



Butanol production by *Clostridium acetobutylicum* ATCC824 through electrofermentation in defined culture medium supplemented with butyrate

Ernesto González

Pontifical Catholic University of Valparaíso, Chile

Abstract

We performed an *in silico* metabolic analysis of *Clostridium acetobutylicum*, the analyses showed that an electron uptake flux result in the coupling of butanol production to cell growth; however, a proportional butyrate uptake flux would be required. Based on these results, we hypothesized that the supplementation of butyrate and an external electron source acting as a co-reducing agent, would result in an increase of the butanol production in batch culture. To test this hypothesis, batch experiments were done with 18 g L⁻¹ of glucose and supplemented with 6 g L⁻¹ of butyrate. The fermentations were performed by a three-electrode potentiostatic system in an H-type reactor, graphite rods were used for anode and cathode and an Ag/AgCl electrode as reference, neutral red was used as electron carrier and a potentiostat was setting up to keep a constant potential of -0.85 V during the experiments. The results obtained shows that the higher initial concentration of butyrate in the culture medium had a negative

effect on the duration of the lag phase but had a positive effect in the butanol titer and also coupled its production to the cell growth, which validates the results obtained *in silico*. The consumption of glucose was complete and in the case of butyrate it was about 65%. Regarding the production of acids, the most remarkable effect was an increase in the production of acetate, which implies a higher ATP production, probably used for butyrate re-assimilation via reverse butyrate kinase. Biomass and butanol reached a concentration of 3.00 ± 0.03 g L⁻¹ and 8.38 g L⁻¹ ± 0.24 g L⁻¹ respectively, while glucose was exhausted in 72 h. The electrofermentation by *Clostridium acetobutylicum* with neutral red and supplementation of butyrate produced more butanol (34.48% ± 0.46) than the control culture.

Biography

Ernesto González completed his PhD at the age of 29 years at The Universidad Complutense de Madrid, Spain. He is lecturer at The Pontificia Universidad Católica de Valparaíso, Chile, since 2016. He is currently leading the project Development of a bioelectrochemical system to generate polyhydroxybutyrate from organic compounds and CO₂.

Publications

1. Publication I: Electron shuttles stimulate the reductive dissolution of jarosite by *Acidiphilium cryptum*
2. Publication II: Engineering a defined culture medium to grow *Piscirickettsia salmonis* for its use in vaccine formulations
3. Publication III: The contribution of *Acidiphilium cryptum* to the dissolution of low-grade manganese ores
4. Publication IV: Reductive Dissolution of Jarosite by *Acidiphilium cryptum* in Presence of Chelating Agents and Dissolved Iron
5. Publication V: Reductive Dissolution of Iron Oxides and Manganese Bioleaching by *Acidiphilium cryptum* JF-5



3rd International Conference on Industrial Biotechnology and Bioprocessing | Paris, France | February 17-18, 2020

Citation: Ernesto González, Butanol production by *Clostridium acetobutylicum* ATCC824 through electrofermentation in defined culture medium supplemented with butyrate, Industrial Biotechnology 2020, 3rd International Conference on Industrial Biotechnology and Bioprocessing | Paris, France | February 17-18, 2020, 10