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Toward scalable biocatalytic conversion of 5-hydroxymethylfurfural by galactose oxidase using coordinated reaction and enzyme engineering[1]

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PURPOSE OF THE ABSTRACT

5-Hydroxymethylfurfural (HMF) has emerged as a crucial bio-based chemical building block in the drive towards developing materials from renewable resources, due to its direct preparation from sugars and its readily diversifiable scaffold. A key obstacle in transitioning to bio-based plastic production lies in meeting the necessary industrial production efficiency, particularly in the cost-effective conversion of HMF to valuable intermediates. Toward addressing the challenge of developing scalable technology for oxidizing crude HMF to more valuable chemicals, here we report coordinated reaction and enzyme engineering to provide a galactose oxidase (GOase) variant with remarkably high activity toward HMF, improved O2 binding and excellent productivity (>1,000,000 TTN). The biocatalyst and reaction conditions presented here for GOase catalysed selective oxidation of HMF to 2,5-diformylfuran offers a productive blueprint for further development, giving hope for the creation of a biocatalytic route to scalable production of furan-based chemical building blocks from sustainable feedstocks.

FIGURES

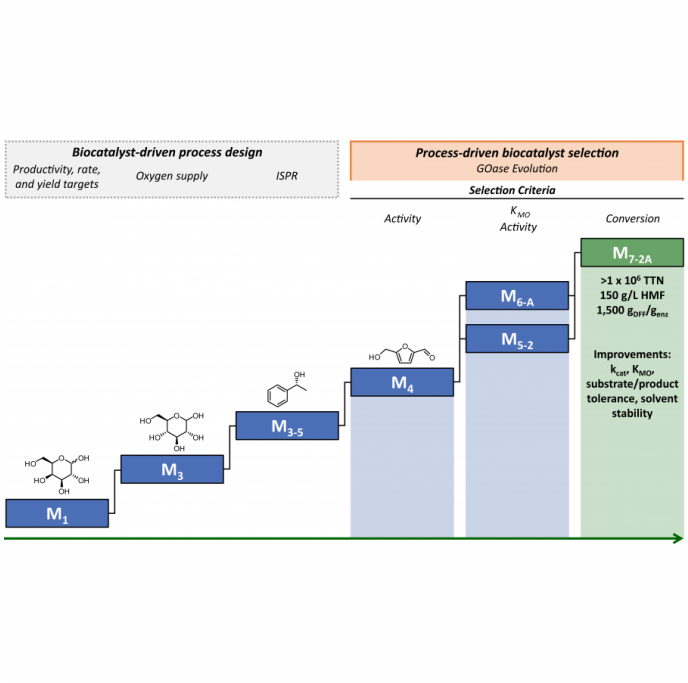

FIGURE 1
Abstract Figure

FIGURE 2

KEYWORDS
Biocatalysis | Galactose Oxidase | 5-Hydroxymethylfurfural

BIBLIOGRAPHY

[1] Birmingham, W. R., Toftgaard Pedersen, A., Dias Gomes, M., Bøje Madsen, M., Breuer, M., Woodley, J. M., Turner, N. J. Nat. Commun. 2021, 12 (1), 10.