CONVERSION OF SPENT MUSHROOM SAWDUST SUBSTRATE TO SIMPLE SUGARS FOR BIOETHANOL PRODUCTION

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DISSERTATION PRESENTED FOR THE FULFILMENT OF THE REQUIREMENTS OF THE MASTER DEGREE OF SCIENCE

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KUALA LUMPUR
2011

ABSRACT

Spent Mushroom Sawdust Substrate (SMSS) was appraised for its potential as a lignocellulosic waste source for conversion of to bioethanol. Aqueous perchloric acid is used to hydrolyze the lignocellulosic waste feedstock to simple sugars which are then fermented to ethanol. Aqueous perchloric acid was chosen as the medium for conversion of SMSS to sugars as it can hydrolyze the recalcitrant cellulosic biomass to give a significant amount of glucose without the need for strong heating or the application of pressure. The products of the breakdown of SMSS by perchloric acid were analysed by HPLC, glucometer and by Fehling's method. HPLC results showed the presence of glucose and xylose. The sugars obtained were then fermented by the yeast, *Saccharomyces cerevisiae*, to yield ethanol. The products obtained from the fermentation were analysed by GC and results show the presence of ethanol and methanol. Some performance parameters for the production of bioethanol such as concentration of perchloric acid and the time of hydrolysis of SMSS were reported. The judicious use of the concentration of perchloric acid was important in order to control the reaction so that it leads to a minumum concentration of inhibitors and the maximum concentration of glucose. A conversion yield of of SMSS up to 12.3% was obtained. This translates to 1L of bioethanol produced for every 22.4 kg of the dried substrate.

ABSTRAK

Substrat habuk gergaji cendawan (SMSS) dikaji sebagai sumber untuk penukaran sisa lignoselulosa menjadi etanol. Asid perklorik digunakan untuk menghidrolisis selulosa biojisim untuk menghasilkan gula ringkas yang kemudian ditapai menjadi etanol. Asid perklorik dipilih sebagai media untuk penukaran SMSS ke glukosa kerana ia memberikan glukosa tanpa pemanasan yang kuat atau tekanan yang tinggi. Produk-produk terhasil daripada hyrolisis dan fermentasi dapat dianalisasi oleh HPLC, meter glukosa dan kaedah Fehling. Keputusan HPLC menunjukkan kehadiran glukosa dan xilosa. Glukosa yang diperolehi kemudian ditapai oleh yis, *Saccharomyces cerevisiae*, untuk menghasilkan etanol. Produk-produk terhasil daripada penapaian dianalisasi oleh GC. Keputusan GC menunjukkan kehadiran etanol dan metanol.

Beberapa parameter seperti kepekatan asid perklorik dan masa hidrolisis SMSS untuk penghasilan bioetanol dilaporkan. Kepekatan asid perklorik adalah penting untuk mengawal reaksi untuk menghasilkan inhibitor yang minimum dan glukosa yang maksimum.

Peratus penukaran setinggi 12.3% dapat diperolehi. Ini bererti, 22.4kg substrat kering dapat menghasilkan 1L etanol.

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ORIGINAL LITERARY WORK DECLARATION

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Name of Degree	:	Master Degree of Science
Title of Research	:	Conversion of Spent Mushroom Sawdust Substrate to Simple Sugars for Bioethanol Production
Field of Study	:	Biofuel

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ACKNOWLEDGEMENTS

I would like to forward my greatest appreciation to my supervisors, Prof. Dr. Zainudin bin Arifin and Dr Teoh Teow Chong for their guidance, ideas, patience, and support.

I would also like to thank Dr Thorsten Heidelberg for giving me a lot of valuable advice on improving the experimental methods, and Dr Kamal Aziz Ketuly for sharing his expertise in HPLC with our research team.

I would also like to thank Ms Cheng Poh Guat from Ganofarm Sdn. Bhd. for sponsoring spent mushroom sawdust substrate for this investigation and my co-workers in Lab-C216, Dayang Siti Shamsiah Bt Awang Bujang and Ainnul Hamidah Syahadah Bt Azizan for helping me in analyzing the sugar samples and the ethanol samples.

I am very grateful to Department of Chemistry, University of Malaya, for providing me the facilities in the laboratory and in the campus. My gratitude also goes to the University of Malaya Research Grants, (RG019/ 09BIO) and (PS336/2009C) for sponsoring this project.

Finally, I would like to extend my appreciation to my parents, Soo Kam Soon and Lim Siew Mui for their continuous encouragement and support in pursuing my postgraduate study in University of Malaya.

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SYMBOLS AND ABBREVIATIONS

%	percent
°C	degree celcius
cm^3	centimeter cube
dm	decimeter
DSMSS	delignified spent mushroom sawdust substrate
g	gram
GC	gas chromatography
GS	green sawdust
h	hour
I_2	iodine
HBA	hydroxybenzylaldehyde
HCl	hydrochloric acid
HMF	5-hydroxymethyl furfural
HPLC	high performance liquid chromatography
kg	kilogram
KI	potassium iodide
KOH	potassium hydroxide
L	liter
LHW	liquid hot water
M	$moldm^{-3}$
min	minute
mg	milligram

mm	millimeter
MSDS	material safety data sheet
NaOH	sodium hydrolxide
$Na_2S_2O_3$	sodium thiosulphate
PAA	peracetic acid
rpm	rounds per minute
SGA	siringaldehyde
SMSS	spent mushroom sawdust substrate
TGA	thermogravimetric analysis
v	volume
w	weight