

PRODUCTION OF ETHANOL FROM BAGASSE SUGARCANE PRETREATED WITH OZONE: STUDY OF INHIBITORS, FERMENTATION AND INDUSTRIAL YEASTS

Roberto da Silva

Institute of Biosciences, Literature and Exact Sciences / São Paulo State University (UNESP)

FAPESP Process 2014/02080-4 | Term: Aug 2014 to Jul 2016

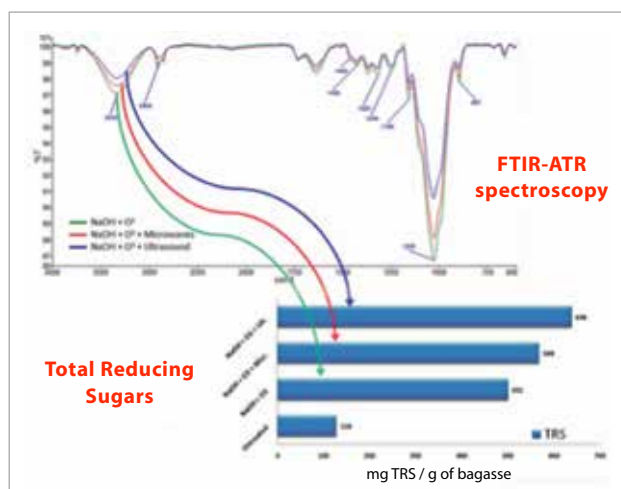


Figure 1. FTIR-ATR spectra of bagasse under ozone, microwave and ultrasound treatments and their respective reducing sugars released. (Perrone, 2015)

This project focuses on the bioenergy production from renewable raw materials. In Brazil, the hydrolysis of bagasse and straw from sugarcane, has been widely investigated by biochemical pathway toward bioethanol production. The goal of the research project is fully evaluate a second-generation ethanol production process, since the sugarcane bagasse until the ethanol obtained. To accomplish this the following steps are been taken: (1) pretreatment of bagasse using ozone for the delignification and increased permeability in the cellulose fiber; (2) enzymatic saccharification of biomass using commercial (or house made) enzymatic formulations; (3) fermentation using different industrial strains of the *Saccharomyces cerevisiae* (Cat1, Pedra2, JP1). After the execution of the fermentation step, it will be possible to close the whole process circle to the final product and, thus, information in integrated way of the three major steps required for the production of second generation ethanol.

SUMMARY OF RESULTS TO DATE AND PERSPECTIVES

This project is a continuation of pretreatment and enzymatic hydrolysis studies that have been developed by our group. In previous work, it was developed a reactor for pretreatment with ozone (Travaini et al. 2013) it was found that this pretreatment generates minimal amounts of inhibitors that do not significantly interfere with the enzymatic saccharification. In this project, other pre-treatments such as acid, alkali, glycerol, microwave, ultrasound, associated or not with ozone, will also be evaluated (Perrone, 2015). Until now it was possible to isolate microorganisms producing cellulases with adequate characteristics for saccharification of biomass (De Cassia Pereira et al, 2014, 2015; Egea et al 2014; Moretti et al 2014). Also, we found that pretreatment using microwave shown significant effects for delignification of biomass (Moretti et al 2014; Diaz, et al 2015). In addition, further analysis will be made of the amount and types of inhibitors present after pretreatment. Also we will perform fermentation studies in the pretreated and saccharified material using commercial yeast strains used in ethanol plants, seeking to evaluate the whole process in an overview.

MAIN PUBLICATIONS

- Diaz AB, Moretti MMS, Bezerra-Bussoli C, Carreira CCN, Blandino A; Da Silva R, Gomes E. 2015. Evaluation of microwave-assisted pretreatment of lignocellulosic biomass immersed in alkaline glycerol for fermentable sugars production. *Bioresource Technology*. **185**: 316-323.
- De Cassia-Pereira J, Paganini-Marques N, Rodrigues A, Oliveira TB, Boscolo M, Da Silva R, Gomes E, Bocchini-Martins DA. 2015. Thermophilic fungi as new sources for production of cellulases and xylanases with potential use in sugarcane bagasse saccharification. *Journal of Applied Microbiology* (Print). **118**: 928-939.
- Moretti MMS, Bocchini-Martins DA, Nunes CCC, Villena MA, Perrone OM, Da Silva R, Boscolo M, Gomes E. 2014. Pretreatment of sugarcane bagasse with microwaves irradiation and its effects on the structure and on enzymatic hydrolysis. *Applied Energy*. **122**: 189-195.
- De Cassia-Pereira J, Leite RSR, Alves-Prado HF, Bocchini-Martins DA, Gomes E, Da Silva R. 2015. Production and characterization of β -glucosidase obtained by the solid-state cultivation of the thermophilic fungus *thermomucor indicae-seudaticae* N31. *Applied Biochemistry and Biotechnology*. **175**: 723-32.
- Egea TC, Rodrigues A, Morais PA, Da Silva R, Gomes E. 2014. Assessment of fungi in soils of sugarcane crops and their potential for production of biomass-degrading enzymes. *African Journal of Microbiology Research*. **8**: 3751.
- Moretti MMS, Bonfa EC, Chierotti MCM, Movio AP, Da Silva R, Gomes E. 2014. Fibrolytic enzyme production of *Myceliophthora thermophila* M.7.7. using inexpensive carbon sources and mineral nutrients. *African Journal of Microbiology Research*. **8**: 4013-4019.
- Travaini R, Otero MDM, Coca M, Da Silva R, Bolado S. 2013. Sugarcane bagasse ozonolysis pretreatment: effect on enzymatic digestibility and inhibitory compound formation. *Bioresource Technology*. **133**: 332-339.

Roberto da Silva

Instituto de Biociências, Letras e Ciências Exatas
de São José do Rio Preto – Univ. Estadual Paulista (Unesp)
Departamento de Química e Ciências Ambientais
Rua Cristóvão Colombo, 2265
CEP 15054-000 – São José do Rio Preto, SP – Brasil

+55-17-3221-2354
dasilva@ibilce.unesp.br