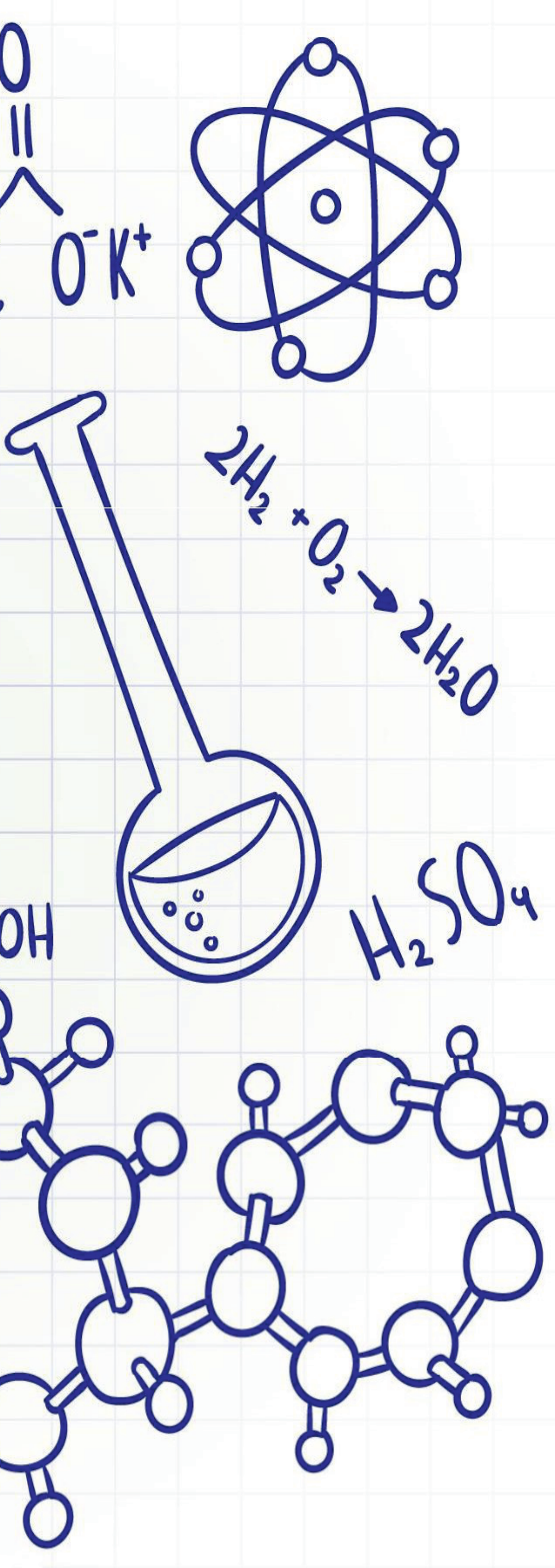

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Ionic Liquid Catalyzed Reaction for Biodiesel Production

Fernanda F. Roman[1,*], Ana Queiroz[1], António E. Ribeiro[1], Eduardo S. Chaves[2], Paulo Brito[1]

[1] Polytechnic Institute of Bragança, Department of Chemical and Biological Technology, School of Technology and Management, Bragança, Portugal

[2] Federal University of Technology - Paraná, Department of Chemical Engineering, Ponta Grossa, Brasil

*fontanarfr@gmail.com

Biodiesel is a promising energy source that could replace petro-diesel [1]. The biodiesel production with the currently employed catalysts presents drawbacks, linked to cost, environmental issues, reaction time, among others [2,3]. Many researches have been shifted towards finding catalysts that are environmentally benign, allow good conversions, permit the use of low cost feedstock and lead to high quality biodiesel. Ionic Liquids (IL) are a class of catalysts that have been considered for biodiesel production, due to the fact that they may surpass some of the downsides of classical catalysts [3]. Thus, the goal of this study is to optimize the conversion of the esterification reaction of oleic acid with methanol, by estimating the optimum conditions, using the IL *1-methylimidazolium hydrogen sulfate* as catalyst, and applying a Response Surface Methodology (RSM).

The experiments were delineated using the Box-Behnken Design (BBD) [4], with 4 factors in 3 levels, which are displayed in **¡Error! No se encuentra el origen de la referencia.**, leading to 27 xperiments. IL, oleic acid and methanol were charged to the reactor and reaction was performed with reflux, under the determined conditions. After the reaction, the mixture was kept under refrigeration until the phases were able to be separated. The oleic acid conversion was estimated by comparing the initial acidity of the oleic acid sample and the final acidity of the biodiesel phase, according to a procedure adapted from EN 14104.

The p-value obtained for the regression is smaller than 0.05 and the lack of fit is estimated as 0.265, both acquired through the Analysis of Variance (ANOVA). The regression fit was determined as R^2=0.986, placing the model as reasonable and statistically reliable. The quadratic model that best fits the experimental results is as follows:

$$Y = 88.77 + 3.36A - 0.11B + 7.07C + 3.76D - 1.43A^2 - 0.044B^2 - 5.08C^2 - 3.37D^2 - 0.39AB + 1.13AC + 0.13AD + 1.29BC + 0.84BD + 1.78CD \quad (1)$$

In general, increasing the value of the factor also increases the response. The order of importance is: C > D > C^2 > A > D^2 > C*D > A^2 > B*C > A*C. The reaction temperature (B) did not greatly influence the response, being statistically irrelevant to this investigation. **¡Error! No se encuentra el origen e la referencia.** displays the influence of the molar ratio and catalyst dosage over the response. The greater value for conversion is obtained when both parameters are set to +1. Similar analysis can be made to all interactions between factors. The best result was obtained when all 4 factors were set to their maximum value, achieving a conversion of 94.8%.

Factor	Coded	-1	0	+1
Reaction time (h)	A	4	6	8
Reaction temperature (°C)	B	80	95	110
Molar ratio(MeOH/OA)[a]	C	5:1	10:1	15:1
Catalyst dosage (%wt)	D	5	10	15

[a] OA – oleic acid; MeOH– methanol

Table 1. Selected factors and respective value

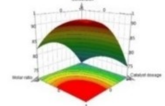

Fig. 1. Influence of molar ratio and catalyst dosage in the conversion.

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A

B

C

D

E

F

G

H