EFEECTS OF FLASHING LIGHT IN CULTIVATION OF MARINE MICROALGAE (*Chlorella* sp.) UTILIZING AIRLIFT PHOTOBIOREACTOR

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DEDICATION

This is especially dedicated to my beloved parent,

Mr. Lananan Mohamad and Mdm. Faridah Sapiee,

For their never ending love and who always pray for my success and guided me through life.

To my dear brother and sister,

Izzati and Mohd. Aimaduddin,

Thank you for supporting my visions and aspirations with love and encouragement, regardless of distance.

To my treasure friends,

Mohd. Mukriz Mohd. Kasim, Mohd. Fauzan Mamat Zawawi,
Mohd. Fazhan Mohd. Hanafiah, Abdul Al-Hafiz Ismail, Khor Wai Ho,
Ainnu Danial, Norasmah Mantali and Rajiah Nasir.

Thank you for your love, support, endurance and patience on me.

- Thank you very much -

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The fact that photoautotrophic cells may utilize strong light only if exposed to such light intermittently has long been recognized. It is known as the flashing light effects or shortly as FLE. Strong light was required to simulate FLE and due to that photo-inhibition characteristic of supplied illumination was determined at batch trial culture of six replicates. In this study, the frequency of FLE was varied by changing the aeration flowrate: 16.94, 25.07 and 49.28 mL s^{-1} which yield respectively the light exposure time of 3.99, 2.02 and 1.1 seconds per cycle. Cell growth in term of density in FLE-PBR was significantly higher at the exponential phase as compared to continuously illuminated culture (P = 5.62E-05, a = 0.05) under intermediate aeration flowrate. Maximal cell density yield of FLE-PBR and Bright-PBR was 31 671 and 28 242 cells mL^{-1} respectively. It is found that the growth performance under low flowrate was suppressed due to insufficient mixing action and low *Reynolds* number causing the formation of biofilm. On the other hand, too high *Reynolds* number had caused FLE-PBR to approach the characteristic of continuously illuminated Bright-PBR thus did not contributed to enhancement to microalgal growth. The determined best flowrate only leads to the understanding the significance of FLE. More detailed study should be done to determine the best possible optimum flowrate for maximum microalgal growth performance.

KESAN LIMPAHAN CAHAYA DALAM PERTUMBUHAN MIKROALGA MARIN (*Chlorella* sp.) MENGGUNAKAN PHOTOBIOREAKTOR ANGKUTAN UDARA

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Fakta bahawa kemungkinan untuk sel fotoautotrof menggunakan sinaran yang kuat dengan pendedahan secara limpahan telah lama diketahui. Kesan ini dikenali sebagai kesan kelipan cahaya secara ringkasnya FLE. Sinaran yang kuat diperlukan untuk simulasi kesan FLE dan disebabkan ini ciri foto-halangan pada sumber pencahayaan telah diuji pada peringkat percubaan kelompok yang terdiri daripada enam replikasi. Dalam kajian ini, frekuensi FLE telah dipelbagaikan melalui cara mempelbagaikan kadar alir pengudaraan: 16.94, 25.07 dan 49.28 mL s^{-1} yang memberikan tempoh pendedahan cahaya selama 3.99, 2.02 dan 1.1 saat setiap kitaran, masing-masing. Pertumbuhan sel dari segi ketumpatan dalam FLE-PBR adalah secara signifikan lebih tinggi daripada kultur sel yang dibekalkan cahaya berterusan PBR-Cerah (P= 5.62E-05, a= 0.05) pada kadar alir sederhana. Ketumpatan sel maksima pada FLE-PBR dan PBR-Cerah adalah masing-masing 31 671 dan 28 242 sel mL^{-1}. Prestasi tumbesaran pada kadar alir rendah adalah terbatas kerana kurang kesan pergolakan yang mengakibatkan pembentukan biofilem. Sebaliknya, nombor *Reynolds* yang terlalu tinggi menyebabkan FLE-PBR menghampiri ciri PBR-Cerah yang disinari cahaya berterusan yang tidak membawa kepada penambahbaikan prestasi tumbesaran. Kadar alir terbaik yang dikenalpasti hanya membawa kepada kefahaman terhadap kesan FLE. Kajian yang lebih mendalam untuk mengenalpasti kadar alir yang terbaik untuk prestasi tumbesaran alga yang maksimum harus dilakukan.