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Comprehensive metabolic profiling validates the importance of synergy in *escherichia coli* 1-propanol production

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Abstract

Depletion of fossil fuels resulted in a pressing need to produce chemicals and fuels from renewable resources. Several promising fuels have been produced in non-native hosts. In particular, longer-chain alcohols are of interest because of their higher energy density and lower hygroscopicity, which are desirable traits for fuel storage and distribution. One attractive higher alcohol is 1-propanol, an important industrial chemical that has been used in paints, cleaners and cosmetics. It can be esterified to yield diesel fuels and be dehydrated to yield propylene, which at present is derived from petroleum. Previously, *Escherichia coli* strains capable of producing 1-propanol from glucose had been constructed. 1-propanol production was achieved via 2-ketobutyrate from two pathways, native threonine pathway and non-native citramalate pathway from *Methanococcus jannaschii*. The strain possessing two pathways resulted in a much higher titer of 1-propanol (2.5 g/L/day), more than 3-folds when compared to the production from a single pathway (0.8 g/L/day). Here, we demonstrate that comprehensive metabolomics analysis by ion pair LC–QqQ–MS and GC–Q–MS can validate the mechanism of synergy between the two pathways in the level of metabolome. Specifically, metabolomics data support the hypothesis that cofactor balance is one of the main driving forces that resulted in higher production in strains having two pathways working synergistically.

Biography

Sastia Prama Putri has completed his Ph.D at the age of 27 years from Osaka University and is currently working as a postdoctoral researcher under "JST-NSF: Metabolomics for low carbon society" project, focusing on application of metabolomics technology for optimization of various higher alcohols for use as biofuels. Her awards include "Outstanding student oral presentation award (1st place)" in the 42nd Annual Meeting of the Society for Invertebrate Pathology, Park City, USA and fellowships from UNESCO and Japanese Government. She has recently written two review articles on current metabolomics: Technological advances and practical applications.