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## Purification of biodiesel produced from used cooking oil using natural-origin adsorbents

Miriam Domingues Guimarães<sup>1,2,\*</sup>, Camila Groxco Smolich<sup>1,2</sup>, João Vitor Fabian<sup>1,2</sup>, Marina Celant De Prá<sup>3</sup>, Ana Queiroz<sup>1,2</sup>, Paulo Brito<sup>1,2</sup>, António E. Ribeiro<sup>1,2</sup>

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Biodiesel is a biofuel with significant potential to replace conventional diesel. It is obtained through a transesterification reaction between oil and alcohol, in the presence of a catalyst. At the end of this reaction, a decantation process is carried out, forming two phases: the upper phase, which is biodiesel, and the lower phase, which is rich in glycerol. Before being used, biodiesel must undergo a purification process to remove glycerin residues and other contaminants [1]. This purification step plays a crucial role in the biodiesel production chain. Among the most common processes are water washing, the use of ion exchange resins, and adsorbents. The use of adsorbents in biodiesel purification eliminates the need for water, thereby avoiding the generation of effluents, and the adsorbents can be reused. Adsorbents function to remove contaminants, such as water, soap, and traces of glycerin, based on their chemical polarities and acidic and basic properties [2].

The use of commercial adsorbents has a significant economic impact due to the increased production costs and environmental concerns regarding their final disposal when saturated. One solution to this problem is the use of natural adsorbents, which are biodegradable and often derived from agro-industrial waste, such as wood, water hyacinth, food, coconut fiber, pecan nutshells, among others [3].

The use of natural adsorbents can occur in two ways: in their natural state or through the production of activated carbon materials which contain a variety of compounds, with carbon as its main constituent. Although it does not have a specific morphology, it has a high surface area and porosity. It is a widely used adsorbent due to its effectiveness in removing contaminants. Furthermore, it can be easily produced in large quantities from various agricultural by-products, making it a sustainable and economically viable option [4].

This work aims to investigate the production and characterization of natural based adsorbent materials, both in their natural form and as activated carbons, and their subsequent use for the purification of crude ethanolic biodiesel produced from waste cooking oil. The materials' precursors were: almond shells, walnut shells, rice husks, olive pits, and powdered cork. The characterization tests conducted include moisture content determination, ash content, pH, bulk density, cellulose content, hemicellulose, and lignin content determination, particle size analysis, specific surface area measurement, determination of the zero point of charge, identification of basic and acidic groups, determination of chemical groups, and thermogravimetric analysis. Subsequently, adsorption performance tests will be carried out.

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