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Bioethanol production by imobilized Saccharomyces cerevisiae using sugarcane juice

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Abstract
Cells of Saccharomyces cerevisiae, immobilized in calcium alginate beads coated with chitosan, were used to produce bioethaol with sugarcane juice on a semi-continue-batch bioreactor (0.5 L) for 168 h, furnished 88% yield and 1,92 g/Lh of productivity. The beads show high stability and without ruptures front.

Key words:
Bioethanol, Saccharomyces cerevisiae, immobilization

Introduction

Bioethanol is one of the most successful renewable fuels developed. In Brazil, it is produced from sugarcane fermentation using *Saccharomyces cerevisiae*.
Aiming for better productivity, easier product purification, longer biocatalyst reuse[1,2], the yeast was immobilized in calcium alginate beads coated with chitosan by using citric acid.
In this work, we report the results of semi-continue-batch process using sugarcane juice.

Results and Discussion

The sugarcane juice utilized was obtained in a local commerce, being properly treated by pasteurization. Fermentation process was carried on a 0,5 L bioreactor, using 75 g of beads and calcium chloride 3 g/L. Every 24 h, 2/3 of fermentation broth was replaced by fresh media, until 168 h.
The total bioethanol production profile and the sugars consumption in each 24 h cycle are both shown in Image 1.

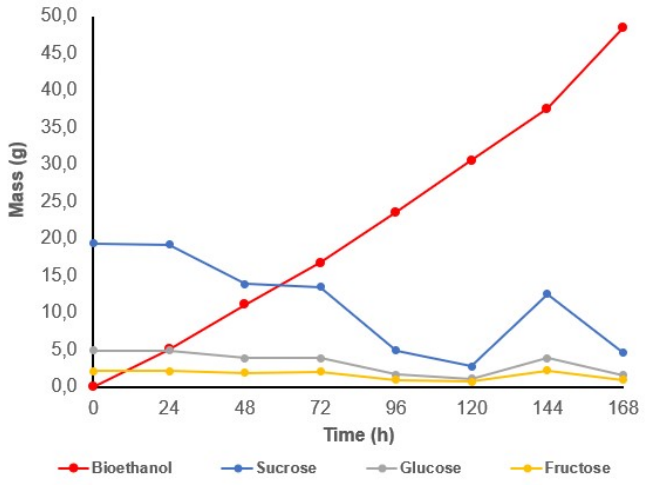

Image 1. Bioethanol production and sugars consumption profiles of sugarcane juice fermentation using immobilized yeast.

The ethanol profile approximates to a straight line, which means a constant production rate, indicating that cells keep stable inside alginate matrix. The yield obtained was 88% with 1,92 g/Lh of productivity.

The immobilization support resistance also is important, because CO_2 production can promote ruptures on the matrix. Image 2 show a photo from the beads at the end of experiment.

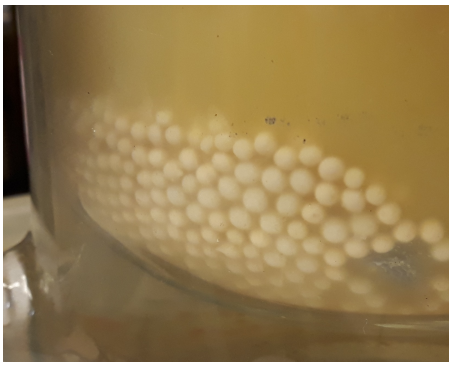

Image 2. Detail of bioreactor at the end of fermentation.

Alginate beads maintained intact at the end of 168 h fermentation, even already being reused from previous experiments, totalizing 672 h (4 reuses). So, the methodology developed led to a high stable and resistant matrix.

Conclusions

Fermentation of sugarcane juice utilizing the immobilized *S. cerevisiae* resulted in 88% yield and 1,92 g/Lh productivity, at constant rate all the experiment. Beads show great resistance, keeping intact after 672 h of intermittent use, showing potential to be even more reutilized. Further experiments may contemplate use of hydrolysate as carbon source or diffusional studies to improve even more the yield and productivity.

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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] Bella de Jesus, T. S.; Fardelone, L. C.; Oura, L. A. K.; Valença, G. P.; Nunhez, J. R.; Rodrigues, J. A. R.; Moran, P. J. S. Produção de bioetanol utilizando células de *Saccharomyces cerevisiae* imobilizadas em esferas de alginato de cálcio revestidas com quitosana. In: Carmen Lúcia Voigt. (Org.). Impactos das Tecnologias na Engenharia Química 3. 1ed.Belo Horizonte (MG): Atena Editora, 2019, v. 3, p. 129-136.