

**SUGAR EVOLUTION FROM MICROBIAL HYDROLYSIS OF CORNCOB AND  
SUGARCANE BAGASSE: EFFECT OF STEAM-EXPLOSION PRETREATMENT**

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## ABSTRACT

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Currently, bioethanol is a promising alternative fuel. It can be easily produced by the conversion of lignocellulosic materials into reducing sugars and further fermented into ethanol. The major lignocellulosic materials, like sugarcane bagasse and corncob residue, have been studied. Corncob consists of 43.35% cellulose, 31.86% hemicellulose, 18.25% lignin, and 6.54% ash, while sugarcane bagasse consists of 41.96% cellulose, 25.96% hemicellulose, and 12.43 % lignin. The aim of this research was to study effects of steam-explosion pretreatment on the glucose evolution from corncob and sugarcane bagasse by microbial hydrolysis of cellulase-producing bacteria, *Bacillus subtilis*, isolated from Thai higher termites, *Microcerotermes* sp., in an aerobic batch reactor. H<sub>2</sub>O and H<sub>2</sub>SO<sub>4</sub> impregnated biomass was steam-exploded by high temperature (120 °C) for 1, 2, and 3 h in order to determine the optimum condition for fermentable sugar production. The optimum pretreatment condition is at 1 h for the H<sub>2</sub>O-impregnated sugarcane bagasse, while the H<sub>2</sub>O-impregnated corncob is at 2 h. The maximum glucose concentration at the optimum condition, for H<sub>2</sub>O-impregnated steam explosion pretreatment of sugarcane bagasse and corncob, are 0.369 g/L at 6 h and 0.262 g/L at 5 h, respectively. Furthermore, the optimum pretreatment condition was at 1 h for the H<sub>2</sub>SO<sub>4</sub>-impregnated sugarcane bagasse and corncob. The maximum glucose concentration at the optimum condition, for H<sub>2</sub>SO<sub>4</sub>-impregnated steam explosion pretreatment of sugarcane bagasse and corncob are 0.6 g/L and 0.265 g/L, respectively.

## บทคัดย่อ

ปารณีย์ ไตรเชษฐกุล : ผลของการใช้กระบวนการระเบิดด้วยไอน้ำต่อการผลิตน้ำตาล โดยการย่อยจุลินทรีย์ของซังข้าวโพดและชานอ้อย (Sugar Evolution from Microbial Hydrolysis of Corncob and Sugarcane Bagasse: Effect of Steam-Explosion Pretreatment) อ.ที่ปรึกษา: รศ.ดร.ปราโมช รังสรรค์วิจิตร และ ศ.ดร.สุเมธ ชวเดช 89 หน้า

ปัจจุบัน ไบโอดีทเป็นหนึ่งในพลังงานทางเลือกซึ่งสามารถผลิตได้จากการเปลี่ยนเซลลูโลสให้กลายเป็นน้ำตาลกลูโคสและน้ำตาลอื่นๆได้น้ำตาลที่ผลิตได้นั้นสามารถใช้เป็นวัตถุดิบตั้งต้นในการผลิตเอทานอลต่อไป วัตถุดิบหลักประเภทซังข้าวโพดประกอบไปด้วยเซลลูโลสร้อยละ 43.35 เฮมิเซลลูโลสร้อยละ 31.86 ลิกนินร้อยละ 18.25 และสารแทรกสร้อยละ 6.54 และสำหรับชานอ้อยประกอบไปด้วยเซลลูโลสร้อยละ 41.96 เฮมิเซลลูโลส 25.96 และลิกนินร้อยละ 12.43 วัตถุประสงค์ของงานวิจัยนี้เพื่อศึกษาผลของการใช้กระบวนการระเบิดด้วยไอน้ำต่อการผลิตน้ำตาลจากซังข้าวโพดและชานอ้อยโดยกระบวนการย่อยด้วยจุลินทรีย์ (Microbial Hydrolysis) ที่แยกได้จากปลวกชั้นสูงซึ่งมีความสามารถในการผลิตเซลลูเลสแบบที่เรียบบิลลัส ซับทีลิสสายพันธุ์ เอ 002 ในเครื่องปฏิกรณ์แบบกะ (Batch Reactor) นอกจากนี้ยังศึกษาการ Pretreatment ของซังข้าวโพดและชานอ้อยโดยการนำไปแช่น้ำและกรดซัลฟิวริก หลังจากนั้นนำไประเบิดด้วยไอน้ำโดยใช้เครื่อง Autoclave ที่มีอุณหภูมิ 120 องศาเซลเซียสเป็นระยะเวลา 1, 2, และ 3 ชั่วโมงเพื่อศึกษาสภาวะที่เหมาะสมที่สุดของการ Pretreatment ผลการศึกษาพบว่าในซังข้าวโพดที่นำไปแช่น้ำและระเบิดด้วยไอน้ำเป็นเวลา 2 ชั่วโมง สามารถผลิตน้ำตาลกลูโคสสูงสุดคือ 0.268 กรัมต่อลิตร ในขณะที่ชานอ้อยใช้เวลา 1 ชั่วโมง และน้ำตาลกลูโคสสูงสุด คือ 0.369 กรัมต่อลิตร สำหรับซังข้าวโพดและชานอ้อยที่นำไปแช่ในกรดซัลฟิวริกและระเบิดด้วยไอน้ำเป็นเวลา 1 ชั่วโมง สามารถผลิตน้ำตาลกลูโคสสูงสุดคือ 0.265 กรัมต่อลิตรและ 0.6 กรัมต่อลิตร ตามลำดับ

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