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WO_3/SO_3H-C CATALYSTS FOR 5-HMF ONE-POT PRODUCTION

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Lignocellulosic biomass is a key renewable feedstock for the sustainable production of platform chemicals. Among them, 5-hydroxymethylfurfural (5-HMF) is a pivotal intermediate that can be sourced from its cellulosic fraction through a cascade process involving the synergistic effect of Brønsted and Lewis acid sites (Fig. 1) [1]. In this work, we report the development of bifunctional carbon-based acid catalysts for a one-pot cellobiose-derived 5-HMF production. The catalytic system consists of activated carbon (SX+ from NORIT, fraction < 50µm) functionalized with WO_3 patches and benzyl sulfonic moieties [2]. The acidic properties were characterized by NH_3-TPD (total acidity) and pyridine-FTIR (Brønsted/Lewis site distribution). The most active WO_3 phase, depending on calcination temperature, was first identified for the conversion of glucose to 5-HMF. The optimized oxide was subsequently integrated in the final materials. Then, the optimal balance between WO_3 and sulfonic groups was elucidated by testing monofunctional mixtures, enabling rational fine-tuning of the bifunctional catalytic systems. The optimal bifunctional catalysts were evaluated for the one-pot conversion of cellobiose under mild conditions (403 K, 6 h). A tetrahydrofuran (THF)/water solvent system significantly enhances 5-HMF yield by improving its extraction and enhancing cellobiose conversion (Fig. 1). Kinetic studies over longer reaction times will be carried out to maximise 5-HMF yield.

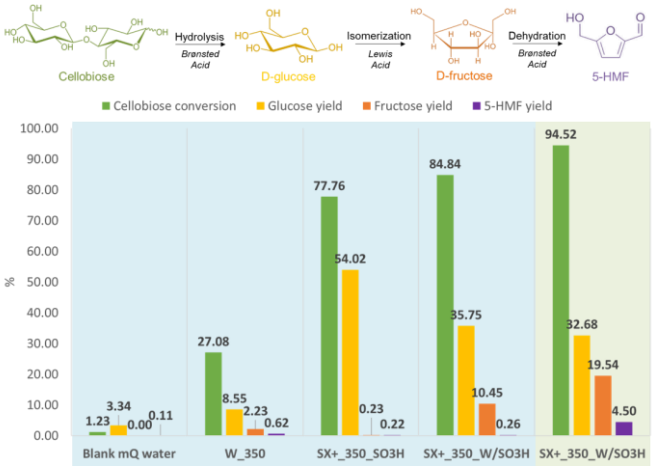

Figure 1: One-pot cellobiose-derived 5-HMF production in water (blue background) and THF/water (green).

References:

[1] Y. Yao, S. Chen, M. Zhang, Front. Chem. 10 (2022), Article 880603
[2] Tonelli A. et al. ChemCatChem 2025, 17, e202500070

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