

Lewis acid Ni/Al-MCM-41 catalysts for H₂-free deoxygenation of Reutealis trisperma oil to biofuels

ABSTRACT

The activity of mesoporous Al-MCM-41 for deoxygenation of Reutealis trisperma oil (RTO) was enhanced via modification with NiO nanoparticles. Deoxygenation at atmospheric pressure and under H₂ free conditions required acid catalysts to ensure the removal of the oxygenated fragments in triglycerides to form liquid hydrocarbons. NiO at different weight loadings was impregnated onto Al-MCM-41 and the changes of Lewis/Brønsted acidity and mesoporosity of the catalysts were investigated. The activity of Al-MCM-41 was enhanced when impregnated with NiO due to the increase of Lewis acidity originating from NiO nanoparticles and the mesoporosity of Al-MCM-41. Increasing the NiO loading enhanced the Lewis acidity but not Brønsted acidity, leading to a higher conversion towards liquid hydrocarbon yield. Impregnation with 10% of NiO on Al-MCM-41 increased the conversion of RTO to hydrocarbons via the deoxygenation pathway and reduced the products from cracking reaction, consequently enhancing the green diesel (C₁₁–C₁₈) hydrocarbon products.