Development of bimetallic nickel-based catalysts supported on activated carbon for green fuel production

ABSTRACT

In this work, the catalytic deoxygenation of waste cooking oil (WCO) over acid–base bifunctional catalysts (NiLa, NiCe, NiFe, NiMn, NiZn, and NiW) supported on activated carbon (AC) was investigated. A high hydrocarbon yield above 60% with lower oxygenated species was found in the liquid product, with the product being selective toward n-(C15 + C17)-diesel fractions. The predominance of n-(C15 + C17) hydrocarbons with the concurrent production of CO and CO2, indicated that the deoxygenation pathway proceeded via decarbonylation and decarboxylation mechanisms. High deoxygenation activity with better n-(C15 + C17) selectivity over NiLa/AC exposed the great synergistic interaction between La and Ni, and the compatibility of the acid–base sites increased the removal of oxygenated species. The effect of La on the deoxygenation reaction performance was investigated and it was found that a high percentage of La species would be beneficial for the removal of C–O bonded species. The optimum deoxygenation activity of 88% hydrocarbon yield with 75% n-(C15 + C17) selectivity was obtained over 20% of La, which strongly evinced that La leads to a greater enhancement of the deoxygenation activity. The NiLa/AC reusability study showed consistent deoxygenation reactions with 80% hydrocarbon yield and 60% n-(C15 + C17) hydrocarbon selectivity within 6 runs.