Cybernetic Modeling of Simultaneous Saccharification & Fermentation (SSF) Process for Bio-ethanol Production

유아림, Silvia Ochoa[1], Jens-Uwe Repke[1], Güter Wozny[1],
양대륙*
고려대학교; [1]Technische Universität Berlin
(dryang@korea.ac.kr*)

The SSF process shows highly nonlinear behavior because the metabolic pathway of yeast is composed by a series of enzyme-catalyzed reactions. Kompala et al. (1986) proposed a cybernetic modeling method to describe the growth behavior of microorganisms. This method can describe the nonlinear behavior by means of two cybernetic variables instead of considering all biochemical reactions inside the cell. Altintas et al. (2002) applied this method to describe the diauxic growth pattern observed experimentally in SSF process. Although the model was simple and seems to have industrial applicability as the authors concluded, it could be seen that the model fails especially for predicting the ethanol and starch dynamic behavior. Looking for a better description of the process for future applications on process control and optimization, we proposed a new cybernetic model following a more complete pathway which was built based on the KEGG database. Optimization based on Monte Carlo method was used for the parameter estimation.

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