Deep Eutectic Solvents: Efficient Media for the Conversion of Inulin into 5-Hydroxymethylfurfural

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In the last decades, the growth in energy demand and the resulting increase consumption in fossil fuels has led to a negative environment impact. Consequently, there has been a growing interest in the search for renewable sources that could replace fossil fuels. In this framework, lignocellulosic biomass is of special interest. It is abundant on the earth, derives from agricultural and food waste, and it is not involved in the food chain, avoiding competitive interests. It is possible to obtain polysaccharide from biomass, that can be used to obtain 5-hydroxymethylfurfural (5-HMF).[1,2] This latter is considered a chemical platform. In this work, we performed the conversion of inulin into 5- HMF. Usually this conversion is carried out using DMSO,[3] as solvent, and strong mineral acids as catalysts.[4] To carry out the process in a sustainable way, we used task specific ionic liquids (TSIILs) as catalysts and deep eutectic solvents (DESs) as reaction media. We employed DESs consisting of ChCl/glycols or ChCl/carboxyl acids, while we used aromatic and aliphatic TSILs. To avoid 5-HMF degradation processes in acidic conditions, the process was carried out in a biphasic system, DES/acetone able to extract and stabilize the product.

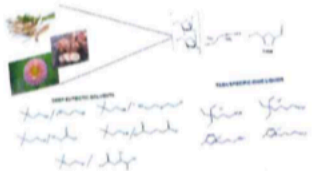

Figure 1. General scheme.

We optimized the reaction conditions in terms of catalyst loading, solvent, reaction time and temperature. Under the best experimental conditions, we obtained a 71 % yield in 5-HMF at 80°C in 3 hours. Furthermore, we were able to isolate 5-HMF, carrying out the scale-up of the process and the reuse of the catalyst-solvents system.

References

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