 biodiesel standards. Thus, $\text{Ca}(\text{OCH}_3)_2$ catalyst prepared in this study was having efficient, low toxicity, cost effective and easy to prepare for green fuels production especially biodiesel.

Keyword: Biodiesel; Calcium methoxide; Catalyst; Heterogeneous; Transesterification