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Biosynthesis of poly(3-hydroxybutyrate-co-3-hydroxyhexanoate) with high C_6-monomer composition from CO_2 by recombinant of *Ralstonia eutropha*

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Poly((R)-3-hydroxybutyrate-co-(R)-3-hydroxyhexanoate) [P(3HB-co-3HHx)], a flexible and practical biodegradable plastic, is generally produced from plant oils and fatty acids by several wild and recombinant bacteria. Fukui and his coworkers constructed many recombinants of *Ralstonia eutropha* for studying biosynthesis of [P(3HB-co-3HHx)] with high 3HHx composition from the structurally unrelated carbon source. The engineered strain with *ΔphaB1* genotype expressing *ccr, phaJ4a, and emd (R. eutropha* strain MF01ΔB1/pBPP-ccr_{Me}J4a-emd) produced P (3HB-co-3HHx) composed of 22 mol% 3HHx at high cellular content from fructose (Metabolic Engineering, 27:38–45, 2015). Such high C_6–monomer composition was achieved by improving artificial pathway for biosynthesis of monomer unit as follows: (i) Depression of (R)-specific reduction of acetoacetyl-CoA by the deletion of *phaB1* for formation of the C_6–monomer unit from fructose driven by crotonyl-CoA carboxylase/reductase (Ccr), (ii) co-overexpression of *phaJ4a*, which encodes medium-chain-length (R)-enoyl-CoA hydratase, with ccr promoted the incorporation of both 3HB and 3HHx units (iii) introduction of emd_{Mm},a synthetic gene encoding ethylmalonyl-CoA decarboxylase derived from mouse which is probably converting ethylmalonyl-CoA generated by the reductive carboxylase activity of Ccr back into butyryl-CoA. *R. eutropha* is a facultative hydrogen-oxidizing bacterium that chemolithoautotrophically grows due to carbon dioxide fixation using H_2 and O_2 as the energy source. Hence, we also investigated the production of P(3HB-co-3HHx) from CO_2 by the engineered strains of *R. eutropha* in chemolithoautotrophic condition using the substrate gas mixture (H_2/O_2/CO_2::8:1:1) and mineral salts medium. As a result, the strain MF01ΔB1/pBPP-ccr_{Me}J4a-emd produced P(3HB-co-3HHx) with a remarkably high composition of 3HHx (51.7 mol%) at a high cellular content (65.1 wt%) from CO_2.

Biography

Kenji Tanaka has completed his PhD from Kyushu University. He is a Professor of Depatment of Biological and Environmental Chemistry, School of Humanity-Oriented Science & Engineering, Kindai University. His research field is Bioprocess Engineering. He has published many papers on microbial production of biodegradable plastic from CO_2 and biomass.

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