

Production of bioethanol fuel using immobilized *Sacharomyces cerevisiae*

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Abstract

The use of *Saccharomyces cerevisiae* immobilized in alginate beads coated with chitosan show stable and continuous ethanol production along a 168 h fermentation utilizing 0,5 L bioreactor. Also, the beads stability has show excellent resistance.

Key words: *bioethanol*, *Saccharomyces cerevisiae*, *calcium alginate*.

Introduction

The use of immobilized cells in bioethanol production has been studied because offers many benefits, as productivity gain, more biocatalyst reuse, simplified separation and purifying^{1,2}.

The method utilized to cell immobilization is the porous matrix entrapment with calcium alginate beads coated with chitosan using citric acid to promoted better resistance to the matrix, preventing its rupture due CO₂ production³.

In this work we report the results of continuous process in 0,5 L bioreactor.

Results and Discussion

The fermentation process was carried out in a volume of 0.5L, using 75 g of immobilized *S. cerevisiae* alginate beads, with culture medium containing 200 g/L of glucose, 2 g/L of ammonium phosphate and 8 g of CaCl₂. Being that 2/3 of its volume was altered every 8 hours to maintain a continuous production of ethanol, during 168 h.

Samples from the medium has glucose and ethanol concentrations determined via HPLC. The Image 1 show the total mass of ethanol produced and the mass of glucose consumed in each cycle.

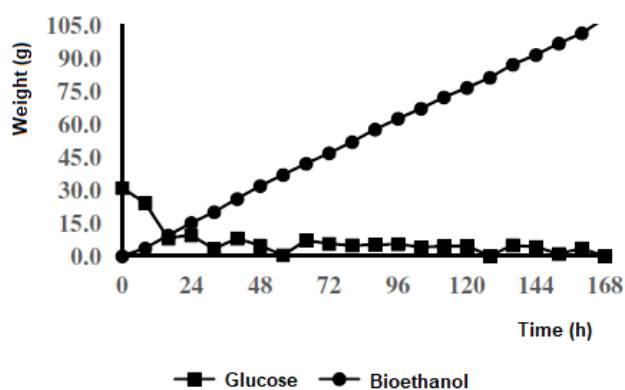


Image 1. Ethanol production and glucose consumption curves of fermentation utilizing immobilized cells.

The bioethanol production curve observed in Image 1 is very close to a straight line. That means a stable ethanol production, in constant rhythm along all experiment. Although the glucose consumption curve shows some

grade of residual glucose, the HPLC results allied with stoichiometry analysis reveal a quantitative glucose in ethanol conversion.

As important as ethanol and glucose curves is the beads stability along the experiment. The Image 2 it's a picture of alginate beads at the end of experiment.



Image 2. Immobilized *S. cerevisiae* alginate beads samples at the end of 168 h fermentation.

The alginate beads have proved very stable. As show in Image 2, there's no disruptions at the end, even taking the fermentation a longer time with higher glucose concentrations.

Conclusions

Results show that methodology have potential to be used in larger scales, showing continuous and stable ethanol production. Also, results show a great potential to yeast reuse, with no beads disruption along the 168 h of fermentation. Front these results, use of more complex fermentation mediums can be studied to analyze bioethanol production and beads stability in even closer industrial conditions.

Acknowledgement

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¹ Călinescu, I., Chipurici, P., Trifan, A. and Bădoiu, C. *U.P.B. Sci. Bull.*, **2012**, Series B 74, 33-40.

² Duarte, J.C., Rodrigues, J. A. R., Moran, P.J.S., Valença, G.P. and Nunhez, J.R., *AMB Express*, **2013**, 3:31.