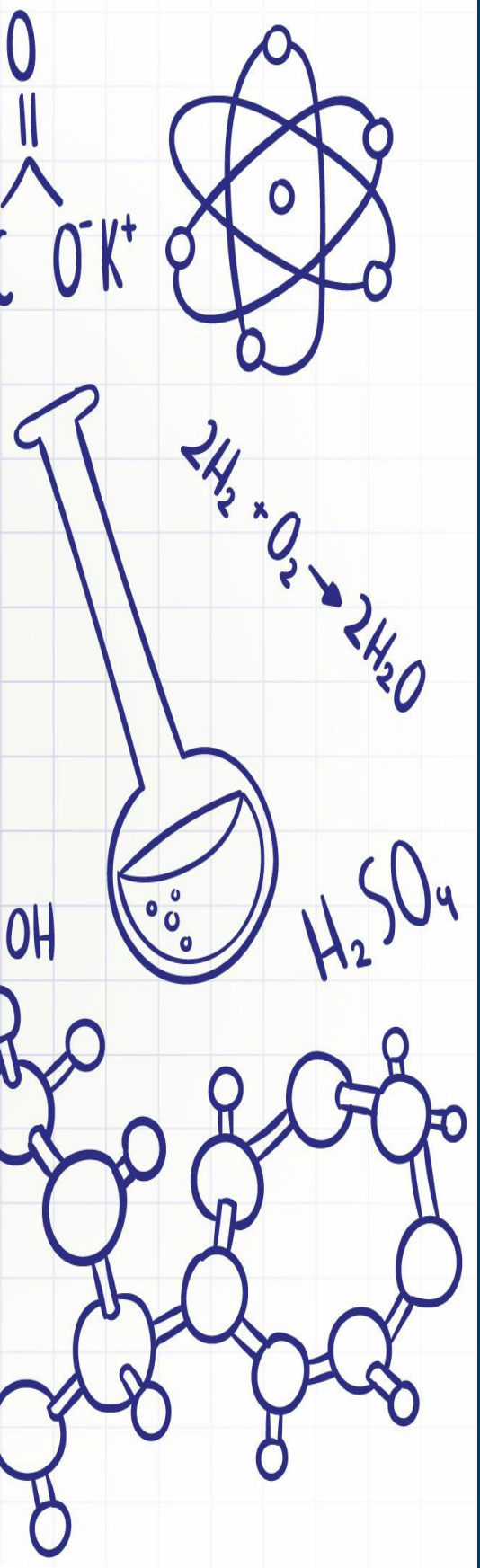

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Pontevedra (España)

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Production of biodiesel through esterification catalyzed by ionic liquids

Bárbara Meireles, António Ribeiro, Ana Maria Queiroz and Paulo Brito

Department of Chemical and Biological Technology, School of Technology and Management, Polytechnic Institute of Bragança, Campus de Santa Apolónia, PO Box 1134, 5301-857 Bragança, Portugal

In recent decades, there is a growing interest in the development of alternative technologies to the oil economy, based on so-called renewable energy sources. One of the possible solutions is a biofuel usable in compression-ignition engines (or diesel engines), produced from biomass rich in fats and oils. Thus, a wide range of raw materials can be used in the production of biodiesel, from the application of edible commercial oils to the recycling of waste oils.

Biodiesel, which chemically is composed by a mix of fatty acid methyl esters (FAME's), is usually produced by transesterification of the triglycerides contained in vegetable oils and animal fats, in the presence of extensive types of homogeneous or heterogeneous catalysts. Alkali catalysts provide high yields for the production of biodiesel, in relatively mild conditions, but require a previous neutralization of the oils. Thus, the usage of high acidic raw materials may introduce problems which necessarily would affect negatively the quality of the biodiesel produced. Particularly, resorting to second generation triglyceride sources that do not compete with the food market like waste cooking oils, which usually feature high levels of free fatty acids (FFA's), can put problems in the classic process of production of biodiesel through alkaline transesterification. However, these problems can be partially overcome by the use of catalysts, such as ionic liquids (IL's) that promote also the reactions of esterification of FFA's to FAME's.

In fact, recently it has been observed an increased interest in the application of IL's in multiple fields, mainly as solvents[1] and catalysts[2-4] to a wide variety of reaction systems. In this work, it is presented a study of the performance of the acidic IL, 1-butyl-3-methylimidazolium hydrogen sulfate ([BMIM]HSO_4), as a catalyst for the esterification of a mix of fatty acids (mainly composed by oleic acid) to the respective FAME's, using methanol, at a relatively low temperature (65 ºC), with reaction times ranging from 5-6 hours.

Multiple reaction batches were designed varying oleic acid/methanol mole ratio and the mass of catalyst. On the other hand, the reaction performance is monitored by, the estimate of the reaction yield, measuring the final product acidic value through volumetric titration, and the assessment of total FAME content of the biodiesel product by Gas Chromatography (GC).

The usage of GC makes possible the identification, and consequent quantification, of the several FAME's present in the produced biodiesel. In the conditions described above the typical reaction yields reach values as high as 90%, and the total weight content of FAME's in the biodiesel product, ranges between 80-90%. Thus, it is possible to sustain that the studied ionic liquid ([BMIM]HSO_4) proves to be a promising possibility for the esterification reaction catalysis, and a viable alternative for the production of biodiesel.

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