

**PRODUCTION OF BIOETHANOL FROM BITTER  
CASSAVA: MASS BALANCE STUDY**

**AFIDAH BINTI ABDUL WAHAB**

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**SCHOOL OF BIOPROCESS ENGINEERING  
UNIVERSITY MALAYSIA PERLIS  
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**PRODUCTION OF BIOETHANOL FROM BITTER  
CASSAVA: MASS BALANCE STUDY**

by

**AFIDAH BINTI ABDUL WAHAB**

**Report submitted in partial fulfillment  
of the requirements for the Degree of  
Bachelor of Engineering**



**UniMAP**

**JUNE 2012**

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## APPROVAL AND DECLARATION SHEET

**This project report titled Production of Bioethanol From Bitter Cassava: Mass Balance Study was prepared and submitted by Afidah Binti Abdul Wahab (Matrix Number: 081140017) and has been found satisfactory in terms of scope, quality and presentation as partial fulfillment of the requirement for the Bachelor of Engineering ( Bioprocess Engineering ) in Universiti Malaysia Perlis (UniMAP).**

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## PENGHASILAN BIOETHANOL DARI UBI KAYU BERACUN: KAJIAN KESEIMBANGAN JISIM

### ABSTRAK

Tujuan penyelidikan ini adalah untuk memeriksa imbangan jisim dalam penghasilan bioethanol dari ubi kayu beracun melalui ujikaji dan mensimulasi menggunakan perisian superpro dan seterusnya membandingkan hasil imbangan jisim diantara dua prosedur tersebut. Untuk pra-rawatan penukaran kanji kepada glukosa, tiga proses dilakukan iaitu proses pengelatinan, pencairan dan sakarifikasi. Pengelatinan dilakukan pada suhu yang tinggi untuk mengembangkan granul kanji. Selepas itu, hidrolisis berenzime menggunakan  $\alpha$ -amylase dilakukan untuk proses pencairan dan diikuti oleh enzim *amyloglucosidase* untuk proses pengsakaridaan. Berikutnya, hasil glukosa ditapai dengan menggunakan *cerevisiae saccharomyces* untuk menukarkannya kepada bioethanol. Selain ujikaji, imbangan jisim dengan mensimulasikan menggunakan perisian superpro juga dilakukan dengan mengaplikasikan semua parameter dan nilai yang sama seperti digunakan didalam ujikaji supaya hasil dapat dibandingkan. Walaupun imbangan jisim oleh proses simulasi mungkin tidak dapat menggantikan ujikaji, tetapi ia mengandungi perkara-perkara yang amat berguna dalam perancangan dan penilai untuk ujikaji seperti menekankan faktor yang kadang-kadang terabai ketika ujikaji. Melalui ujikaji, 3 kg ubi kayu beracun akan menghasilkan lebih kurang 450 g tepung kanji dan 8.29 mg/L kepekatan bioethanol manakala hasil dari simulasi adalah 11624.36 mg/L. Peratus ralat dari ujikaji dan proses simulasi adalah 99.93 %. Peningkatan dalam ujikaji boleh dilakukan untuk mengurangkan peratusan ralat.

## ABSTRACT

The aim of this research was to examine the mass balance in bioethanol production from bitter cassava by experimental work and simulating using superpro and then compare the mass balance finding between this two procedure. For the pretreatment to convert starch into glucose, three processes must be done which were gelatinization, liquefaction and saccharification processes. Gelatinization was done at high temperature to swell the starch granule. After that, the enzymatic hydrolysis using  $\alpha$ -amylase was used for liquefaction process and followed by enzyme amyloglucosidase for saccharification process. Next, the glucose produced was fermented by using *saccharomyces cerevisiae* to convert it into bioethanol. Apart of experiment, by simulating mass balance through superpro software, all the parameter and value involve in experiment would be applied in order to compare the result. Even mass balance by process simulation might not be able to replace the experiments, but it constitutes a useful tool in the planning and evaluation of experiments such as highlight the factor that was sometimes neglected in experimental studies. By experimental, 3 kg of raw bitter cassava would produce approximately 450 g starch flour and 8.29 mg/L bioethanol while the result getting from the simulation was 11624.36 mg/L. The percentage error from the experimental and simulation process was 99.93 %. From the percentage error, the improvement in experimental can be done to reduce the percentage error.

## TABLE OF CONTENTS

	<b>Page</b>
<b>ACKNOWLEDGMENT</b>	ii
<b>APPROVAL AND DECLARATION SHEET</b>	iii
<b>ABSTRAK</b>	iv
<b>ABSTRACT</b>	v
<b>TABLE OF CONTENTS</b>	vi
<b>LIST OF TABLES</b>	ix
<b>LIST OF FIGURES</b>	x
<b>LIST OF PLATES</b>	xii
<b>LIST OF ABBREVIATIONS, SYMBOLS AND NOMENCLATURES</b>	xiii
<b>CHAPTER 1: INTRODUCTION</b>	
1.1 Background	1
1.2 Problem Statements	3
1.3 Objectives	4
<b>CHAPTER 2 : LITERATURE REVIEW</b>	
2.1 Introduction	5
2.2 Bioethanol	6
2.3 Fuel properties of bioethanol	7
2.4 Raw Material	8



2.5	Process involve in bioethanol production	
2.5.1	Gelatinization	13
2.5.2	Liquefaction	14
2.5.3	Saccharification	16
2.5.4	Fermentation	16
2.6	Factor that effect bioethanol process	
2.6.1	Temperature	19
2.6.2	pH	20
2.6.3	Substrate concentration	21
2.6.4	Enzyme concentration	22
2.7	Mass balance studies	23

### **CHAPTER 3: METHODOLOGY**

3.1	Introduction	25
3.2	Substrate Preparation	27
3.3	Chemical Solution Preparation	
3.3.1	DNS Solution	28
3.3.2	Iodine Solution	28
3.4	Medium Preparation	
3.4.1	Potato Dextrose Agar (PDA)	28
3.4.2	Yeast extract, Peptone and dextrose (YPD)	29
3.5	Standard Curve Preparation	
3.5.1	Yeast Growth profile	30
3.5.2	Glucose Standard curve	30
3.5.3	Bioethanol Standard curve	30
3.6	Experimental Method	
3.6.1	Analytical method (Determination of glucose concentration)	31
3.6.2	Analytical method (Determination of bioethanol concentration)	31
3.6.3	Scale up	31

## **CHAPTER 4: RESULT AND DISCUSSION**

4.1	Introduction	33
4.2	Experimentally	
4.2.1	Experimental Process	33
4.3	Result simulation of Superpro Software	37
4.4	Comparison of mass balance result from experimental and SuperPro software	44

## **CHAPTER 5: CONCLUSION**

5.1	Summary	46
5.2	Recommendation	46
5.3	Commercilization	47

<b>REFFERENCE</b>	<b>48</b>
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## **APPENDICES**

<b>Appendix A</b>	<b>53</b>
<b>Appendix B</b>	<b>55</b>
<b>Appendix C</b>	<b>57</b>
<b>Appendix D</b>	<b>58</b>
<b>Appendix E</b>	<b>59</b>
<b>Appendix F</b>	<b>60</b>
<b>Appendix G</b>	<b>67</b>

## LIST OF TABLE

<b>Table No.</b>		<b>Page</b>
2.0	Properties of alcohol fuels [4].	8
2.1	Composition of lignocellulose in several sources on dry basis [33]	10
2.2	Source microorganism and properties of thermostable starch hydrolyzing enzymes. [36]	16
2.3	Summary of temperature for liquefaction and saccharification	20
2.4	Summary of pH for liquefaction and saccharification	22
2.5	Summary of substrate concentration	23
2.6	Summary of enzyme concentration	24
4.0	Glucose Production	36
4.1	Glucose and bioethanol production	37
4.2	Summary of mass balance at fermenter	40
4.3	Summary of mass balance for all the process involve	43
4.4	Comparison of mass balance result from experimental and simulation	45
A1	Preparation of buffer	53
B1	Data for liquefaction process	55
B2	Data for saccharafication process	55
B3	Data for fermentation process (bioethanol production)	56

## LIST OF FIGURE

Figure No.		Page
2.0	Lignocellulosic structure [18]	9
2.1	Amylose structure [43]	11
2.2	Amylopectin structure [43]	11
2.3	$\alpha$ -amylase activity on starch to produce maltose and glucose [19]	15
2.4	Process glycolysis and fermentation [39]	18
2.5	Mass balance concept [42]	25
3.0	Overview bioethanol production	27
4.0	Scheme bioethanol production from bitter cassava	39
C1	Glucose standard curve	57
D1	Bioethanol standard calibration curve	58
E1	Graph yeast growth profile	59
F1	Input for gelatinization and liquefaction process (raw material)	60
F2	Input for gelatinization and liquefaction process (enzyme $\alpha$ -amylase)	61
F3	Input for gelatinization and liquefaction process (water)	62
F4	Output of liquefaction process	63
F5	Enzyme for saccharification process	64
F6	Input fermentation	65

F7	Output of fermentation	66
G1	Chromatogram of bioethanol concentration 1	67
G2	Chromatogram of bioethanol concentration 2	68
G3	Chromatogram of bioethanol concentration 3	69
G4	Chromatogram of bioethanol concentration 4	70

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## LIST OF PLATE

<b>Plate No.</b>		<b>Page</b>
2.0	Bitter Cassava tuber	13
3.0	Streaking method of <i>saccharomyces cerevisiae</i>	30

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