Enzymatic hydrolysis of rice straw and glucose fermentation using a Vertical Ball Mill Bioreactor (VBMB): Impact of operational conditions

Castro, Rafael C.A.; Mussatto, Solange I.; Roberto, Inês C.

Publication date:
2017

Document Version
Publisher's PDF, also known as Version of record

SBFC
Symposium on Biotechnology for Fuels and Chemicals

Enzymatic hydrolysis of rice straw and glucose fermentation using a vertical ball mill bioreactor (VBMB): impact of operational conditions

Tuesday, May 02, 2017
6:00 PM - 8:00 PM
San Francisco Marriott Marquis - Yerba Buena Salons 9, B2 Lower Level

The effects of agitation speed (100-200 rpm), number of glass spheres (0-30 units) and temperature (40-46 °C) on both enzymatic hydrolysis of rice straw (8% w/v) and glucose fermentation (50 g/L) by *Kluyveromyces marxianus* NRRL Y-6860 were evaluated using a Vertical Ball Mill Bioreactor (VBMB). This bioreactor was equipped with adjustable flat round plate impellers, allowing its operation with glass spheres as shear agent. For enzymatic hydrolysis, the spheres were the only variable with significant impact on the results, being achieved 87% cellulose conversion after 24 h when using the highest level of spheres at 46 °C. For glucose fermentation, none of the variables influenced the ethanol yield from glucose, which achieved 80% on average. However, for ethanol volumetric productivity, the spheres showed an interactive effect with temperature, being obtained 2.16 g/L.h when both variables were used in the lowest level. These results revealed that the glass spheres played an important role during biomass' fiber liquefaction and yeast's fermentative performance. Nevertheless, the shear effect caused by the spheres was positive for enzymatic hydrolysis and negative for glucose conversion into ethanol. By applying the needed adjustments on the levels of the variables for each process (hydrolysis and fermentation), the VBMB can be efficiently used for rice straw bioconversion into ethanol. In addition, the design of this bioreactor would allow its use in different processes, such as simultaneous saccharification and fermentation, in batch or fed-batch configurations, and with possibilities of operating at high solids content.

Acknowledgments: FAPESP (2013/13953-6 and 2015/24813-6) and CNPq.

Authors

Rafael C. A. Castro
Escola de Engenharia de Lorena, Universidade de São Paulo

Inês C. Roberto
Escola de Engenharia de Lorena, Universidade de São Paulo

Solange I. Mussatto
Technical University of Denmark

View Related Events

Day: Tuesday, May 02, 2017

SYMPOSIUM ON BIOTECHNOLOGY FOR FUELS AND CHEMICALS
3929 Old Lee Highway, Suite 92A • Fairfax, VA 22030
P: 703.691.3357 • F: 703.691.7991
www.simbhq.org

To whom it may concern:

The Society for Industrial Microbiology hereby certifies that Solange I. Mussatto has attended the 39th Symposium on Biotechnology for Fuels and Chemicals (Monday, May 1 – Thursday, May 4 2016, in San Francisco, California), and presented the following abstract:

Enzymatic hydrolysis of rice straw and glucose fermentation using a vertical ball mill bioreactor (VBMB): impact of operational conditions

Sincerely,

Christine Lowe

Christine Lowe
Conference Coordinator

39TH SYMPOSIUM ON BIOTECHNOLOGY FOR FUELS AND CHEMICALS

A SPECIAL CONFERENCE OF THE SOCIETY FOR INDUSTRIAL MICROBIOLOGY & BIOTECHNOLOGY
IN CONJUNCTION WITH NATIONAL RENEWABLE ENERGY LABORATORY AND
OAK RIDGE NATIONAL LABORATORY

MAY 1-4, 2017

SAN FRANCISCO MARRIOTT MARQUIS • SAN FRANCISCO, CA

SIMB | Society for Industrial Microbiology and Biotechnology

NREL
NATIONAL RENEWABLE ENERGY LABORATORY

OAK RIDGE
National Laboratory

T86 **Cellulase synergy increases with substrate conversion**
J. Pelck Olsen*, Novozymes, Bagsværd, Denmark, K. Borch, Novozymes, Bagsvaerd, Denmark, P. Westh, Roskilde University, Roskilde, Denmark and M. Resch, National Renewable Energy Laboratory, Golden, CO, USA

T87 **Investigating determinants of lytic polysaccharide monooxygenases (LPMOs) stability**
L. Olsson*, A. Peciulyte and K. Salomon Johansen, Chalmers University of Technology, Gothenburg, Sweden

FEEDSTOCK PRETREATMENT AND FRACTIONATION

T88 **Assessing the solid loading and the enzyme dosage on enzymatic hydrolysis of sugarcane straw**
A.J.G. Cruz*, Universidade Federal de São Carlos (UFSCar), São Carlos, Brazil and R.B. Alencar de Souza, Chemical Engineering Graduate Program/ Federal University of São Carlos, São Carlos, Brazil

DESIGN AND ASSESSMENT OF INTEGRATED BIOPROCESSES, INCLUDING SEPARATIONS

T89 **Assessing vinasse biogas production in different sugarcane biorefinary configurations**
A.J.G. Cruz*, Universidade Federal de São Carlos (UFSCar), São Carlos, Brazil; A.A. Longati and A.R. de Andrade Lino, Chemical Engineering Graduate Program/Federal University of São Carlos, São Carlos, Brazil; F.F. Furlan and R.C. Giordano, Federal University of São Carlos, São Carlos, Brazil

FEEDSTOCK PRETREATMENT AND FRACTIONATION

T90 **Enzymatic hydrolysis of cellulose from sugarcane bagasse in a packed bed flow-through column reactor with high solid loading**
L. Ramos, M.H. Vasconcelos, A. Ferraz, A.M.F. Milagres and J.C. Santos, Escola de Engenharia de Lorena, Universidade de São Paulo, Lorena, Brazil; F. Mendes*, Laboratório Nacional de Ciência e Tecnologia do Bioetanol (CTBE), Campinas, Brazil

DESIGN AND ASSESSMENT OF INTEGRATED BIOPROCESSES, INCLUDING SEPARATIONS

T91 **Impact of varied compositional profiles of sugarcane experimental hybrids on a biorefinery producing 1G-2G ethanol and electricity**
F. Mendes* and A. Bonomi, Laboratório Nacional de Ciência e Tecnologia do Bioetanol (CTBE), Campinas, Brazil; M. Dias, Instituto de Ciência e Tecnologia, Universidade Federal de São Paulo, São José dos Campos, Brazil; A. Ferraz, A.M.F. Milagres and J.C. Santos, Escola de Engenharia de Lorena, Universidade de São Paulo, Lorena, Brazil

T92 **Butanol biorefineries - use of novel technologies to produce biofuel butanol from sweet sorghum bagasse (SSB)**
N. Qureshi*, National Center for Agricultural Utilization Research, USDA-ARS, Peoria, IL, USA; K.T. Klasson, United States Department of Agriculture, ARS, New Orleans, LA, USA; V. Boddu, B.C. Saha, S. Liu and S. Hughes, United States Department of Agriculture, Peoria, IL, USA

T93 **Enzymatic hydrolysis of rice straw and glucose fermentation using a vertical ball mill bioreactor (VBMB): impact of operational conditions**
R.C.A. Castro and I.C. Roberto*, Escola de Engenharia de Lorena, Universidade de São Paulo, Lorena, Brazil; S.I. Mussatto, Technical University of Denmark, Kongens Lyngby, Denmark

T94 **Characterization of lignocellulosic biorefinery waste streams for enhanced treatment options**
T. Tobin*, R. Gustafson and R. Bura, University of Washington, Seattle, WA, USA

T95 **Techno-economic analysis of fuel ethanol production from palm oil waste**
B.E.P.D.C. Delgado*, L. Moreira and F.L.P. Pessoa, Federal University of Rio de Janeiro, Rio de Janeiro, Brazil

T96 **Pilot scale green biorefining of grass and legumes for local protein feed production in temperate regions.**
M. Ambye-Jensen*, Aarhus University, Aarhus, Denmark