

**BIOBUTANOL PRODUCTION BY IMMOBILIZED *CLOSTRIDIUM*  
*BEIJERINCKII* TISTR1461 ONTO CARBON MATERIALS**

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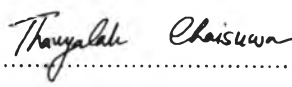
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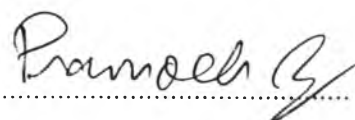
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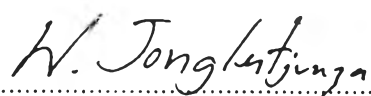
  
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## ABSTRACT

5671026063    Petrochemical Technology Program  
Piyawat Chinwatpaiboon: Biobutanol Production by Immobilized  
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Biobutanol is considered as one of the most attractive biofuels because it has an energy density closer to gasoline. It can be produced via Acetone-Butanol-Ethanol (ABE) fermentation using *Clostridium* species. There are numerous attempts to improve butanol production via cell immobilization to increase cell density and productivity. Furthermore, cell immobilization can protect microbial cells from environmental stresses and operate for a long period with stable operation. Activated carbon, a highly porous material with a large adsorption capacity, was used as an immobilized material for the fermentation process. *Clostridium beijerinckii* TISTR1461 was adsorbed on the activated carbon, which was treated with various chemicals. The DARCO® activated carbon was treated by different chemicals; nitric acid, sodium hydroxide, and 3-aminopropyltriethoxysilane. The results were analyzed and compared to a free cell system. The aminosilane treatment provided the highest butanol concentration of 10.66 g/l.

## บทคัดย่อ

ปิยวัฒน์ ชินวัฒน์ไพบุลย์: ชื่อหัวข้อวิทยานิพนธ์ การผลิตไบโอบิวทานอลโดย *Clostridium beijerinckii* TISTR 1461 ตรึงเซลล์บนวัสดุคาร์บอน (Biobutanol Production by Immobilized *Clostridium beijerinckii* TISTR1461 onto Carbon Materials) อาจารย์ที่ปรึกษา: รศ. ดร.อาภาณี เหลืองนฤมิตชัย และ ผศ. ดร. ธัญญลักษณ์ ฉายสุวรรณ 61 หน้า

ในปัจจุบันการใช้เชื้อเพลิงชีวภาพเป็นพลังงานทดแทนมีบทบาทสำคัญมากขึ้น บิวทานอลเป็นอีกทางเลือกหนึ่งที่น่าสนใจนอกเหนือจากการใช้เอทานอลเนื่องจากบิวทานอลให้พลังงานที่ใกล้เคียงกับเชื้อเพลิงฟอสซิล ซึ่งการผลิตบิวทานอลนั้นสามารถผลิตได้จากกระบวนการหมักด้วยเชื้อแบคทีเรีย *Clostridium beijerinckii* TISTR 1461 ทั้งนี้การหมักแบบตรึงเซลล์เป็นเทคนิคที่ถูกศึกษาเพื่อเพิ่มผลผลิตบิวทานอล โดยเทคนิคการตรึงเซลล์นี้ช่วยป้องกันเซลล์จากสภาวะแวดล้อมต่างที่ไม่เอื้ออำนวยต่อการดำรงอยู่ เช่น อุณหภูมิ แรงเฉือน รวมถึงความเป็นพิษที่เกิดขึ้นในระบบ นอกจากนี้จะเพิ่มประสิทธิภาพในการหมักแล้วยังสามารถหมักได้ระยะเวลานานมากขึ้น ซึ่งมีการศึกษาวัสดุที่ใช้ในกระบวนการหมักเทคนิคการตรึงเซลล์นี้มากมาย เช่น อิฐมอญ, ฟองน้ำ, ผ้าขนหนู, ซีโอไลต์, ถ่านกัมมันต์ ฯลฯ ทั้งนี้โครงการนี้ทำการศึกษาเทคนิคการตรึงเซลล์ด้วยถ่านกัมมันต์ เนื่องจากถ่านกัมมันต์เป็นวัสดุที่มีความเป็นรูพรุนสูง หาได้ง่าย และราคาถูก ศึกษาการปรับสภาพถ่านกัมมันต์ด้วยสารเคมีต่างๆเช่นกรดไนตริก, โซเดียมไฮดรอกไซด์ และ 3-aminopropyltriethoxysilane จากนั้นเปรียบเทียบการหมักระหว่างการหมักแบบเซลล์อิสระกับการหมักแบบตรึงเซลล์ด้วยถ่านกัมมันต์เหล่านี้ จากผลการทดลองพบว่าการหมักแบบตรึงเซลล์ด้วยถ่านกัมมันต์ที่ผ่านการปรับสภาพด้วย 3-aminopropyltriethoxysilane ให้ผลผลิตบิวทานอลสูงที่สุด มีค่า 10.66 กรัมต่อลิตร

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