

Using hydrotalcite for biodiesel production

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Keywords: hydrotalcite, biodiesel, catalyst.

As everybody knows, the present global energy system is long term unsustainable as consequence of the environmental impact generated the geopolitics dependencies and its unequal distribution of the resources. In this context, it is necessary to develop new mechanisms to get alternative energy sources, with low cost and lower environmental impacts due to its generation and use. In this sense, the sustainable use of biomass represents an interesting alternative.

More specifically, it is important to emphasize that each day is more and more necessary to solve the social and environmental needs of using renewable energies, especially those related to biofuels and their uses in the transport sector. Thus, biodiesel appears as one of the principal candidates to be a complete substitute of the diesel used in the current engines [Mittelbach (1996), Canakci and Van Germe (2001)]. Moreover, it is interesting to remark that the production of biodiesel and bioethanol as biofuels has been duplicated each year since 2004.

Despite of the European directives that will control the gradual introduction of biofuels during the next 10 years (from 2010 to 2020), there are still some aspects that require the continual research, not only to get better yields but also to reduce some existing difficulties. In this way, the heterogeneous catalysts [Chapman and Roe (1990), Haushalter and Mundi (1992), Jitputti et al. (2006), Gryglewicz (1999), Xie et al. (2006), Kim et al. (2004), Serio et al. (2006), Bournay et al.(2005)] are getting importance because they facilitate the recovery of the own catalyst (only by filtering the solid catalyst in this case), and therefore reduce the contamination problems of the biodiesel and its subproducts. Moreover, the heterogeneous catalysts also may reduce the problems of soap production and the quantity of the necessary water in the biodiesel washing step. As result, the consumption of this valuable natural recourse and obviously, the dumping of the contaminated water will decrease, having also in mind that this water should be also treated lately and that will additionally contaminate and increase the salt content of the mud produced in the corresponding sewage-disposal plant (reducing its feasibility as natural fertilizer).

The present work is orientated, inside the use of biomass as an energy source, in the study of the biodiesel production from the transesterification of vegetal and frying oil, using hydrotalcite as heterogeneous catalyst (pure state or modified for increasing its alkali behaviour and reactivity). The objective is to analyse the main variables of the process in order to get a better knowledge of the process and catalyst, and to achieve the optimum design of the process and the necessary equipments. The most important variables are:

Temperature, stirring speed and reaction time

Typology, pre-treatment and initial concentration of heterogeneous catalyst

Molar relation alcohol/ raw material

% hydrotalcite modification (introducing sodium in its structure)

It is important to mention that this kind of catalysis introduces a variety of new problems, specially related with the dispersion of the catalyst in the reaction environment, the necessity of activate or pre-treat the solid catalyst to get the correct structure and fundamentally the initial necessity of using higher temperatures because their lower efficiencies (compared with the homogeneous catalysts).

The following techniques have been used to characterise the different samples: Gas-chromatografic/ mass spectrometry, Thermogravimetric analysis, X-ray diffraction and X-ray photoelectron Spectroscopy, Scanning electron microscopy.

Acknowledgements

The authors wish to thank the University of Alicante (Vice-presidency of Research, Development and Innovation) for financial support (project GRE 07-8P).

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