

Liquefied Cellulosic Biomass for Enzyme Production

Liquefaction of sugarcane bagasse enhances endoglucanase production via submerged fermentation, yielding approximately 15 times higher productivity than solid-state methods and reducing power required for mixing.

The industrial competitiveness of second-generation cellulose ethanol depends on achieving efficient production and use of cellulase enzymes. Cellulase production by filamentous fungi may be achieved through either solid-state fermentation (SSF) or submerged fermentation (SmF). Despite many advantages of SSF over SmF, enzyme production in large-scale SSF bioreactors is hindered by low-solids loadings or if high solids are used, by solids handling and mass and heat transfer gradients during the cultivation process. Submerged cultivations with high-solids loadings remain challenging since mass transfer and gas holdup limitations are compounded by viscosity increases that occur during the first hours of cultivation due to fungal growth.

Researchers at Purdue University have developed technology that utilizes liquefaction of pretreated and sterilized sugarcane bagasse for enhancing endoglucanase production through SmF by *Aspergillus niger* (A. niger). After initial SSF of steam pretreated bagasse solids by A. niger, fed-batch addition of the substrate to cellulase in buffer and reaction, resulted in a liquid slurry with a viscosity of 0.30 plus or minus 0.07 Pa s at 30% (w/v) solids. The addition of A. niger for submerged fermentation of sterile liquefied bagasse at 23% (w/v) solids resulted in approximately 15 times higher productivity than SSF of non-liquefied bagasse. These results demonstrate the utility of liquefied bagasse as a culture medium for enzyme production in submerged fermentations.

Advantages:

- Reduced power input required for mixing the slurry
- Liquefied biomass gives a 15 times higher enzyme yield compared to solid-state fermentation

Technology ID

2015-LADI-66923

Category

Biotechnology & Life Sciences/Bioprocessing & Biomanufacturing
Chemicals & Advanced Materials/Green & Bio-Based Chemistry

Authors

Alberto Badino
Fernanda Marisa da Cunha
Cristiane Farinas
Thomas Kreke
Michael R Ladisch
Eduardo Ximenes

Further information

Aaron Taggart
adtaggart@prf.org

View online



-Enhancement of the enzyme yield

Potential Applications:

-Enzyme Production

-Endoglucanase production

TRL: 3

Intellectual Property:

Provisional-Patent, 2014-09-09, United States | Utility Patent, 2015-09-09,
United States

Keywords: Cellulose ethanol, cellulase enzymes, solid-state fermentation, submerged fermentation, sugarcane bagasse, liquefaction, endoglucanase production, *Aspergillus niger*, SmF, enzyme yield, Biofuels, Biomass, Cellulosic Biomass, Chemical Engineering, Chemistry and Chemical Analysis, Enzymes, Green Technology