The level of glucose-6-phosphate dehydrogenase activity strongly influences xylose fermentation and inhibitor sensitivity in recombinant Saccharomyces cerevisiae strains - DTU Orbit (12/01/2019)

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Disruption of the ZWF1 gene encoding glucose-6-phosphate dehydrogenase (G6PDH) has been shown to reduce the xylitol yield and the xylose consumption in the xylose-utilizing recombinant Saccharomyces cerevisiae strain TMB3255. In the present investigation we have studied the influence of different production levels of G6PDH on xylose fermentation. We used a synthetic promoter library and the copper-regulated CUP1 promoter to generate G6PDH-activities between 0% and 179% of the wildtype level. G6PDH-activities of 1% and 6% of the wild-type level resulted in 2.8- and 5.1-fold increase in specific xylose consumption, respectively, compared with the ZWF1-disrupted strain. Both strains exhibited decreased xylitol yields (0.13 and 0.19 g/g xylose) and enhanced ethanol yields (0.36 and 0.34 g/g xylose) compared with the control strain TMB3001 (0.29 g xylitol/g xylose, 0.31 g ethanol/g xylose). Cytoplasmic transhydrogenase (TH) from Azotobacter vinelandii has previously been shown to transfer NADPH and NAD(+) into NADP(+) and NADH, and TH-overproduction resulted in lower xylitol yield and enhanced glycerol yield during xylose utilization. Strains with low G6PDH-activity grew slower in a lignocellulose hydrolysate than the strain with wild-type G6PDH-activity, which suggested that the availability of intracellular NADPH correlated with tolerance towards lignocellulose-derived inhibitors. Low G6PDH-activity strains were also more sensitive to H2O2 than the control strain TMB3001.

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