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The Combined Action of DES and Ionic Liquids in Biomass Valorization Processes

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Most of the carbon-based products that our society uses daily, derive from petroleum and therefore require the exploitation of fossil fuels; this leads to a consequent increase in carbon dioxide emissions and global warming.[1] For this reason, interest in alternative and renewable energy sources has grown in recent years. Lignocellulosic biomass (LCB) represents a raw material of high interest for the sustainable production of chemical platforms. Among the chemical products that can be obtained from lignocellulosic biomass, 5-hydroxymethylfurfural (5-HMF) stands out because there are several high-value chemicals and fuels that can be obtained from it.[2] In this work, the conversion of D-fructose and sucrose into 5-HMF was studied, using DES as solvents and TSILs as catalysts (Figure 1).

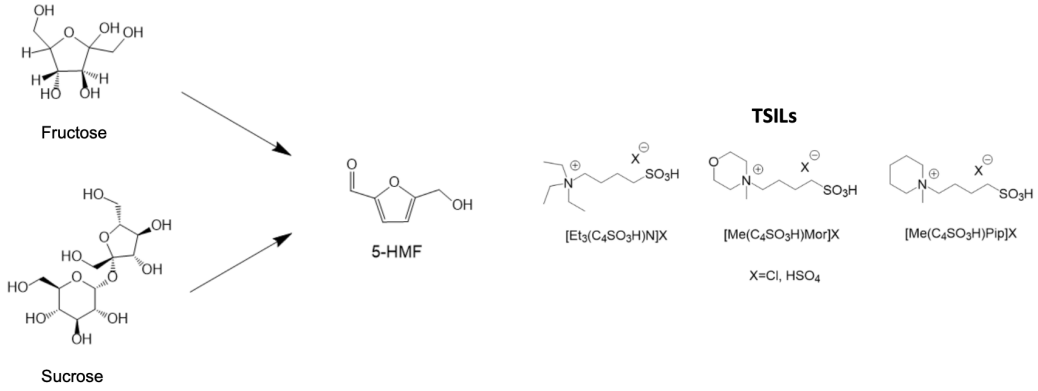

Figure 1: Scheme of the conversion reaction of sugars into 5-HMF and structures of TSILs used as catalysts.

The operational variables that could have led to an increase in the 5-HMF yield were optimized, such as the amount of catalyst, the reaction temperature, and the initial amount of substrate, also studying the progress of the reaction as a function of time. Finally, the possibility of recycling the catalyst/solvent system was evaluated. In the case of fructose, the most efficient catalysts were [Me(C_4SO_3H)Mor]Cl and [Et_3(C_4SO_3H)N][HSO_4], allowing 5-HMF yields of 65% and 54% to be achieved respectively. In the case of sucrose, the most efficient catalysts were [Me(C_4SO_3H)Mor]Cl and [Me(C_4SO_3H)Mor][HSO_4], allowing to

reach, in both cases, 5-HMF yields around 30%. The used catalysts showed promising recycling potential for the conversion of both substrates. In particular $[Et_3(C_4SO_3H)N][HSO_4]$ was reused for four cycles for the conversion of fructose.

References

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[2]Jiang, Z.; Zeng,Y.; Hu, D.; Guo, R.; Yana, K.; Luque, R., *Green Chem.*, **2023**, 25(3), 871-892.

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