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Assessing the Potential of Local Yeast Isolate for Biomass Conversion Into Bioethanol

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ABSTRACT

Bioethanol is one of the potential future fuels that could replace fossil fuels. In general, bioethanol is produced from biomass by microbial fermentation. The production efficiency of this bioethanol depends mainly on the chemical composition of the feedstock and the type of microorganisms used. In this study, previously local yeast isolate *Saccharomyces cerevisiae* S3 was used for the production of bioethanol using sugarcane molasses as substrate. A maximum ethanol concentration of 56.64 g/l was obtained after 72 h at pH 4.5, 30°C and 15 °Brix under aerobic conditions. These results showed that *Saccharomyces cerevisiae* S3 can be used as a promising yeast for ethanol production from sugarcane molasses.

Keyword: fermentation, bioethanol, yeast, sugarcane molasses

1. Introduction

In order to reduce the risk of climate change, it is essential to develop sustainable alternative energy sources like Biofuels [1] . Bioethanol is an environmentally important fuel that helps to reduce greenhouse gas emissions caused by the global use of fossil fuels [2]. It can be produced from various feedstocks through fermentation process by microorganisms. The choice of yeast has a significant impact on the profitability of ethanol production [3]. *Saccharomyces cerevisiae* is the most popular yeast, known for its ability to produce bioethanol [4]. Moreover, several wild type strains have produced the highest ethanol more than commercial strains [4] [5], in this context, our study was designed for the efficient bioconversion of biomass to ethanol by local yeast isolate. Sugarcane molasses was chosen as substrate, due to its rich chemical composition.

2. Experimental

Microorganisms

The fermentative yeast *Saccharomyces cerevisiae* S3 was previously isolated in our laboratory from figs [6]. Stock cultures were maintained on YM medium with the following composition ($g.L^{-1}$): (yeast extract 3, malt extract 3, peptone 5, glucose 10). The pH was adjusted to 5.5 with 1 M sulfuric acid, and the culture was maintained at 30°C for 24 h, until reaching the OD level of 1.

Feedstock

Sugar cane molasses was used as the substrate, obtained from an Algerian sugar factory (CEVITAL) and stored at 4°C until use.

Fermentation process

The batch Fermentation was carried out in fermentor, each containing 3L of pretreated sterile molasses. The pH was adjusted to 4.5 with sulfuric acid 1 M at a constant temperature of 30°C while being agitated at 120 rpm, and fermentation continued for 72 hours. Samples were collected for analysis.

Analytical methods

The optical density of yeast was measured by using a spectrophotometer at 620 nm. Ethanol and sugar consumption were quantified by a High Performance Liquid Chromatography.

3. Results

Growth of biomass

The growth curve of the yeast during the fermentation period is shown in figure.1. A short lag phase of S3 in the first hours was observed, the yeast reached a maximum OD at 72h of fermentation, after it, S3 enter on stationary phase followed by a decline phase.

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Sugar consumption and bioethanol production

Fig.2 illustrate evolution of total sugar consumption and bioethanol production during the fermentation. Sugar consumption and bioethanol production progressed conversely, the maximum ethanol production was about 56.64 g/l when the sugar concentration was decrease to 60 g/l, this indicate that a maximum sugar was consumed and converted to ethanol.

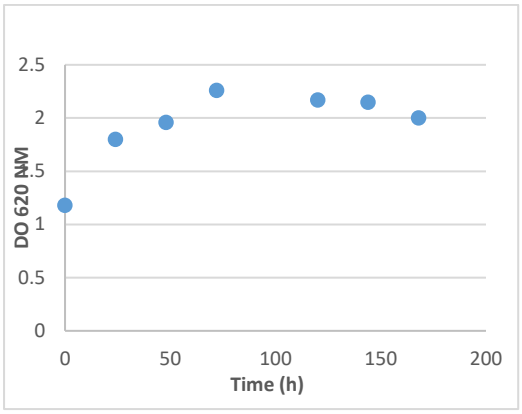

Figure.1: Yeast growth during the fermentation.

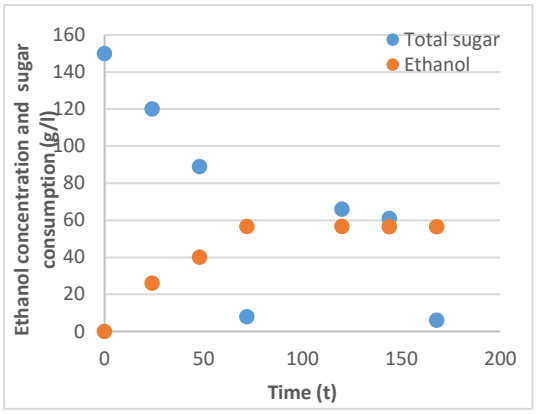

Figure.2: Ethanol production and sugar consumption by yeast during the fermentation.

4. Conclusion

This work evaluated local yeast isolate *Saccharomyces cerevisiae* S3 to produce bioethanol from sugarcane molasses. The study showed that the highest ethanol yield was obtained after 72 hours, at pH 4.5, 15°Brix and 30°C. This yield is promising to explore ability of this yeast to produce bioethanol in larger-scale bioreactors.

References

[1] E. Hawaz, M. Tafesse and A. e. a. Tesfaye, "Isolation and characterization of bioethanol producing wild yeasts from bio-wastes and co-products of sugar factories.," *Ann Microbiol 72, 39*, 2022.

[2] R. Abdulla, N. H. Ahmad, M. K. Sabullah and J. A. & Gansau, "Characterization of wild type yeast isolated from Sabah soil for environmental friendly biofuel production.," *In : IOP Conference Series: Earth and Environmental Science.*, p. p. 012024., (2022, November)..

[3] M. Knauf and K. & Kraus, "Specific yeasts developed for modern ethanol production.," *Sugar Industry/Zuckerindustrie*, vol. 131, no. (11), pp. 753-758., 2006.

[4] S. H. M. Azhar, R. Abdulla, S. A. Jambo, H. Marbawi, J. A. Gansau, A. A. M. Faik and K. F. & Rodrigues, "Yeasts in sustainable bioethanol production: A review.," *Biochemistry and biophysics reports, 10, 52-61.*, pp. 10, 52-61., 2017.

[5] E. A. D. S. Filho, H. F. de Melo, D. F. Antunes, S. K. B. D. Santos, A. D. M. Resende and D. A. &. d. M. J. M. A. Simões, "Isolation by genetic and physiological characteristics of a fuel-ethanol fermentative Saccharomyces cerevisiae strain," *Journal of Industrial Microbiology and Biotechnology, 32(10), 481-486.*, vol. 32(10), pp. 481-486., 2005.

[6] M. Kechkar, W. Sayed, A. A. Cabrol, A. Z. T. M., A. Amrane and H. & Djelal, "Isolation and identification of yeast strains from sugarcane molasses, dates and figs for ethanol production under conditions simulating algal hydrolysate," *Brazilian Journal of Chemical Engineering*, vol. 36, pp. 157-169, 2019.

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