11th International Conference
on Advanced Materials
Rio de Janeiro Brazil
September 20 - 25
ICAM2009

Synthesis of Aluminum Based Heterogeneous Catalysts for the Biodiesel Production

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Abstract – Biodiesel is a biofuel obtained from natural and renewable sources that can be used as fuel in diesel engine. With regard to the catalysis, this can be divided among homogeneous and heterogeneous routes. the focus of this work is to synthesize solid heterogeneous catalysts supported by oxide and hydroxide materials, obtained from the sol-gel process, to be used in the transesterification of vegetable oils for the Biodiesel production. The obtained catalysts were characterized by X-ray diffraction and Scanning Electron Microscopy measurements. The catalysts efficiency was tested by performing transesterification reactions.

Biodiesel is a biofuel obtained from natural and renewable sources that can be used as fuel in diesel engine. This fuel is composed of monoalkil esters produced by a chemical reaction in vegetable oils, animal fats or discarded cooking oil, using an alcohol, usually methanol or ethanol. Among the processes used in the Biodiesel obtaining, the transesterification combines better use/conversion taxes, with smaller environmental impact. The transesterification, for this purpose, is implemented with the catalysts use [1]. Natural vegetable oils and animal fats are extracted or pressed to obtain crude oil or fat. These usually contain free fatty acids, phospholipids, sterols, water, odorants and other impurities. Even refined oils and fats contain small amounts of free fatty acids and water. The free fatty acid and water contents have significant effects on the transesterification of glycerides with alcohols using alkaline or acid catalysts. They also interfere with the separation of fatty acid esters and glycerol [2]. With regard to the catalysis, this can be divided among homogeneous and heterogeneous routes [3]. However, the process of heterogeneous catalysis is the better to the reuse of the catalysts, as well as his separation of the catalyzed medium [3]. In this context, the focus of this work is to synthesize solid heterogeneous catalysts supported by oxide and hydroxide materials, obtained from the sol-gel process, to be used in the transesterification of vegetable oils for the Biodiesel production. In order to prepare catalysts and for the respective transesterification reactions, we used as precursors aluminum nitrate ($Al(NO_3)_3.9H_2O$),sodium hydroxide (NaOH), methanol (CH_3OH), deionized water, and refined soybean oil. The heterogeneous catalyst was obtained from the sol-gel process. After having carried out the sol-gel process, it was obtained aluminum hydroxide ($AlOH_3$). The obtained catalysts were characterized by X-ray diffraction (XRD) and Scanning Electron Microscopy (SEM) measurements. The catalysts efficiency was tested by performing transesterification reactions. The authors would like to thank CNPq Brazilian agency for financial support.

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