RESEARCH AND DEVELOPMENT AIMING AT THE INTEGRATED EXPLOITATION OF SUGARCANE BAGASSE FOR THE BIOTECHNOLOGICAL PRODUCTION OF LIGNOCELLULOSIC ETHANOL

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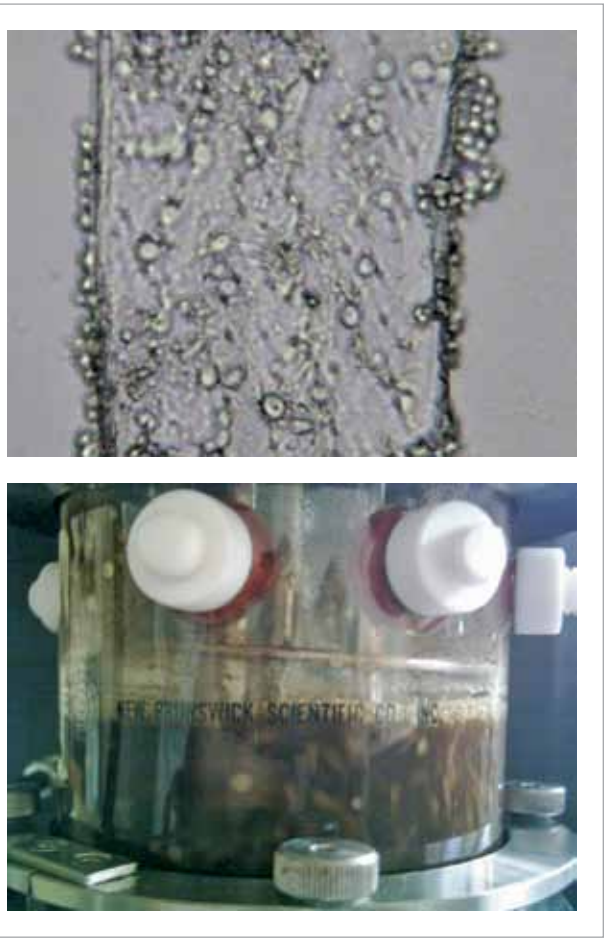


Figure 1. Growth of xylose-fermenting yeasts in bagasse fiber and fermentation of sugarcane bagasse hydrolysate in a batch bioreactor aiming bioethanol production

This project is a collaborative research within the BIOEN-FAPESP/FAPEMIG call between the Biotechnology Department of the Lorena School of Engineering (EEL/USP), Physics Department of the Federal University of Juiz de Fora (UFJF), Microbiology Department of the Federal University of Minas Gerais (UFMG) and Microbiology Laboratory, São Paulo State University (UNESP Rio Claro).

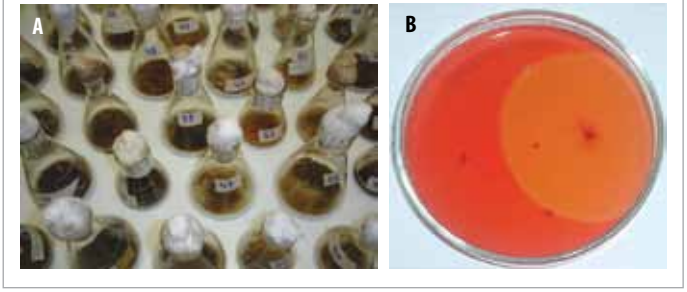
The project aims at the fractioning of sugarcane bagasse in its main components (cellulose, hemicellulose and lignin) for their use in the production of ethanol. The acid hydrolysis will be used to remove the hemicellulosic fraction followed by alkaline hydrolysis. The enzymatic hydrolysis of the cellulose fraction will be performed. The hydrolysates will be characterized by advanced spectroscopic techniques as Raman scattering, infrared absorption with Fourier transformation (FTIR), absorption in the near infra-red ray (NIR), thermal lens and photo-acoustic. The use of these techniques is interesting due to their nondestructive character, possibility of *in situ* measurements and further development of compact prototypes. In the further stage, the xylose and glucose rich hydrolysates will be properly treated by detoxification methods and used as fermentation media for the production of ethanol by xylose-fermenting yeasts and *S. cerevisiae*, respectively. Xylose-arabinose fermenting species isolated from the Atlantic Rain Forest, Amazon Forest and Brazilian Cerrado ecosystems will be tested. Yeasts inhabiting rotting-wood substrates will be collected and tested for xylose-arabinose fermentation. This project aims at finding new species from these Brazilian ecosystems capable to be used in industrial processes.

In all the involved unitary operations in this study, conditions will be optimized by experimental design and data analysis by means of appropriate statistical methodologies. Obtained results will allow establishing advanced technologies and innovations in order to extend the national and international competitiveness of "bioenergy" to reach second generation technologies for alcohol program. It will allow the formation of teams and cooperation among the participant institutions for training and exchange of knowledge.

SUMMARY OF RESULTS TO DATE AND PERSPECTIVES

- Generate scientific knowledge with approaches related to the integrated use of sugarcane bagasse for bioethanol obtainment;
- Fractionation of sugarcane bagasse in a lab scale reactor under controlled acid hydrolysis;
- Screening of new microorganisms able for utilization of xylose-arabinose as carbon sources in bioprocesses aiming ethanol production and identification of new selected yeasts by physiological and molecular methods (PCR);
- Isolation of yeasts with cellulolitic activity and preservation;
- Comparison of different strategies for sugarcane bagasse hydrolysate detoxification;
- Fermentation of sugarcane bagasse hemicellulosic hydrolysate by the new xylose-fermenting selected strains.
- Development of new analytical methods based on spectroscopic principles for characterization of sugarcane bagasse, hydrolysates and ethanol produced by fermentation process. It is expected the characterization measurements of these materials by Fourier Transform Infrared Spectrometry (FTIR), Near infrared spectroscopy (NIR), Raman spectroscopy, thermal lens and photo-acoustic.
- Development of a spectroscopic data processing software using the Principal Component Regression (PCR) and Partial Least Square (PLS) methods to be inserted in programmable microcontrollers (PIC-Programmable).

Figure 2. Screening of new xylose–arabinose fermenting yeasts from Amazon, Atlantic Rain Forest and Brazilian Cerrado ecosystems and cellulolytic activity of selected isolated strains



MAIN PUBLICATIONS

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