

Valorization of used cooking oils through ionic liquid catalyzed biodiesel conversion processes

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Background

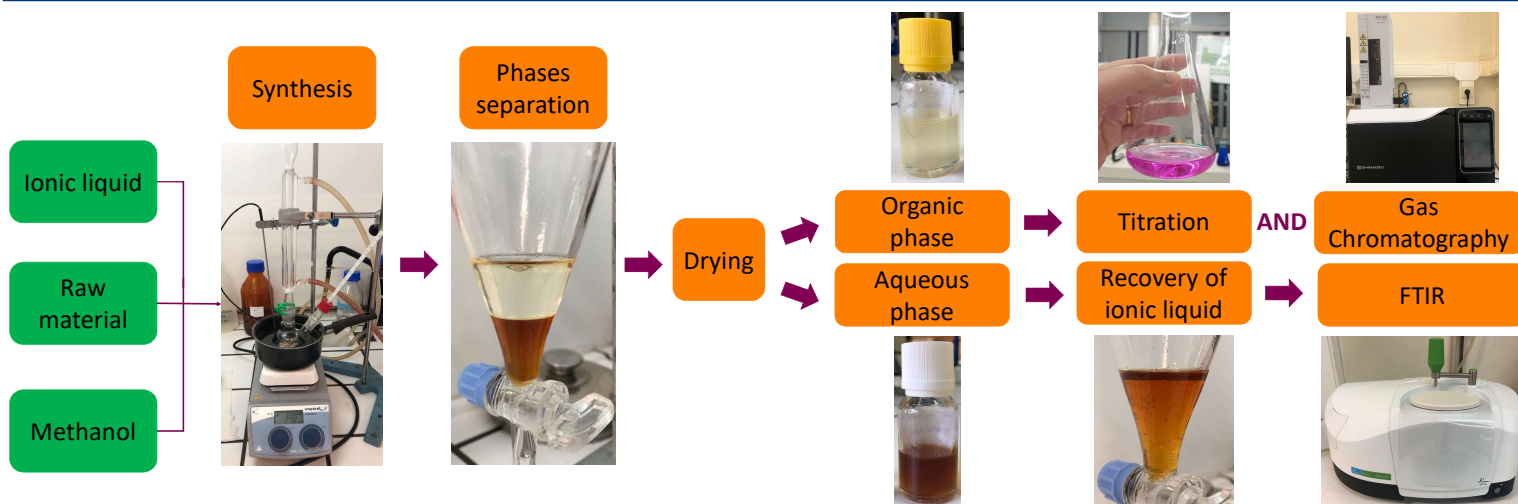
Why biodiesel?

Biodiesel is a source of energy that can replace fossil diesel by reducing environmental impacts. It consists of a mixture of long chain fatty acid alkyl esters and is produced by converting vegetable oils or animal fats by transesterification or esterification processes.

Why ionic liquids?

Due to the high cost of the conventional raw materials, it is viable to reduce the final price of biodiesel by using oil sources that do not compete with the food market, such as waste cooking oils. However, these oils show high levels of free fatty acids, which can bring problems to the classic biodiesel production process. To overcome these problems, ionic liquids (IL) are used as catalysts.

Methodology



Experimental Results

Reaction conditions:

Time - 4 hours

Temperature - 65°C

Molar ratio of oleic acid to methanol - 1:10

10%wt. of ionic liquid ([HMIM][HSO₄])

Reaction	Cycle	Conversion (%)	IL Recovery (%wt.)
1	0	81,2	73,9
2	1	79,8	84,2
3	2	79,5	78,9
4	3	78,1	74,7
5	4	74,2	81,2
6	5	72,4	80,6
7	6	69,4	71,3

- The reaction conversion decreases 11,8% from reaction 1 to reaction 7.
- The correlation between the initial IL and the recovered IL from the seventh reaction was 99,3%.

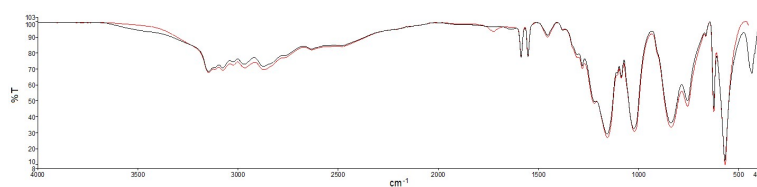


Figure 1 – Comparison between FTIR of initial ionic liquid and recovered ionic liquid from reaction 7.

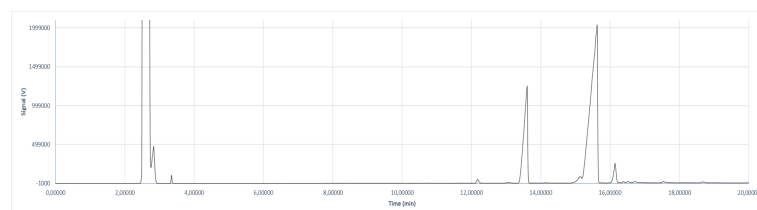


Figure 2 – FAME Analysis of reaction 1 using GC-FID.

Conclusions and Future Work

- Preliminary study shows that it is possible to produce biodiesel from oleic acid using [HMIM][HSO₄] as catalyst.
- It is possible to recover and reuse the catalyst.
- The recovery method is efficient.
- The next step is to use waste oil as a raw material.

References

- [1] Z. Ullah, M. A. Bustam, Z. Man. "Biodiesel production from waste cooking oil by acid ionic liquid as a catalyst". Renewable Energy, vol.77 (2015) pp. 521-526.
- [2] A. Baú, G. G. Lenzi, A. Ribeiro, A. Queiroz, P. Brito, Acidic waste cooking oil valorization by biodiesel synthesis catalysed by hydrogen sulfate 1-butyl-3-methylimidazolium, XXIV Encontro Luso-Galego de Química, CAT20, Porto, 21-23 november 2018.