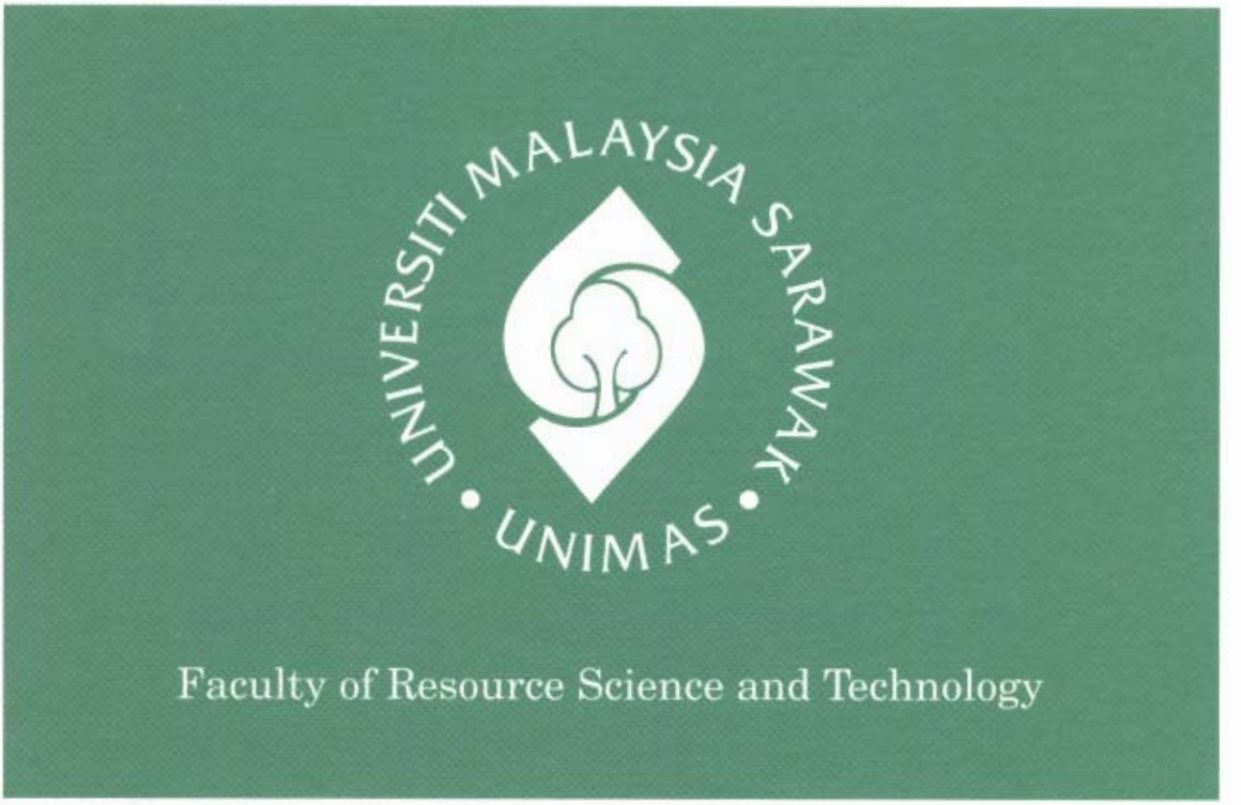

A STUDY ON THE PHYSIOLOGY OF DINOFLAGELLATE *ALEXANDRIUM TAYLORI* BALECH (DINOPHYCEACE) FROM MALAYSIA

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Bachelor of Science With Honours
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A study on the physiology of dinoflagellate *Alexandrium taylori* Balech (Dinophyceae) from Malaysia

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ABSTRACT

Key words : *Alexandrium taylori*, salinity, nitrate, division rate

A study of nitrogen source effect (nitrate, NO_3^-) and influence of salinity on the growth of *Alexandrium taylori* was carried out in batch culture. The clonal cultures was grown in ES medium with temperature 26°C and salinity of 33 PSU under a 12:12 hourr photoperiod. Under nitrate-unlimited culture, the strain showed optimal growth of 0.254 division day^{-1} and 3000 cells per mL whereas the division rate and cell yield in nitrate-limited culture is one-half compared to the nitrate-unlimited culture, indicating that the cells were indeed nitrate deficient. However, the spiking of $NaNO_3$ markedly enhanced the growth in nitrate-limited culture in which the cells increased significantly to c.a. 1800 cells per mL. However a similar addition of $NaNO_3$ had no effect on the nitrate-unlimited culture. In the study of salinity influence, cultures grown at salinity between 20 to 30 PSU showed considerable growth but no growth was observed at salinity 10 and 15 PSU. Optimal growth was observed at 20 PSU with 0.18 division day^{-1}. Further study on the effect of other environmental conditions and the toxins production is needed to gain better understanding of this species.

ABSTRAK

Kata kunci : *Alexandrium taylori*, saliniti, nitrat, kadar pembahagian

Satu kajian penggunaan sumber nitrogen (nitrat) dan kesan saliniti terhadap *Alexandrium taylori* telah dijalankan dalam kultur berkelompok. Kultur klonal *A. taylori* dibiakkan dalam medium ES, pada suhu 26°C, saliniti 33 PSU dan di bawah pencahayaan 12:12 jam terang:gelap. Kultur mengalami pertumbuhan optimum dengan kadar pembahagian 0.254 sehari dan densiti sel mencecah 3000 sel per mL pada keadaan pengkulturan nitrat tidak terhad manakala pada keadaan pengkulturan nitrat terhad, kadar pembahagian dan penghasilan sel adalah separuh daripada pengkulturan nitrat tidak terhad. Ini menunjukkan keperluan nitrat adalah tidak mencukupi untuk pertumbuhan optimum sel. Apabila penambahan nitrat dilakukan terhadap kultur nitrat terhad, densiti sel meningkat sehingga 1800 sel per mL tetapi pada kultur nitrat tidak terhad, peningkatan sel tidak berlaku. Dalam kajian terhadap kesan saliniti pula, pembahagian sel jelas berlaku pada saliniti antara 20 hingga 30 PSU tetapi sebaliknya tiada pembahagian sel pada 10 dan 15 PSU. Pertumbuhan optimum dikesan pada saliniti 20 PSU dengan kadar pembahagian 0.18 sehari. Kajian selanjutnya mengenai pengaruh persekitaran yang lain dan penghasilan toksin perlu dilakukan untuk memahami dengan lebih lanjut lagi mengenai spesies ini.

1.0 INTRODUCTION

Harmful algal blooms (HABs) also known as red tide has attracted global attention due to its huge impact on aquatic life and human health (Li *et al.*, 2001). These occurrences of toxic or harmful microalgae represent a significant and seemingly expanding threat to human health, fishery resources and marine ecosystems throughout the world and besides that, toxic and harmful blooms cause negative impacts and economic losses in many parts of the world. The consequences and mechanisms of impact blooms vary depending on the species involved (Gilbert & Pitcher, 2001). Generally, HAB species are classified into two main groups; the toxin producers that can contaminate seafood and kill fish and the high-biomass producers that are not toxic but causes anoxia that leads to mortalities of marine life after reaching dense concentration (Gilbert & Pitcher, 2001). Toxic harmful algal species causes several types of poisoning; *paralytic shellfish poisoning* (PSP), *diarrhetic shellfish poisoning* (DSP), *amnesic shellfish poisoning* (ASP), *ciguatera fish poisoning* (CFP) and *neurotic shellfish poisoning* (NSP).

Species from the genus *Alexandrium* represent the largest species groups known to cause HABs (30 identified species) though not all are toxin producers (Anderson, 1998). The genus *Alexandrium* are also responsible for the outbreaks of paralytic shellfish poisoning (PSP) in temperate coastal areas around the world (Anderson, 1989). Previously, five species are found in the Malaysian waters; *A. minutum* Halim, *A. tamarense* (Lebour) Balech, *A. leei* Balech, *A. affine* (Inoue and Fukuyo) Balech and *A. tamiyavanichii* Balech. Recently, *A. taylori* Balech was discovered from Muara Samariang. Two of the species, *A. minutum* Halim and *A. tamiyavanichii* Balech are

known to cause PSP (Usup *et al.*, 2002). The first PSP in Malaysia occurred in Sabah in 1976. Hundreds of poisoning cases and 22 fatalities have been reported (1976 – 1990). The first PSP incidence in Peninsula Malaysia was reported in 1991 in Sebatu, in the Straits of Malacca. The following incidence of PSP in Malaysia occurred in September 2001 in Tumpat, Kelantan on the east coast of Peninsula Malaysia. Those affected showed symptoms of PSP (Lim *et al.*, 2002).

It has been well documented that the genus *Alexandrium* produce potent neurotoxins responsible for *paralytic shellfish poisoning* (PSP) in coastal waters of Japan and other parts of the world (Hashimoto & Noguchi, 1989).

Alexandrium taylori is phototrophic marine dinoflagellates and in addition to a motile vegetative form, *A. taylori* had two benthic forms : temporary and resting cysts. According to Garces *et al.* (1998), in the present study the term 'resting cysts' is used for a dormant zygote and the term 'temporary cysts' for a temporally quiescent stage (Taylor, 1987). The first reported blooms attributed to this species and it produced recurrent blooms during the summer month (July and August) of 1994 to 1997 in NW Mediterranea (Garces *et al.*, 1998).

The wild vegetative cells of *A. taylori* had a mean length of 33.6 μm (range 26.3 – 42.7 μm, SD = 3.8 μm, n = 50). There are several chloroplast in the cytoplasm. The thecal morphology of this species is characterized by the complete disconnection of the P_0 and 1' plates and compared with *A. margalefi*, both species have a similar shape of the 1' plate and location of the ventral pore. Besides that, detailed analysis shows some fine