

In silico perturbation and validation of a capnophilic bacterium *Mannheimia succiniciproducens* MBEL55E for overproducing succinic acid

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This study presents an in-depth study on the organism behavior of *Mannheimia succiniciproducens*, the cell growth rate and succinic acid production rate, under varying rumen gas conditions. Constraints-based flux analysis of the genome-scale metabolic model of *M. succiniciproducens* was employed to estimate intracellular fluxes and the exchange fluxes across the cellular system associated with the metabolism of H₂ and CO₂. Results from fermentations performed previously and constraints-based flux analyses of *M. succiniciproducens* in this study revealed that there is a limit of CO₂ level in the medium for the increment in the cell growth rate. Furthermore, uptake rates of H₂ and CO₂ from the medium have a direct relationship with one another, significantly influencing the rates of cell growth and succinic acid production as a result [This work was supported by the Genome-based Integrated Bioprocess Project of the Ministry of Science and Technology. Further supports by the LG Chem Chair Professorship, IBM SUR program, Microsoft, and by the KOSEF through the Center for Ultramicrochemical Process Systems are appreciated.]