BIODIESEL SYNTHESIS FROM CRUDE JATROPHA OIL USING AN ACTIVE HETEROGENEOUS NANO CATALYST: AN OPTIMIZED PROCESS.

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Abstract

Heterogeneous catalysts are often used at large to produce biodiesel from non-edible crude oils such as crude Jatropha oil (CJO) due to their numerous advantageous over homogeneous catalysts. In this study, an active heterogeneous calcium oxide (CaO) nano-catalyst was synthesized from waste egg shells and catalytic efficiency of CaO was investigated in a two-step transesterification of CJO triglycerides as biodiesel. The CaO nano-catalyst was synthesized using a hydro-thermal technique. Fourier transform infrared (FT-IR) spectroscopy, Brunauer-Emmett-Teller (BET), Scanning electron microscopy (SEM) and X-ray diffraction (XRD) techniques were employed to evaluate the catalyst structural characteristics. Transesterification reaction kinetics and their impact on biodiesel were analyzed by utilizing a response surface model based on central composite design. The primary reaction parameters such as catalyst concentration and the reaction time were considered for the two-factor-five-level, full factorial model. The remaining parameters that include, methanol to oil ratio, stirring RPM and reaction temperature were treated as constants. The sufficiency of the predicted model was conformed through experiments, and a 96.47% biodiesel was noted at 0.02:1 (w/w) catalyst concentration and 128 min reaction time. An average of 93.2% biodiesel yield was recorded from the CaO catalyst recycling studies up to 5th reuse cycle.

Keywords: Biodiesel; Heterogeneous catalyst; waste egg shells; Response surface methodology.