385c Applications of Adsorption Technology for the Optimization of Processes for Biodiesel Production

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Biofuels production has raised increasing attention lately with the increasing awareness on the environmental problems related to the continuous use of fossil fuels. Besides being obtained from renewable natural resources, such as vegetable oils, biofuels usually yield fewer emissions of sulfur compounds to the atmospheric environment. Recent government regulations in Brazil are enhancing the production and usage of biodiesel oil from vegetable oils, such as mamona oil, in mixtures to the diesel oil obtained from petroleum refining. Processing alternatives to optimize the biodiesel production from mamona oil would be welcome in this context.

In the current biodiesel processes employed in Brazil, the vegetable oil is reacted with an alcohol (methanol or ethanol), in the presence of an alkaline catalyst in a homogeneous reactor. A transesterification reaction takes place, yielding biodiesel (fatty acids esters) in an organic phase with glycerol as a byproduct. The industrial process involves several steps: catalytic preparation, transterification reaction, phases separation, alcool and soap removal. We are studying the application of adsorption processes to enhance the productivity in the biodiesel production process in several different steps.

At the catalyst preparation step, water is formed as an undesirable byproduct, so its removal would displace the reaction to favor the catalyst production. Molecular sieve adsorbents are being studied for this purpose. At the reaction step, glycerol is formed as another product of the transesterification reaction. Its removal from the reaction medium would displace the reaction equilibrium to increase the yield of the reaction to the esters, and also facilitate the following purification step of the biodiesel product. For that, we are evaluating several molecular sieves for the purpose of removing glycerol from the system. Finally, also at the reaction step, soap (fatty acid salts) may be formed from the presence of hydroxide ions in excess that react with the vegetable oil. Soap is an undesirable contaminant for biodiesel oil, increasing the alkalinity of the product. Silica adsorbents are being evaluated for soap removal after the reaction step, which is currently performed by successive washings with water and acid.