THE FATTY ACID CONCENTRATION AND COMPOSITION ON THE GROWTH OF THREE CULTURED MICROALGAE SPECIES

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2013

The fatty acid concentration and composition on the growth of three cultured microalgae species / Nur Safawati Abd Manab.

Lihat Sebelah

THE FATTY ACID CONCENTRATION AND COMPOSITION ON THE GROWTH OF THREE CULTURED MICROALGAE SPECIES.

By

NUR SAFAWATI ABD MANAB

Research Report submitted in partial fulfillment of
the requirements for the degree of
Bachelor of Science (Marine Biology)

Department of Marine Science
Faculty of Maritime Studies and Marine Science
UNIVERSITI MALAYSIA TERENGGANU
2013

This project report should be cited as:

Safawati, N.A.M. (2013). The fatty acid concentration and composition on the growth of three cultured microalgae species. Undergraduate Thesis, Bachelor of Science (Marine Biology), Faculty of Maritime Studies and Marine Science, Universiti Malaysia Terengganu, Terengganu. 65 pp.

DEPARTMENT OF MARINE SCIENCE
FACULTY OF MARITIME STUDIES AND MARINE SCIENCE
UNIVERSITI MALAYSIA TERENGGANU

DECLARATION AND VERIFICATION REPORT

FINAL YEAR RESEARCH PROJECT

It is hereby declared and verified that this research report entitled:

THE FATTY ACID CONCENTRATION AND COMPOSITION ON THE GROWTH OF THREE CULTURED MICROALGAE SPECIES

by NUR SAFAWATI BINTI ABD MANAB, Matric No. UK 22533 have been examined and all errors identified have been corrected. This report is submitted to the Department of Marine Science as partial fulfillment towards obtaining the Degree BACHELOR OF SCIENCE (MARINE BIOLOGY), Faculty of Maritime Studies and Marine Science, University Malaysia Terengganu.

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ACKNOWLEDGEMENTS

First of all, I would like to express my ultimate gratitude to Allah S.W.T. for good health and blessings in completing the research project including surviving from any obstruction and misfortune until I able to finish the research project completely.

Secondly, I would like to express gratitude to my supervisors; Dr. Roswati Mohd Amin and Assoc. Prof. Dr. Zainudin Bachok for all the helps, supports and guidance that had been given along the period in completing the final year research project. The invaluable advice and supervision including technical supports given by my supervisors were invaluable and precious as I learn lots of things along the research period.

I also would like to wish a grateful thank to Assoc. Prof. Dr. Siti Aishah Abdullah and Mrs. Maizah Mohd Abdullah including Final Year Project Coordinator Dr. Saifullah Arifin Jaaman, Dr. Antonina Abdullah, Mr. Yong Jaw Chuen and Dr. Lee Jen Nie on advice and support given throughout the period in facilitate the research project process.

Moreover, I would like to wish deeply thank to the Mrs. Noor Zuliana Mohd Nor, Mr. Abdul Manaf Ahmad, Ms. Nurul Hana Mohd Bakri, Ms. Siti Hajar Abdul Hamid, Ms. Nur Hazwani Zakaria, Mr. Fathurrahman Lananan, Ms. Mardiah Hayati Yahaya, Mr. Azahari Muda, Ms. Noor Azariyah Mohtar, Mr. Hassan Rashid Ali, Mr. Wan Mohd Redhuan Wan Azmi, Mr. Abdul Jalal Bilal and Mr. Sainol Aimi Saidin for assistance during progress of the research project on microalgae culture and fatty acid production including supplying invaluable information, guidance, opinion and advice.

In addition, I also would like to express speechless thanks to all of the lab assistants in Biodiversity Laboratory and Oceanography Laboratory especially Mr. Che Mohd Zan Husin, Mr. Abdul Manaf Ahmad and Mr. Suliman Kasim for supplying all the equipment and chemicals needed throughout the research project. On the other hand, I also would like to express the thank to the science officers in Institute of Oceanography and Environment (INOS) and Institute of Tropical Aquaculture (AKUATROP) for the guidance and cooperation during preparation, preliminary study and experimental period in Marine Pollution and Chemical Oceanography Laboratory (INOS) and Live Feed Laboratory (AKUATROP) including their permission in utilizing the existing facilities provided at the laboratories.

I also would like to express appreciation towards FRGS Research Grant (MOHE), Faculty of Maritime Studies and Marine Science, and Institute of Oceanography and Environment, Universiti Malaysia Terengganu on granting fund to the project entitled 'The fatty acid concentration and composition on the growth of three cultured microalgae species'. Plus, I would like to express the thanks to all my friends who always give support and advice all through this project especially in managing data analysis. I am hoping more project regarding the marine ecosystem would be continued in the future to update and maintain the quality of research in Marine Science Department of Faculty of Maritime Studies and Marine Science.

Finally, I would like to give precious gratitude and thank to my beloved families who always give moral support and understanding including financial supports so that I able to complete my final project successfully.

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LIST OF ABBREVIATIONS

ARA	Arachidonic acid
BF_3	Boron tri-fluoride
CH_2Cl_2	Dichloromethane
DHA	Docosahexaenoic acid
DPA	Docosapentaenoic acid
EPA	Eicosapentaenoic acid
FA	Fatty acid
FAME	Fatty acid methyl ester
FASW	Filtered autoclave sea water
g	gram
GC-FID	Gas chromatography – Flame Ionization Detector
HUFA	Highly unsaturated fatty acid
ind.	individual
mg	milligram
ml	millimetre
MUFA	Monounsaturated fatty acid
n-3	Omega-3
n-6	Omega-6
PAH	Polynuclear aromatic hydrocarbon
*p*g	picogram
PUFA	Polyunsaturated fatty acid
rpm	revolutions per minute
SAFA	Saturated fatty acid
t_g	Division time

LIST OF FORMULAE

Concentration of fatty acid (C_{FA}) $= A_S/A_{IS} \times C_{IS}/W_S$

Where; A_S: peak area of fatty acid in the sample in chromatogram.

A_{IS}: peak area of internal standard in chromatogram.

C_{IS}: concentration of internal standard (mg)

W_S: weight of sample (g) (eq. 1)

Cell density (cell/ml) $= \dfrac{C \times A_t}{A_s \times S \times V}$

Where: C: total number of cells counted in the counting unit

A_t: area of both grids used, mm^2 (18 mm^2)

A_s: area of counting unit used, mm^2 (0.25 mm x 0.25 mm)

S: number of counting units counted (24)

V: volume of sample under the grids used, ml (0.0018 ml) (eq. 2)

Growth rate (μ) $= \dfrac{\ln X_2 - \ln X_1}{t_2 - t_1}$ (eq. 3)

Division time (t_g) $= \dfrac{0.6931}{\mu}$ (eq. 4)

Where; X: number of cells

μ: growth rate

t: time in days

ABSTRACT

Microalgae contain various types of essential fatty acid that functional in enhancing the growth and development of juvenile zooplankton. Three microalgae species had been culture with controlled condition and the culture method was inoculated with f/2 medium. The growth of microalgae culture affects the composition and component of fatty acid content. Fatty acid content in the analysis differs between microalgae species and across the growth phases due to different in microalgae strains, culture conditions and relative distribution at major lipid classes. The highest specific growth rate was dominated by *Dunaliella* sp. followed by *Rhodomonas* sp. and *Chlorella* sp. with 0.41 ind.d^{-1}, 0.22 ind.d^{-1} and 0.20 ind.d^{-1} value respectively. On the other hand, the highest cell density dominated by *Chlorella* sp. followed by *Rhodomonas* sp. and *Dunaliella* sp. Among the three species studied, the highest fatty acid contents dominated by *Rhodomonas* sp. where it displayed the highest total fatty acid contents (1075.578 *p*g $cell^{-1}$) in early log (EL) phase followed with *Dunaliella* sp. and *Chlorella* sp. In n-3 and n-6 fatty acids, *Rhodomonas* sp. also high in quantity across phases except in late log (LL) phase where the phases dominated by *Chlorella* sp. The fatty acids from polyunsaturated fatty acid (PUFA) division play main role in fatty acid contents as the highest contributor to fatty acid contents were from PUFA. The results obtained were significant in all microalgae species across four phases ($p < 0.05$).

Kepekatan dan Komposisi Asid Lemak pada Pertumbuhan Tiga Spesis Microalga yang Dikultur

ABSTRAK

Mikroalga mengandungi pelbagai jenis asid lemak yang bermanfaat dimana ia berfungsi dalam meningkatkan tumbesaran dan pertumbuhan zooplankton juvenil. Tiga spesies mikroalga telah dikultur dengan kondisi terkawal dan kaedah pengkulturan dinokulasi dengan f/2 media. Tumbesaran pengkulturan mikroalga memberi kesan kepada komposisi dan komponen kandungan asid lemak. Kandungan asid lemak di dalam analisis berbeza diantara mikroalga spesies dan seluruh fasa pertumbuhan disebabkan oleh perbezaan strain microalgae, kaedah pengkulturan dan pengedaran relatif di dalam kelas utama lipid. Kadar pertumbuhan tertentu didapati tertinggi di dalam spesies *Dunaliella* sp. diikuti dengan spesies *Rhodomonas* sp. dan *Chlorella* sp. masing-masing dengan nilai 0.41 $ind.d^{-1}$, 0.22 $ind.d^{-1}$ dan 0.20 $ind.d^{-1}$. Sebaliknya, ketumpatan sel tertinggi dikuasai oleh *Chlorella* sp. diikuti oleh *Rhodomonas* sp. dan *Dunaliella* sp. Antara ketiga-tiga spesies yang dikaji, kandungan asid lemak yang tertinggi dikuasai oleh *Rhodomonas* sp. di mana ia memapaparkan jumlah kandungan asid lemak tertinggi (1075.578 *pg* sel^{-1}) dalam fasa log awal (EL) diikuti dengan *Dunaliella* sp. dan *Chlorella* sp. Dalam n-3 dan n-6 asid lemak, *Rhodomonas* sp. juga didapati tertinggi dalam kuantiti di seluruh fasa kecuali dalam fasa log akhir (LL) mana fasa tersebut dikuasai oleh *Chlorella* sp. Asid lemak dari asid lemak politaktepu (PUFA) memainkan peranan utama dalam kandungan asid lemak dan bertindak sebagai penyumbang tertinggi kepada kandungan asid lemak. Keputusan yang diperolehi adalah signifikan dalam semua spesis mikroalga diantara empat fasa ($p < 0.05$).