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TOPIC(s) : Biomass conversion

Catalytic conversion of hexose to levulinic acid.

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PURPOSE OF THE ABSTRACT
During the last years, on the worldwide scale, the fructose demand has dramatically decreased due to health problems such as obesity or diabetes caused by the use of fructose for food applications. [1] In order to find alternative uses of fructose, the industry is currently seeking new methodologies to valorize fructose, in particular as a feedstock for the synthesis of chemicals such as levulinic acid.

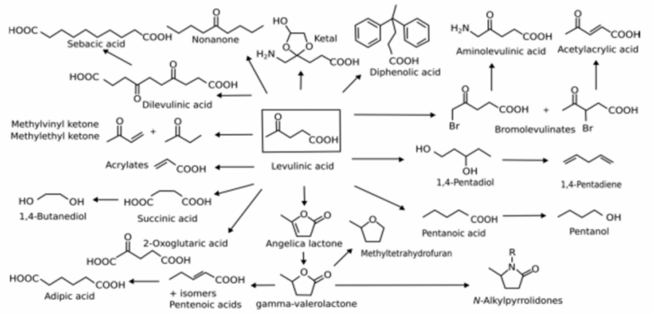
Levulinic acid is considered as a platform molecule that can be converted into many chemicals with applications in the areas of solvents, polymers, pharmaceuticals, ... [2]
However, so far, the production of levulinic acid is performed under semi-industrial conditions, from cellulose at high temperature (220°C) and with a homogeneous catalyst (H_2SO_4). This production gives a yield of about 70% in levulinic acid. [3]

The objective of our work is to develop a heterogeneously-catalyzed pathway for the conversion of fructose to levulinic acid, a process that should be ultimately conducted in continuous way.

The synthesis of levulinic acid was carried out from fructose, and first in a batch reactor in order to determine the catalyst and the best experimental conditions giving a yield in levulinic acid higher than 50%.
In a first step, different acid catalysts were studied. It is the case of acid ion exchange resins. These heterogeneous catalysts appeared particularly active and stable (10 recycles) leading to yields of 65% levulinic acid.
Next, the influence of the temperature of the reaction medium on the yield and selectivity of the reaction was studied. A temperature of 140°C proved to be a good compromise between the activity and the stability of the catalyst. In a second step, different fructose contents (5%-40%) were used to increase the reactor productivity. These experiments show an increasing of the reactor productivity from 3,4 to 20 kg/m3/h.

These preliminary results collected in batch are now serving as a scientific base for the design of a continuous flow reactor which represent the main perspective to this work.

FIGURES



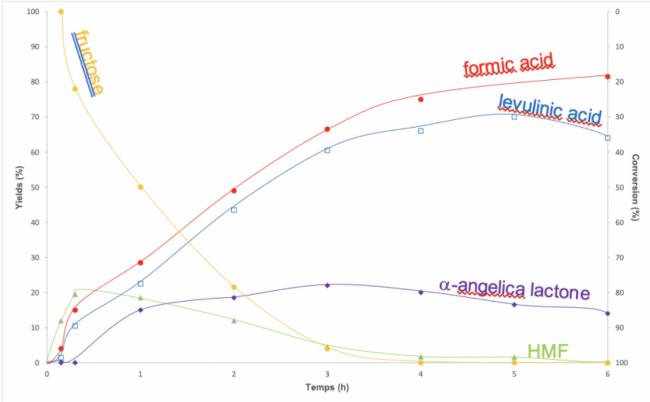


FIGURE 1

Figure 1.

Figure 1 levulinic acid : platform molecule

FIGURE 2

Figure 2.

Figure 2 Kinetic profile of levulinic acid production with heterogeneous and acid catalyst

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KEYWORDS

Levulinic acid | Fructose | Catalytic conversion

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