USE OF WHEY FOR THE BIOCATALYTIC SYNTHESIS OF LACTOBIONIC ACID

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Abstract

Lactobionic acid and sorbitol are obtained by the conversion of lactose and fructose, respectively, by the periplasmic enzymes glucose-fructose oxidoreductase (GFOR) and glucono-δ-lactonase (GL) present in *Zymomonas mobilis* cells. Lactobionic acid has a very high commercial value as a component of a solution used to preserve human organs to be transplanted, as an active principle for many cosmetics and also as part of drug delivery systems. Sorbitol is a polyol widely used in the food industry as non-cariogenic sweetener, in formulation of cosmetics and as raw material for ascorbic acid production. Because of these important applications, alternative biotechnological routes to minimize costs for obtaining lactobionic acid and sorbitol have been studied. The aim of this work was to evaluate the use of whey as an alternative lactose source in the lactobionic acid bioproduction by the enzymatic system of *Z. mobilis* ATCC 29191 immobilized in calcium alginate beads. Whey is a by-product from cheese industry, which contains a high content of protein and lactose. The bioconversion runs were carried out using initial substrate concentration of 0.6 mol/L fructose and 0.7 mol/L lactose, being lactose the variable of these tests. The experiments were performed at standard operational conditions - pH 6.4 and 39°C - using purified lactose, commercial freeze-dried whey and commercial freeze-dried whey previously deproteinized. Whey proteins were precipitated by acidifying whey solution with lactic acid. The concentration of lactobionic acid and sorbitol in relation to the volume of liquid phase in bioconversion tests was stoichiometrically inferred from the volume of NaOH used to pH control. Once sorbitol and lactobionic acid are formed in an equimolar basis, the molar concentration of sorbitol may be considered as the same as the acid. The results indicate that deproteinized whey solution could be used in the lactobionic acid biosynthesis by the GFOR/GL enzyme complex present in calcium alginate-immobilized *Z. mobilis* cells. The product concentration, volumetric productivity and yield were similar to results obtained with purified lactose, around 180g/L, 78% and 7,5 g/L/h, respectively, in reactions carried out for 24 hours. These results were higher than the attained by using lyophilized whey solution. The results indicate the technical feasibility of using whey instead of purified lactose for lactobionic acid production by this process.

Keywords: *Zymomonas mobilis*, GFOR / GL enzymes, lactobionic acid, lactose, whey.

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