Operation Optimization Strategy of a Fermentation Reactor Integrated with Adsorption Columns for Continuous Biobutanol Production

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Biobutanol has been considered as alternative renewable energy source due to its high energy content, low volatility, and low water solubility. The butanol has to be removed from the broth during fermentation because the cell growth becomes inhibited when butanol concentration reaches some critical limits. To achieve continuous fermentation with a high volumetric productivity, a fermentation reactor is integrated with adsorption columns. Since the adsorption column is switched periodically because of the limited capacity of the adsorbent, the proposed system reaches a cyclic steady state after few cycles. A dynamic model for continuous extractive fermentation is developed based on the Monod equation and the Langmuir theory, and used for simulating the concentration profiles at acyclic steady state. In this study, we propose the optimization strategy to maximize the productivity at cyclic steady state and determine the major operating variables that satisfy given requirement.