ABSTRACT

The increase in carbon emissions in the aviation sector drives the urgency of developing bio-jet fuel from coconut oil via hydrocracking reactions. This study aims to synthesize and characterize sulfided Ni-Mo bimetallic catalysts supported on rice husk-based mesoporous silica, and to evaluate the effect of the Ni:Mo mole ratio on their catalytic activity. Silica was extracted from rice husks using NaOH, which was subsequently synthesized into mesoporous silica using P123 copolymer as a structure-directing agent. Catalyst preparation was conducted via the co-impregnation method with a combined metal weight loading of 5% and varying Ni:Mo mole ratios of 1:1 (KW11), 2:1 (KW21), and 3:1 (KW31), followed by a sulfidation process using thiourea. Catalyst characterization was performed using FTIR, XRF, XRD, and GSA analyses. The coconut oil hydrocracking activity test was carried out using a catalyst-to-oil mass ratio of 1:50, and the resulting liquid products were analyzed using GC-MS. The XRD characterization results confirmed the presence of amorphous SiO_2, MoS_2, and NiS phases, while the FTIR spectra exhibited the vibrational bands of silanol and siloxane groups, as well as the presence of acid sites. Physicochemical analysis indicated that an increase in the Ni ratio decreased the surface area and increased the acidity of the catalyst; KW11 exhibited the highest surface area and acidity, at 547.40 m^2/g and 8.96 mmol/g, respectively. The catalytic test results demonstrated that an increase in the Ni:Mo mole ratio was directly proportional to the selectivity of the aviation fuel fraction (C_8-C_{16}) and the liquid product yield, with the KW31 catalyst providing the highest values of 97.06% and 44.01%, respectively. The KW11 catalyst possessed the most optimal deoxygenation capability, indicated by the lowest percentage of oxygenate products at 50.05%.

Keywords: *Sustainable aviation fuel (SAF), hydrocracking, Ni-Mo catalyst, mesoporous silica, sulfidation.*