

GROWTH AND PROXIMATE COMPOSITION OF TROPICAL  
*Tetraselmis* sp. CULTURE WITH DIFFERENT MEDIA IN  
INDOOR AND OUTDOOR CULTURE

MOHAMAD SUKRI BIN MOHAMED YUSOFF

FACULTY OF MARITIME STUDIES AND MARINE SCIENCE  
UNIVERSITI MALAYSIA TERENGGANU

2013

110091334

1100091334

Pusat Pembelajaran Digital Sultanah Nur Zahirah (UMT)  
Universiti Malaysia Terengganu.



LP 14 FMSM 2 2013



1100091334  
Growth and proximate composition of tropical Tetraselmis sp.  
culture with different media in indoor and outdoor culture /  
Mohamad Sukri Mohamed Yusoff.

PUSAT PEMBELAJARAN DIGITAL SULTANAH NUR ZAHIRAH  
UNIVERSITI MALAYSIA TERENGGANU (UMT)  
21030 KUALA TERENGGANU

1100091334		

Lihat Sebelah

HAK MILIK  
PUSAT PEMBELAJARAN DIGITAL SULTANAH NUR ZAHIRAH

**Growth and proximate composition of tropical *Tetraselmis* sp. culture with different media in indoor and outdoor culture**

**By**

**Mohamad Sukri bin Mohamed Yusoff**

**Research Report submitted in partial fulfilment of  
the requirement 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 thesis should be cited as:

S. Yusoff (2013). Growth and proximate composition of tropical *Tetraselmis* sp. culture with different media in indoor and outdoor culture. Undergraduate thesis, Bachelor of Science in Marine Biology. University Malaysia Terengganu. Terengganu, Malaysia. 90p

No part of this thesis may be reproduced by any mechanical, photographic, or electronic process, or in the form of phonographic recording, nor may it be stored in retrieval system, transmitted, or otherwise copied for public or private use, without written permission from the author and the supervisor (s) of the project



**DECLARATION AND VERIFICATION REPORT  
 FINAL YEAR RESEARCH PROJECT**

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

*Growth and Proximate Composition of Tropical Tetraselmis sp.  
 Culture with different Media in Indoor and Outdoor culture*  
 by *Mohamad Supri bin Mohamed Yusoff*, Matric No. *JK 24157*

have been examined and all errors identified have been corrected. This report is submitted to the Department of Marine Science as partial fulfilment towards obtaining the Degree *Science of Marine Biology*, Faculty of Maritime Studies and Marine Science, Universiti Malaysia Terengganu.

Verified by:

*HKhatoun*

Principal Supervisor

Name: *HELENA KHATOON*

**DR. HELENA KHATOON**

Official stamp:

Lecturer  
 Department of Aquaculture Science  
 Faculty of Fisheries and Aqua-Industry  
 Universiti Malaysia Terengganu  
 21030 Kuala Terengganu

Date: *11th June 2013*

*Christine A. Orasco*

Second Supervisor (where applicable)

Name:

**PROF. MARYAM SHARIFAH ABDULLAH**  
**@ CHRISTINE A. OROSCO**  
 PENYELARAS PROGRAM BIOLOGI MARIN  
 JABATAN SAINS MARIN  
 FAKULTI PENGAJIAN MARITIM DAN SAINS MARIN  
 UNIVERSITI MALAYSIA TERENGGANU (UMT)  
 21030 KUALA TERENGGANU

Official stamp:

Date: *11th June 2013*

## DECLARATION

I hereby that the work in this thesis is my own expect for quotations and summaries which have  
been dully acknowledged

Signature



Name

: Mohamad Sukri bin Mohamed Yusoff

Matric number : UK24157

Date

: 19<sup>th</sup> June 2013

## ACKNOWLEDGEMENT

Praises be to ALLAH Subhanahuwata'ala in support of give me strength to strong along doing the final year project and successfully completed.

Firstly, I would like to express my greatest thank to my beloved first supervisor Dr. Helena Khatoon and co-supervisor Prof Madya Dr. Siti Aishah bt Abdullah for their guidance and encouragement all the way during my research. I am really thankful to them for giving me advice and guide to get the good quality research. They always support me and willing to spend their time to instruct and exposed me regarding the research.

Besides that, my special thanks also goes to Mrs. Zuliana, Mr. Saberi , Mr. Zulkarami, Mr. Shafiq and others masters student of AKUATROP because give me opportunity to run project out their place. They always gave me advice and instructed to conduct and utilize the laboratory equipment. I am thankful to Miss Siti Aisha from Institute Biotechnology Marine (IMB) who helping and guided me in handling centrifuge machine and freeze-dried technique. Thanks also to others Biodiversity Laboratory staffs especially Mr. Mahzan and Mr. Manaf in helping to prepare all glassware for the period of the project. Then, lots of thanks to Anatomy and Physiology Laboratory (MAF) staff help to do proximate analysis especially to Ms Suzana, Ms. Faridah, Mr. Shahrul. Thanks also to all staff at Marine Hatchery especially to Mr. Yaacob, Mr. Suhaimi, Mr. Zain for their assistance with equipments in the hatchery.

I am thankful to the entire member especially Siti Haslinda, Siti Suhada, Naruzah, Noraziera and Khairunnisa because cooperation during project running. Last but not least, I am very thankful to my beloved friend and family especially to my parent Mr. Yusoff and my sister Mrs. Suzana who always support and advise me to be strong during do the project.

	TABLE OF CONTENT	PAGE
Acknowledgement		Ii
Table Of Content		Iv
List Of Table		Vi
List Of Figure		Vii
Abbreviations		Ix
Abstract		X
Abstrak		Xi
1.0 INTRODUCTION		1
1.1 Background of the study		1
1.2 Problem statement		3
1.3 Significant of study		3
1.4 Objective of the study		4
2.0 LITERATURE REVIEW		5
2.1 Characteristics of <i>Tetraselmis</i> sp.		5
2.2.Importance of <i>Tetraselmis</i> sp.		6
2.3 Factors affecting growth of <i>Tetraselmis</i> sp.		7
2.3.1 Light		8
2.3.2 pH		9
2.3.3 Aeration/mixing		9



2.3.4 Temperature	9
2.3.5 Salinity	10
2.3.6 Culture medium/nutrients	11
2.4 Growth phases of <i>Tetraselmis</i> sp.	11
2.5 Nutritional value of <i>Tetraselmis</i> sp.	13
3.0 METHODOLOGY	15
3.1 Microalgae sample collection, culture and maintenance	15
3.2 Media preparation	16
3.3 Growth Curve Experiment	18
3.4 Experimental design	19
3.5 Analysis of growth parameters	19
3.5.1 Determination of cell count	20
3.5.2 Determination of optical density	20
3.6 Proximate composition	20
3.6.1 Protein analysis	21
3.6.2 Lipid analysis	20
3.6.3 Carbohydrates analysis	22
3.7 Statistical analysis	22
4.0 RESULT	24
4.1 Growth Curve Experiment	24
4.2 Proximate composition	33

4.3 Physical parameter	38
5.0 DISCUSSION	41
6.0 CONCLUSION	52
REFERENCES	59
APPENDICES	61
CURRICULUM VITAE	

## LIST OF TABLE

TABLE	TITLE	PAGE
3.1	Preparation of Conway Medium (Tompkins <i>et al.</i> , 1995)	16
4.1	Table 4.1: Comparison of cell density and optical density <i>Tetraselmis</i> sp. growth cultured at different media in different condition.	32
4.2	Two-Way Anova statistical analysis of protein (%) in <i>Tetraselmis</i> sp.	33
4.3	Two-Way Anova statistical analysis of lipid (%) in <i>Tetraselmis</i> sp.	35
4.4	Two-Way Anova statistical analysis of carbohydrate (%) in <i>Tetraselmis</i> sp.	36
4.5	Percentage (%) proximate composition of <i>Tetraselmis</i> sp. cultured at different media in different condition	37
4.6	Daily temperature (°C) measurement of <i>Tetraselmis</i> sp. culture	38
4.7	Daily light intensity (°C) measurement of <i>Tetraselmis</i> sp. culture	39
4.8	Specific Growth Rate (SGR) of <i>Tetraselmis</i> sp.	41

## LIST OF FIGURE

FIGURE	TITLE	PAGE
2.2	Five growth phases of microalgae cultures	11
4.1	Cell density of <i>Tetraselmis</i> sp. cultured in Conway medium under indoor and outdoor culture conditions	24
4.2	Optical density of <i>Tetraselmis</i> sp. cultured in Conway medium under indoor and outdoor culture conditions	25
4.3	Cell density of <i>Tetraselmis</i> sp. cultured in KW21 medium under indoor and outdoor culture conditions	26
4.4	Optical density of <i>Tetraselmis</i> sp. cultured in KW21 medium under indoor and outdoor culture conditions	27
4.5	Cell density of <i>Tetraselmis</i> sp. cultured in Conway and KW21 media under indoor culture conditions	29
4.6	Optical density of <i>Tetraselmis</i> sp. cultured in Conway and KW21 medium under indoor culture conditions	30
4.7	Cell density of <i>Tetraselmis</i> sp. cultured in Conway and KW21 media under outdoor culture conditions	31

4.8	Optical density of <i>Tetraselmis</i> sp. cultured in Conway and KW21 media under outdoor culture conditions	32
4.9	Proximate composition of protein for <i>Tetraselmis</i> sp. cultured in different media with different conditions	33
4.10	Proximate composition of lipid for <i>Tetraselmis</i> sp. cultured in different media with different conditions	34
4.11	Proximate composition of carbohydrate for <i>Tetraselmis</i> sp. cultured in different media with different conditions	35

## ABBREVIATIONS

Lux	Luminous flux
G	Gram
MI	Millimeter
Rpm	Revolution per minute
Nm	Nanometer
OD	Optical density
FAO	Food Agriculture Organization

## Abstract

Light intensity, temperature, and culture medium are important factors regulating the growth of microalgae. This study was conducted at Universiti Malaysia Terengganu. Marine microalgae *Tetraselmis* sp. was isolated and cultured in two different media such as Conway and KW21 at different condition indoor and outdoor. This study investigated the effect of different culture media and culture condition on the growth and proximate composition of *Tetraselmis* sp. At indoor culture, *Tetraselmis* sp. had 24 hours continuous fluorescent lamp while outdoor culture the growth of *Tetraselmis* sp. was depended on natural sunlight 12:12 light: dark cycles. The growth of *Tetraselmis* sp. was determined by using two parameters which was cell density (cells/ml) and optical density (ABS), while for the proximate composition was determined by using dry weight percentage (%). The growth and proximate composition-Protein, lipid and carbohydrate of all culture treatments were determined at stationary phase. *Tetraselmis* sp. was growing slightly higher in Conway medium when compare KW21 medium at indoor (laboratory/controlled) culture. Then, outdoor (natural) culture condition was shown, higher grown in KW21 medium when compare Conway medium. The percentage (%) of protein in *Tetraselmis* sp. cultured using KW21 medium had significantly higher compared with Conway medium for both culture

conditions. Lipid accumulation in *Tetraselmis* sp. was slightly higher cultured in KW21 medium (16.66%) under indoor condition while Conway medium was higher cultured under outdoor condition (12.8%). The carbohydrates productions seem slightly higher in Conway medium (30.18%) under indoor culture while KW21 medium (27.2%) slightly higher in under outdoor condition. From the result, can concluded that *Tetraselmis* sp. had no significant differences for growth in both Conway and KW21 media under indoor and outdoor culture condition because of influenced by some physical factor such as light intensity and temperature as well as nutrient composition such as phosphate, nitrogen and trace metals.



## Abstrak

Keamatan cahaya, suhu dan media kultur yang digunakan merupakan faktor yang sangat penting untuk menentukan pertumbuhan mikroalga. Kajian ini dijalankan di Universiti Malaysia Terengganu. Mikroalga marin *Tetraselmis* sp. telah diasingkan dan ditenak di dua media yang berbeza seperti Conway dan KW21 pada keadaan yang berbeza dalaman dan luaran. Kajian ini bertujuan untuk menyiasat kesan perbezaan keamatan cahaya, suhu dan nutrien media memberi kesan kepada pertumbuhan dan komposisi nutrisi dalam *Tetraselmis* sp. *Tetraselmis* sp. dikulturkan di kawasan yang berbeza iaitu di dalam sistem kultur tertutup dalam bilik kultur dan kawasan yang terbuka supaya memudahkan untuk mendapat sumber cahaya semulajadi. *Tetraselmis* sp. di kultur dalam dua media yang berbeza seperti media Conway dan KW21. Sistem kultur tertutup dibekalkan dengan cahaya lampu buatan secara berterusan 24 jam dan suhu adalah tetap manakala sistem kultur terbuka hanya bergantung kepada sumber semulajadi cahaya matahari dengan kitaran 12 jam cerah dan 12 jam gelap. Pertumbuhan *Tetraselmis* sp. di ukur dengan dua cara iaitu dengan menggunakan kepadatan sel dan kepadatan optical. Selain itu, kandungan komposisi nutrisi seperti protein, lipid dan karbohidrat diukur dengan menggunakan peratusan berat kering (%) sel *Tetraselmis* sp. *Tetraselmis* sp. akan di tuai apabila mencapai kepadatan sel yang

paling tinggi iaitu di fasa dimana sel tidak bergerak atau tetap. Keputusan daripada hasil kajian menunjukkan pertumbuhan sel *Tetraselmis* sp. lebih tinggi untuk kultur tertutup apabila menggunakan media nutrien Conway berbanding KW21. Apabila menggunakan sistem kultur terbuka, pertumbuhan sel *Tetraselmis* sp. lebih tinggi untuk kultur nutrien KW21. Untuk peratusan (%) protein dalam *Tetraselmis* sp, lebih tinggi apabila kultur menggunakan media KW21 berbanding media Conway untuk sistem luaran dan dalaman. Pengumpulan lipid dalam *Tetraselmis* sp. lebih tinggi dalam media KW21 di dalam sistem luaran iaitu (16.66%) manakala untuk media Conway, lipid lebih tinggi pada sistem luaran iaitu (12.8%). Dalam media Conway, penghasilan karbohidrat lebih tinggi pada kultur sistem dalaman iaitu (30.18%) manakala untuk media KW21 penghasilan karbohidrat lebih tinggi apabila kultur sistem luaran. Secara keseluruhan keputusan menunjukkan tiada perbezaan yang signifikan untuk pertumbuhan *Tetraselmis* sp. dalam kedua-dua media conway dan KW21 disebabkan oleh beberapa faktor fizikal seperti keamatan cahaya dan suhu serta komposisi nutrien seperti fosfat, nitrogen dan kesan logam.