

**Evaluation of Monomeric Sugar Yield from Various Grasses Grown in Thailand
as Biofuel Feedstock by Two-Stage Microwave/Chemical Pretreatment Process**

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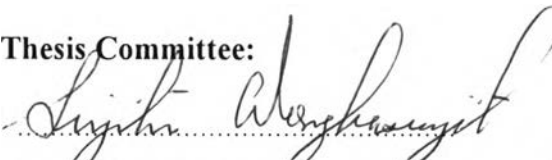
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ABSTRACT

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Cogon grass (*Imperata cylindrica*), Guinea grass (*Panicum maximum*), Kans grass (*Saccharum spontaneum*), Giant reed (*Arundo donax*), and Mission grass (*Pennisetum polystachyon*) were locally collected to test as bioethanol feedstock. Mission grass, Kans grass, and Giant reed, showing high cellulose and hemicellulose compositions, were treated by a two-stage chemical/microwave pretreatment method. The optimum conditions of the pretreatment were investigated and the maximum monomeric sugar yields were compared. The microwave-assisted NaOH and H₂SO₄ with 15:1 liquid to solid ratio were studied by varying catalyst concentration, temperature, and time to maximize the amount of the obtained monomeric sugar. The maximum monomeric sugars from microwave-assisted NaOH pretreated Mission grass, Kans grass, and Giant reed were 6.6 (at 120 °C, 10 min, 3%(w/v) NaOH), 6.8 (at 80 °C, 5 min, 5%(w/v) NaOH), and 6.8 (at 120 °C, 5 min, 5%(w/v) NaOH) g/100g biomass, respectively, while maximum monomeric sugars from microwave-assisted H₂SO₄ pretreatment were 34.3 (at 200 °C, 5 min, 1%(w/v) H₂SO₄), 33.8 (at 200 °C, 10 min, 0.5%(w/v) H₂SO₄), and 31.9 (at 180 °C, 30 min, 0.5%(w/v) H₂SO₄) g/100g biomass, respectively. The structural changes in weeds were characterized by Fourier transform infrared spectroscopy (FTIR) and Scanning electron microscope (SEM).

บทคัดย่อ

นาย ปฐมวัฒน์ ตติเจริญ: การประเมินศักยภาพในการผลิตน้ำตาลโมเลกุลเดี่ยวของวัชพืชในประเทศไทยเพื่อใช้เป็นวัตถุดิบสำหรับพลังงานชีวมวลด้วยกระบวนการปรับสภาพพืชสองขั้นตอน จากรังสีไมโครเวฟและสารเคมี (Evaluation of Monomeric Sugar Yield from Various Grasses Grown in Thailand as Biofuel Feedstock by Two-Stage Microwave/Chemical Pretreatment Process) อ. ที่ปรึกษา: รองศาสตราจารย์ ดร. สุจิตรา วงศ์เกษมจิตต์ รองศาสตราจารย์ ดร. อาภาณี เหลืองนฤมิตชัย และ ผู้ช่วยศาสตราจารย์ ดร. ธัญญลักษณ์ ฉายสุวรรณ 140 หน้า

หญ้าคา หญ้ากีนี หญ้าดอกเลา ต้นอ้อ และหญ้าจรจบดอกเล็ก ที่ขึ้นเองตามธรรมชาติในประเทศไทย ถูกนำมาประยุกต์ใช้เป็นวัตถุดิบในการผลิตไบโอเอทานอล โดยในจำนวนหญ้า 5 ชนิดนี้พบว่า หญ้าจรจบดอกเล็ก หญ้าดอกเลา และต้นอ้อ มีองค์ประกอบของเซลลูโลสและเฮมิเซลลูโลสสูงสุด จึงถูกนำมาศึกษาต่อเพื่อหาสภาวะที่ดีที่สุดในการปรับสภาพพืชสองขั้นตอนด้วยรังสีไมโครเวฟและสารเคมีที่ใช้เป็นตัวเร่งปฏิกิริยา และเปรียบเทียบกับน้ำตาลโมเลกุลเดี่ยวที่ผลิตได้จากหญ้าทั้งสามชนิดนี้ โดยในการศึกษาสภาวะของกระบวนการปรับสภาพพืชสองขั้นตอนนั้น รังสี ไมโครเวฟถูกใช้ร่วมกับ โซเดียมไฮดรอกไซด์และกรดซัลฟิวริก ที่อัตราส่วนของเหลวต่อของแข็ง 15:1 และทำการศึกษาผลของอุณหภูมิ เวลา และความเข้มข้นของตัวเร่งปฏิกิริยา เพื่อหาสภาวะที่ดีที่สุดของกระบวนการนี้ จากผลการศึกษาพบว่า ในขั้นตอนแรกการใช้รังสีไมโครเวฟร่วมกับโซเดียมไฮดรอกไซด์สามารถผลิตน้ำตาลโมเลกุลเดี่ยวจากหญ้าจรจบดอกเล็ก หญ้าดอกเลา และต้นอ้อ ได้ 6.6 กรัม (ที่อุณหภูมิ 120 องศาเซลเซียส 10 นาที 3%(w/v) NaOH) 6.8 กรัม (ที่อุณหภูมิ 80 องศาเซลเซียส 5 นาที 5%(w/v) NaOH) และ 6.8 (ที่อุณหภูมิ 120 องศาเซลเซียส 5 นาที 5%(w/v) NaOH) กรัมต่อ 100 กรัมชีวมวล ตามลำดับ ในขณะที่เมื่อใช้รังสีไมโครเวฟร่วมกับกรดซัลฟิวริกในการปรับสภาพพืชขั้นที่สองนั้นสามารถผลิตน้ำตาลโมเลกุลเดี่ยวจากหญ้าจรจบดอกเล็ก หญ้าดอกเลา และต้นอ้อ ได้ 34.3 กรัม (ที่อุณหภูมิ 200 องศาเซลเซียส 5 นาที 1%(w/v) H₂SO₄) 33.8 กรัม (ที่อุณหภูมิ 200 องศาเซลเซียส 10 นาที 0.5%(w/v) H₂SO₄) และ 31.9 กรัม (ที่อุณหภูมิ 180 องศาเซลเซียส 30 นาที 0.5%(w/v) H₂SO₄) ต่อ 100 กรัมชีวมวล ตามลำดับ การเปลี่ยนแปลงโครงสร้างทางกายภาพและทางเคมีของตัวอย่างจากกระบวนการปรับสภาพพืชนั้นถูกศึกษาโดยใช้กล้องจุลทรรศน์อิเล็กตรอนแบบส่องกราดและเทคนิคฟูเรียรทรานสฟอร์มสเปกโตรสโกปี

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