UNIVERSITI PUTRA MALAYSIA

INVESTIGATION ON THE USE OF RED AND YELLOW LIGHT-EMITTING DIODES (LEDS) TO PROMOTE GROWTH, PROXIMATE COMPOSITION AND CELL MORPHOLOGY OF MARINE MICROALGA TETRASELMIS SP.

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CERTIFICATION

It is hereby certified that we have read this project paper entitled "Investigation on the use of red and yellow light-emitting diodes (LEDs) to promote growth, proximate composition and cell morphology of marine microalga *Tetraselmis* sp.", by Nuur Fatin Binti Kamarul Zaman and in our opinion it is satisfactory in terms of scope, quality, and presentation as partial fulfilment of the requirement for the course VPD 4999 – Project

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ABSTRAK

Abstrak daripada kertas projek yang dikemukakan kepada Fakulti PerubatanVeterinar untuk memenuhi sebahagian daripada keperluan kursus VPD 4999 – Projek

Pengkajian penggunaan diod pemancar cahaya merah dan kuning dalam mengalakkan pembesaran, komposisi proksimat dan sel morfologi di dalam mikroalga marin *Tetraselmis*sp.

Oleh

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2016

Penyelia: Profesor DatoDr. Mohamed Shariff Mohamed Din

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Jarak gelombang cahaya yang berbeza mempengaruhi pembesaran dan komposis proksimat mikroalga marin *Tetraselmis sp.* dengan menggunakan diod pemancar cahaya merah dan kuning , lampu pendarfluor sebagai kawalan. Tiada perbezaan ketara ($p < 0.05$) di antara diod pemancar cahaya merah ,

kuning dan lampu pendarfluor sepanjang 11 hari kecuali lampu pendaflour lebih tinggi berbanding LED merah pada hari ke 12 & 13 pengkulturan dari sudut densiti sel , optikal sel dan spesifik kadar pertumbuhan spesifik. Kandungan lipid dan protein lebih tinggi di bawah diod pemancar cahaya merah , manakala komposisi karbohidrat tinggi di bawah lampu pendarflour. Dari sudut morfologi sel menggunakan *scanning electron microscope* (SEM), tiada perbezaan dari sudut morfologi sel diantara tiga lampu. Di dalam kajian ini menunjukkan fasa permulaan mempunyai bentuk eliptikal manakala eliptikal lebar pada fasa akhir. Tambahan lagi, kehadiran proses pembagian sel dan flagella dapat dijumpai. Keputusan kajian ini menunjukkant *Tetraselmis* sp. mempunyai persamaan dari sudut kadar pembesaran and dan morfologi sel di bawah lampu merah, kuning dan pendarfluor**.**

ABSTRACT

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

Investigation on the use of red and yellow light-emitting diodes (LEDs) to promote growth, proximate composition and cell morphology of marine microalga *Tetraselmis* sp.

By

Nuur Fatin Binti Kamarul Zaman

2016

Supervisor: Professor Dato Dr. Mohamed Shariff Mohamed Din

Co-supervisors: Dr Sanjoy Banerjee

The growth and proximate composition of marine microalga, *Tetraselmis* sp.using red and yellow color LEDs and fluorescent as a control were compared under different wavelengths. There were no significant differences ($p > 0.05$) between the red, yellow and fluorescent lights during the 11 days of culture except fluorescent light had higher cell density and optical density compared to red on day 12 & 13. However,specific growth rates showed similar values.

Lipid and protein content was significantly higher under red LEDs whereas, carbohydrate composition show significant higher under floursescent light. In terms of cell morphology observe under scanning electron microscope (SEM), the sizes of the cells among the treatments did not reveal significant difference. The cells were broad elliptical in initial stage and elliptical in final stagein in all three lights. There were also dividing cells and flagella observed on the cells. Final stage showss the cell is more folded especially under the yellow LED and significant difference between initial and final in term of size. The results showed that *Tetraselmis* sp. had similar growth rate, and and cell morphology under the red, yellow LEDs and fluorescent light wherease high carbohydrate in florescent light and high protein and lipid under red LED.

Key words: Growth, proximate composition, *Tetraselmis* sp. light wavelength, morphology

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1. INTRODUCTION

Microalgae are unicellular plants that are able to manufacture their own food material by photosynthesis. It is important in aquaculture development because it is one of the primary food sources for a large number of aquatic organisms. Microalgae need light as their main energy source thus it known as photoautotrophic organism. The effects of light intensity, salinity, media nutrients, and temperature, on the growth and proximate composition of microalgae have been widely explored (Brown et al., 1997). Furthermore, light conditions affect directly the growth and photosynthesis of microalgae.

In tropical countries, microalgae are used for larval feeding. It is produced in indoor hatcheries to avoid bio-contamination. Thus, indoor hatcheries are believed to improve the quality and reliability of microalgae production. According to Thompson et al., (1992) culturing microalgae outdoors under ambient conditions is less costly as compared to indoor. However outdoor production will exposed to high seasonal unpredictability and cause the cells exposed to rapid fluctuations to light and temperature. In addition, the climate where the microalgae are grown is often suboptimal as an example there is a lack of sufficient light during the rainy season due to cloud cover. Thus, all these parameters will influence the proximate composition and growth of the microalgae.

Recently, wavelength of light has been found to influence the growth of marine microalgae (Loong et al., 2014). Colored LEDs have a fixed wavelength and are considered to be more efficient than fluorescent light. Thus, it can

improve the quality and quantity of microalgae biomass (Martins, 2014). Adjusting the environmental conditions is one of the effective ways to optimize the growth rates of microalgae (Mata et al. 2010). Since LEDs have relatively narrow wavelengths bands, it allows them to produce specific wavelengths (color). Besides that it is easily obtained and in small size in various forms and is easy to use. LEDs also have an advantage in that it consumes low energy, and is easy to install that make LEDs more environmentally friendly than other sources of light. In addition, the LEDs do not produce as much heat as other types of lights. Thus it can prevent overheating of the growth medium surrounding the microalgae cells (Koc et al., 2013).

Hence, this study was undertaken to fulfil the following objectives:

i. To investigate the effects of red and yellow LEDs on the growth rate of *Tetraselmis* sp.

ii. To examine the effects of red and yellow LEDs on nutritional profile: protein, lipid and carbohydrate, content of *Tetraselmis* sp.

iii. To examine the morphology of *Tetraselmis* sp. cultured under the red and yellow LEDs

For this research, the following hypotheses were proposed:

1. Ho: There are no effects on growth and nutritional profile enhancement and morphology of microalgae culture using red and yellow LEDs.

2. Ha: There are effects on growth and nutritional profile enhancement and morphology of microalgae culture using red and yellow LEDs.

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