

Rational design of xylose reductase and xylitol dehydrogenase for efficient xylose-to-ethanol fermentation

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Xylose is one of the major fermentable sugars present in lignocellulosic biomass, the second most abundant carbohydrate polymer in nature. Therefore, many research efforts have been focused on the screening or developing of xylose-fermenting microbes. For example, native *Saccharomyces cerevisiae* (*S. cerevisiae*), widely used for industrial ethanol production, can not ferment xylose, so that by genetical introduction of xylose reductase (XR) and xylitol dehydrogenase (XDH) into *S. cerevisiae*, xylose-utilizing recombinant yeast has been developed. However, still efficient xylose-fermentation has not yet been achieved which is required to develop economically viable processes for producing biofuel, ethanol, from biomass. In this study, we employed two kinds of rational design strategy for XR and XDH; (1) cofactor-preference design, (2) thermostability-increase design. When recombinant *S. cerevisiae* expressing the newly-designed XR and XDH was employed for xylose fermentation, efficient ethanol production was achieved.