Microbial synthesis gas utilization: C1 biorefinery

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Eubacterium limosum KIST612 is a syngas(H_2, CO, and CO_2)-utilizing acetogen. The strain produces acetate and butyrate as an end product from the syngas via Wood-Ljungdahl pathway. The strain showed relatively high organic acid production rates from CO oxidation with high threshold of substrate inhibition. Compared to other(homo) acetogens, the strain showed a fast growth rate, (μ=0.17-0.25 h-1) on phosphate-buffered basal medium with 1 atm of CO partial pressure. The complete genome of the strain is available. Based on the genome analysis and experimental validation, we hypothesized the bioenergetics model for energy conservation along with quantification of ATP generation in the strain on syngas fermentation. Only a few acetogens are known to produce higher carbon compounds(e.g. butyrate) via syngas fermentation. Butyrate has biotechnological potential because it can be simply converted to butanol having a high energy density via chemical and biological processes. We propose the KIST612 strain as a powerful candidate model organism for C1 biorefinery because our studies and data about genome, physiology, and bioenergetics are available for a knowledge-based guide to design synthetic syngas fermentation process.