Preparation of Ni, Mg, and Fe Ions Doped Carbon-Based Catalyst with Ordered Mesoporous Configuration for Catalyzing the Production of Green Diesel from Fatty Acid and Waste Cooking Oil

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Abstract : Green diesel is a renewable biofuel obtained from plant oil or fatty acid deoxygenation. Because the molecular structure of green diesel is similar to that of fossil fuel, green diesel can be directly used in present vehicle engines without blending with fossil fuel. In this study, mesoporous carbon-based catalysts with doped metal ions, such as Mg, Ni, or Fe, were prepared using co-polymers and gallic acid as molecular templates and carbon sources, respectively. The prepared catalysts were then applied to carry out the deoxygenation of fatty acid and waste cooking oil. To obtain the highest net energy from the produced green diesel, the catalyzed deoxygenation reaction and catalyst preparation processes were carried out under ambient conditions, respectively, to avoid using H_2 as a reagent and reducing agent. XRD, BET, SEM, EDS, FT-IR, and pyridine-IR characterized the composition and configuration of the prepared catalyst. The results display that the doped metal ions were well-dispersed in the carbon-based catalyst and the surface of the catalysts was rich in Lewis acid sites after the catalysts were calcined at the proper temperature. The pore size present on the catalyst was 9-11 nm. To catalyze the deoxygenation of fatty acid by the prepared catalysts at 320℃ under H_2-free conditions, high fatty acid conversion (99%) and high selectivity for hydrocarbons (78%) were obtained when the ratio of doped Ni to doped Mg was optimized.

Keywords : ordered mesoporous carbon, catalysts, hydrocarbons, deoxygenation
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