

CURRENT RESEARCH AND DEVELOPMENT IN BIOTECHNOLOGY ENGINEERING AT IIUM

VOLUME II

Editors:

Ibrahim Ali Noorbatcha
Hamzah Mohd. Salleh
Mohamed Elwathig Saeed Mirghani
Raha Ahmad Raus



IIUM PRESS

INTERNATIONAL ISLAMIC UNIVERSITY MALAYSIA

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

(VOLUME II)

Editors:

Ibrahim Ali Noorbacha

Hamzah Mohd. Salleh

Mohamed Elwathig Saeed Mirghani

Raha Ahmad Raus

**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

Ibrahim Ali Noorbacha, Hamzah Mohd. Salleh, Mohamed Elwathig Saeed Mirghani & Raha Ahmad Raus: Current Research and Development in Biotechnology engineering at IIUM
Volume II

ISBN: 978-967-418-151-2

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 | SCREENING FOR ANTI-CANCER COMPOUND FROM SELECTED MALAYSIAN PLANTS BY SULFORHODAMINE B ASSAY ON MCF-7 CANCER CELL LINE <i>Azura Amid, Abdul Aziz Ahmad and Raha Ahmad Raus</i> | 1 |
| CHAPTER 2 | THE EVALUATION ON ANTICANCER PROPERTIES FROM KENAF SEEDS OIL FROM DIFFERENT VARIETIES <i>Azura Amid, Parveen Jamal, Nurul Elyani Mohamad and Engku Hasmah Engku Abdullah</i> | 9 |
| CHAPTER 3 | SCREENING AND EVALUATION OF ANTICANCER PROPERTY IN MANGO FRUIT <i>Mangifera indica</i> <i>Azura Amid, Irwandi Jaswir and Muhd. Ezza Faiez Othman</i> | 16 |
| CHAPTER 4 | SENSORY EVALUATION AND CONTAMINATION TEST ON MANGO FRUIT (<i>Mangifera indica</i>) PUREE <i>Azura Amid, Irwandi Jaswir and Muhd. Ezza Faiez Othman</i> | 23 |
| CHAPTER 5 | THE OBSERVATION ON THE INHIBITION OF ANTI- INFLAMMATORY MEDIATOR OF THE TOMATO LEAVES EXTRACT <i>Azura Amid, Sulawati Semail and Parveen Jamal</i> | 30 |
| CHAPTER 6 | A STUDY OF BACTERIAL CELL IMMOBILIZATION IN ALGINATE GEL BEADS FOR THE PRODUCTION OF MYO- INOSITOL PHOSPHATES <i>Noor Illi Mohamad Puad, Abd-ElAzizem Farouk and Hamzah Mohd. Salleh</i> | 36 |
| CHAPTER 7 | EXTRACTION AND EVALUATION OF ANTIBACTERIAL ACTIVITY FROM SELECTED FLOWERING PLANTS <i>Raha Ahmad Raus, Erlina Abdullah and Parveen Jamal</i> | 43 |

| | | |
|------------|--|-----|
| CHAPTER 8 | EXTRACTION OF ANTIBACTERIAL COMPOUNDS FROM PLANTS USING SONICATOR <i>Raha Ahmad Raus, Nur Shazwana Mohd Puzi and Parveen Jamal</i> | 50 |
| CHAPTER 9 | EXTRACTION AND EVALUATION OF ANTICANDIDAL ACTIVITY FROM SELECTED MALAYSIAN PLANTS <i>Raha Ahmad Raus, Nor Azlin Alia Nor Muhammad and Jacinta Santhanam</i> | 57 |
| CHAPTER 10 | EXTRACTION AND EVALUATION OF ANTIFUNGAL ACTIVITY FROM SELECTED MALAYSIAN PLANTS <i>Raha Ahmad Raus, Hayatunissa Samsuddin, Nor Hafizah Addnan and Jacinta Santhanam</i> | 62 |
| CHAPTER 11 | MOLECULAR MODELING OF BIODEGRADATION POLYESTERS USING LIPASE <i>Ibrahim Ali Noorbatcha, Nor Afina Eidura Hussin and Hamzah Mohd Salleh</i> | 68 |
| CHAPTER 12 | POTENTIAL OF NAHAR SEED OIL EXTRACT AS ANTIMICROBIALS <i>Mohamed E. S. Mirghani, I. A. Ahmed, S. A. Muyibi., J. I. Daoud and M. A. Mikail</i> | 74 |
| CHAPTER 13 | NAHAR (<i>Mesua ferrea</i>) TREE AS A MEDICINAL PLANT <i>Mohamed E. S. Mirghani, I. A. Ahmed, S. A. Muyibi., J. I. Daoud and M. A. Mikail</i> | 82 |
| CHAPTER 14 | EXPLOIT OF MALAYSIAN MANGO KERNEL EXTRACT AS ANTIBACTERIAL AGENT <i>Mohamed Elwathig Saeed Mirghani, Nasereldin A. Kabbashi, Parveen Jamal and H. A. Abdullah</i> | 90 |
| CHAPTER 15 | PREPARATION OF NUTRITIOUS DRINK FROM DATE PALM KERNEL (DPK) <i>Mohamed Elwathig Saeed Mirghani, Irwandi Jaswir and Nurul Hanan Mustapha</i> | 101 |
| CHAPTER 16 | DATE SEED EXTRACT AS PRESERVATIVES <i>Mohamed E. S. Mirghani, M. A. Mikail, I. A. Ahmed, M. I. Abdul Karim and J. I. Daoud</i> | 113 |

| | | |
|------------|--|-----|
| CHAPTER 17 | IMMOBILIZATION OF LIPASE BY CROSS-LINKED ENZYME AGGREGATE (CLEA) TECHNOLOGY <i>Faridah Yusof and Nik Rashidah Nik Abdul Ghani</i> | 120 |
| CHAPTER 18 | DETECTION OF ETHANOL IN BEVERAGES USING AN ELECTRONIC NOSE <i>Irwandi Jaswir, Nurul Asyikeen A.M and Rini Akmeliawati</i> | 130 |
| CHAPTER 19 | EFFECTS OF CELL IMMOBILIZATION TO THE PHYTATE-DEGRADING ENZYME ACTIVITY <i>Noor Illi Mohamad Puad, Abd-ElAzim Farouk and Hamzah Mohd. Salleh</i> | 137 |
| CHAPTER 20 | ENZYMATIC DEVULCANIZATION OF WASTE RUBBER <i>Faridah Yusof and Ainie Asyikin Ahmad</i> | 144 |
| CHAPTER 21 | EXTRACTION AND CHARACTERIZATION OF ASTAXANTHIN FROM MARINE SOURCES <i>Irwandi Jaswir, Shazana Azfar and Azura Amid</i> | 154 |
| CHAPTER 22 | EXTRACTION OF FISH COLLAGEN USING ENZYMATIC PROCESS <i>Irwandi Jaswir, Noor Yulsida Hazahari and Mohamed Elwathig Saeed Mirghani</i> | 159 |
| CHAPTER 23 | FROM RECREATION MATHEMATICS TO PSEUDO-GENES <i>Ibrahim Ali Noorbatcha and Ahmad Faizul Shamsudin</i> | 166 |
| CHAPTER 24 | MECHANICAL PROPERTIES OF A GELATIN REPLACER, PECTIN, FROM BANANA AND MANGO PEELS <i>Hamzah Mohd. Salleh, Irwandi Jaswir and Hamida Zakaria</i> | 173 |
| CHAPTER 25 | DEVELOPMENT OF <i>IN-VIVO</i> BIOFUEL CELL FOR IMPLANTABLE MEDICAL DEVICES <i>Hamzah Mohd. Salleh, Nur Syaheera Mohd Yusoff, Raihan Othman and Mohd. Firdaus Abd. Wahab</i> | 182 |
| CHAPTER 26 | IMPROVEMENT OF EXTRACTION PROCESSING CONDITIONS FOR ANTIBACTERIAL COMPOUNDS FROM <i>Curcuma longa</i> | 192 |

*Raha Ahmad Raus, Nur Fariah Abdul Malek, Mohd Saufi Bastami
and Noriha Mat Amin*

| | | |
|------------|--|-----|
| CHAPTER 27 | IMPROVEMENT OF SONICATION PROCESSING CONDITIONS FOR EXTRACTION OF ANTIBACTERIAL COMPOUNDS FROM <i>Spathiphyllum cannifolium</i> <i>Raha Ahmad Raus, Nur Shazwana Mohd Puzi and Parveen Jamal</i> | 199 |
| CHAPTER 28 | IMPROVING ENZYME CATALYSIS THROUGH THE IMPROVEMENT OF BINDING STRENGTH: SIMULATED MUTATION TO PREDICT THE MUTATIONAL EFFECT ON XYLANASE CEX <i>Ibrahim Ali Noorbatcha, Muaz Abdul Hadi, Ahmad Faris Ismail and Hamzah Mohd Salleh</i> | 207 |
| CHAPTER 29 | MOLECULAR INTERACTION ANALYSIS TO DESIGN NEW DRUG CANDIDATES FOR LYSOSOMAL STORAGE DISEASE <i>Ibrahim Ali Noorbatcha, Muaz Abdul Hadi, Zarul Azwan Adam and Hamzah Mohd. Salleh</i> | 215 |
| CHAPTER 30 | MECHANICAL IMPROVEMENT OF HALAL GELATIN FROM MARINE SOURCES <i>Irwandi Jaswir, Aniza Binti Asari and Hamzah Mohd. Salleh</i> | 222 |
| CHAPTER 31 | PERFORMANCE OF ARTIFICIAL ANTIOXIDANTS IN RBD PALM OLEIN DURING DEEP-FAT FRYING <i>Irwandi Jaswir and Ahmad Badli Yusoff</i> | 229 |
| CHAPTER 32 | PHYSICO-CHEMICAL PROPERTIES OF COLLAGEN EXTRACTS FROM TWO LOCAL FISH SPECIES <i>Irwandi Jaswir, Nur'ain Che Kamaludin and Hamzah Mohd. Salleh</i> | 237 |
| CHAPTER 33 | PHYTOCHEMICAL SCREENING AND PURIFICATION OF XO1 FROM SELECTED MEDICINAL PLANT <i>Parveen Jamal, Azura Amid and Suhana Abdullah</i> | 242 |
| CHAPTER 34 | POTENTIAL ENERGY SURFACES FOR REACTIONS AMONG HYDROGEN FLUORIDE MOLECULES <i>Ibrahim Ali Noorbatcha, Borhannuddin Arifin and Sharifudin M Zain</i> | 251 |

| | | |
|------------|--|-----|
| CHAPTER 35 | POTENTIAL REMEDIES FOR GOUT FROM MEDICINAL PLANTS <i>Parveen Jamal, Saiful Mohammad Nizam Azmi and Azura Amid</i> | 262 |
| CHAPTER 36 | PRODUCTION OF CARRAGEENAN FROM MALAYSIAN SEAWEED <i>Irwandi Jaswir, Ainur Farhana and Parveen Jamal</i> | 272 |
| CHAPTER 37 | PRODUCTION OF GELATIN REPLACERS FROM MALAYSIAN TUBEROUS PLANTS <i>Irwandi Jaswir, Nurul Ain Zafirah Binti Kamalurudin and Hamzah Mohd. Salleh</i> | 279 |
| CHAPTER 38 | PURIFICATION OF PATATIN-LIKE PROTEIN (HEV B7) FROM SKIM LATEX OF <i>Hevea brasiliensis</i> <i>Faridah Yusof and Nurul Ain Harmiza Abdullah</i> | 285 |
| CHAPTER 39 | PURIFICATION OF SUPEROXIDE DISMUTASE FROM <i>Hevea brasiliensis</i> LEAF EXTRACT <i>Faridah Yusof and Nazhirah Mohamed</i> | 296 |
| CHAPTER 40 | QUALITATIVE AND QUANTITATIVE ANALYSIS OF ANTI-GOUT FROM <i>Carica papaya</i> LEAVES <i>Parveen Jamal, Saiful Mohammad Nizam Azmi and Azura Amid</i> | 306 |
| CHAPTER 41 | RECYCLING OF WASTE RUBBER VIA MICROBIAL DEVULCANIZATION <i>Faridah Yusof and Ainie Asyikin Ahmad</i> | 316 |
| CHAPTER 42 | SCREENING ANTI-CANCER COMPOUNDS FROM PALM OIL INDUSTRIAL WASTES <i>Raha Ahmad Raus, Syamsa Shazwan Shamsudin and Parveen Jamal</i> | 326 |
| CHAPTER 43 | SCREENING ANTI-CANCER COMPOUNDS FROM MEDICINAL MALAYSIAN PLANTS <i>Raha Ahmad Raus, Yusuf Johari and Azura Amid</i> | 332 |
| CHAPTER 44 | SCREENING ANTI-CANCER COMPOUNDS FROM RICE INDUSTRIAL WASTES <i>Raha Ahmad Raus, Mohd Hafizul Muhammad and Parveen Jamal</i> | 338 |

| | | |
|------------|---|-----|
| CHAPTER 45 | SOLUBILIZATION OF VITAMIN E IN CULTURE MEDIUM AND ITS ANTIOXIDANT ACTIVITY <i>Irwandi Jaswir and Siti Fairus Sahul Hamid</i> | 342 |
| CHAPTER 46 | STRUCTURE ACTIVITY RELATIONS IN PENTACYCLIC TRITERPENOID TOWARDS HYALURONIDASE INHIBITORY ACTIVITY <i>Ibrahim Ali Noorbatcha, Nor Hayati Abdullah and Khalijah Awang</i> | 348 |
| CHAPTER 47 | <i>IN SILICO</i> PREDICTION OF ANTICANCER ACTIVITY OF NITROSOUREAS <i>Ibrahim Ali Noorbatcha, Farahana Hamzah, Hamzah Mohd. Salleh and Syed Zahir Idid</i> | 356 |
| CHAPTER 48 | BIOMOLECULAR COMPUTING IN DEGENERATIVE BRAIN RESEARCH <i>Ibrahim Ali Noorbatcha and Ahmad Faizul Shamsudin</i> | 363 |
| CHAPTER 49 | ISOLATION AND IDENTIFICATION OF FERULIC ACID FROM RICE BRAN <i>Faridah Yusof and Aimi Izyana Ismail</i> | 370 |
| CHAPTER 50 | IMPROVEMENT OF EXTRACTION PROCESSING CONDITIONS FOR ANTIFUNGAL COMPOUNDS FROM <i>Alpinia galanga</i> <i>Raha Ahmad Raus, Nor Hafizah Addnan, Noriha Mat Amin and Syamsiah Aini Shohaimi</i> | 379 |

CHAPTER 21

EXTRACTION AND CHARACTERIZATION OF ASTAXANTHIN FROM MARINE SOURCES

Irwandi Jaswir, Shazana Azfar and Azura Amid

Department of Biotechnology Engineering, Faculty of Engineering,
International Islamic University Malaysia, P.O. Box 10, 50728 Kuala Lumpur, Malaysia

ABSTRACT

A study has been conducted to extract and to characterize carotenoid astaxanthin from tiger shrimp (*Penaeus monodon*), one of most commercial marine sources in Malaysia. Astaxanthin is a red pigment belonging to the family of the xanthophylls, the oxygenated derivatives of carotenoids and is widely used as a pigmentation sources in aquaculture and poultry industries, nutraceutical and pharmaceutical industries. Results showed the carotenoid yield for all combinations of extraction condition ranged from 65-138 $\mu\text{g/g}$. The optimum solvent to waste ratio and the percentage of hexane in solvent mixtures were 1:5.553 and 32.105% which gave the highest yield of 141.474 $\mu\text{g/g}$. The percentage purity of the astaxanthin (predicted as 13-*cis*-astaxanthin monoester) was about 86.907%. Astaxanthin, astaxanthin monoester, astaxanthin diester, α -carotene are the major pigments in *Penaeus monodon*.

Keywords: astaxanthin, red pigment, crustaceans, carotenoids

INTRODUCTION

Astaxanthin is a red pigment, belongs to the family of the xanthophylls, the oxygenated derivatives of carotenoids (Kachik, 2009). Most crustaceans are tinted in red by accumulation of this pigments. Astaxanthin are widely used as a pigmentation sources in aquaculture and poultry industries, nutraceutical and pharmaceutical industries (Kachik, 2009).

In Malaysia, shrimp processing industry generates quantities of waste. However, not much attention has been given towards the recovery of other valuable products like carotenoids. Studies on extraction of carotenoid in crustaceans are restricted to species from temperate waters. The scientific data on qualitative and quantitative distribution of carotenoid in crustaceans from Malaysian waters is lacking.

Hence, growing demand for natural carotenoid and high cost of synthetic carotenoids will force the industry players to maximize its economic use and link extraction process with chitin production.