Integrated Stirred-Tank Bioreactor with Internal Adsorption for the Removal of Ammonium to Enhance the Cultivation Performance of gdhA Derivative Pasteurella multocida B:2

ABSTRACT

Growth of mutant gdhA Pasteurella multocida B:2 was inhibited by the accumulation of a by-product, namely ammonium in the culture medium during fermentation. The removal of this by-product during the cultivation of mutant gdhA P. multocida B:2 in a 2 L stirred-tank bioreactor integrated with an internal column using cation-exchange adsorption resin for the improvement of cell viability was studied. Different types of bioreactor system (dispersed and internal) with resins were successfully used for ammonium removal at different agitation speeds. The cultivation in a bioreactor integrated with an internal column demonstrated a significant improvement in growth performance of mutant gdhA P. multocida B:2 (1.05 × 1011 cfu/mL), which was 1.6-fold and 8.4-fold as compared to cultivation with dispersed resin (7.2 × 1010 cfu/mL) and cultivation without resin (1.25 × 1010 cfu/mL), respectively. The accumulation of ammonium in culture medium without resin (801 mg/L) was 1.24-fold and 1.37-fold higher than culture with dispersed resin (642.50 mg/L) and culture in the bioreactor integrated with internal adsorption (586.50 mg/L), respectively. Results from this study demonstrated that cultivation in a bioreactor integrated with the internal adsorption column in order to remove ammonium could reduce the inhibitory effect of this by-product and improve the growth performance of mutant gdhA P. multocida B:2.

Keyword: Cation-exchange resin; Adsorption; Removal; Ammonium; Cell viability; Mutant gdhA P. multocida B:2