

Conversion of Glycerol to 3-Hydroxypropanoic Acid by Genetically Engineered *Bacillus subtilis*

Authors : Aida Kalantari, Boyang Ji, Tao Chen, Ivan Mijakovic

Abstract : 3-hydroxypropanoic acid (3-HP) is one of the most important biomass-derivable platform chemicals that can be converted into a number of industrially important compounds. There have been several attempts at production of 3-HP from renewable sources in cell factories, focusing mainly on *Escherichia coli*, *Klebsiella pneumoniae*, and *Saccharomyces cerevisiae*. Despite the significant progress made in this field, commercially exploitable large-scale production of 3-HP in microbial strains has still not been achieved. In this study, we investigated the potential of *Bacillus subtilis* to be used as a microbial platform for bioconversion of glycerol into 3-HP. Our recombinant *B. subtilis* strains overexpress the two-step heterologous pathway containing glycerol dehydratase and aldehyde dehydrogenase from various backgrounds. The recombinant strains harboring the codon-optimized synthetic pathway from *K. pneumoniae* produced low levels of 3-HP. Since the enzymes in the heterologous pathway are sensitive to oxygen, we had to perform our experiments in micro-aerobic conditions. Under these conditions, the cell produces lactate in order to regenerate NAD⁺, and we found the lactate production to be in competition with the production of 3-HP. Therefore, based on the *in silico* predictions, we knocked out the glycerol kinase (*glpk*), which in combination with growth on glucose, resulted in improving the 3-HP titer to 1 g/L and the removal of lactate. Cultivation of the same strain in an enriched medium improved the 3-HP titer up to 7.6 g/L. Our findings provide the first report of successful introduction of the biosynthetic pathway for conversion of glycerol into 3-HP in *B. subtilis*.

Keywords : *Bacillus subtilis*, glycerol, 3-hydroxypropanoic acid, metabolic engineering

Conference Title : ICBEEM 2017 : International Conference on Biological Engineering and Beneficial Microbes

Conference Location : London, United Kingdom

Conference Dates : February 16-17, 2017