Development of novel chemo-enzymatic processes for the conversion of lignocellulosic biomass towards the production of furans

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The growing global energy needs and the depleting fossil fuel reserves constantly increase the need for the emergence of a bio-based economy that can act as a partial replacement for the traditional fossil-based. Lignocellulosic biomass, being the most abundant renewable source on earth, can function as a promising feedstock for the production of second generation fuels and value added chemicals.[1,2]

In this work, we examine the overall process for the conversion of lignocellulosic biomass to furan derivatives, mainly 5-hydroxymethylfurfural (HMF). The first step towards this goal was the enzymatic hydrolysis of avicel cellulose as well as other pretreated lignocellulosic materials for the production of glucose rich pulps. The hydrolysates were then subjected to isomerization in order to convert glucose to fructose, using a commercial immobilized isomerase. This stage is essential for effective production of HMF in high yields, due to the fact that the dehydration step to HMF is straightforward in the case of fructose. In order to increase the yield of fructose, sodium tetraborate, which is found to shift the reaction equilibrium towards fructose, was added to the reaction.[3] The final step of the process includes the chemocatalytic treatment of the isomerization products. In this stage, an acidic catalyst was added to the fructose-rich product of the reaction in order to incur the dehydration of fructose to HMF.

The effective production of furans from lignocellulosic biomass plays an important role towards a more bio-based economy as furans can in turn function as precursors for the production of monomers for biobased polymer synthesis.

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