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POLYHYDROXYALKANOATE (PHA) BIOSYNTHESIS FROM STRUCTURALLY UNRELATED CARBON SOURCES BY *Hydrogenophaga pseudoflava* DSM1034

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Abstract

Polyhydroxyalkanoates (PHA) are polyesters synthesized by a variety of bacterial strains as intracellular carbon and energy storage compounds when grown under stress conditions. As biodegradable and biocompatible materials, PHA have drawn industrial attention for potential purposes in many fields, including biomedical and environmental applications. The incorporation of 4HB units into the polymer influences the physical properties ranging from highly crystalline plastic to elastic rubber, depending on the polymer composition. Different compositions of the co-polymer P(3HB-co-4HB) are promising materials with interesting mechanical properties that can be hydrolyzed by both PHA depolymerases and lipases at relatively rapid degradation rate, as compared with other PHAs. P(3HB-co-4HB) has been produced by a few bacteria, including *R. eutropha*, *Alcaligenes latus*, *Comamonas acidovorans*, *Comamonas testosteronii* and *Hydrogenophaga pseudoflava*. Generally, carbon sources structurally related to 4HB are required to produce 4HB monomeric unit PHA, such as 4-hydroxybutyric acid, γ-butyrolactone and 1,4-butanediol. However, these carbon sources are much more expensive than glucose or other 3HB-generating carbon sources, so the use of structurally unrelated substrates or waste materials to generate these copolymers represent a reliable way to cost reduction.

In this work we report the growth of *H. pseudoflava* DSM 1034 in minimal medium supplemented with sucrose, lactose and whey permeate without any co-substrate added. *H. pseudoflava* was found able to synthesize various PHAs with 3-hydroxybutyrate (3HB), 3-hydroxyvalerate (3HV) and 4-hydroxybutyrate (4HB) monomer units from this structurally unrelated carbon sources. The PHAs isolated from cultures grown in lactose and sucrose presented molecular weights of 1732 and 1120 Da, polydispersity index values (MW/MN) of 1.19 and 1.07 with a crystallinity of 66.4 and 67.8 % respectively. When grown on whey permeate *H. pseudoflava* was able to incorporate three different monomer units: 3-hydroxybutyrate, 3-hydroxyvalerate and 4-hydroxybutyrate. Future activities will be addressed to expedite experimental routes enabling an increase of the production yields and above all an increase of the molecular weight of the samples from *scl* to *mcl* specimens.