

Title: Single and two-step homogeneous catalyzed transesterification of waste cooking oil: optimization by response surface methodology

Author/Authors: Amin Talebian-Kiakalaieh, Nor Aishah Saidina Amin

Abstract: Large number of studies related to alkali and acid catalyzed transesterification of waste cooking oil are widely available, but references for optimization and modeling comparison between single and two-step transesterification are scarce. Therefore, response surface methodology (RSM) has been employed to study the relationship between process variables and predict the optimal conditions. Sulfuric acid and sodium hydroxide were utilized in the pretreatment step and alkali catalyzed transesterification reaction, respectively. The highest free fatty acid (FFA) conversion in the two- and single-step reactions was 93.8% and 82.7%, respectively at the optimal reaction conditions being 1.1 wt% catalyst loading, 6.5:1 methanol to oil ratio, 60°C reaction temperature, and 65 min reaction time. RSM could accurately predict the optimal FFA conversion in both two- and single-step processes by only 0.3% and 1.01% error, respectively. In addition, the two-step method produced higher fatty acid methyl ester (FAME) yield (86.7%) and also improved the final product quality compared to single-step method with only 73.7% biodiesel yield.