

Poster

Electrochemically-assisted growth of purple phototrophic bacteria for PHB production.



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ABSTRACT

Motivation:

Purple Phototrophic Bacteria (PPB) are considered one of the most versatile microorganisms ever found. They have autotrophic, heterotrophic and photoheterotrophic metabolism in order to adapt the different conditions in the environment. This characteristics altogether with the capacity of produce and accumulate bioplastics such as polyhydroxybutyrate (PHB) make PPB an interesting choice for biotechnological processes (Monroy & Buitrón, 2020).

The microbial electrochemical technologies (METs) have been successfully used in the last few years as an alternative to conventional wastewater treatment. With the development of this technologies a wide range of applications have been discovered. For example, in Microbial Electrochemical Synthesis (MES), we can modulate the metabolism of the microorganisms attached to the electrode with the application of an electric current and, in consequence, altering the redox power inside the cell (Guzman et al., 2019).

The main purpose of this work consists in combining the qualities of the PPB together with METs to study the influence of the latter in bacterial metabolism and PHB biosynthesis. Furthermore, the production and quantification of the biopolymer will be optimized to increase the PHB yield.

Methods:

The enrichment of PPB culture was carried out from brewery wastewater. Near infrared light was used to activate PPB growth. Four different reactors were built, one half was polarized, the other one was kept in open circuit. Microorganisms were cultured with acetate as carbon source, and ammonium chloride as nitrogen source under various [Acetate]:[ammonia] ratios to test efficiency in PHB synthesis. To induce PHB production the "feast and famine" technique was conducted, in which, the nitrogen source is retired so that the microorganisms get stressed (Padovani, Emiliani, Giovanelli, Traversi, & Carozzi, 2018).

Growth was measured by spectrophotometry, acetate consumption was analysed by chemical oxygen demand, the ammonia assimilation was quantified by ionic chromatograph and the PHB production was studied with the indirect measurement of crotonic acid in the High Performance Liquid Chromatography (HPLC).

The reactors were poised using a potentiostat, the electrodes used in this work were graphite for the working electrode; platinumized titanium for the counter electrode and a reference electrode. Electric current was measured every second and cyclic voltammeteries were performed to prove electroactivity.

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