

Transesterification of used cooking oil over alkali metal (Li, Na, K) supported rice husk silica as potential solid base catalyst

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ABSTRACT

Investigation was conducted on three alkali metals (Li, Na, and K) supported by rice husk silica as catalysts for methyl esters production. A simple pseudo-heterogeneous transesterification process of used cooking oil with methanol was conducted to produce methyl esters using calcined alkali metal supported rice husk silica as a solid catalyst. Alkali metal silicate catalysts showed longer lasting activity than the traditional alkali catalysts. The optimum conditions for the process were: alkali metals silicate calcination temperature 500 °C, time 3 h; catalyst amount 3%; methanol to oil molar ratio 9:1; and a reaction temperature of 65 °C. The process was able to transesterify oil to methyl esters in the range of 96.5–98.2% in 1 h for all series. The catalyst is able to tolerate free fatty acid and moisture up to 1.25% and 1.75%, respectively. The catalyst was easily separated from the reaction mixture by filtration and able to reuse six times. The final product met the selected biodiesel fuel properties in accordance with Euro-pean Standard (EN) 14214.

Keywords:

Used cooking oil Transesterification; Alkali metal; Rice husk silica; Pseudo-heterogeneous catalyst Methyl ester