HYDROGENATION OF SUNFLOWER OIL USING COMPOSITES OF NICKEL WITH ACTIVATED CARBON AS CATALYSTS

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The search for alternative fuels is an urgent task for Ukraine due to high prices for petroleum products and dependency on foreign suppliers. Biodiesel is a promising candidate for diesel fuel substitution, a blend of methyl esters of fatty acids enriched with methyl cis-oleate. Typically derived from the hydrogenation of hydrolyzed vegetable oil products, biodiesel production holds significant promise for Ukraine, given its status as the world's leading producer of sunflower oil. However, the hydrogenation reactions require either precious metals catalysts or a substantial excess of sponge-like Raney nickel, thereby reducing atom economy of the process.

The aim of the study was to develop hydrogenation catalysts with reduced nickel content, enabling the production of mixtures of fatty acids methyl esters with high methyl cis-oleate content. Partial hydrogenation of the components of oil is essential for improvement of its storage capacity, however complete hydrogenation leads to formation of solid, which is not desired.

A series of nickel composites was prepared by deposition of nickel oxide of basic carbonate on various carriers (SiO_2, activated carbon, bentonite) followed by reduction in flow of hydrogen, or by thermal decomposition of nickel compounds (acetylacetonate, formate) on the respective carriers followed by reduction in hydrogen.

The composites were tested in the hydrogenation reaction of commercially available sunflower oil; the products were analyzed by ^1H NMR as well as gas chromatography with mass-spectral detection of products after methanolysis. The sunflower oil contained the residues of unsaturated fatty acids, among which the derivatives of 9,12-octadecadienoic and 9-octadecenoic acids were dominating components. Hydrogenation of the oil led to decrease of the content of the first component and respective growth of the second one or formation of the derivatives of octadecanoic acid. It was found that the content of double bonds linearly decreased with time upon hydrogenation, allowing control of the process completeness.

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