Optimization Study of a Fermentation Process with Ex-Situ Butanol Recovery at Cyclic Steady State

김보은, 장 홍, 이재형†
한국과학기술원
(jayhlee@kaist.ac.kr†)

In our previous work, we suggested a fermentation process integrated with adsorption columns where the fermentation broth is continuously circulated between the fermenter and the adsorption column during operation and the saturated column is switched to a fresh one. In such process, the butanol concentration in the broth can be maintained below the threshold level, and the switching of the adsorption columns enables continuous biobutanol production resulting in increased butanol concentration and volumetric productivity. However, there are many operation requirements on the components' concentration, and the system has the complicated operation scheme and dynamic nature; nonlinear kinetics of fermentation and adsorption, and the convergence of cyclic steady state (CSS) due to the periodic switching of the adsorption columns. Therefore, it becomes a challenge to optimize the operating condition of the system at CSS. In this study, we define the optimization problem in terms of productivity and loss involving operation requirements as constraints. The optimization at CSS is solved using sequential approach and simultaneous approach, and the results from two methods, e.g. objective function value, CPU time, and CSS accuracy, are compared.