Metabolic engineering of Escherichia coli for the production of polyhydroxyalkanoates incorporating 2-hydroxybutyrate

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E. coli strain was metabolically engineered to synthesize polyhydroxyalkanoates (PHAs) containing 2-hydroxybutyrate (2HB) monomer from glucose. The recombinant E. coli expressing evolved Clostridium propionicum propionyl-CoA transferase (PctCp) and Pseudomonas sp. MBEL 6-19 PHA synthase 1 (PhaC1Ps6-19) was developed and cultured in a chemically defined medium containing 20 g/L of glucose and varying concentrations of 2HB and 3HB. PHAs consisting of 2HB, 3HB, and a small fraction of lactate were synthesized. Also, heterologous metabolic pathway to supply 2-hydroxybutyrate from glucose was constructed via the citramalate pathway. Recombinant E. coli expressing the phaC1437, pct540, cimA3.7, and leuBCD genes together with the L. lactis Il1403 panE gene successfully produced PHAs consisting of 2HB, 3HB, and a small fraction of lactate by varying the 3HB concentration in the culture medium. [This work was supported by the Korean Systems Biology Research Project (20090065571) of the Ministry of Education, Science and Technology (MEST), the R&D Program of MKE/KEIT (10032001) and KRICT]