Replacing Water and Nutrients for Ethanol Production by *Zymomonas mobilis* Strain

Mingxiong He
PhD, Professor
Biomass Energy Technology Research Centre,
Key Laboratory of Development and Application of Rural Renewable Energy (Ministry of Agriculture), Biogas Institute of Ministry of Agriculture (BIOMA)
Section 4-13, Renmin Rd. South, Chengdu 610041, China
hemingxiong@caas.cn

Abstract

Biogas slurry replaced process water and nitrogen sources during cellulosic ethanol production were investigated. Ethanol fermentation using the ethanologenic bacterial strain *Z. mobilis* ZMT2 was conducted without supplementing with additional nitrogen sources. After pretreatment with 1.34% NaOH (w/v) diluted in 100% biogas slurry and continuous enzymatic hydrolysis for 144 h, 29.19 g/L glucose and 12.76 g/L xylose were generated from 30 g dry corn straw. The maximum ethanol concentration acquired was 13.75g/L, which was a yield of 72.63% ethanol from the hydrolysate medium. Nearly 94.87% of the ammonia nitrogen was depleted and no nitrate nitrogen remained after ethanol fermentation. The use of biogas slurry as an alternative to process water and nitrogen sources may decrease the cost of cellulosic ethanol production by 10.0-20.0%.

For further improvement of its efficiency, two rounds of atmospheric and room temperature plasma (ARTP) mutagenesis combined with adaptive laboratory evolution (ALE) were applied to improve the adaptability and genetic stability of *Zymomonas mobilis* in biogas slurry. The highest ethanol productivity reached 0.634 g/L/h which was 61.7% higher than ZM4 (0.392 g/L/h). Genomic re-sequencing results also revealed that single nucleic variations (SNVs) and Indels occurred in the mutants, which are likely related to inhibitor in biogas slurry and low pH tolerance. These results not only provide a novel method for utilizing biogas slurry, but also demonstrates a means of reducing the overall cost of cellulosic ethanol.

Speaker's biography

Prof. He is recipient of Elite Program of Chinese Academy of Agricultural Sciences (CAAS) and winner of Youth Science and Technology Award. He received bachelor degree in Biotechnology in 1995 and Ph.D. degree in biochemistry and molecular biology from Sichuan University in 2008. He joined Biomass Energy Technology Research Centre, Biogas Institute of Ministry of Agriculture in 2008, and has been director of the centre since 2017. His main research interest focuses on microbial metabolic engineering and biomass energy. His research have been granted by many organizations such as NSFC, National Science and Technology Support Program, the Excellent Youth Foundation of Sichuan Province, Sichuan Province Science and Technology Program, etc. He has been granted 3 national invention patents and has published over 80 academic papers in prestigious journals including *Biotechnology for Biofuels*, *Applied Microbiology and Biotechnology*, *Bioresource Technology*, *Microbial Cell Factories* and *Carbohydrate Polymer* with total citation over 700 times. Meanwhile, he served as a reviewer for some journals such as *Biotechnology for Biofuels*.

Brief CV

Mingxiong He, Ph.D.

Professor

Biogas Institute of Ministry of Agriculture

Education:

BS Biotechnology, Sichuan University, China,1999

Ph.D. Biochemistry and Molecular Biology, Sichuan University, China,2008

Professional Career:

2008-2010: Biogas Institute of Ministry of Agriculture, Asistant Professor

2011-2015: Biogas Institute of Ministry of Agriculture, Associate Professor

2016-date: Biogas Institute of Ministry of Agriculture, Professor

Research Interests:

1. Lignocellulosic Biofuels and bioproducts
2. Metabolic engineering and Synthetic Biology

Selected publications

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