Effective D-lactic acid production from corncobs by simultaneous saccharification and fermentation using metabolically engineered *Lactobacillus plantarum*

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Abstract

A metabolically engineered Lactobacillus plantarum mutant, which could produce D-lactic acid from both glucose and xylose, was applied for the production of optically pure D-lactic acid from corncobs by simultaneous saccharification and fermentation (SSF). Using a corncob hydrolysate obtained by a combination of dilute acid treatment using 1.5% H2SO4 followed by enzymatic saccharification, the L. plantarum mutant completely assimilated both glucose and xylose in the corncob hydrolysate within 20 hours, resulting in the successful production of D-lactic acid with high optical purity in a batch culture. To improve the performance of D-lactic acid production from corncobs, SSF experiments from 100 to 250 g/L of acid-hydrolyzed corncobs using 1.5% H2SO4 were performed, and 49.7 to 101 g/L of D-lactic acid with 96.8-98.6% of optical purity was successfully produced. The D-lactic acid yield from corncobs (YL/C) was approx. 0.61 when 100-150 g/L of acid-hydrolyzed corncobs was used; however, the YL/C decreased to 0.49 as the concentration of acid-hydrolyzed corncobs because of insufficient acid hydrolysis of the corncobs. Therefore, by increasing the H2SO4 concentration to 3.5%, D-lactic acid production from corncobs significantly increased to 134 g/L with YL/C of 0.63 and 2.88 g/(L*h) of productivity from 250 g/L of acid-hydrolyzed corncobs.

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