Hydrocracking of soybean, castor and palm-tree oils catalyzed by rhodium and ruthenium nanoparticles

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As a consequence of the oil supply crisis and the increasing demand for liquid fuels and the environmental awareness, the study of biomass as alternative energy sources has intensified in the last decades. Several alternative liquid fuels for diesel engines have been proposed, such as the direct use of fats and oils, the use of methyl or ethyl fatty acid esters (biodiesel) and hydrocarbons produced by thermal cracking of fatty materials (renewable diesel). The production of renewable diesel by thermal cracking has several issues due to incomplete deoxygenation of the fuel, leading to a mixture containing not only hydrocarbons but also a wide variety of oxygenated compounds, such as fatty acids, aldehydes and ketones. In order to address this issue different approaches have been proposed, such as performing the cracking in the presence of steam, solid catalysts (catalytic cracking) and the use of catalysts and hydrogen (hydrocracking). In this work we processed vegetable oils by hydrocracking in order to deoxygenate triacilglycerides and hydrogenate the alkyd chains and produce linear hydrocarbons in the range of diesel fuel. We have hydrocracked soybean, palm-tree and castor oil in the presence and absence of ruthenium and rhodium nanoparticles supported on a magnetic responsive material. At 200 ºC it was observed only the hydrogenation of C=C bonds. At 400 ºC was observed the decomposition of the triacilglycerides, leading to hydrocarbons and oxygenated compounds. In the presence of the catalyst, the deoxygenated products strongly increased. The catalyzed hydrocracking of soybean, castor and palm-tree oils increases the formation of long chain linear hydrocarbons, which are suitable to be used as diesel fuel, when compared with the pyrolysis (reaction in the absence of the catalysts). The ruthenium catalyst is more effective than rhodium, especially for castor oil, probably due to its higher oxophilicity when compared to rhodium.

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