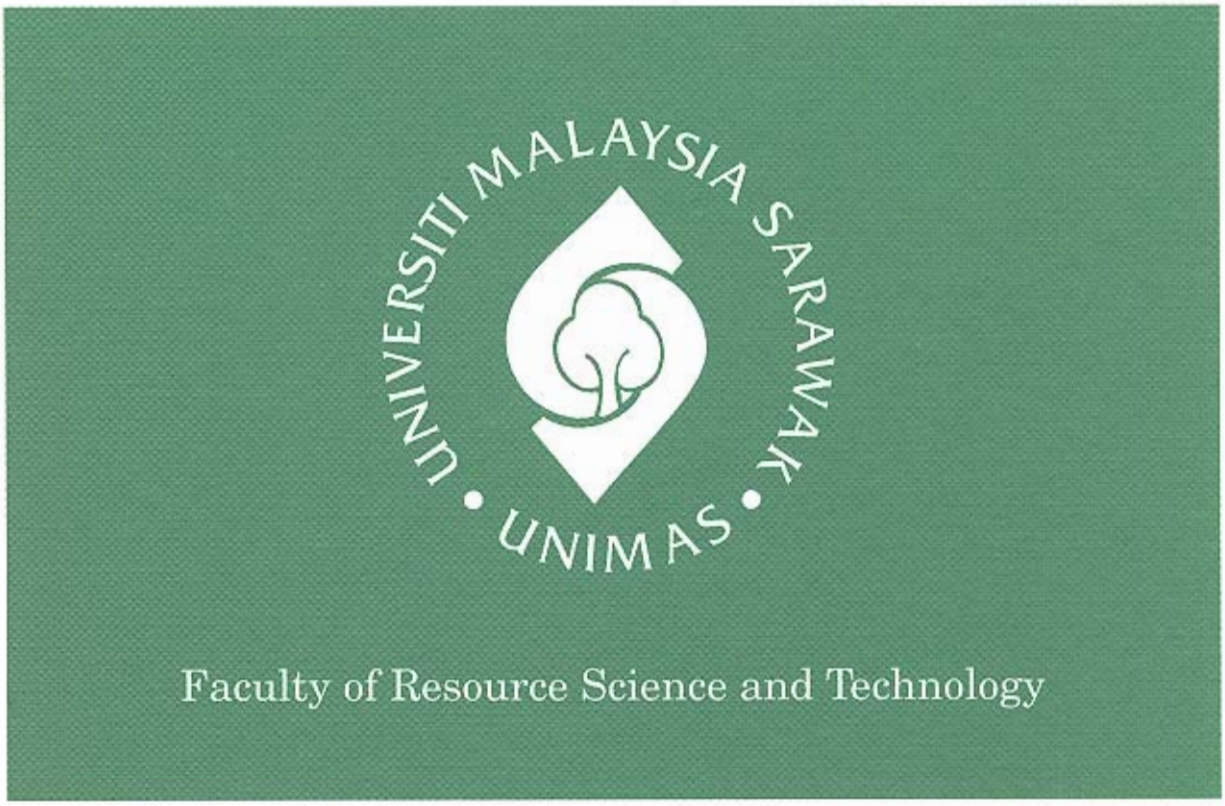

EFFECT OF LIGHT INTENSITY ON THE GROWTH OF *CHATTONELLA MARINA* SUBRAHMANYAN (RAPHIDOPHYCEAE)

Nor Akmar Binti Saili

Bachelor of Science With Honours
(Aquatic Resource Science and Management)
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Effect of Light Intensity on the Growth of *Chattonella marina* Subrahmanyan (Raphidophyceae)

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Abstract

Chattonella marina Subrahmanyan (Raphidophyceae), an organism that could cause the red tide phenomenon, were cultured in ES Medium at 26°C with salinity of 30PSU, light cycle of 12:12 hr photoperiod at 821µmol m^{-2} s^{-1}. Five light intensities were tested which is 0, 100, 300, 500 and 700 µmol m^{-2} s^{-1}. The culture showed maximum growth of 0.9461 divisions day^{-1} at 700 µmol m^{-2} s^{-1} in strain P1B4 and for strain P1C4 and P1D4, the division rate were at 0.8453 and 0.8190 divisions' day^{-1} respectively. However, no growths were observed at 0 µmol m^{-2} s^{-1}, which can be concluded that *C. marina,* cannot survive without light.

Key word: *Chattonella marina*, light intensity, growth, division rate.

Abstrak

Chattonella marina Subrahmanyan (Raphidophyceae), suatu organisma yang boleh mengakibatkan berlakunya fenomena ombak merah, telah dikulturkan secara berkelompok didalam media ES pada suhu 26°C, dengan saliniti 30 PSU dan dibawah pencahayaan 12:12 jam terang: gelap. Lima tahap keamatan cahaya telah diuji keatas kultur iaitu 0, 100, 300, 500 and 700 µmol m^{-2} s^{-1}. Kultur menunjukkan pertumbuhan yang maksima dengan kadar pembahagian 0.9461 sehari bagi strain P1B4 pada keamatan cahaya 700 µmol m^{-2} s^{-1}, 0.8453 dan 0.8190 sehari bagi strain P1C4 dan P1D4. Tiada pertumbuhan sel yang dapat dilihat pada keamatan cahaya 0 µmol m^{-2} s^{-1}, ini dapat disimpulkan bahawa *C. marina* tidak dapat hidup dengan ketiadaan cahaya.

Kata kunci: *Chattonella marina*, keamatan cahaya, pertumbuhan, kadar pembahagian.

Introduction

Red tide is a massive bloom of algae that causes major fish kill which then leads to significant damages to the fisheries economy (Van Den Hoek *et al.*, 1995; Nakamura and Watanabe, 1983b). Marine Raphidophyceans, such as *Chattonella* and *Fibrocapsa* are known for their ability to form toxic bloom. Raphidophyceans consists of nine genera, occurring in both freshwater and marine habitat (Van Den Hoek *et al.*, 1995). Fresh water species, usually exist in semi acidic water while the marine genera stays in the bottom sediment in the water column, only to germinate and becomes an active form during summer (Van Den Hoek *et al.*, 1995).

There are five species of *Chattonella* have been described to date; *C. marina, C. antiqua* (Hada), *C. globosa* (Y. Hara et Chihara), *C. subsalsa* (Biecheler) and *C. verruculosa* (Y. Hara et Chihara) (Hallegraeff and Hara, 1995). They can be distinguished from each other by their shapes, sizes and the number of chromosomes that they have (Hallegraeff and Hara, 1995). *Chattonella* was once called "Hornellia" in Japan (Nakamura and Watanabe, 1983a) because of its resemblance between *Hemieutrephia antiqua* and *Hornellia marina* (Takano, 1974) but then scientist agree to describe it under the name of *C. antiqua* as *Hornellia marina* was the same species as *Chattonella subsalsa* (Ono and Takano, 1980; Hara and Chihara, 1982).

The size of *Chattonella marina* (Plate 1, 2, 3) is within 30 - 70 μm long and 20 - 30 μm wide, where it is asymmetrical in lateral view, slightly flattened and oblong in shape with a posterior tail (Hallegraeff and Hara, 1995). They have 2 subequal flagella and have many chloroplasts, ranging from green to yellowish-brown in colour and are arranged radially (Hallegraeff and Hara, 1995).

Some species of *Chattonella* can produce brevetoxins (Onoue and Nozawa, 1989; Onoue *et al.*, 1990; Ahmed *et al.*, 1995a, b), which is a fatty acid that acts on gill tissue, producing mucus and suffocating the fishes (SMHI Oceanography Service. 1998). Recent studies demonstrate that a decrease in oxygen partial pressure of arterial blood is the earliest physiological disturbance observed in fish after exposure to *C. marina* (Ishimatsu *et. al.* 1991, Tsuchiyama *et. al.*, 1992 in Oda et. al., 2000). In addition, excessive mucus can be found on the gill surface, interfere the transferring of oxygen to the fish, resulting in asphyxia (Ishimatsu *et. al.*, 1996, Hishida *et. al.*, 1997 in Oda *et. al.*, 2000). Approximately 14 million cultured yellowtails were killed in 1972 along the coast of Harima Nada in the Seto Island Sea, Japan (Nishijima and Hara, 1986) due to this toxin. Brevetoxin, a neurotoxin was also responsible for the death of millions of fishes in the Gulf of Mexico (Baden, 1983).

There are many factors contributing to the blooming of microalgae. Light and temperature are known to affect the organisms' physiology, such as pigment composition, toxin composition and even its growth rate (Haque and Onoue, 2002). Other than that, water-column stratification during weak wind and temperature (20° – 22°C), which usually occur during the summer season (Graham and Wilcox, 2002), is also believed to have contributed to blooming of these microalgae. According to Nakamura and Watanabe (1983a), *C. antiqua* growth constants and final cell concentration reached maximum above $0.04d^{-1}$ in the light intensity of 0.023ly min^{-1} considering the temperature was 22.5°C. Haque and Onoue (2002) however find that *C. antiqua* and *C. marina* were best grown at 25ppt, at 25°C, pH 8.2 and the light intensity was 60μE m^{-2} s^{-2}.

Currently there are no studies done in Malaysia regarding *Chattonella*, since it hasn't done much damage to the Malaysian waters and there were no cases reported. Hopefully this

report will bring help to those who consider in studying the organisms, where it examines the effect of light intensity on the growth of *Chattonella marina* in order to determine the relative importance of this factor in the population dynamics of this species.

Materials and Methods

2.1 Culture

Cells of *Chattonella marina* were isolated from Selat Johor in August 2002 by Mr. Lim Po Teen. Cultures were maintained in ES (Enriched Seawater) Medium (Table 1) at 26°C under a photoperiod of 12:12 hour light and dark cycle supplied with white fluorescent light. The irradiance in the incubator was at 821 μmol m^{-2} s^{-1} and the salinity of the medium is 30 PSU. Three strains used for the experiments. These three strains were collected within the same time and location but were sub sampled individually.