Selection of Furfural Tolerant-xylan Degrading Native Yeasts for Bioethanol Production

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Background & Objectives: Bioethanol production from lignocellulosic hydrolysate has attracted worldwide attention as a strategy for reducing global warming and improving energy security. In order to release fermentable sugars, the lignocellulosic materials need to be hydrolyzed by dilute acid pretreatment. In this process, degradation products include weak acids, furan derivatives and phenolics are generated. Pentose sugars can degrade to furfural, toxic compound that can inhibit microorganisms. Consequently, an inhibitor-tolerant microorganism is usually required for effective hydrolysate fermentation.The goal of this study was selection of native yeasts showing xylan (as a lignocellulosic substrate) degrading ability and capability to tolerate furfural stresses for efficient ethanol fermentation.

Methods: 5 native isolated yeasts on xylan containing medium was investigated for ethanol production. The effect of different concentrations of furfural on ethanol production was compared in fermentation basal medium with or without furfural. Fermentation medium was consisted of 1 to 5 g/l furfural and supplemented with 5% (w/v) xylose.

Results: In various concentrations of furfural, the strain Y2 showed the best result. The growth and ethanol production of all yeast strains were almost unaffected in the presence of 1 g/l furfural. However, at concentration of 2 g/l mainly elongated the lag phase and except for the strain Y2, the lag time extended to 24h for the other isolates.Y2 could tolerate 2-3 g/l furfural and cell growth was detectable after 24, however the sugar consumption and ethanol production was decreased from 5.9 g/l to 4.5 g/l.

Conclusion: The lack of a need to detoxify the lignocllusic hydrolysates enhances the potential of this newly isolated yeast for ethanol production because detoxification processes usually leads to loss of sugars, which reduces the efficiency of the fermentation.Thus a natural xylose fermenting yeast with high inhibitor tolerance has the capacity to improve economics of lignocellulosic ethanol production.

Keywords: Furfural; Ethanol; Xylan