

An optimization study for transesterification of palm oil using Response Surface Methodology (RSM)

ABSTRACT

Biodiesel was produced via transesterification of palm oil with methanol in the presence of CaO-Nb₂O₅ mixed oxide catalyst. Response surface methodology (RSM) with central composite design (CCD) was performed to determine the optimum operating conditions and to optimize the biodiesel yield. In this study, the reaction variables being optimized were reaction time, catalyst loading and methanol to oil molar ratio. From the analysis of variance (ANOVA), the most influential parameter on biodiesel production was reaction time. The predicted yield was found in good agreement with the experimental value, with $R^2 = 0.9902$. The optimum biodiesel yield of 97.67% was achieved at 2.67 h reaction time, with 3.60 wt. % of catalyst and with methanol to oil molar ratio of 13.04. The high biodiesel yield can be correlated to the synergic effect of basicity between the metallic ions of CaO-Nb₂O₅ shown in the physicochemical analysis.

Keyword: Biodiesel; Optimization; Palm oil; RSM; Transesterification