World Academy of Science, Engineering and Technology
International Journal of Mathematical and Computational Sciences
Vol:14, No:12, 2020

NaOH/Pumice and LiOH/Pumice as Heterogeneous Solid Base Catalysts for Biodiesel Production from Soybean Oil: An Optimization Study

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Abstract : Transesterification reaction of soybean oil with methanol was carried out to produce fatty acid methyl esters (FAME) using calcined alkali metal (Na and Li) supported by pumice silica as the solid base catalyst. Pumice silica catalyst was activated by loading alkali metal ions to its surface via an ion-exchange method. Response surface methodology (RSM) in combination with Box-Behnken design (BBD) was used to optimize the operating parameters in biodiesel production, namely: reaction temperature, methanol to oil molar ratio, reaction time, and catalyst concentration. Using the optimized sets of parameters, FAME yields using sodium and lithium silicate catalysts were 98.80% and 98.77%, respectively. A pseudo-first order kinetic equation was applied to evaluate the kinetic parameters of the reaction. The prepared catalysts were characterized by several techniques such as X-ray diffraction (XRD), Fourier transform infrared spectroscopy (FTIR), Brunauer-Emmett-Teller (BET) sorptometer, and scanning electron microscopy (SEM). In addition, the reusability of the catalysts was successfully tested in two subsequent cycles.

Keywords : alkali metal, biodiesel, Box-Behnken design, heterogeneous catalyst, kinetics, optimization, pumice, transesterification
Conference Title : ICSRD 2020 : International Conference on Scientific Research and Development
Conference Location : Chicago, United States
Conference Dates : December 12-13, 2020