438e Effect of Carbon Sources on Propionic Acid Fermentation by *Propionibacterium Acidipropionici*

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Propionic acid and its salts are widely used as preservatives in foods and animal feeds due to its antimicrobial activity. Propionic acid has numerous applications as a specialty chemical in production of herbicides, artificial fruit flavors, fine chemicals, and pharmaceuticals. Currently, the market of propionic acid is mainly supplied by production via petrochemical routes. The high demand of propionic acid for use as a natural preservative in foods and grains has stimulated developments of new fermentation processes to achieve improved propionic acid production from low-cost biomass and food processing wastes such as cheese whey, corn steep liquor and corn fiber. The fermentation using these agricultural byproducts as substrates could produce value-added products and help reduce environmental pollution.

Propionibacterium acidipropionici mainly utilizes carbon sources to produce propionic acid, as a main product, and acetic acid, succinic acid and CO_2, as byproducts, via the dicarboxylic acid pathway. The goal of this work was to elucidate metabolic patterns in propionic acid fermentation and a quantitative understanding of flux distributions among various metabolic pathways influenced by different carbon sources, which are useful in investigating and controlling a complex metabolism. This could lead to a potential means of improving propionic acid production.

Glucose, sorbitol, gluconate, and xylose as carbon sources affected kinetics of propionic acid fermentation by *P. acidipropionici* due to cells responded to a particular carbon source by redistributing the pattern of fermentation end-product compositions for a redox balance. Sorbitol provided the highest propionic acid production. As compared to glucose, the fermentation by *P. acidipropionici* using sorbitol achieved ~63%, ~37%, ~33%, and ~121% enhanced productivity (0.24 vs. 0.39 g/L/h), propionic acid yield (0.164 vs. 0.224 mol/mol C), final propionic acid concentration (15.3 vs. 20.4 g/L), and propionate: acetate (P/A) molar ratio (2.9 vs. 6.4), respectively with ~39% and ~13% reduced yields of acetate (0.057 vs. 0.035 mol/mol C) and succinate (0.023 vs. 0.020 mol/mol C), respectively. A P/A molar ratio of 8.1 was obtained from the fermentation using gluconate as the carbon source since succinic acid was produced as a main byproduct instead of acetic acid. As compared to other carbon sources, xylose and glucose gave the similar pattern of end-product compositions and much higher (~60-200%) acetate yields, which resulted in a much lower P/A molar ratio of ~3.0. Various acid-forming enzymes with significant changes in their activities and overall protein expression pattern involved the controlling mechanism in the fermentation as well. The enhanced propionic acid production with reduced acetate and succinate formations obtained from the fermentation by *P. acidipropionici* using sorbitol as the substrate could facilitate simple and inexpensive downstream processing.