EFFECT OF CHEMICAL PRETREATMENT ON BANANA TRUNK FOR GLUCOSE PRODUCTION: OPTIMIZATION STUDIES

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EFFECT OF CHEMICAL PRETREATMENT ON BANANA TRUNK FOR GLUCOSE PRODUCTION: OPTIMIZATION STUDIES

by

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APPROVAL AND DECLARATION SHEET

This project report titled Effect of Chemical Pretreatment on Banana Trunk for Glucose Production: Optimization Studies was prepared and submitted by Chang Jia Yun (Matric Number: 141282449) and has been found satisfactory in terms of scope quality and presentation as partial fulfilment of the requirement for the Bachelor of Chemical Engineering Technology (Honours) (Industrial Biotechnology) in Universiti Malaysia Perlis (UniMAP).

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KESAN PRA-RAWATAN KIMIA PADA BATANG PISANG BAGI PENGELUARAN GLUKOSA: KAJIAN PENGOPTIMUMAN

ABSTRAK

Batang pisang adalah salah satu contoh gentian bukan kayu yang terdiri daripada kandungan selulosa yang tinggi dan kandungan lignin yang rendah dan sesuai untuk penukaran glukosa yang tinggi. Pra-rawatan yang berkesan terhadap batang pisang sebagai bahan lignoselulosa dapat meningkatkan penghasilan glukosa dalam proses hidrolisis berikutnya. Kaedah Satu Faktor pada Satu Masa (OFAT) digunakan untuk menilai kesan tiga faktor penting yang mempengaruhi dalam pra-rawatan kimia (2% (v/v) H_2SO_4) iaitu kepekatan serbuk batang pisang (4 – 10% (w/v)), tempoh rawatan (10 – 40 minit), dan suhu rawatan (40 – 100 ℃). Keadaan optimum pra-rawatan yang diperoleh dari Kaedah Gerak Balas Permukaan (RSM) adalah kepekatan serbuk batang pisang sebanyak 25% (w/v), tempoh rawatan sepanjang 35 minit, dan suhu rawatan setinggi 100 ℃ dapat memberikan hasil glukosa yang tinggi iaitu 97.69 g/L. Keadaan pra-rawatan optimum dan hasil glukosa yang tinggi terbukti dari model yang dibangunkan dengan kecukupan yang memuaskan dari penentuan kadar pekali 0.9713.

ABSTRACT

Banana trunk is one of the examples of non-wood fibre which consists of high cellulose content and low lignin content suitable for high glucose conversion. Effective pretreatment of banana trunk as lignocellulosic biomass can significantly enhance the glucose conversion performance in subsequent hydrolysis process. One-Factor-at-A-Time (OFAT) method was used to evaluate the influencing effects of three targeted process parameters in acidic (2% (v/v) H_2SO_4) chemical pretreatment, which are the substrate concentration (4 – 10% (w/v)), treatment duration (10 – 40 minutes) and treatment temperature (40 – 100 ℃). The optimum pretreatment conditions derived from Response Surface Methodology (RSM) were substrate concentration of 25% (w/v), treatment duration of 35 minutes, and treatment temperature of 100 ℃ which provided the highest glucose yield of 97.69 g/L. This optimum pretreatment conditions and glucose yields are proved to be significant from the developed model with satisfactory adequacy of 0.9713 in coefficient determination.

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LIST OF SYMBOLS

R^2	correlations of determination
℃	degree Celsius
F	Fisher value
g	gram
g/L	gram per litre
L	litre
µm	micrometer
mL	millimeter
min	minutes
M	mole per litre
nm	nanometer
%	percentage
pH	potential of Hydrogen
v/v	volume per volume
v/w	volume per weight
w/v	weight per volume

LIST OF ABBREVATIONS

ANOVA	Analysis of Variance
CCD	Central Composite Design
CCRD	Central Composite Rotatable Design
DOE	Design of Experiment
DNS	Dinitro Salicylic Acid
HMF	Hydroxymethylfurfural
OFAT	One-Factor-at-A-Time
RSM	Response Surface Methodology
UV-vis	Ultraviolet-visible

LIST OF NOMENCLATURES

$C_6H_8O_7 \cdot H_2O$	Citric acid monohydrate
$C_6H_{12}O_6$	Glucose
NaOH	Sodium hydroxide
Na-K-tartarate	Sodium potassium tartarate
H_2SO_4	Sulphuric acid
$C_6H_5O_7Na_3 \cdot 2H_2O$	Trisodium citrate dihydrate