Área: AMB

Using organic acids compositions to produce biopolymer polyhydroxyalkanoate (PHA) by wild *Cupriavidus taiwanensis*

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Highlights

Wild *C. taiwanensis* biosynthesized PHA from organic acids, with a preference for butyric acid. Statistical analysis determined the optimal time for maximum PHA production.

Abstract

Polymers, which are ubiquitous in modern society, remain heavily dependent on petroleum and its derivatives. These materials are not only highly polluting but also resistant to decomposition, posing significant environmental challenges. To mitigate this issue, there is an urgent need to transition to greener alternatives, such as polyhydroxyalkanoates (PHA). PHAs are biodegradable polymers that can decompose in soil within months and can be used either as standalone materials or blended with other eco-friendly polymers.[1] Their widespread adoption could significantly reduce the accumulation of waste from disposable plastics and packaging, contributing to a cleaner and more sustainable environment. This study focuses on *Cupriavidus taiwanensis*, a wild bacterium isolated from soil at a deactivated gas station in Cubatão, SP, Brazil.[2] *Cupriavidus* species are of particular interest due to their well-documented ability to produce PHA and their remarkable versatility in utilizing various carbon sources. The research explores the use of organic acids to simulate the utilization of agro-industrial waste, which either naturally contains these acids or can be enriched through the activity of specific microorganisms.[3] In this work, *C. taiwanensis* was initially cultured in a nutrient-rich medium (LB medium supplemented with 3 g/L ammonium sulfate) for 24 hours at 30°C. The cells were then transferred to a nutrient- and nitrogen-limited medium (MSM, 0.12 g/L ammonium sulfate) containing a fixed initial carbon concentration of 166 mM, provided as acetic acid (HAc/A), butyric acid (HBut/B), or a combination of both (Table 1). Samples were collected at 0, 2, 4, 6, 8, 10, 24, 48, 72, and 144 h, and the concentrations of organic acids, as well as the optical density at 600 nm (OD_{600}), were measured. By analyzing these data and applying treatments and extrapolations, the time of maximum PHA accumulation was estimated (Figure 1), along with the corresponding organic acid concentrations. Comparative evaluations of PHA production were conducted using OD_{600} measurements. Moreover, the use of the three different conditions suggested a greater preference for the conversion of butyric acid into PHA compared to acetic acid.

Table 1 – Growing conditions.

#	HAc	HBut	[C]
F# A	5.0 g/L	-	**166 mM**
F# AB	2.5 g/L	1.9 g/L	**166 mM**
F# B	-	3.7 g/L	**166 mM**

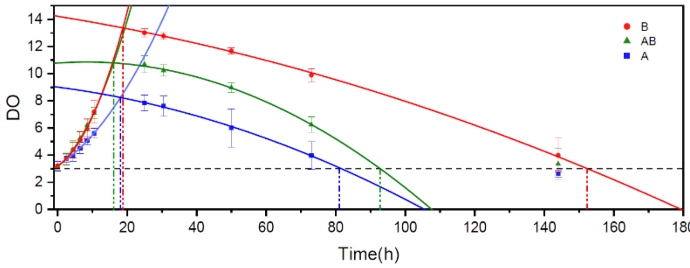

Figure 1 – OD_{600} x t(h) plot to estimate de maximum PHA production.

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