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Inulin conversion towards fructose or lactic acid by Mn2+ mediated metabolic flux in *Lactobacillus paracasei*

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Presuming the important role of cations in carbohydrate metabolism, sugars transport, and potentially, in the regulation of genes transcription levels, it may be expected that they would exert a significant influence on inulin conversion by *L. paracasei*. The aim of this study was to obtain maximal amounts of two valuable bio-chemicals: lactic acid and fructose, by engagement of bivalent metal ions as a new instrumentality to govern the process of inulin conversion. The kinetics of batch processes of direct inulin conversion to LA showed that Mn2+addition accelerated the inulin hydrolysis and sugars consumption by allosteric activation of inulinase and enhancement of the glycolytic flux. The highest LA concentration was reached by 15 mM Mn2+ addition - 151 g/L, corresponding to 40% increase, with yield 0.83 g/g substrate. This LA amount is the highest ever obtained from inulin and discloses the role of Mn2+ as a powerful tool for LA production intensification. On the other hand, the exclusion of bivalent metal ions led to elevated expression of fosE gene, encoding fructan-ß-fructosidase - the key enzyme for inulin hydrolysis. Thus, if the process of inulin conversion is conducted by fed-batch fermentation mode (providing substrate excess) and in medium devoid of salts and microelements, maximal fructose concentrations could be achieved. During such process total amountof 675 g inulin was hydrolyzed, giving rise to formation of359 g/L fructose, along with 55.2 g/L LA, 34.8 g/L glucose,17.9 g/L sucrose, and about 25 g/L oligo sugars. In conclusion, the present study is the first that reveals the important role of bivalent cations on the overall process of inulin fermentation by *Lactobacilli.* The obtained fructose concentration is the highest ever received during microbial process (36% solution), allowing the developmentof a novel approach for fructose production via microbial fermentation of inulin.

Biography

Kaloyan K Petrov is the Head of the Department of Chemical and Biochemical Reactors in the Institute of Chemical Engineering, Bulgarian Academy of Sciences. His work is devoted to optimization of downstream processes by the techniques of bioprocess and metabolic engineering. His team develops biotechnologies for microbial production of platform chemicals and fuels by conversion of waste or renewable energy resources, including the cutting-edge biotechnologies for 2,3-Butanediol production from glycerol and starch by the use of natural and recombinant strains, and novel bio-processes for lactic acid synthesis by utilization of starch and inulin. Other topics of his work are the fermentative production of enzymes and valuable chemicals in respect of their industrial application, strain's improvement by gene engineering, microbiological and molecular biological tools, development and analysis of probiotics and prebiotics

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