KLUYVEROMYCES MARXIANUS ESTABLISHMENT AS A WHOLE-CELL BIOCATALYST TO PRODUCE HIGH VALUE FURAN DERIVATIVES

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Body

Cost-effective and environmentally sustainable biorefineries development for simultaneous production of biofuels and value-added chemicals from renewable feedstocks, such as lignocellulosic biomass, constitutes the fundamental foundation for the transition to a circular bioeconomy. The establishment of lignocellulosic biorefineries depends on microorganisms being able to cope with the stressful conditions resulting from the release of inhibitory compounds during pretreatment and hydrolysis steps of biomass processing. In this regard, the yeast *Kluyveromyces marxianus* emerges as an alternative microbial factory due to its thermotolerance and ability to metabolize several different sugars. Moreover, some studies report *K. marxianus* ability to cope with lignocellulose-derived inhibitors [1,2].

Despite being generally considered as undesirable inhibitors in lignocellulosic processes, 5-hydroxymethylfurfural (HMF) and furfural are considered promising building-block platforms that can be converted into a wide variety of high-value derivatives with applications in the plastic, pharmaceutical, and textile industries. Up until now, the production of these higher-value derivatives has been mainly based on chemical catalysis, but recently biocatalysis has appeared as a more environmentally friendly alternative.

In this work, the potential of *K. marxianus* strains, isolated from cocoa fermentation, to reduce furfural and HMF at high inhibitory loads was disclosed and characterized. In addition, furans' inhibitory effect was higher when combined with xylose consumption. The furan derivatives 2,5-bis(hydroxymethyl)furan (BHMF), 5-hydroxymethyl-2-furan carboxylic acid (HMFCA), furfuryl alcohol and furoic acid produced by *K. marxianus* in different conditions were identified. Furthermore, one selected isolate was efficiently used as a whole-cell biocatalyst to convert high concentration of furfural and HMF into their derivatives, furfuryl alcohol and BHMF. To the extent of our knowledge, the furfuryl alcohol productivities presented in our work using glucose (5.74 g/L/h) or xylose (6.46 g/L/h), commonly present together with furfural in the hemicellulosic hydrolysates of lignocellulosic biomass, are the highest reported for yeast, and the 99.65% BHMF yield attained is the highest reported in the literature. Our results validate *K. marxianus* as a promising microbial platform in lignocellulosic biorefineries [3].

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Palavras-chave : Kluyveromyces marxianus, HMF, furfural, furan derivatives