BIOTECHNOLOGICAL PRODUCTION OF XYLITOL: ENGINEERING INDUSTRIAL *SACCHAROMYCES CEREVISIAE* FOR VALORIZATION OF LIGNOCELLULOSIC BIOMASS

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Abstract

The use of renewable biomass, such as lignocellulosic materials, for the production of biofuels and chemicals within a biorefinery scheme contributes to achieve a sustainable development. Xylitol has been identified as one of the top 12 value added chemicals to be obtained from biomass, and can be produced from hemicellulose-derived xylose through biotechnological processes [1]. In this work, xylitol was produced from xylose (using glucose as co-substrate for co-factor regeneration) in batch fermentations by the industrial *Saccharomyces cerevisiae* PE-2 strain (over)expressing (1) a wild type xylose reductase from *Pichia spititis* (XR); (2) a NADH-preferable xylose reductase mutant (mut-XR) from *Pichia spititis* and (3) the endogenous *GRE3* gene which encodes for an unspecific aldose reductase (AR). Maximum yield (0.98 g g^{-1}) was obtained by the strain overexpressing the *GRE3* gene. Moreover, the recombinant strain PE-2-GRE3 showed significantly higher xylitol productivity than the laboratory strain, CENPK.113-5D overexpressing the same gene. This strain (PE-2-GRE3) was selected for bioconversion of 160 g L^{-1} of xylose in a fed-batch fermentation, which resulted in 149 g L^{-1} of xylitol concentration with a productivity of 1.2 g L^{-1} h^{-1}. These results open new perspectives and opportunities for the valorisation of hemicellulosic hydrolysates through the production of xylitol within a biorefinery concept.

[1] T. Werpy, G. Petersen, A. Aden, J. Bozell, J. Holladay, J. White, A. Manheim, D. Eliot, L. Lasure, and S. Jones, “Top value added chemicals from biomass. Volume 1-Results of screening for potential candidates from sugars and synthesis gas,” Department of Energy Washington DC, 2004.