INFLUENCE OF NITROGEN SOURCES ON GROWTH PROFILE AND THEIR KINETIC STUDIES IN NEWLY ISOLATED ACIDOPHILIC MICROALGAE, *COCCOMYXA DISPAR* AND *SCENEDESMUS PARVUS*

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by

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A dissertation submitted in the partial fulfillment of the requirements for the degree of
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School of Industrial Technology
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DECLARATION BY AUTHOR

This dissertation is composed of my original work, and contains no material previously published or written by another person except where due reference has been made in the text. The content of my dissertation is the result of work I have carried out since the commencement of my research project and does not include a substantial part of work that has been submitted to qualify for the award of any other degree or diploma in any university or other tertiary institution.

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LIST OF SYMBOLS AND ABBREVIATIONS

Symbol	Caption
+	plus
-	minus
±	plus-minus
=	equal
%	percent
<	less than
^{o}C	degree Celsius
e.g.	for example
H_2O	water
HCl	Hydrochloric acid
CO_2	carbon dioxide
O_2	oxygen
Mg^{2+}	magnesium ion
Ca^{2+}	calcium ion
K^{+}	potassium ion
$(NH_2)_2CO$	urea
H_2CO_3	carbonic acid
NH_3	ammonia
NH_4^{+}	ammonium
NO_3^{-}	nitrate
NO_2^{-}	nitrite

Abbreviation	Caption
cm	centimetre
day $^{-1}$	per day
DNA	deoxyribonucleic acid
EC	Enzyme commission number
g	gram
g L^{-1} day^{-1}	gram per litre per day
h	hour
L min^{-1}	litre per minute
Lux	luminious flux per unit area
mg L^{-1}	milligram per litre
mL	millilitre
mM	millimolar
nm	nanometre
OD_{680}	optical density at wavelength 680 nanometre
pKa	ion dissociation constant
R^2	correlation coefficient
RNA	ribonucleic acid
rpm	revolutions per minute
sp.	species
SD	standard deviation
USD	United States Dollar
µmol photons m^{-2} s^{-1}	micro mol photons per metre square per second
v/v	volume per volume
w/v	weight per volume

KESAN NITROGEN TERHADAP PROFIL PERTUMBUHAN DAN KAJIAN KINETIK DUA MIKROALGA ASIDOFILIK, *COCCOMYXA DISPAR* DAN *SCENEDESMUS PARVUS*

ABSTRAK

Biojisim mikroalga merupakan bahan mentah yang diperbaharui sesuai sebagai tenaga baharu pada masa depan. Walaubagaimanapun, penghasilan biojisim yang rendah tetap menjadi cabaran yang harus dikuasai dan beberapa faktor telah dikenalpasti untuk meningkatkan penghasilan biojisim. Nitrogen yang merupakan makronutrien menjadi unsur yang penting untuk dikaji kerana nitrogen yang sesuai dapat mengubah tapak jalan metabolik mikroalga dan seterusnya meningkatkan penghasilan biojisim. Walaupun banyak kajian tentang kesan nitrogen terhadap spesies mikroalga yang berbeza telah dijalankan, namun maklumat tentang kesan nitrogen terhadap spesies mikroalga *Coccomyxa dispar* dan *Scenedesmus parvus* masih kurang. Kajian ini telah dijalankan untuk mengkaji kesan nitrogen dengan mengkulturkan *Coccomyxa dispar* dan *Scenedesmus parvus* dalam Medium Bold Basal yang kekurangan nitrogen tetapi digantikan dengan amonium sulfate, sodium nitrat dan urea dalam kepekatan 0.1 peratus berat isipadu. Data kinetik pertumbuhan juga dibandingkan dengan menggunakan tiga model pertumbuhan (Logistik, Gompertz dan Baranyi-Roberts). Keputusan menunjuk bahawa kesan nitrogen terhadap penghasilan biojisim kedua-dua mikroalga adalah berbeza ketara. Sodium nitrat merupakan nitrogen yang terbaik untuk meningkatkan penghasilan biojisim bagi *Coccomyxa diapar* dan *Scenedesmus parvus* dengan menghasilkan produktivti biojisim masing-masing sebanyak 0.080 g L^{-1} $hari^{-1}$ and 0.037 g L^{-1} $hari^{-1}$. Keputusan juga menunjukkan model Logistik paling sesuai kepada *Coccomyxa diapar* (R^2 0.9954) dan model Baranyi-Roberts paling sesuai kepada *Scenedesmus parvus* (R^2 0.9972) untuk meramalkan profil kadar pertumbuhan mikroalga.

INFLUENCE OF NITROGEN SOURCES ON GROWTH PROFILE AND THEIR KINETIC STUDIES IN NEWLY ISOLATED ACIDOPHILIC MICROALGAE, *COCCOMYXA DISPAR* AND *SCENEDESMUS PARVUS*

ABSTRACT

Microalgae are potential candidates to be sustainably developed in the future as a new energy resource. However, low biomass production remains a big challenge to be tackled. Several factors had been tested to increase biomass production including abiotic and biotic factors. Nitrogen is the macronutrient in which uptake is of particular importance. This is because by supplying suitable nitrogen sources, metabolic pathways can be manipulated thus expand the production capabilities of microalgae. Despite many studies conducted on effect of nitrogen sources in different microalgae species, there is still limited information on *Coccomyxa dispar* and *Scenedesmus parvus.* Thus, this research is conducted to determine the influence of nitrogen sources on two acidophilic microalgae strains, *Coccomyxa dispar* and *Scenedesmus parvus* through cultivating them in nitrogen-deficient Bold Basal Medium (BBM) supplemented with 0.1% w/v ammonium sulphate, sodium nitrate and urea. The growth data were fitted into three mathematical models (Logistic, Gompertz and Baranyi-Roberts) to analyse the cell growth profile. Results indicated that both microalgae strains were significantly influenced by the type of nitrogen sources. With the best nitrogen source (0.1% w/v sodium nitrate), the biomass productivity achieved by *C. dispar* (0.080 g L^{-1} day $^{-1}$) was almost double compared to *S. parvus* (0.037 g L^{-1} day $^{-1}$). Besides, Logistic model model was the most suitable kinetic growth model for *Coccomyxa dispar* with R^2 of 0.9954 and standard error of estimate of 0.0251 while Baranyi-Roberts model was the most suitable kinetic growth model for *Scenedesmus parvus* with R^2 of 0.9972 and standard error of estimate of 0.0098, to predict the growth profile when cultivated in 0.1% w/v sodium nitrate.