ABSTRACT

The increasing energy demand and the implementation of the B40–B50 biodiesel program in Indonesia have encouraged the development of sustainable feedstocks and catalysts for biodiesel production. Sunan candlenut oil, characterized by its high oil content and non-edible nature, is a promising biodiesel feedstock. This study aimed to synthesize and characterize an MgO-Al_2O_3/KIT-6 catalyst derived from rice husk silica and evaluate its performance in biodiesel production. Silica obtained from rice husk waste contained 95.10% SiO_2, as determined by XRF analysis, and was used as a precursor for KIT-6 synthesis via the hydrothermal method. The MgO-Al_2O_3/KIT-6 catalyst was prepared through wet impregnation and mechanical mixing. XRD analysis revealed the presence of amorphous silica as well as characteristic peaks of Al_2O_3 and MgO. FTIR spectra confirmed the presence of Si–O–Si, Si–OH, Si–O–Al, and Mg–O groups, while SEM–EDS analysis verified the successful incorporation and uniform distribution of the active species. The catalyst exhibited a specific surface area of 154.74 $m^2\ g^{-1}$ and possessed weak to strong basic sites according to CO_2-TPD analysis. The optimum transesterification conditions were obtained at 70 °C and an oil-to-methanol molar ratio of 1:18, yielding 76% biodiesel with a FAME content of 88.73%. The produced biodiesel met the requirements of SNI 7182:2015.

Keywords: *biodiesel; kemiri sunan; transesterification; heterogeneous catalyst; silica*


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