152c Optimization of Microbial Xylitol Production from Corn Cobs Based on a Metabolic Reaction Model

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Microbial xylitol production from agricultural wastes has recently attracted much attention from industries because it has potentials to realize the cheaper production of xylitol with low environmental impact [1]. In order to realize the effective xylitol production by a xylose utilizing yeast, the oxygen supply is a key for maximizing xylitol yield over consumed xylose (Yxl) because the intracellular xylitol metabolism is strongly influenced by the amount of available oxygen. In the present work, we tried to apply a metabolic reaction model in order to determine the optimal oxygen transfer rate (OTR) in a fermentor for maximizing xylitol yield. Corn cob hydrolysates containing 25 g-xylose/L was employed as medium for xylitol production by computer-controlled batch cultures using Candida magnoliae (FERM P-16522, AIST). A metabolic reaction model considering main xylitol metabolisms including glycolysis, pentose-phosphate pathway, TCA cycle and cell synthesis was developed. The model allows to estimate various intracellular metabolic flux distributions including a xylitol production rate. The oxygen uptake rate to maximize the ratio of xylitol production rate over xylose consumption rate corresponds to the OTR condition to maximize xylitol production over xylose consumed. Based on the metabolic reaction model, the OTR was optimized by a linear programming, the optimal OTR and the maximum xylitol yield were estimated as 0.5 mmol-O2/L-h and 0.81 g-xylitol/g-xylose, respectively. The experimental verification using the optimal OTR demonstrated that the xylitol yield was greatly improved to 0.75 g-xylitol/g-xylose from 0.6 g-xylitol/g-xylose in our previous study. [1] K. Tada, J.-i. Horiuchi, T. Kanno and M. Kobayashi: Microbial xylitol production from corn cobs using Candida magnoliae., J. Biosci. Bioeng., 98, 3, 228-230 (2004)