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AREA: Catalysis applied to the production of fuels, biofuels, chemical products and energy.

Catalytic hydropyrolysis of licuri oil for the production of sustainable biofuels

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Resumo-Abstract.

The dependence on energy sources that pollute the environment and contribute to global warming is a problem that requires multiple solutions to be overcome. Brazil is a major producer of oilseeds that can serve as raw material for the production of sustainable biofuels, such as the licuri palm (Syagrus coronata). Licuri oil is composed mainly of medium-chain saturated fatty acids, predominantly lauric and myristic acids. Pyrolysis of these fatty acids can produce hydrocarbons in the range of aviation kerosene. However, pyrolysis in an inert environment produces many oxygenated compounds. One way to reduce these oxygenates is the use of catalysts and the pyrolysis process in the presence of hydrogen, hydropyrolysis. This study aims to evaluate the potential of hydrodeoxygenation (HDO) of licuri oil in the presence of catalysts for the production of biofuels via catalytic hydropyrolysis under a hydrogen atmosphere. HZSM-5 zeolite catalysts, either pure or impregnated with 15% Mo and 3.5% Ni, were used. The catalysts were characterized by X-ray diffraction (XRD), nitrogen adsorption/desorption and temperature programmed reduction (TPR). Hydropyrolysis was performed in a microreactor at 400 °C coupled to a gas chromatograph (GC/MS). The characterization of the licuri oil indicated low acidity (1%), with lauric acid being the predominant component. XRD analysis revealed that the crystal structure of the zeolites was not altered after metal impregnation. TPR indicated that the catalysts presented high initial reduction temperatures, suggesting strong interactions between the support and the metals. Nitrogen adsorption/desorption demonstrated a decrease in surface area and pore volume with the addition of metals (from 335 to 229 m^2/g and from 0.062 to 0.053 cm^3/g), suggesting possible pore filling by metals. In the hydropyrolysis of licuri oil, it was observed that both zeolites showed greater selectivity for hydrocarbons (especially aromatics such as benzene, toluene and xylene) compared to uncatalyzed hydropyrolysis. The addition of Ni and Mo to the zeolite improved the selectivity for alkenes such as nonene, decene, undecene and dodecene, in addition to increasing the conversion of licuri oil. Meanwhile, the zeolite without metals led to less oxygenate formation and greater selectivity for aromatic compounds. Thus, catalytic hydropyrolysis is identified as a promising method for the production of biofuels and high value-added compounds. The use of licuri oil as a raw material promoted the production of hydrocarbons in the sustainable aviation kerosene range.

Keywords: Deoxygenation, HZSM-5, Lauric acid.

Referências

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