

CARBON DIOXIDE GASIFICATION OF CELLULOSE

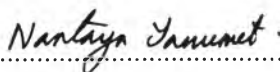
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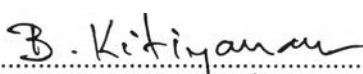
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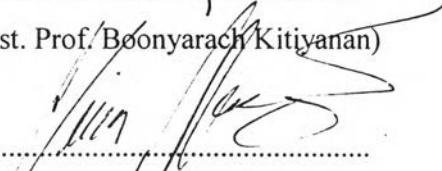
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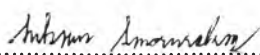

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ABSTRACT

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Keywords: Biomass/ Carbon dioxide/ Cellulose/ Gasification/ Dry reforming

Biomass can be converted to gaseous products via the gasification process. Major components of biomass are cellulose, hemi-cellulose and lignin. This work focused on the gasification of cellulose using CO₂ as the gasifying agent. Cellulose was gasified at specified temperatures ranging from 600 to 900 °C with ZSM-5, Fe, Co, and Co-Fe bimetallic as catalysts. The main gasification products were CO, CH₄ and H₂. An increase in gasifying temperature led to higher total gas yield and lower liquid yield. The use of CO₂ produced CO rich gas products. When steam was used as the gasifying agent, H₂ was produced more, while CO was produced less. The use of catalysts produced more CO and H₂ yields in the gas phase, and reduced the amount of liquid yield. Some light hydrocarbons such as ethylene, ethane, and propane were also found in the gaseous products. The liquid products from both CO₂ and steam gasification contained mainly aliphatic and alicyclic compounds, alcohols, esters, nitrogenated and oxygenated compounds.

บทคัดย่อ

วสันต์ ชีวาสุขถาวร : กระบวนการแกสซิฟิเคชันของเซลลูโลสในสถานะที่มีแก๊สคาร์บอนไดออกไซด์ (Carbon dioxide Gasification of Cellulose) อ. ที่ปรึกษา : ผศ.ดร. บุนนิตย์ กิตยานันท์, ศ.ดร. โจฮานเนส ชวังก์, รศ.ดร. วิษณุ มียู่, รศ.ดร. ปราโมช รั้งสรรค์วิจิตร และ รศ.ดร. ธีรศักดิ์ ฤกษ์สมบูรณ์ 96 หน้า ISBN 974-9937-07-4

งานวิจัยนี้ศึกษาถึงการแปรรูปของเซลลูโลสเป็นผลิตภัณฑ์ที่มีคุณค่าเพิ่มจากกระบวนการแกสซิฟิเคชันในสถานะที่มีแก๊สคาร์บอนไดออกไซด์และใช้ตัวเร่งปฏิกิริยาได้แก่ เหล็ก, โคบอลต์, โลหะผสมของเหล็กกับโคบอลต์ และ ZSM-5 การศึกษานี้ได้ศึกษาถึงผลของอุณหภูมิ ตัวเร่งปฏิกิริยา และไอน้ำ จากการศึกษาพบว่าผลิตภัณฑ์หลักเกิดในรูปของก๊าซได้แก่ ไฮโดรเจน คาร์บอนมอนอกไซด์ และมีเทน การเพิ่มอุณหภูมิส่งผลให้ปริมาณผลิตภัณฑ์ในรูปก๊าซเพิ่มขึ้น ในขณะที่ผลิตภัณฑ์ในรูปของเหลว และของแข็งลดลง สำหรับกระบวนการแกสซิฟิเคชันภายใต้บรรยากาศของก๊าซคาร์บอนไดออกไซด์จะให้สัดส่วนของก๊าซคาร์บอนมอนอกไซด์มากที่สุด ในขณะที่กระบวนการแกสซิฟิเคชันภายใต้บรรยากาศของไอน้ำจะให้สัดส่วนของก๊าซไฮโดรเจนมากที่สุด ผลิตภัณฑ์ในรูปของเหลวจะลดลงเมื่อใช้ตัวเร่งปฏิกิริยา และจะให้ผลิตภัณฑ์ที่เป็นก๊าซไฮโดรเจน กับคาร์บอนมอนอกไซด์เพิ่มขึ้นเนื่องจากตัวเร่งปฏิกิริยามีส่วนช่วยส่งเสริมการเกิดปฏิกิริยารีดิวซ์ของผลิตภัณฑ์ที่เป็นของเหลว จากการศึกษาพบว่ามีการไฮโดรคาร์บอน น้ำหนักเบาเช่น เอทิลีน อีเทน และ โพรเพนเกิดขึ้นในผลิตภัณฑ์ที่เป็นก๊าซ สำหรับผลิตภัณฑ์ที่เป็นของเหลวจะประกอบไปด้วยสารประกอบหลายประเภทเช่น อะลิฟาติก, อะลิไซคลิก, เอสเทอร์, แอลกอฮอล์, สารประกอบที่มีออกซิเจน และสารประกอบที่มีไนโตรเจน

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