PH CONTROL IN LACTIC ACID PRODUCTION BY LACTOBACILLUS ACIDOPHILUS

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Key words: control, pH, modeling

Introduction. Lactic acid is a versatile chemical widely used in food and pharmaceutical industries; this product can be obtained from renewable sources by means of fermentation processes. The Lactobacilli bacteria naturally produce D-lactic acid in a stereochemically pure way, this chemical specie is very useful to produce biopolymers with high-melting point (such as polylactic acid, PLA) suitable for manufacturing biodegradable plastics (1). The world market of lactic acid is growing every year. Unfortunately, in Mexico lactic acid demand is supplied by imports (2). This paper presents a comparative study of the lactic acid fermentation process using a bioreactor with and without pH control device.

Methods. *Lactobacillus acidophilus* strain was employed in this work. Inocula were grown in 150 mL of MRS broth medium placed in 250 mL Erlenmeyer flasks. After 24 h of shaking (150 rpm, 39°C), the flasks content was transferred to a bioreactor with 1.5 L of sterile MRS broth. Media composition was (g/L): polypeptone, 10; meat extract, 8; glucose, 20; yeast extract, 5; K_2HPO_4, 2; $(NH_4)_2HPO_4$, 0.2; sodium acetate, 5; ammonium citrate, 2; $MnSO_4$, 0.05, $MgSO_4$, 0.2 (3). The bioreactor was equipped with a heat electrical jacket (39 °C), an agitating system (110 rpm) and a pH probe. *Fermentations processes*: (a) the fermentations without pH control device were conducted for 16 hours; (b) the fermentations with pH control device were initially carried out without pH control, when the pH value reached 4.6, the pH control started to operate until process final (16 hours). *Analytical methods: the* glucose consumption was measured by the DNS method (4), the biomass and lactic acid productions were determined by dry weight and HPLC with UV/VIS detector, respectively. Experiments were performed for duplicate.

Results. Substrate consumption is shown in Fig. 1; comparing the glucose consumption after 8 hours, where was started the pH controller operation, the glucose consumption rate without pH control (0.74 g/L-h) is lower than operation with pH control (0.85 g/L-h). Therefore, the lactic acid production is higher in the fermentation with a pH controller (6.52 g/L); meanwhile maximum lactic acid production without pH control was 5.95 g/L (see Fig 2). On the other hand, the lactic acid fermentation with *Lactobacillus acidophilus* in MRS medium follows Luedeking and Piret model (α=0.43 g/g, β=1.05 g/g-h).

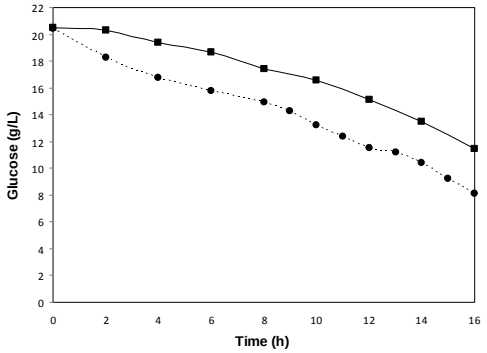

Fig.1 Substrate consumption by *Lactobacillus acidophilus* in a synthetic medium MRS. (■ without and ● with pH control).

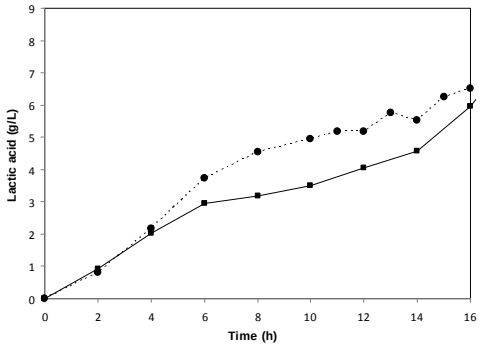

Fig. 2 Lactic acid production (■ without and ● with pH control).

Conclusions. The lactic acid fermentation can be improved if the process is performed by controlling the pH of the medium.

References.

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