Biodiesel from *Jatropha curcas* oil using Li/Pumice as heterogeneous catalyst

L. Diaz Rodriguez [(1)], M.E. Franco, C. Díaz García, K. Rodríguez Espinoza

[(1)] Chemical Engineering Department, University of La Laguna; Avda. Astrofísico Fco. Sánchez s/n, La Laguna, Tenerife, Canary Island, 38200, Spain

1. Introduction- Biodiesel from edible oils such as sunflower oil, soybean oil or rapeseed oil lead to a competition of usage of food versus fuel, but second generation biodiesel includes non-edible vegetable oils, waste cooking oils as well as animal fats. Furthermore, using cheaper feedstock's such as waste cooking oils or non-edible oil have been suggested to lower the cost. Transesterification is the most common method used for industrial biodiesel production process using a basic homogeneous catalyst (KOH or NaOH). However, the large amounts of free fatty acids present in this type of oils are a problem due to the soap formation. The use of a bifunctional heterogeneous catalyst could solve this problem [1-2]. The aim of this work is the synthesis of a solid catalyst, by impregnation of pumice stone with $LiNO_3$, for the production of biodiesel from *Jatropha Curcas* oil (non-edible oil).

2. Experimental- Pumice granules (1.40–3.0 mm) were impregnated with solutions with different concentration of $LiNO_3$ (1-5% w/w) and the solids obtained were analysed by SEM, XRD, mercury porosimetry and FT-IR. Methanol and sunflower oil was first used as feedstock in the transesterification reaction to test the effect of the Li concentration in the solid when low acidity oil is used. Afterwards *Jatropha Curcas* oil, previously extracted from the seeds, was used with the material that showed better catalytic behaviour. The reaction took place in a batch slurry reactor during 2h, 60ºC, 20:1 MeOH/oil molar ratio, 35% w/w of catalyst. After completion of the reaction, the two phases were separated and the fatty acid methyl esters content (FAME) of main product of the reaction (biodiesel product) was determined by gas chromatography. The catalytic activity of the Li/Pumice and its potential reutilization were examined.

3. Results and Discussion- SEM images show that textural properties of the pumice were modified when was impregnated with Li. Furthermore, pumice is amorphous material according to the XRD results, Fig.1, while Li/Pumice presents crystallinity. The activity of the catalyst (Li/Pumice), increases as Li concentration during impregnation increases, Fig.2, presenting its highest value for concentration of 5% when sunflower oil is used. In the transesterification of *Jatropha Curcas* oil, with high acidity, the latter catalyst gives 81.2% FAMES in a single step reaction. Other biofuel parameters like density, viscosity and acid number are within the UNE- EN 14214 standard. 5% Li /Pumice was reused three times with a decrease of only 16% of its activity.

4. Conclusions

The main physicochemical and structural properties of Li/Pumice have been studied showing that the textural properties of the pumice have been modified when impregnated with Li. For example, according to the XRD results Pumice is amorphous; however Li/Pumice presents crystallinity. The 5% Li / Pumice is the material that presents a higher catalytic activity and gives a good performance for *Jatropha Curcas* oil, maintaining a high activity when it is reused.

5. References

[1] A.K. Endalew, Y. Kiros and R. Zanzi, *Energy*,**36**(5), (2011) p. 2693.

[2] M.E. Borges and L. Díaz, *Renewable and Sustainable Energy Reviewsnergy*,**16**(5), (2012) p. 2839.