

HETEROTROPHIC CULTURE TRIALS ON MARINE MICROALGA
Chaetoceros species FOR BIODIESEL PRODUCTION

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FACULTY OF MARITIME STUDIES AND MARINE SCIENCE
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**HETEROTROPHIC CULTURE TRIALS ON MARINE MICROALGA, *Chaetoceros*
species FOR BIODIESEL PRODUCTION**

By

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**DEPARTMENT OF MARINE SCIENCE
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**DECLARATION AND VERIFICATION REPORT
 FINAL YEAR RESEARCH PROJECT**

It is hereby declared and verified that this research report entitled:

HETEROTROPHIC CULTURE TRIALS ON MARINE MICROALGA
 CHAETOCEROS SPECIES FOR BIODIESEL PRODUCTION

by GAN YEW SUN, Matric No. have
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LIST OF ABBREVIATIONS

°C	-	degree celcius
g	-	gram
µm	-	micrometre
mL	-	millilitre
L	-	litre
%	-	percentage
mg	-	milligram
rpm	-	revolutions per minute
psu	-	practical salinity unit
HCl	-	hydrochloric acid
SD	-	standard deviation
dH ₂ O	-	deionized water
HCL	-	hydrochloric acid

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ABSTRACT

Biodiesel was once developing in the early 1940s, however during the late 1940s, in terms of price and quality, biodiesel was being discredited by public for petroleum. But later, continued use of petroleum was known to be unsustainable due to intensified air pollution and magnified global warming. This helped biodiesel to regain back its confidence from the public. Since biodiesel was being established in numerous countries, potential raw material is crucially needed and experts have proven that microalgae as the most promising source for biodiesel production. However, cultivation method commonly used in microalgae industry was not able to satisfy the demand. Thus, an alternative method is needed. In this present study, the marine diatom, *Chaetoceros* sp. was selected and cultured using heterotrophic cultivation. The aim of this study is to determine (1) whether the marine diatom, *Chaetoceros* sp. can survive heterotrophically and (2) the glucose concentration (0.0 g.L⁻¹, 12.5 g.L⁻¹, 25.0 g.L⁻¹, 50.0 g.L⁻¹, 75.0 g.L⁻¹) that was optimum for specific growth rate, total lipid and triacylglycerol content. Two heterotrophic cultivation trials were conducted in total darkness condition using Conway medium. Slightly higher growth rates were obtained in all heterotrophic cultures than autotrophic culture. The highest growth rate was recorded at 25 g.L⁻¹ during second cultivation trial with the value of 0.8962d⁻¹. In addition, 25 g.L⁻¹ was also the only heterotrophic culture that produced detectable lipid content. The lipid in 25 g.L⁻¹ was 24.77 ± 4.97 % which is seven times higher compared to autotrophic culture. As for triacylglycerol content, there was no significant difference between autotrophic and heterotrophic *Chaetoceros* sp. ($p > 0.05$). Overall, the specific growth rate, total lipid and

triacylglycerol contents suggest that heterotrophic cultivation on marine *Chaetoceros* sp. is potentially feasible for biodiesel production.

PENCUBAAN KULTUR HETEROTROFIK KE ATAS DIATOM MARIN, *Chaetoceros* sp. BAGI PERNGELUARAN BIODIESEL

ABSTRAK

Biodiesel pernah berkembang di awal 1940-an, namun di akhir 1940-an, dari segi harga dan kualiti, biodiesel mula digugur oleh orang ramai disebabkan pengenalan petroleum. Akan tetapi, kelangsungan penggunaan petroleum telah dibuktikan tidak baik disebabkan ia melaratkan keadaan pencemaran udara dan pemanasan global. Hal ini telah membantu biodiesel untuk mengembalikan reputasi dan keyakinan dari orang ramai. Oleh sebab, pengembangan berlaku di pelbagai negara, bahan mentah yang berpotensi adalah amat diperlukan dan para ahli yang berkenaan telah membuktikan mikrolaga sebagai sumber yang berpotensi tinggi dalam penjanaaan biodiesel. Namun, kaedah kultur microalga yang biasa digunakan di jangka tidak dapat memenuhi permintaan pasaran. Oleh itu, kaedah alternative adalah amat diperlukan. Dalam kajian ini, diatom marin, *Chaetoceros* sp. telah dipilih untuk menjalankan kultur heterotrofik. Tujuan kajian ini adalah untuk membuktikan keberkesanan diatom marin, *Chaetoceros* sp. dalam menjalankan pertumbuhan heterotrofik dan kepekatan glukosa (0.0 g.L^{-1} , 12.5 g.L^{-1} , 25.0 g.L^{-1} , 50.0 g.L^{-1} dan 75.0 g.L^{-1}) yang optimum bagi factor kadar spesifikasi pertumbuhan, kandungan lemak dan triasilgliserol. Dua cubaan kultur heterotrofik telah dijalankan dalam keadaan gelap dengsn menggunakan media Conway. Kadar spesifikasi pertumbuhan yang tinggi diperolehi dalam semua heterotrofik kultur berbanding dengan autotrofik kultur. Kadar spesifikasi pertumbuhan yang tertinggi dicatatkan pada kepekatan glukosa 25 g.L^{-1} dalam cubaan heterotrofik kedua dengan nilai 0.8962 d^{-1} . Tambahan

pula. 25 g.L^{-1} heterotrofik kultur merupakan satu-satunya heterotrofik kultur yang mampu menghasilkan kadar lemak yang dapat dikenalpasti. Peratusan lemak yang dicatat adalah $24.77 \pm 4.97 \%$ di mana adalah jauh lebih tinggi berbanding dengan autotrofik kultur. Menjurus kepada kandungan triasigliserol, tiada perbezaan yang jelas di antara *Chaetoceros* sp. dari autotrofik dan heterotrofik. Secara keseluruhannya, kadar spesifikasi pertumbuhan, kandungan lemak dan triasigliserol menunjukkan bahawa *Chaetoceros* sp. marin adalah berkemampuan dalam pengeluaran bioidiesel.