Hydrodeoxygenation of oleic acid for effective diesel-like hydrocarbon production using zeolite-based catalysts

ABSTRACT

This study investigated the hydrodeoxygenation (HDO) of oleic acid (OA) that is abundantly found in palm oil for the production of renewable diesel. The effectiveness of mesoporous catalysts, HZSM-5 and zeolite beta, in favoring diesel hydrocarbons was determined. The catalysts were activated by calcination at 550 °C for 5 h and their physicochemical properties were determined using X-ray diffraction (XRD), scanning electron microscopy (SEM), temperature-programmed desorption using ammonia probe molecules (TPD-NH3), and Brunauer–Emmett–Teller analysis (BET). XRD analysis of both zeolite beta and HZSM5 showed high crystalline size of 24 and 84 nm, respectively. BET analysis found that the zeolite beta catalyst had a greater surface area (648 m2 g−1) than HZSM5 (465 m g−1) without significant differences in pore size and volume. According to the TPD-NH3 study, zeolite beta had the most weak medium acid sites when compared to HZSM5. It should be noted that HZSM5 also demonstrated the presence of strong acid sites. The optimal conditions for both catalysts were 350 °C, 4 MPa hydrogen pressure, and 5% catalyst load over a 2 h reaction period. From the results, the zeolite beta exhibited superior HDO reaction activity than HZSM5 with diesel selectivity~77%.