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Esterification of free fatty acids with methanol to biodiesel using heterogeneous catalysts: From model acid oil to microalgae lipids

Marc Veillette^{a,b}, Anne Giroir-Fendler^b, Nathalie Faucheux^a, Michèle Heitz^{a*}

^a Department of Chemical Engineering and Biotechnological Engineering, Faculty of Engineering, Université de Sherbrooke, 2500 Boul. de l'Université, Sherbrooke (Qc), Canada

^b Université Lyon 1, CNRS, UMR 5256, IRCELYON, Institut de recherches sur la catalyse et l'environnement de Lyon, 2 avenue Albert Einstein, 69626 Villeurbanne Cedex, France

* Author for correspondence: Telephone 819-821-8000 ext. 62827; Fax 819-821-7955; e-mail: Michele.Heitz@USherbrooke.ca

One of the main problems of microalgae lipids is their high content of free fatty acids (FFAs), which creates problems of soap formation during homogeneous alkali transesterification. The main purpose of this study was to test heterogeneous catalysts to transform the FFAs from a oil (oleic acid + canola oil) used as a model and from microalgae lipids (*Scenedesmus obliquus* and *Chlorella protothecoides*) into biodiesel.

Under the conditions tested (temperature: 120 °C, autogenous pressure, reaction time: 60 min, methanol to lipid ratio: 0.57 mL/g and 2.5 wt% Amberlyst-15 relative to microalgae lipids), *Chlorella protothecoides* lipids allowed to reach a higher conversion (84%) compared to *Scenedesmus obliquus* lipids (34%). However, the study showed that both microalgae lipids suffered from mass transfer limitations, due to impurities, because FFAs conversions higher than 90% were obtained with the model oils (20 to 33 wt% FFAs in canola oil).

Despite the fact that the FFAs from both microalgae were suitable to produce biodiesel, further studies must be made on alkali transesterification of the remaining lipids still present in microalgae biodiesel and on crude lipid purification in order to limit the mass transfer problems.

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