

Bioproduction of L(+)-Lactic Acid and Purification by Ion Exchange Mechanism

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Abstract : Lactic acid exists in nature optically in two forms, L(+), D(-)-lactic acid, and has been used in food, leather, textile, pharmaceutical and cosmetic industries. Moreover, L(+)-lactic acid constitutes the raw material for the production of poly-L-lactic acid which is used in biomedical applications. Microbially produced lactic acid was aimed to be recovered from the fermentation media efficiently and economically. Among the various downstream operations, ion exchange chromatography is highly selective and yields a low cost product recovery within a short period of time. In this project, *Lactobacillus casei* NRRL B-441 was used for the production of L(+)-lactic acid from whey by fermentation at pH 5.5 and 37°C that took 12 hours. The product concentration was 50 g/l with 100% L(+)-lactic acid content. Next, the suitable resin was selected due to its high sorption capacity with rapid equilibrium behavior. Dowex marathon WBA, weakly basic anion exchanger in OH form reached the equilibrium in 15 minutes. The batch adsorption experiments were done approximately at pH 7.0 and 30°C and sampling was continued for 20 hours. Furthermore, the effect of temperature and pH was investigated and their influence was found to be unimportant. All the adsorption/desorption experiments were applied to both model lactic acid and biomass free fermentation broth. The ion exchange equilibria of lactic acid and L(+)-lactic acid in fermentation broth on Dowex marathon WBA was explained by Langmuir isotherm. The maximum exchange capacity (qm) for model lactic acid was 0.25 g La/g wet resin and for fermentation broth 0.04 g La/g wet resin. The equilibrium loading and exchange efficiency of L(+)-lactic acid in fermentation broth were reduced as a result of competition by other ionic species. The competing ions inhibit the binding of L(+)-lactic acid to the free sites of ion exchanger. Moreover, column operations were applied to recover adsorbed lactic acid from the ion exchanger. 2.0 M HCl was the suitable eluting agent to recover the bound L(+)-lactic acid with a flowrate of 1 ml/min at ambient temperature. About 95% of bound L(+)-lactic acid was recovered from Dowex marathon WBA. The equilibrium was reached within 15 minutes. The aim of this project was to investigate the purification of L(+)-lactic acid with ion exchange method from fermentation broth. The additional goals were to investigate the end product purity, to obtain new data on the adsorption/desorption behaviours of lactic acid and applicability of the system in industrial usage.

Keywords : fermentation, ion exchange, lactic acid, purification, whey

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