Metabolic engineering of *Escherichia coli* for the production of 3-aminopropionic acid

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A novel metabolic pathway was designed for the production of 3-aminopropionic acid (3-AP). Using a fumaric-acid producing *E. coli* strain as a host, the *C. glutamicum panD* gene (encoding L-aspartate-α-decarboxylase) was overexpressed and the native promoter of the *aspA* gene was replaced with the strong *trc* promoter, which allowed aspartic acid production through the aspartase (AspA)-catalyzed reaction. Additional overexpression of the *aspA* and phosphoenolpyruvate carboxylase (*ppc*) genes, and the supplementation of ammonium sulfate in the medium allowed production of 3.49 g/L 3-AP. This was further increased to 3.94 g/L by optimizing the expression level of PPC, which was achieved by evaluating 12 different combinations of synthetic promoters and RBS sequences. Fed-batch culture of the final strain yielded 17.9 g/L 3-AP in 89 h, with an overall yield and productivity of 0.186 g 3-AP/g glucose and 0.200 g/L/h, respectively.
(Development of systems metabolic engineering platform technologies for biorefineries; NRF-2012-C1AAA001-2012M1A2A2026556) funded by the Ministry of Education, Science and Technology)