

## RESUMO - BIOCOMBUSTÍVEIS

### HETEROGENEOUS CATALYSTS REINFORCED WITH NANOPARTICLES FOR BIODIESEL PRODUCTION

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Faced with a critical scenario for the environment, developing technologies focused on preventing environmental damage is becoming increasingly important. Promoting more sustainable practices, which help develop alternative energy sources to reduce environmental degradation, it's fundamental to the process in question. Biodiesel, a sustainable and renewable fuel, emerges as a promising substitute for fossil-based diesel. It is a biofuel composed of monoalkyl esters of long-chain fatty acids, obtained through the

transesterification of vegetable oils and animal fats. This advance in biodiesel production not only represents an environmentally conscious alternative, but also arouses considerable interest in its low-cost economic production, with a view to its use in blends with fossil diesel to promote a more sustainable future for society. However, many difficulties are still encountered in its production. The use of homogeneous catalysts results in the formation of soap during the reaction, beside the generation of large quantities of wastewater during purification, high-energy costs and corrosion of the reactors. The use of a heterogeneous catalyst in the process helps to optimize the product purification process, as well as avoiding secondary reactions. The geopolymer is an inorganic material synthesized through a chemical reaction, containing a material composed of silicon and aluminum combined with an alkaline activator. Scientific progress in the production of geopolymers has demonstrated high catalytic activity in the production of biodiesel. The purpose of this study is to develop a heterogeneous catalyst with the addition of magnetic nanoparticles produced by the green route. Therefore, a survey was carried out in the Scopus database, searching for the keywords: TITLE-ABS-KEY ("catalyst\*" biofuel AND nano\*) AND (LIMIT-TO (DOCTYPE, "ar") ). The study was conducted on 15/07/2024, covering the period from 01/01/2000 to 15/07/2024, resulting in a total of 1686 documents. The information was exported as a file in RIS format for later loading into the VOSviewer software, which is a tool for building and visualizing bibliometric networks. The growing trend in the number of publications on the use of heterogeneous catalysts demonstrates the great potential for development in this area of study. Based on the analysis of the results obtained using the VosViewer software, it is possible to affirm that heterogeneous catalysis presents aspects of extreme relevance for making it possible to reduce the cost and improve the yield of biofuel. The synthesized catalyst was characterized using X-Ray Diffraction (XRD), Fourier Transform Infrared Spectroscopy (FTIR), Magnetic Strength, Apparent Porosity and Total Porosity. To assess their catalytic activity, vegetable oil biodiesels were produced, the products were evaluated by Density, Viscosity, Thermogravimetric Analysis (TGA) and FTIR. The first results showed that the addition of magnetic nanoparticles increased the active sites of the geopolymer, leading to an increase in the conversion rate in the synthesis of biodiesel (98%) and a 3-fold

reuse rate. The biodiesel obtained had parameters in accordance with ANP Resolution 920/2023.

Palavras-chave: biofuels; biodiesel; characterization; catalysis magnetic nanoparticles; green synthesis sustainability.