Catalytic deoxygenation of waste cooking oil utilizing nickel oxide catalysts over various supports to produce renewable diesel fuel

ABSTRACT

The development of renewable diesel fuel from the deoxygenation of non-edible oil is an alternative to non-renewable fuels. Herein, the evaluation of catalytic deoxygenation of waste cooking oil (WCO) over supported Ni-based catalysts was investigated. A series of Ni-based catalysts supported on activated carbon (AC), reduced graphene oxide (rGO), and beta zeolite (Zeo) were prepared via the wet-impregnation method and later carbonised under N_2 flow at 550 °C for 4 h. Addition of Ni to AC improves the good physicochemical properties of the catalyst, owing to the high number of acid-base sites, high surface area, smaller crystallite size, and high pore volume of the catalyst. From the catalytic results, Ni_{20}/AC was the most active catalyst by giving 90% hydrocarbon yield and 89% selectivity towards n-(C_{15} + C_{17}) under H_2-free and solvent-free conditions for 3 h at 350 °C and 300 rpm. Furthermore, it was stable up to the fourth cycle with consistent hydrocarbon yield (85–87%) and 66–77% selectively towards n-(C_{15} + C_{17}). Overall, Ni_{20}/AC shows highly promising catalytic performance due to its good physiochemical properties and high catalyst stability.