Precise flux redistribution around the glyoxylate and TCA cycles for efficient tyrosine production from acetate in escherichia coli

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Acetate in one of promising feedstocks owing to its cheap price and great abundunce. Tyrosine production from acetate can be attempted to improve the economic feasibility of its production. Here, we engineered a previously reported strain, SCK1, for efficient production of tyrosine from acetate. Initially, the acetate uptake and gluconeogenic pathway were amplified to maximize the flux toward tyrosine. For flux redistribution between glyxoylate and TCA cycles, the activity of the glyoxylate cycle was precisely controlled by expression of isocitrate lyase gene under different-strength promoters. Consequently, the engineered strain with optimal flux distribution produced 0.70 g/L tyrosine with 20% of the theoretical maximum yield which are 1.6-fold and 1.9-fold increased values of the parental strain. Tyrosine production from acetate requires precise tuning of the glyoxylate cycle and we obtained substantial improvements in production titer and yield by synthetic promoters and 5' untranslated regions (UTRs). This is the first demonstration of tyrosine production from acetate. Our strategies would be widely applicable to the production of various chemicals from acetate in future.