

SiO₂-rich sugar cane bagasse ash catalyst for transesterification of palm oil

ABSTRACT

This study demonstrated the performance of the sugarcane bagasse ash (SCBA) impregnated with calcium oxide (CaO) as a novel heterogeneous basic catalyst in biodiesel production. The SCBA was prepared by calcination for 2 h at 500 to 800 °C and impregnated with CaO loadings (10 to 40 wt.%). The prepared SCBA/CaO catalyst was characterized using Fourier transform infrared spectroscopy (FTIR), scanning electron microscopy (SEM), X-ray diffraction (XRD), temperature programmed desorption of carbon dioxide (TPD-CO₂), thermal gravimetric analysis (TGA), X-ray fluorescence (XRF) and Brunauer-Emmett-Teller (BET) surface characteristics. A series of transesterification reactions were conducted to evaluate the performance of the catalysts. As a result, highest FAME yield of 93.8% was obtained by using SCBA600°C/CaO(40%) catalyst at 20:1 methanol-to-oil molar ratio, reaction temperature of 65 °C, with 6 wt.% catalyst in 3 h. Besides, the catalyst can be reused up to 5 reaction cycles with biodiesel yield of 93.0% and 70.3% at first and fifth cycles, respectively. In this work, it was found that the natural SiO₂ in the SCBA has a significant role to enhance the catalytic performance and reduce the catalyst's deactivation drawback by minimizing the leaching of active sites.