

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

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GROWTH OF THREE CULTURED MICROALGAE SPECIES.

By

NUR SAFAWATI ABD MANAB

Research Report submitted in partial fulfillment of
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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
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LIST OF ABBREVIATIONS

ARA	Arachidonic acid
BF ₃	Boron tri-fluoride
CH ₂ Cl 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
pg	picogram
PUFA	Polyunsaturated fatty acid
rpm	revolutions per minute
SAFA	Saturated fatty acid
t _g	Division time

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

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)

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

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 ($0.25 \text{ mm} \times 0.25 \text{ mm}$)

S : number of counting units counted (24)

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

$$\text{Growth rate } (\mu) = \frac{\ln X_2 - \ln X_1}{t_2 - t_1} \quad (\text{eq. 3})$$

$$\text{Division time } (t_g) = \frac{0.6931}{\mu} \quad (\text{eq. 4})$$

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 pg 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 Mikroalga 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 memaparkan jumlah kandungan asid lemak tertinggi ($1075.578 \text{ pg sel}^{-1}$) 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 ($p < 0.05$).