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Extended Abstract

Microbial Production of Polyhydroxyalkanoates from Structural Correlated Substrates †

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† Presented at the 15th International Symposium "Priorities of Chemistry for a Sustainable Development" PRIOCHEM, Bucharest, Romania, 30th October–1st November 2019.

Published: 15 October 2019

Keywords: biosynthesis; *mcl*-polyhydroxyalkanoates; *Pseudomonas* spp.; fatty acids; precursor

Polyhydroxyalcanoates (PHAs) are polyesters of aliphatic hydroxy acids. They have properties similar to petroleum-derived polymers and form a class of thermoplastic materials whose mechanical properties vary between elasticity similar to rubber and hardness comparable to crystalline textolite. These characteristics recommend PHAs to be used in various forms and in different areas [1–5]. PHAs are naturally produced by bacteria and accumulate in the form of granules in the cytoplasm, as an energy reserve, and carbon (C) atoms, in particular culture broth conditions. The aim of this work was to obtain medium chain length (co)polyhydroxyalkanoates (*mcl*-PHA) with controlled composition (containing monomers with 5–14 carbon atoms), through microbial biosynthesis, using *Pseudomonas* spp. strains (from the National Institute for Chemical-Pharmaceutical Research and Development (ICCF) culture collection of micro-organisms), by varying the carbon sources and the precursors. Continuing our previous studies on PHA production [6], in this work, assays were performed at the laboratory level with fermentation media seeded with inoculum cultures of strain *Pseudomonas putida* in a proportion of 10%. The influence on *mcl*-PHA production of glucose and citrate as carbon sources for strains development, as well as of octanoic (C8) and decanoic (C10) acids, as polymers precursors, were analyzed.

Bacterial strain: *Pseudomonas putida* (ICCF 391), inoculum culture: 24 h, 30 °C, 220 rpm, biosynthesis: Submerged fermentation in a medium containing mineral salts and Na-octanoate / Na-decanoate, at regular time intervals (0 and 24 h), in order to assure a constant precursor concentration (0.16% g/v), 10% inoculum culture; 48 h, 30 °C, 220 rpm, pH = 7. The precursors, sodium octanoate and sodium decanoate were added separately or together (in volume ratio 1:1) in the fermentation media.

The results showed the optimum conditions for metabolizing the fatty acids, and the ability of the microorganisms to easily and more productively metabolize the octanoic acid rather than decanoic acid. This behavior was proved in the experimental model of biosynthesis and down-stream processing, to obtain PHA containing predominantly C8 monomers or C10 monomers in different ratios.

Correlating the data obtained from several experiments in shake flasks, we can conclude the following: In case that all the precursor amount (octanoate) is used up during the fermentation (19.8–22.6 g), with an average conversion degree of total C in polymer of 32.5% which corresponds to 3.3–3.7 g/L dry bacterial biomass and to 1.7–1.9 g/L PHAs, represented predominantly by polyhydroxyoctanoate PHO (88%).

Acknowledgments: This work was supported by the Ministry of Education and Scientific Research, the Grant number: PN 19-41 041 01/ 2019.

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