UNIVERSITI PUTRA MALAYSIA

INVESTIGATION ON THE USE OF BLUE AND YELLOW LEDS FOR GROWTH, PROXIMATE COMPOSITION ENHANCEMENT AND MORPHOLOGY OF MARINE MICROALGA Isochrysis SP.

NORHAYATI BINTI SUHAIMI

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NORHAYATI BINTI SUHAIMI

FACULTY OF VETERINARY MEDICINE

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By

NORHAYATI BINTI SUHAIMI

162710

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CERTIFICATION

It is hereby certified that I have read this project paper entitled '**Investigation on the use of blue and yellow LEDs for growth, proximate composition enhancement and morphology of marine microalga *Isochrysis* sp.**'.by Norhayati Binti Suhaimi and in my opinion it is satisfactory in terms of scope, quality and presentation as partial fulfillment of the requirement for the course VPD 4999 - Project.

PROF. DATO' DR. MOHAMED SHARIFF BIN MOHAMED DIN
DVM (Faizalabad), M. Sc. (Scotland), Ph. D. (Scotland)
Professor
Department of Veterinary Clinical Studies
Faculty of Veterinary Medicine
Universiti Putra Malaysia
(Supervisor)

DR. SANJOY BANERJEE
B. Sc. (India), M. Sc. (India), Ph. D. (India)
Fellow Researcher
Laboratory of Marine Biotechnology
Institute of Biosciences
Universiti Putra Malaysia
(Co-Supervisor)

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ABSTRAK

Abstrak kertas projek yang dikemukakan kepada Fakulti Perubatan Veterinar untuk memenuhi sebahagian daripada keperluan kursus VPD4999 – Projek

PENYIASATAN KE ATAS PENGGUNAAN DIOD PEMANCAR CAHAYA BIRU DAN KUNING UNTUK PERTUMBUHAN, KOMPOSISI PROKSIMAT DAN MORFOLOGI DALAM MIKROALGA LAUT *Isochrysis* sp.

NORHAYATI BINTI SUHAIMI

2016

Penyelia: Prof. Dato' Dr. Mohamed Shariff Bin Mohamed Din

Penyelia bersama: Dr. Sanjoy Banerjee

Mikroalga ialah organisma yang memerlukan cahaya sebagai sumber tenaga utama. Dalam kajian ini, perbandingan dalam pertumbuhan, komposisi proksimat dan morfologi mikroalga laut, *Isochrysis* sp. dilakukan dengan menggunakan diod pemancar cahaya (LED) biru dan kuning, manakala lampu pendafluor dijadikan sebagai kawalan. Pertumbuhan mikroalga diperhatikan selama 13 hari dan kesan perbezaan jenis lampu ke atas bilangan sel, ketumpatan optik dan kadar pertumbuhan spesifik dikenalpasti. Di akhir kajian ini, keputusan menunjukkan *Isochrysis* sp. yang disemai menggunakan lampu pendarfluor mempunyai nilai kadar pertumbuhan spesifik yang tertinggi manakala LED kuning dan biru menhasilkan nilai kadar pertumbuhan spesifik yang sama. LED

kuning dan lampu pendarfluor juga menghasilkan densiti sel yang tinggi. Mikroalga tersebut dituai apabila tiba fasa stasioner diikuti dengan analisis proksimat. *Isochrysis* sp. yang disemai mengunakan LED kuning mempunyai kandungan lipid yang tinggi. Manakala, komposisi protein menunjukkan ketinggian yang ketara di dalam *Isochrysis* sp. yang disemai menggunakan LED biru dan kuning. LED kuning dan lampu pendarfluor juga menghasilkan kandungan karbohidrat yang tinggi berbanding LED biru. Morfologi sel pada peringkat awal dan akhir pertumbuhan telah dikaji menggunakan mikroskop imbasan electron. Lampu pendarfluor mampu menghasilkan sel yang terbesar. Oleh itu, melalui kajian ini dapat disimpulkan bahawa LED kuning merupakan lampu yang optimum untuk penyemaian *Isochrysis* sp. Selain itu, perbezaan jenis lampu juga memberi kesan ke atas morologi sel mikroalga.

Kata kunci: Mikroalga, *Isochrysis* sp., Diod pmancar cahaya (LED), komposis proksimat, morfologi

ABSTRACT

An abstract of the project paper presented to the Faculty of Veterinary Medicine in partial fulfillment of requirement for the course VPD 4999 – Project

INVESTIGATION ON THE USE OF BLUE AND YELLOW LEDS FOR GROWTH, PROXIMATE COMPOSITION ENHANCEMENT AND MORPHOLOGY OF MARINE MICROALGA *Isochrysis* SP.

NORHAYATI BINTI SUHAIMI

2016

Supervisor: Prof. Dato' Dr. Mohamed Shariff Bin Mohamed Din

Co- Supervisor: Dr. Sanjoy Banerjee

Microalgae are photoautotrophic organisms that need light as their main energy source. In this study, the growth, proximate composition and morphology of marine microalga, *Isochrysis* sp., cultured under blue and yellow light-emitting diodes (LED) with fluorescent light as control were compared. Growth of the microalga was observed for 13 days and the effect of the three different light sources on cell count, optical density and specific growth rate were determined. At the end of the experiment, results showed that *Isochrysis* sp. cultured under fluorescent light had highest specific growth rate (SGR)while yellow LED and blue LED cultures had similar SGR. Yellow LED and fluorescent light produced higher cell density in culturing *Isochrysis*sp. The cultures were harvested during the stationary phase and proximate analysis was done. Lipid content

was significantly higher in *Isochrysis* sp. grown under yellow LED, whereas, protein composition was significantly higher in blue and yellow LED cultures. Yellow LED and fluorescent light cultures also had significantly high carbohydrate composition compared to blue LED cultures. Cell morphology was studied under scanning electron microscope during initial and final stage of the microalga cultures and fluorescent light produced the largest cells. Thus, it can be concluded that yellow LED had the optimum wavelength for *Isochrysis* sp. culture. Besides that, different wavelength of lights also affected the morphology of the microalga cells.

Keywords: Microalga, *Isochrysis* sp., LED light, proximate composition, morphology

1.0 INTRODUCTION

Microalgae are of strategic interest for aquaculture as they are an irreplaceable food for aquatic animals like mollusks, shrimps, and fish, especially for early stages (Richmond & Qiang, 2013). Microalgae are the primary food source for a large number of aquatic organisms and play a key role in aquaculture development. According to Cordoba-Matson *et al*. (2013), most of the microalgal species being grown commercially on a large scale are *Spirulina* sp. and *Chlorella* sp. for health food, along with a handful of other species principally used in aquaculture as live food for farmed species.

The microalgae cultivated are not only used as feed for aquatic animals, but have importance in the production of useful compounds, such as biofilters to remove nutrients and other pollutants from wastewaters, in cosmetic and pharmaceutical industry. Microalgae are also potentially good sources for biofuel production because of their high oil content and rapid biomass production (Sirakov *et al*. 2015).

Microalgae need light, carbon dioxide and nutrients for growth. Microalgae are photoautotrophic organisms that need light as their main energy source (Banerjee *et al*. 2011). Photoautotrophic organisms grow through photosynthesis by converting sunlight, carbon dioxide and a few nutrients, including nitrogen and phosphorous, into material known as biomass (Algae Biomass Organization, 2012). The effects of light intensity, temperature, salinity and nutrients on the growth and proximate composition of microalgae have been widely explored (Brown *et al*. 1997). Since there is an increase of demand for microalgae, we need to improve the growth and production of the microalgae. Sunlight is a good source for growth, however, in our tropical country,

Malaysia, we do not get continuous sunlight source especially during rainy season. Numerous investigations have been made on the optimal growth conditions for microalgae in the laboratory. The usage of light-emitting diodes (LEDs) is cost-saving plus the life-span is longer compared to fluorescent light that is commonly used in laboratory.

Thus, the objectives of this study are:

1) To evaluate the effects of different wavelengths of light on the growth and nutritional profile enhancement of *Isochrysis* sp.
2) To determine the morphology of *Isochrysis* sp. using different wavelengths of light.

The hypothesis for this study is:

$H_{o:}$ The different wavelength of light used will not influence the growth, nutritional profile and morphology of *Isochrysis* sp.

$H_{a:}$ The different wavelength of light used will influence the growth, nutritional profile and morphology of *Isochrysis* sp.

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