OPTIMISATION ZEOLITE SUPPORTED Ni CATALYST FOR HYDROTREATMENT OF SOLVOLYSED LIGNOCELLULOSIC BIOMASS

Manuel Ojeda[a], Nika Osterman[b,c], Ljudmila Fele Žilnik[b], Nataša Novak Tušar[b,d], Antonio A. Romero[a], José M. Marinas[a].

[a]*Universidad de Córdoba, Campus de Rabanales, Edificio Marie Curie (C-3), Ctra Nnal IV, Km 396, Córdoba, E-14014 Spain.*

[b]*National Institute of Chemistry, Hajdrihova 19, 1000 Ljubljana, Slovenia.*

[c]*Faculty for Chemistry and Chemical Technology, University of Ljubljana, Večna pot 113, Ljubljana, Slovenia.*

[d]*School of Engineering and Management, University of Nova Gorica, Vipavska 13, 5000 Nova Gorica, Slovenia.*

The development of renewable fuel from bioresources has been an important key to the future energy. Biofuel is a nontoxic and biodegradable alternative fuel compared to petroleum diesel, which has been attracting attention due to the limited nature of fossil fuel and the environmental concerns. Different technologies to convert lignocellulosic biomass into a biofuel have been developed in the last years. A promising upgrading technology for biomass-derived oils is catalytic hydrotreatment, a process widely used in petroleum industry to remove sulphur, nitrogen and oxygen heteroatoms.

Hydrodeoxygenation (HDO) occurs during the hydrotreatment, oxygen-free molecules being obtained, after the oxygen is removed in the form of water. HDO is accompanied by decarboxylation, decarbonylation and hydrocracking reactions, which result in the formation of CO_2, CO and light hydrocarbons, respectively. ZSM-5 zeolite is well known as an efficient catalyst for the production of hydrocarbons. This catalyst presents a high proportion of acid sites located on the external surface, making possible the interaction of oils with these catalytic sites, since the access to the inner network is limited for these large reactants because of the diffusional limitations in the narrow channels. Besides, zeolites properties can be finely tuned allowing possible activity and selectivity enhancements. Also, the acidity and textural properties of zeolites can be modified by the addition of transition metal oxides, obtaining bi-functional catalysts. Herein, in the present study, we report the development of sustainable nickel functionalized HZSM-5 catalyst for deoxygenation of biomass-derived oils.[1]

The aim of this study is to optimize the catalytic material to intensify the deoxygenation process. Template-free zeolite synthesis is considered as a green and sustainable process, avoiding the use of any organic structure-directing agent (template) in the synthesis method, which has been developed by local zeolite producer in Slovenia SILKEM Company. Although the utilization of noble metals has been widely probed in deoxygenation process, they are expensive and unattractive for commercial applications. Nowadays, cost-effective transition metals-based catalysts, such as nickel, are still being studied, due to they favor the diesel-like hydrocarbons production.[2]

Acknowledgments

The authors gratefully acknowledge the financial support of Consejería de Ciencia e Innovación, Junta de Andalucía for project P07-FQM-02695, P09-FQM-4781 and P10-FQM-6711, Fondos FEDER, Slovenian Research Agency (ARRS) (Programs P1-0021 and P2−0152), EU COST Action TD1203 and EU COST Action FP1306.

[1] Peng, B.; Zhao, C.; Kasakov, S.; Foraita, S.; Lercher, J. A., *Chem. Eur. J.* **2013**, *19*, 4732.
[2] Botas, J. A.; Serrano, D. P., García; A.; Ramos, R., *Appl. Catal. B Environ.* **2014**, *145*, 205.