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ROBUST YEASTS FOR THE CONVERSION OF LIGNOCELLULOSIC HYDROLYSATES INTO ETHANOL

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Abstract

In recent years increasing attention has been devoted to the production of bioethanol from lignocellulose. The process requires a pretreatment of biomass, which may result in the formation of inhibitory compounds. Ethanol production from biomass hydrolysates is the subject of a number of works, but only limited research has been conducted on looking for yeasts able to both tolerate inhibitors and ferment sugars with high yield.

This study aimed at the selection of robust yeasts suitable for the industrial scale bioethanol production. One hundred yeast strains, mainly newly isolates belonging to *Saccharomyces cerevisiae*, were screened for their fermentative abilities at different temperatures in minimal media supplemented with high glucose and/or xylose concentrations. Moreover, the strains were evaluated for inhibitor tolerance in rich and defined broth having increasing concentrations of weak acids (acetic, formic, lactic acid) and furans (furfural and 5-hydroxymethyl-2-furaldehyde). The effects of pH value and high sugars levels on yeast inhibitor tolerance were also considered.

Ten *S. cerevisiae* strains showed outstanding ethanol yield from glucose at both 25 and 40°C. Moreover, their fermentative abilities were not affected by the presence in the medium of high xylose concentrations. Among them, few isolates were able to tolerate well different levels of inhibitors. Their tolerance was influenced by the pH in the medium and high sugar levels seemed to enhance their ability to withstand weak acids. The newly isolated *S. cerevisiae* F17 and *S. cerevisiae* MEL2 were further studied for their fermentative abilities in a defined medium supplemented with 100 g/L glucose, 50 g/L xylose and increasing concentrations of inhibitors. Both yeasts exhibited interesting ethanol yield within 48h, producing about 48 g/L ethanol. The selected strains have been adopted for the production of ethanol from real lignocellulosic hydrolysates and the most tolerant yeasts for an evolutionary engineering approach to further improve their robustness. Their genetic modification for the integration of different genes (glycoside hydrolases and pentose metabolising enzymes) will also be addressed.