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Gene expression cross-profiling in genetically modified industrial*Saccharomyces cerevisiae* strains during high-temperature ethanol production from xylose

Abstract

Production of ethanol from xylose at high temperature would be an economical approach since it reduces risk of contamination and allows both the saccharification and fermentation steps in SSF to be running at elevated temperature. Eight recombinant xylose-utilizing *Saccharomyces cerevisiae* strains developed from industrial strains were constructed and subjected to high-temperature fermentation at 38 °C. The best performing strain was sun049T, which produced up to 15.2 g/L ethanol (63% of the theoretical production), followed by sun048T and sun588T, both with 14.1 g/L ethanol produced. Via transcriptomic analysis, expression profiling of the top three best ethanol producing strains compared to a negative control strain, sun473T, led to the discovery of genes in common that were regulated in the same direction. Identification of the 20 most highly up-regulated and the 20 most highly down-regulated genes indicated that the cells regulate their central metabolism and maintain the integrity of the cell walls in response to high temperature. We also speculate that cross-protection in the cells occurs, allowing them to maintain ethanol production at higher concentration under heat stress than the negative controls. This report provides further transcriptomics information in the interest of producing a robust microorganism for high-temperature ethanol production utilizing xylose.

Keywords; Bioethanol, Xylose, Thermotolerance, Microarray, Gene expression