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Microbial conversion of lactose to calcium lactobionate

Hiromi Murakami, Takaaki Kiryu, Taro Kiso and Hirofumi Nakano
Osaka Municipal Technical Research Institute, Japan

Objective: Concerned about utilization of lactose and development of high-soluble calcium supplement, with an interest on biological oxidation of oligosaccharide, we examined microbial and enzymatic oxidation of lactose and aimed to establish effective production systems of calcium lactobionate. Lactobionate, β-1, 4-D-galactosyl-D-gluconate, is an oxidized product of lactose. It has been reported to have mineral-absorption-promoting effects, biffidobacterium-growing activity, moisturizing effect and high solubility in water. Despite its useful properties, lactobionate has been supplied only in a small scale by chemical oxidation because there is no easy and efficient way to produce it.

Results: As per fermentation, we isolated a mutant strain of *Burkholderia cepacia* which has no β-galactosidase activity to avoid hydrolysis of lactose and has sugar-tolerance to react with concentrated lactose. After 4-day cultivation, lactose was completely disappeared and the equivalent molarity of calcium lactobionate was accumulated. In the case of 10-day-fed-batch culture, the final concentration of the product reached 400 g/L in 100% yield. The product was purified from culture supernatant by ethanol precipitation. As for microbial conversion, cells were incubated with 100 to 200 g/L of lactose and half mole equivalent calcium carbonate to lactose. The oxidation activity of the cells was defined as the amount of cells which produced 1 μmol of D-gluconate per minute from 0.1M D-glucose under the assay conditions. When 2 U/mL of cells were incubated with 100, 150 and 200 g/Lof lactose, it took 18, 27 and 48 h for 100% conversion. Reuse of resting cells was available for repeated conversions. Cells of Gluconobacter sp. were also used for microbial conversion. As for enzymatic conversion, we isolated a strain of *Paraconiothyrium* sp. which secreted a stable oxidase in culture. These biological conversion systems of lactose were effective to produce calcium lactobionate with high yield, no by-product, easy purification and easy operation in one-pot synthesis.

Biography

Hiromi Murakami has been working at Osaka Municipal Technical Research Institute since graduating from Konan University in Kobe, Japan and has been engaged in research into microbial enzymes, such as glycosidases, glycosyl transferases and oxidases. She has received a Doctoral degree on “Levan degrading enzymes” and is also been interested in enzymatic and microbial oxidation of saccharides; productions of Lactobionic acid, D-glucuronic acid and D-glucaric acid are good examples for effective conversion of aldose to aldonic acid, uronic acid and aldaric acid.

murakami@omtri.or.jp

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