

**CURRENT RESEARCH
AND DEVELOPMENT IN
BIOTECHNOLOGY
ENGINEERING
AT IIUM**

VOLUME I

Editors:

Suleyman Aremu Muyibi
Mohammed Saedi Jami
Zaki Zainudin



IIUM PRESS

INTERNATIONAL ISLAMIC UNIVERSITY MALAYSIA

**CURRENT RESEARCH AND
DEVELOPMENT IN
BIOTECHNOLOGY ENGINEERING
AT IIUM**

(VOLUME I)

Editors:

Suleyman Aremu Muyibi

Mohammed Saedi Jami

Zaki Zainudin

**Department of Biotechnology Engineering
Faculty of Engineering
International Islamic University Malaysia**



IIUM PRESS

Published by:
IIUM Press
International Islamic University Malaysia

First Edition, 2011
©IIUM Press, IIUM

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system, or transmitted, in any form or by any means, electronic, mechanical, photocopying, recording, or otherwise, without any prior written permission of the publisher.

Perpustakaan Negara Malaysia

Cataloguing-in-Publication Data

Suleyman Aremu Muyibi, Mohammed Saedi Jami & Zaki Zainudin: Current Research and Development in Biotechnology Engineering at IIUM Volume I

ISBN: 978-967-418-150-5

Member of Majlis Penerbitan Ilmiah Malaysia – MAPIM
(Malaysian Scholarly Publishing Council)

Printed by :
IIUM PRINTING SDN. BHD.
No. 1, Jalan Industri Batu Caves 1/3
Taman Perindustrian Batu Caves
Batu Caves Centre Point
68100 Batu Caves
Selangor Darul Ehsan

CONTENTS

PREFACE		v
CHAPTER 1	SELECTION OF POTENTIAL FUNGAL STRAINS FOR THE PRODUCTION OF GLUCOAMYLASE USING NON-FOOD CASSAVA <i>Md. Zahangir Alam, Hamzah Mohd Salleh, Juwairiyah Abd Karim, and Aliyu Salihu</i>	1 (4157/20570)
CHAPTER 2	WATER QUALITY MODELING TO ASSESS THE IMPACTS OF PALM OIL MILL EFFLUENT (POME) IN SG. KALUMPANG BASIN <i>Zaki Zainudin</i>	7 (6601/20573)
CHAPTER 3	WATER QUALITY CHARACTERIZATION STUDIES ON SPRING WATER FOR USE IN PONDS FOR KELAH FISH BREEDING IN KELAH SANCTUARY <i>Suleyman Aremu Muyibi, Siti Hatijah Binti Mortan, and Mohamed Ismail Abd Karim</i>	13 (4164/20576)
CHAPTER 4	THE SOLID WASTE MANAGEMENT SYSTEM ISSUES ON POLLUTION AND WASTE DISPOSAL PROBLEMS <i>Nassereldeen Kabbashi, Najla Shuhud, and Mohammed Saedi Jami</i>	19 (4286/20578)
CHAPTER 5	SETTLING COLUMN ANALYSIS FOR WATER TURBIDITY REMOVAL USING CHITOSAN <i>Nassereldeen Ahmed Kabbashi and Muhammad Fazil B Anoiar</i>	26 (4286/20584)
CHAPTER 6	PROCESS DEVELOPMENT OF REMOVING LOW TURBIDITY WATER USING CHITOSAN AS A BIOCOAGULANT <i>Nassereldeen Ahmed Kabbashi and Muhammad Fazil B Anoiar</i>	32 (4286/20580)
CHAPTER 7	OPTIMIZATION OF PROCESS CONDITIONS FOR GLUCOAMYLASE PRODUCTION USING NON-FOOD CASSAVA <i>Md. Zahangir Alam, Hamzah Mohd Salleh, Radhiah Ariffin, and Noor Mohammad</i>	38 (4157/20590)
CHAPTER 8	DEVELOPMENT OF RAPID ENZYMATIC PROCESS FOR ACID OIL PRODUCTION FROM SLUDGE PALM OIL <i>Md. Zahangir Alam, Hamzah Mohd Salleh, and Noraini Mohd Yusof</i>	44 (4157/20596)
CHAPTER 9	OPTIMISATION OF CHROMATOGRAPHY CONDITION FOR BIOPHENOLS SEPARATION FROM OIL PALM FRUIT FIBER <i>Parveen Jamal, Shahrul Yahaya, Md Zahangir Alam, and Azlin Azmi</i>	51 (2937/20598)
CHAPTER 10	MORINGA SEED OIL EXTRACTION AND CAKE PROCESSING: FROM BENCH TO COMMERCIAL PRODUCTION OF ALTERNATIVE WATER TREATMENT CHEMICALS FOR DEVELOPING COUNTRIES <i>Suleyman A. Muyibi and Idris M. Bugaje</i>	60 (4146/20603)
CHAPTER 11	INVESTIGATION OF ANTIBACTERIAL ACTIVITY OF MORINGA OLEIFERA SEEDS FOR APPLICATION IN WATER TREATMENT <i>Suleyman A. Muyibi and Farhana Aina Bt Ahmad Nazir</i>	66 (4164/20605)
CHAPTER 12	SCREENING OF LIGNOCELLULOSIC MATERIALS FOR THE PRODUCTION OF FERMENTABLE SUGAR <i>Md. Zahangir Alam, Abdullah-Al-Mamun, Hikmah Mohd Noor, and Noor Mohammad</i>	72 (4157/20606)
CHAPTER 13	LOCAL SOURCING FOR RENEWABLE AND SUSTAINABLE REPLACEMENT FOR WATER AND WASTEWATER TREATMENT CHEMICALS: ACTIVATED CARBON FROM AGRO-WASTES <i>Suleyman Aremu Muyibi, Md Ismail Abdulkarim, Md Zahangir Alam, Emad S. M. Ameen, and Nassereledeen A. Kabbashi</i>	77 (4164/20610)
CHAPTER 14	EVALUATION OF THE PERFORMANCE OF WATER TREATMENT SYSTEM FOR KELAH BREEDING IN FISH PONDS <i>Suleyman Aremu Muyibi, Siti Sara Binti Ghazali, and Mohamed Ismail Abd Karim</i>	85 (4164/20612)

CHAPTER 15	DESIGN OF TERTIARY TREATMENT SYSTEM FOR EFFLUENT FROM STP AT IIUM FOR HORTICULTURAL USES	91 (4164/20613)
	<i>Suleyman A. Muyibi and Tamrin Tajari</i>	
CHAPTER 16	COMPARATIVE STUDIES OF MORINGA OLEIFERA AND ALUMINIUM SULPHATE AS COAGULANTS IN TURBIDITY REMOVAL FROM SURFACE WATER	96 (4164/20618)
	<i>Suleyman A. Muyibi, Eman N. Ali, Md Zahangir Alam, and Hamzah.M. Salleh</i>	
CHAPTER 17	AN EXPERT SYSTEM FOR DESIGN OF WATER TREATMENT PLANT	101 (4286/20619)
	<i>Nassereldeen Kabbashi, Anwar Bin Mohamad, and Suleyman A. Muyibi</i>	
CHAPTER 18	ISOLATION AND SCREENING OF POTENTIAL MICROORGANISM FOR BIOREMEDIATION OF HYDROCARBON CONTAMINATED SITES	106 (2937/20625)
	<i>Parveen Jamal, Md. Zahangir Alam, and Nur Aneem Fadza</i>	
CHAPTER 19	SLUDGE PALM OIL AS A POTENTIAL SOURCE FOR EMULSIFIER PRODUCING STRAIN	113 (2937/20631)
	<i>Parveen Jamal, Md. Zahangir Alama, and Nur Fathiah Abd. Sania</i>	
CHAPTER 20	MICROBIAL FERMENTATION FOR PRODUCING SURFACE ACTIVE AGENT BY USING PALM OIL MILL EFFLUENT ISOLATE.	119 (2937/20632)
	<i>Parveen Jamal., Md. Zahangir Alam, Nur Aneem Fadza, and Wan Mohd Fazli Wan Nawawi</i>	
CHAPTER 21	A BATCH PROCESS PRODUCTION OF COMPOST AND KINETICS ORDER OF REACTION STUDY BY ISOLATED FUNGAL STRAINS	126 (4286/20635)
	<i>Nassereldeen A. Kabbashi, Optakun Suraj, and Md Zahangir Alam</i>	
CHAPTER 22	ANALYSIS OF ELECTROFORCED SEDIMENTATION OF ZINC OXIDE	137 (5545/20639)
	<i>Mohammed S. Jami, Masashi Iwata, Ma'an Alkhatib, and Mujeli Mustapha</i>	
CHAPTER 23	PRODUCTION OF BIODIESEL BY ACID-BASE CATALYZED TRANSESTERIFICATION OF WASTE COOKING OIL IN A BATCH REACTOR	143 (4157/20641)
	<i>Md. Zahangir Alam, Parveen Jamal and Nor Rashid Bin Mohamad</i>	
CHAPTER 24	FRACTIONATION, IDENTIFICATION AND QUANTIFICATION OF BIOPHENOLS FROM OIL PALM FRUIT FIBER	150 (2937/20644)
	<i>Parveen Jamal, Shahrul Yahaya, Md Zahangir Alam, and Azlin Azmi</i>	
CHAPTER 25	CELLULASE PRODUCTION FROM RICE STRAW AND CORN COB BY SOLID STATE BIOCONVERSION	158 (4157/20646)
	<i>Md. Zahangir Alam, Mazlinor Mohd Awal, and Aliyu Salihu</i>	
CHAPTER 26	NATURAL DISINFECTANTS FOR WATER TREATMENT	164 (4971/20649)
	<i>Mohamed E. S. Mirghani, I. A. Ahmed, S. A. Muyibi., J. I. Daoud and M. A. Mikail</i>	
CHAPTER 27	REMOVAL OF WATER TURBIDITY BY USING FABA BEANS	173 (4971/20653)
	<i>Mohamed E. S. Mirghani, Nasereldin A. Kabbashi, and Fasehah Abdul Kadir</i>	
CHAPTER 28	WASTE TO WEALTH: DATE SEED PITS	180 (4971/20656)
	<i>Mohamed E. S. Mirghani, M. A. Mikail, I. A. Ahmed, M. I. Abdul Karim and J. I. Daoud.</i>	
CHAPTER 29	EFFECT OF HYDROGEN PEROXIDE ON SETTLEABILITY AND FILTERABILITY OF SLUDGE FROM DRINKING WATER TREATMENT PLANT	188 (5545/20659)
	<i>Mohammed Saedi Jami, Suleyman Aremu Muyibi, and Mohd Shahril Bin Kamaruddin</i>	
CHAPTER 30	ENHANCING THE DEWATERABILITY OF SLUDGE FROM WASTEWATER TREATMENT PLANT	194 (5545/20661)
	<i>Mohammed Saedi Jami, Suleyman Aremu Muyibi, and Nur Salimah Embong</i>	
CHAPTER 31	EVALUATION OF AMMONIA NITROGEN REMOVAL IN AN EXISTING SEQUENTIAL BATCH REACTOR	200 (5545/20664)
	<i>Mohammed Saedi Jami, Suleyman Aremu Muyibi, and Nur Faizah Bt Ismail</i>	
CHAPTER 32	PRODUCTION OF GLUCOAMYLASE FROM RICE BRAN USING	206 (4157/20666)

	POTENTIAL FUNGAL STRAINS	
	<i>Md Zahangir Alam, Hamzah Mohd Salleh, and Nurhidayah Binti Ahmad Hassan</i>	
CHAPTER 33	OPTIMIZATION OF PROCESS CONDITIONS FOR GLUCOAMYLASE PRODUCTION USING RICE BRAN	213 (4157/20668)
	<i>Md. Zahangir Alam, Hamzah Mohd Salleh, and Siti Najilaa Othman</i>	
CHAPTER 34	MEMBRANE PROCESS FOR REUSE OF TREATED PALM OIL MILL EFFLUENT (POME)	219 (5545/20672)
	<i>Mohammed Saedi Jami, Suleyman Aremu Muyibi, Siti Noor Hayati Abdul Kudus, and Munirat Idris Oseni</i>	
CHAPTER 35	PRODUCTION OF FERMENTABLE SUGAR FROM LIGNOCELLULOSIC MATERIALS USING STATISTICAL DESIGN	225 (4157/20674)
	<i>Md. Zahangir Alam, Abdullah-Al-Mamun, and Hikmah Mohd Noor</i>	
CHAPTER 36	STUDY OF THE DEWATERABILITY OF KAOLINE AS A MODEL SUBSTANCE FOR SLUDGE	231 (5545/20616)
	<i>Mohammed Saedi Jami, Tariq Jameel, Mardhiah Farhanah Bt Noor Izan, and Jabir Hussain</i>	
INDEX		237

CHAPTER 7

OPTIMIZATION OF PROCESS CONDITIONS FOR GLUCOAMYLASE PRODUCTION USING NON-FOOD CASSAVA

Md. Zahangir Alam, Hamzah Mohd Salleh, Radhiah Ariffin, Noor Mohammad

Department of Biotechnology Engineering, Faculty of Engineering, International Islamic University Malaysia, Gombak, 50728 Kuala Lumpur, Malaysia

ABSTRACT

A lab study was carried out to optimize the process conditions for glucoamylase production using bitter cassava by employing *Aspergillus niger*. Central composite design from MINITAB software was used and statistical optimization techniques based on ANOVA, t-test, p-values were used to evaluate the model and to determine the effects of linear, quadratic and interactive factors from the regression equation. The maximum glucoamylase activity produced was 19.99 U/ml using the optimum conditions of pH, temperature, agitation, inoculum concentration of 4, 25°C, 100 rpm and 5% respectively using four days of fermentation. The coefficient of determination (R^2) was 93.3% which satisfied the adjustment of experimental data in the model.

Keywords: glucoamylase, *Aspergillus niger*, bitter cassava, optimization

INTRODUCTION

Glucoamylase (1, 4- α -D-glucan glucohydrolase, EC 3.2.1.3) catalyses the release of glucose from the non-reducing ends of starch and related poly- and oligo-saccharides. Like most amylolytic enzymes, fungal glucoamylases are multidomain proteins; the organization of the individual domains along the polypeptide chain in glucoamylases depends on the species (Windish et al., 1965). There are many potential raw materials that can be used as substrate for amylase production. these include rice bran, wheat, barley, sugarcane and other starchy materials.

According to Ghazali and Zaiton (1998), demand of cassava for starch processing utilized in food industries is about 1, 051, 000 tonnes per year. However, bitter cassava (non-edible) is planted mainly for research purposes. To meet the demand of these industries, fermentation of amylase that utilizes a lower cost medium is required. One method is to use cheaper and non conventional raw materials to get a high yield of the desired product. Production of amylase under solid state fermentation and submerged fermentation using agro-industrial residues, agricultural products and by-products are among the methods attempted to reduce the high cost of production of glucoamylase (Wang et al., 2008; Spier et al., 2006; Hernandez et al., 2006).