

Parametric sensitivity in sunflower oil ethanolysis using Shea nut shell based catalyst

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Abstract

The present work reports the production of ethanolic biodiesel with a carbon based catalyst. Shea (*Vitellaria paradoxa*) nut shells (SNS) were used as raw material to prepare carbon based catalyst by chemical activation with potassium hydroxide (KOH). The catalysts were characterized by XRD, EDX, SEM, ICP/OES and FTIR. The influence of ethanolysis reaction parameters including reaction temperature, reaction time, catalyst loading, ethanol to oil molar ratio and reaction stirring speed were investigated to identify the optimal conditions. With the optimal and highly stable catalyst prepared at a pyrolysis temperature of around 650 °C, 120 min pyrolysis residence time and a KOH to SNS ratio of 14 wt%, a conversion yield of 98% was obtained using the following transesterification conditions: 30 °C reaction temperature, 30 min reaction time, a 12:1 ethanol to oil molar ratio, catalyst loading of 10 wt% (oil weight basis) and a stirring speed of 650 rpm. The catalytic activity was linked to the development of active species of K₂CO₃. The catalyst lost activity when water was present in the ethanol, conversion yield decreased to respectively 86% and 72% at 2% and 5% ethanol water content. Catalyst recyclability and stability were investigated. The catalyst was used 3 times and catalyst activity was still 75.7% at the third run after regeneration of the catalyst by thermal treatment.

Keywords: Biodiesel; Shea nut shell; Carbon based catalyst; Ethanolysis; Parametric sensitivity.

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