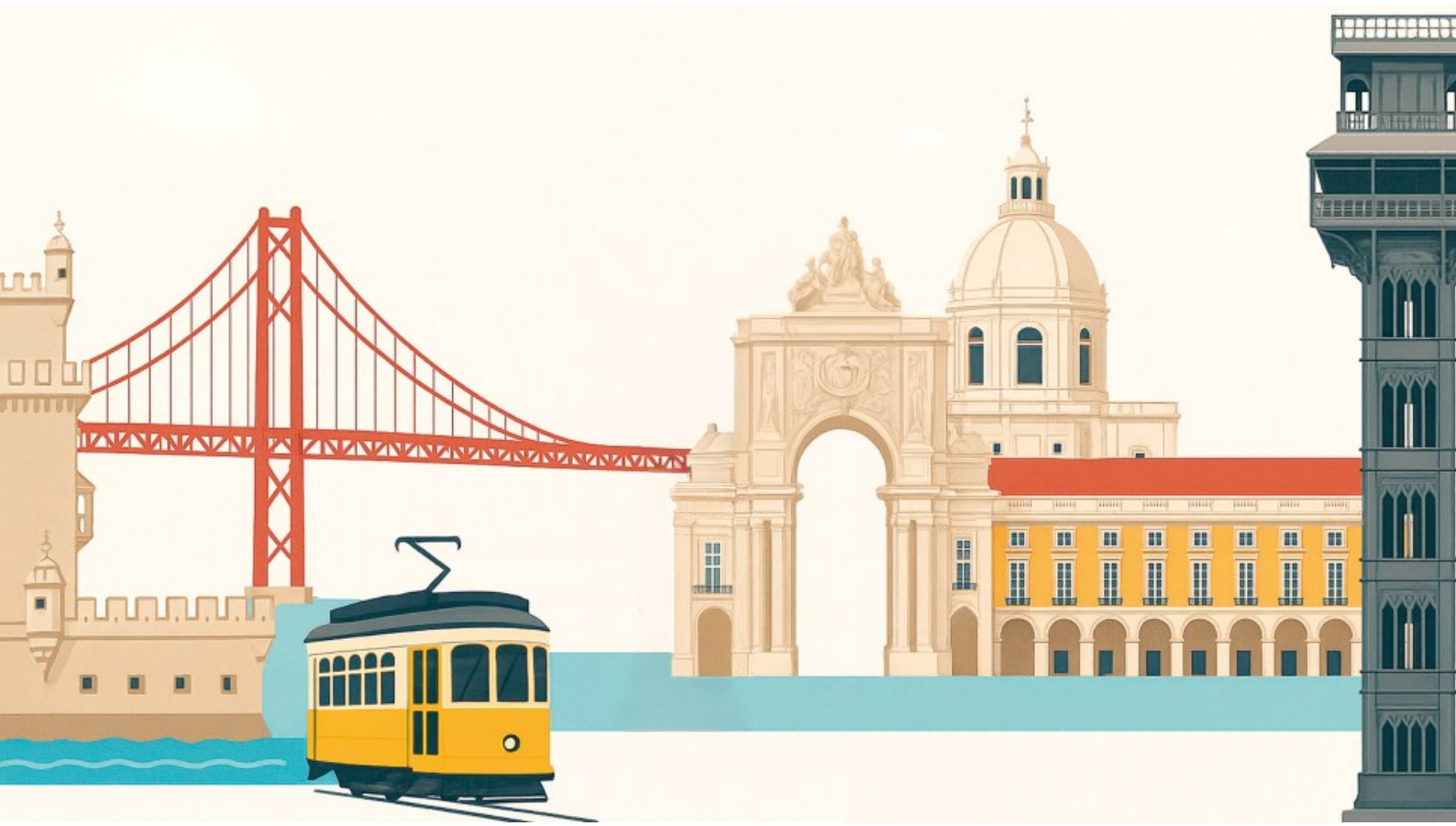

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P13 Catalytic conversion of biomass-derived sugars to furfural

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Scientific topic: Heterogeneous Catalysis

Furfural is one of the most important platform molecules that can be produced from lignocellulosic biomass, owing to its wide applicability in the synthesis of fuels, solvents, polymers, and other value-added chemicals.[1] Its production from hemicellulosic sugars represents a promising route for biomass valorization and for the development of more sustainable chemical processes.[1] In this work, the catalytic conversion of xylose into furfural was investigated as a first step toward the development of efficient catalytic systems for the conversion of waste-derived feedstocks.

A series of materials was initially evaluated, including activated carbon, carbon black P80, xerogel, graphite, graphene, ordered mesoporous carbon, alumina, zeolites (HY and HZSM5), carbon nanotubes (CNT), HNO_3 oxidized carbon nanotubes (CNT_{ox}), and CNT-supported metal catalysts based on cobalt (2.5 wt.%) and ruthenium (0.4 wt.%), namely Co/CNT, Co/CNT_{ox}, Ru/CNT, and Ru/CNT_{ox}. The oxidation treatment with HNO_3 was used to modify the surface properties of CNT. Xylose was selected as a model compound for hemicellulose-derived carbohydrates, allowing the preliminary assessment of catalyst performance in furfural production. The catalytic tests were conducted for 3-5 h in a 1000 mL batch Parr reactor, in which xylose (0.9 g), catalyst (0.2 g) and water (0.3 L) were added under stirring (300 rpm). The reactor was then purged with N_2 and subsequently heated to the desired temperature (170 ºC). Samples were periodically withdrawn for analysis by high performance liquid chromatography (HPLC).

Under the tested conditions, xylose conversion varied between 71 and 100 %, while furfural yield remained moderate, ranging from 14.2 to 27.2 % depending on the catalyst used. These results indicate that, although the catalytic systems are highly active for xylose conversion, furfural selectivity is still limited, suggesting the occurrence of side reactions such as degradation and condensation of intermediates and products. The observed differences among CNT, CNT_{ox}, and metal-supported catalysts also highlight the influence of support surface chemistry and active metal phase on catalytic performance.

These preliminary results demonstrate the potential of biomass-derived sugars conversion to furfural, while also emphasizing the need for further catalyst development and process optimization. Future work will focus on improving furfural yield through the optimization of reaction conditions and the design of more efficient catalytic materials, in particular waste-derived carbon materials based on our previous experience.[2] In addition, the study will be extended from xylose to xylan to approach more realistic hemicellulosic substrates, and subsequently to food waste residues such as orange and banana peels, aiming at the direct valorization of renewable waste streams into furfural.

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References

1 Y. Wang, M. Li, Z. Wang, S. Liu and L. O'Young, *Ind Crops Prod*, 2025, **230**, 121103.
2 L. S. Ribeiro, R. G. Morais, J. J. M. Órfão and M. F. R. Pereira, *Sustain Energy Fuels*, 2024, **8**, 4588-4601.

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