Poster 2. Whole-cell production of high-value furan derivatives by Kluyveromyces marxianus for lignocellulosic valorization processes

Bapista M[1,2], Cunha J[1,2], Domingues L[1,2]

[1]CEB - Centre of Biological Engineering, University of Minho, [2]Labbels - Associate Laboratory

The establishment of lignocellulosic-based biorefineries relies on microorganisms that can withstand inhibitory compounds released during pretreatment and hydrolysis of biomass. The thermotolerant yeast Kluyveromyces marxianus has emerged as a promising microbial factory with the ability to metabolize a variety of sugars and capacity to tolerate inhibitors derived from lignocellulose [1].

The main lignocellulosic-derived inhibitors, 5-hydroxymethylfurfural (HMF) and furfural hold potential as building-blocks to be transformed into a diverse range of high-value derivatives applicable in industries such as plastics, pharmaceuticals, and textiles. The production of these valuable derivatives has relied mainly on chemical catalysis; however, biocatalysis has emerged as an eco-friendlier substitute.

We aimed to investigate the capability of a K. marxianus isolated from cocoa fermentation to reduce high concentration of furfural (up to 66 mM) and HMF (up to 55.5 mM). Under oxygen-limited conditions, K. marxianus converted furfural to furfuryl alcohol with the highest reported productivities among yeast to date (5.74 g/L/h and 6.46 g/L/h in glucose and xylose rich medium, respectively). The yield of 2,5-bis(hydroxymethyl)furan (BHMF), the alcohol derivative from HMF, was also found to be the highest reported in the literature (99.65%) from glucose. These findings confirmed the potential of K. marxianus as a promising whole-cell biocatalyst for application in lignocellulosic biorefineries [2]. Nonetheless, HMF detoxification in xylose medium is still a challenge most probably due to co-factor imbalance. Alternative strategies are being studied to surpass this bottleneck and will be presented.

[1] Baptista, M. et al. Biotechnol. Adv., 60 (2022)
[2] Baptista, M. et al. J. Fungi, 7, 1047 (2021).