Title: **Glucose isomerization reaction to fructose over basic catalysts**

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The growing concern for the climate change and the reduction of petroleum and natural gas reserves has led to the research of new renewable sources of energy. Biomass is the largest source of renewable energy and it is also used for the production of commodity chemicals and bio-based materials.

Lignocellulose is a form of biomass used in the production of biofuels and other chemical products such as biogas, biodiesel, syngas or bioalcohols.

5-hydroxymethylfurfural (5-HMF) is an intermediate product in the production of biofuels from lignocellulose and it has more applications in other areas such as the production of bioplastics, adhesives, solvents, etc. 5-HMF can be obtained from the glucose that comes from the treatment of lignocellulose. Nevertheless, fructose reactivity is higher than glucose reactivity.

In this work, the most effective heterogeneous catalyst for the glucose to fructose isomerization is determined in terms of glucose conversion, fructose yield and fructose selectivity.

The catalysts tested are the following basic ion exchange resins: Amberlyst 21, Amberlyst 26(OH^-) and Purolite CTA196. Amberlyst 26(OH^-) is the resin that obtained the highest values of glucose conversion (51.32 ± 1.33 %), fructose yield (37.37 ± 0.08 %) and fructose selectivity (72.84 ± 2.06 %), operating at 80 ºC for 6 hours. The final fructose concentration has been of (0.19 ± 0.01) mol/L, from an initial glucose concentration of 0.5 mol/L.

Also, Amberlyst 21 has been tested for different operating temperatures. The increase of the temperature from 80 ºC to 90 ºC has led to the increases of glucose conversion (+11.38 %), fructose yield (+64.43 %) and fructose selectivity (+46.97 %).

Results obtained experimentally have been compared with those ones obtained in another study, using glucose isomerase as catalyst (Solà Mas, S. Glucose Isomerization by Enzymes. TFG. Publicacions i Edicions de la Universitat de Barcelona, Barcelona, 2020). Results obtained for the production of fructose (glucose conversion and final fructose concentration) using Amberlyst 26(OH^-) were slightly higher than the ones

obtained operating with glucose isomerase. However, results obtained using glucose isomerase, were operating with 1 g of enzyme while the results obtained with Amberlyst 26(OH^-) have been achieved using 5 g of resin. It could be deduced that, if the catalyst masses were the same, better results would be obtained using glucose isomerase as catalyst. Nevertheless, the main disadvantage of glucose isomerase is its high price in comparison with Amberlyst 26(OH^-).

Finally, the results obtained with the ion exchange resins used in this study have been compared with the results obtained in other studies from the available scientific literature. Although the experimental conditions of these studies are different, the heterogeneous catalysts that showed high effectiveness towards the production of fructose from glucose are: Amberlite IRA400(OH^-), MgO, Sn-Beta zeolite, Amberlyst 26(OH^-) and meglumine. To determine which catalyst is the most effective, there should be done experiments at the same conditions for each one of these catalysts.

Keywords: biomass, lignocellulose, biofuels, 5-hydroxymethylfurfural, glucose to fructose isomerization, heterogeneous catalysts, ion exchange resins, glucose isomerase.