

**DILUTE PHOSPHORIC ACID PRETREATMENT OF CORNCOB
FOR BIOFUELS PRODUCTION**




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The Petroleum and Petrochemical College, Chulalongkorn University
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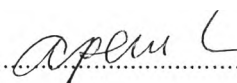
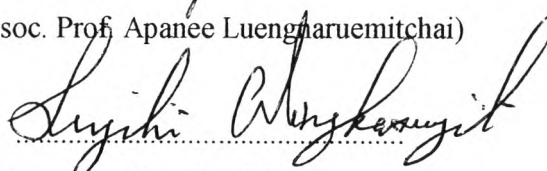
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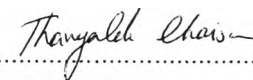
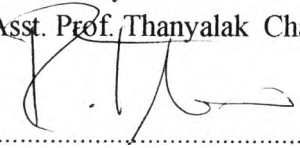
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ABSTRACT

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A waste product from corn production, corncob, is one type of lignocellulosic material, which is a new targeted source of fermentable carbohydrates that can be converted into second generation biofuels. In order to convert corncob to biofuels, the first problem that must be solved is that the structure of corncob limits the extent to which enzymatic hydrolysis of polysaccharides into sugar can occur. Therefore, a pretreatment process is an essential step to remove hemicelluloses and break down cellulose crystallinity to amorphous form prior to the enzymatic hydrolysis process, and enhance cellulose accessibility in the hydrolysis step. Various conditions in the pretreatment process, such as temperature, time, acid concentration, and liquid-to-solid ratio were investigated to determine optimum conditions. After pretreatment, a high yield of 27.62 g/L total sugar was obtained under optimal conditions of 140 °C, 10 min pretreatment time, 2 % (w/w) H₃PO₄ at a 10:1 liquid-to-solid (LSR) ratio. The total sugar yield of 46.14 g/L was obtained with the two-stage process (pretreatment and enzymatic hydrolysis).

บทคัดย่อ

ศิริกาญจน์ สติมานนท์ : การปรับสภาพซังข้าวโพดโดยกรดฟอสฟอริกเจือจางให้ได้ น้ำตาลที่พร้อมนำเข้าสู่กระบวนการหมักเพื่อผลิตเป็นเชื้อเพลิงชีวภาพ (Dilute Phosphoric Acid Pretreatment of Corn Cob for Biofuels Production) อ. ที่ปรึกษา : รศ.ดร. อาภาณี เหลืองนฤมิตชัย และ รศ.ดร. สุจิตรา วงศ์เกษมจิตต์ 76 หน้า

ซังข้าวโพดซึ่งเป็นวัสดุเหลือใช้ทางการเกษตรจากการผลิตข้าวโพดถือเป็นวัตถุดิบที่ได้รับความสนใจในการนำมาแปรสภาพเป็นน้ำตาลโมเลกุลเดี่ยวเพื่อผลิตเป็นเชื้อเพลิงชีวภาพ แต่ในการแปรสภาพวัสดุเหลือใช้ทางการเกษตรเพื่อผลิตเป็นเชื้อเพลิงชีวภาพนั้นมีข้อจำกัดคือ โครงสร้างและองค์ประกอบของวัสดุเหลือใช้ทางการเกษตรไม่เอื้ออำนวยต่อการแปรสภาพไปเป็น น้ำตาลโมเลกุลเดี่ยว ดังนั้นกระบวนการแปรสภาพวัสดุเหลือใช้ในทางการเกษตรนั้นจึงมีความสำคัญอย่างยิ่งในการกำจัดเฮมิเซลลูโลสซึ่งมีผลขัดขวางการผลิตน้ำตาลโมเลกุลเดี่ยวที่ได้จากการย่อยสลายโดยเอนไซม์และทำลายโครงสร้างของเซลลูโลสที่ไม่เอื้ออำนวยในการผลิตน้ำตาลโมเลกุลเดี่ยว นอกจากนี้กระบวนการแปรสภาพนี้ยังช่วยเพิ่มประสิทธิภาพในการผลิตน้ำตาลโมเลกุลเดี่ยวที่ได้จากการย่อยสลายเซลลูโลสโดยเอนไซม์อีกด้วย ในงานวิจัยนี้มุ่งเน้นศึกษาตัวแปร ในขั้นตอนกระบวนการแปรสภาพวัสดุเหลือใช้ทางการเกษตร อาทิ อุณหภูมิ เวลา ความเข้มข้นของกรด และอัตราส่วนของเหลวต่อของแข็ง ที่มีผลต่อการผลิตน้ำตาลโมเลกุลเดี่ยวจากกระบวนการแปรสภาพวัสดุเหลือใช้ทางการเกษตรและกระบวนการย่อยสลายโดยเอนไซม์ หลังจากการปรับสภาพของวัสดุเหลือใช้ทางการเกษตรโดยใช้กรดฟอสฟอริกเจือจางภายใต้ภาวะที่เหมาะสม (140 องศาเซลเซียส, 10 นาที, ความเข้มข้นกรด 2% โดยน้ำหนัก และ อัตราส่วนของเหลวต่อของแข็ง 10: 1) ให้ผลผลิตน้ำตาล 27.62 กรัมต่อลิตร และปริมาณน้ำตาลรวมจากสองกระบวนการ (กระบวนการแปรสภาพวัสดุเหลือใช้ทางการเกษตรและกระบวนการย่อยสลายโดยเอนไซม์) มีปริมาณ 46.14 กรัมต่อลิตร

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TABLE OF CONTENTS

	PAGE
Title Page	i
Abstract (in English)	iii
Abstract (in Thai)	iv
Acknowledgements	v
Table of Contents	vi
List of Tables	x
List of Figures	xiii
 CHAPTER	
I INTRODUCTION	1
 II LITERATURE REVIEW	 3
 III EXPERIMENTAL	 25
3.1 Materials and Chemicals	25
3.1.1 Corncob waste	25
3.1.2 Phosphoric Acid (H ₃ PO ₄)	25
3.1.3 pH Meter	25
3.1.4 Citrate Buffer	25
3.1.5 Filter Paper	25
3.1.6 Enzyme	25
3.1.7 Standard Glucose, Xylose, Arabinose, Cellobiose, Mannose, Rhamnose, Galactose, and Furfural	 25
3.2 Equipment	25
3.2.1 High Performance Liquid Chromatograph (HPLC)	 25
3.2.2 Scanning Electron Microscope (SEM)	25
3.2.3 Thermogravimetric Analyzer (TGA)	25

CHAPTER	PAGE
3.2.4 X-Ray Diffraction Analyzer (XRD)	25
3.2.5 UV-VIS Spectrometer (UV)	25
3.2.6 Gas Chromatograph (GC)	25
3.2.7 Incubator Shaker	25
3.2.8 Oven	25
3.2.9 Stainless Steel Reactor	25
3.2.10 Waterbath	25
3.2.11 Glassware	25
3.3 Methodology	26
3.3.1 Dilute Phosphoric Acid Pretreatment	26
3.3.2 Enzymatic Hydrolysis	26
3.3.3 Ethanol Production	27
3.4 Analysis Method	27
3.4.1 High Performance Liquid Chromatography (HPLC)	27
3.4.2 UV-VIS Spectrometer (UV)	27
3.4.3 Scanning Electron Microscope (SEM)	27
3.4.4 X-Ray Diffraction (XRD)	28
3.4.5 BET	28
3.4.6 Gas Chromatography (GC)	28
3.4.7 Fibertect M6	28
 IV RESULTS AND DISCUSSION	 30
4.1 Biomass Characterizations	30
4.1.1 Chemical Composition of Corncob Waste	30
4.1.2 Thermal Gravimetric Analysis	31
4.2 Optimization of Dilute Acid Pretreatment	32
4.2.1 Effect of Time and Temperature	32
4.2.2 Effect of Acid Concentration	36
4.2.3 Effect of Liquid-to-Solid Ratio	38

CHAPTER	PAGE
4.3 Enzymatic Hydrolysis	39
4.3.1 Effect of Time and Temperature	39
4.3.2 Effect of Acid Concentration	43
4.3.3 Effect of Liquid-to-Solid Ratio	45
4.4 Total Sugar Yield	47
4.4.1 Effect of Time and Temperature	47
4.4.2 Effect of Acid Concentration	49
4.4.3 Effect of Liquid-to-Solid Ratio	51
4.5 A Comparison between Conventional Heating and Microwave Irradiation Method at an Optimal Pretreatment Condition	53
4.6 Physical Characterization of Pretreated Corncob at an Optimal Condition	57
4.7 Ethanol Production	62
V CONCLUSIONS AND RECOMMENDATIONS	63
5.1 Conclusions	63
5.2 Recommendations	63
REFERENCES	64
APPENDICES	71
Appendix A Stainless Steel Reactor	71
Appendix B Retention Time and Calibration Curve of Monomeric Sugar and Furfural by HPLC	72
Appendix C Retention Time and Calibration Curve of Ethanol by GC	74
Appendix D Ethanol Yield	75

CHAPTER	PAGE
CURRICULUM VITAE	76

LIST OF TABLES

TABLE		PAGE
2.1	Specifications of ethanol, butanol, and gasoline	4
2.2	Contents of cellulose, hemicelluloses, and lignin in common agricultural residues and wastes	6
2.3	Effect of inhibiting compounds on fermentation	14
4.1	Chemical composition of corncob waste	30
4.2	Monomeric sugar and furfural yield of corncob in prehydrolysate after dilute phosphoric acid pretreatment by using 1.75% (w/w) H ₃ PO ₄ , at a 15:1 LSR, and different pretreatment times and temperatures	34
4.3	Monomeric sugar and furfural yield of corncob in prehydrolysate after dilute phosphoric acid pretreatment at 140 °C, 10 min pretreatment time, at a 15:1 LSR, and different acid concentrations	37
4.4	Monomeric sugar and furfural yield of corncob in prehydrolysate after dilute phosphoric acid pretreatment at 140 °C, 10 min pretreatment time, 2% (w/w) H ₃ PO ₄ , and different LSRs	38
4.5	Monomeric sugar yield of corncob in hydrolysate after enzymatic hydrolysis under the pretreatment conditions by using 1.75% (w/w) H ₃ PO ₄ , at a 15:1 LSR, and different pretreatment temperatures and times	41
4.6	Monomeric sugar yield of corncob in hydrolysate after enzymatic hydrolysis under the pretreatment conditions at 140°C, 10 min pretreatment time, at 15:1 LSR, and different acid concentrations	44

TABLE	PAGE
4.7 Monomeric sugar yield of corncob in hydrolysate after enzymatic hydrolysis under the pretreatment conditions at 140 °C, 10 min pretreatment time, 2% (w/w) H ₃ PO ₄ , and at different LSRs	46
4.8 Total sugar yield of corncob in prehydrolysate, hydrolysate, and combined two-stage under pretreatment conditions by using 1.75% (w/w) H ₃ PO ₄ at a 15:1 LSR, and different pretreatment temperatures and times	48
4.9 Total sugar yield of corncob in prehydrolysate, hydrolysate, and combined two-stage under pretreatment conditions at 140 °C, 10 min pretreatment time, at a 15:1 LSR, and different acid concentrations	50
4.10 Total sugar yield of corncob in prehydrolysate, hydrolysate, and combined two-stage under pretreatment conditions at 140 °C, 10 min pretreatment time, 2% (w/w) H ₃ PO ₄ , and at different LSRs	52
4.11 Monomeric sugar yield of corncob in prehydrolysate and hydrolysate under an optimal condition at 140 °C, 10 min pretreatment time, 2% (w/w) H ₃ PO ₄ , and at a 15:1 LSR by using conventional heat and microwave radiation method	54
4.12 Total sugar yield of corncob in prehydrolysate, hydrolysate, and combined two-stage under an optimal condition at 140°C, 10 min pretreatment time, 2% (w/w) H ₃ PO ₄ , at a 15:1 LSR by using conventional heat and microwave radiation method.	55

TABLE	PAGE
4.13 Characterization of untreated corncob and pretreated corncob at an optimal condition; 140 °C, 10 min pretreatment time, 2% (w/w) H ₃ PO ₄ , and at a 10:1 LSR by BET	59
4.14 Crystallinity index (CrI) of untreated corncob and pretreated corncob under various pretreatment conditions	60

LIST OF FIGURES

FIGURE	PAGE
2.1 General flowchart for ethanol production from lignocellulosic material	5
2.2 Lignocellulose consists of cellulose, hemicelluloses, and lignin	6
2.3 Structure of cellulose chain	7
2.4 Structure of arabinoxylan	9
2.5 Structure of glucomannan	9
2.6 Structure of monolignols	10
2.7 Schematic of goals of pretreatment on lignocellulosic material	11
2.8 Structure of (a) Acetic acid, (b) Formic acid, (c) Octanoic acid, and (d) Levulinic acid	15
2.9 Molecular structure of furfural	16
2.10 Acid-catalyzed pathway for the hydrolysis of hemicelluloses to xylose and the degradation of xylose to furfural	17
2.11 Molecular structures of Hydroxymethylfurfural	18
2.12 Molecular structures of Phenol	19
2.13 Molecular structures of Vanillin	20
4.1 Thermal Gravimetric Analysis curve of corncob waste	31
4.2 Monomeric sugar and furfural yield of corncob in prehydrolysate after dilute phosphoric acid pretreatment by using 1.75% (w/w) H ₃ PO ₄ , at a 15:1 LSR, and different pretreatment times and temperatures: (a) 100 °C, (b) 120 °C, (c) 140 °C, and (d) 160 °C	35

FIGURE	PAGE
4.3 Monomeric sugar and furfural yield of corncob in prehydrolysate after dilute phosphoric acid pretreatment at 140 °C, 10 min pretreatment time, at a 15:1 LSR, and different acid concentrations	37
4.4 Monomeric sugar and furfural yield of corncob in prehydrolysate after dilute phosphoric acid pretreatment at 140 °C, 10 min pretreatment time, 2% (w/w) H ₃ PO ₄ , and different LSRs	39
4.5 Monomeric sugar yield of corncob in hydrolysate after enzymatic hydrolysis under the pretreatment conditions by using 1.75% (w/w) H ₃ PO ₄ , at a 15:1 LSR, and different pretreatment temperatures and times: (a) 100 °C, (b) 120 °C, (c) 140 °C, and (d) 160 °C	42
4.6 SEM images of samples after pretreated with dilute phosphoric acid under the condition of 1.75% (w/w) H ₃ PO ₄ , at a 15:1 LSR: (a) fresh corncob, (b) 100 °C 10 min, (c) 140 °C 10 min, and (d) 140 °C 60 min	42
4.7 Monomeric sugar yield of corncob in hydrolysate after enzymatic hydrolysis under the pretreatment conditions at 140 °C, 10 min pretreatment time, at a 15:1 LSR, and different acid concentrations	44
4.8 SEM images of samples after pretreated with dilute phosphoric acid under the condition at 140 °C, 10 min pretreatment time, at a 15:1 LSR: (a) 2% (w/w) H ₃ PO ₄ , and (b) 10% (w/w) H ₃ PO ₄	45
4.9 Monomeric sugar yield of corncob in hydrolysate after enzymatic hydrolysis under the pretreatment conditions at 140 °C, 10 min pretreatment time, 2% (w/w) H ₃ PO ₄ , and at LSRs	46

FIGURE	PAGE
4.10 SEM images of samples after pretreated with dilute phosphoric acid under the condition at 140 °C, 10 min pretreatment time, 2% (w/w) H ₃ PO ₄ : (a) 10:1 LSR, and (b) 20:1 LSR.	47
4.11 Total sugar yield of corncob in prehydrolysate, hydrolysate, and combined two-stage under pretreatment conditions by using 1.75% (w/w) H ₃ PO ₄ , at a 15:1 LSR, and different pretreatment temperatures and times (a) 100 °C, (b) 120 °C, (c) 140 °C, and (d) 160 °C	49
4.12 Total sugar yield of corncob in prehydrolysate, hydrolysate, and combined two-stage under pretreatment conditions at 140 °C, 10 min pretreatment time, at a 15:1 LSR, and different acid concentrations	51
4.13 Total sugar yield of corncob in prehydrolysate, hydrolysate, and combined two-stage under pretreatment conditions at 140 °C, 10 min pretreatment time, 2% (w/w) H ₃ PO ₄ , and at different LSRs.	52
4.14 Monomeric sugar yield of corncob in prehydrolysate and hydrolysate under an optimal condition at 140 °C, 10 min pretreatment time, 2% (w/w) H ₃ PO ₄ , and at a 15:1 LSR by using different pretreatment reactor	55
4.15 Total sugar yield of corncob in prehydrolysate, hydrolysate, and combined two-stage under an optimal condition at 140 °C, 10 min pretreatment time, 2% (w/w) H ₃ PO ₄ , at a 15:1 LSR by using conventional heat and microwave radiation method	56

FIGURE	PAGE
4.16 SEM images of samples after pretreated with dilute phosphoric acid under the condition at 140 °C, 10 min pretreatment time, 2% (w/w) H ₃ PO ₄ at a 10:1 LSR by using different pretreated reactor ; (a) conventional heat, (b) microwave radiation.	56
4.17 X-ray diffraction patterns of the corncob. Symbols; (a) fresh corncob, (b) pretreated corncob at 100 °C, 10 min pretreatment time by using 1.75% (w/w) H ₃ PO ₄ at a 15:1 LSR, (c) pretreated corncob at 140 °C, 10 min pretreatment time by using 1.75% (w/w) H ₃ PO ₄ at a 15:1 LSR, (d) pretreated corncob at 140 °C, 60 min pretreatment time by using 1.75% (w/w) H ₃ PO ₄ at a 15:1 LSR, (e) pretreated corncob at 140 °C, 10 min pretreatment time by using 10% (w/w) H ₃ PO ₄ at a 15:1 LSR, (f) pretreated corncob at 140 °C, 10 min pretreatment time by using 2% (w/w) H ₃ PO ₄ at a 20:1 LSR, and (g) pretreated corncob at 140 °C, 10 min of pretreatment time by using 2% (w/w) H ₃ PO ₄ at a 10:1 LSR	61
4.18 Composition of untreated corncob and pretreated corncob after pretreatment and enzymatic hydrolysis under an optimal pretreatment condition; 140°C, 10 min pretreatment time, 2% (w/w) H ₃ PO ₄ , and at a 10:1 LSR.	62