

**DETERMINATION OF THE EFFECT OF pH ON
MICROALGAL GROWTH AND PROTEIN
CONTENT IN LOCALLY ISOLATED
TETRASELMIS SUECICA AND
*SCENEDESMUS PARVUS***

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UNIVERSITI SAINS MALAYSIA

JUNE 2020



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TETRASELMIS SUECICA AND
*SCENEDESMUS PARVUS***

By

YEONG KAH CHUEN

A dissertation submitted in the partial fulfilment of the requirements for the degree of
Bachelor of Technology (B.Tech) in the field of Bioprocess Technology
School of Industrial Technology
Universiti Sains Malaysia

June 2020

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.



YEONG KAH CHUEN

JUNE 2020

ACKNOWLEDGEMENT

First and foremost, I would like to express my gratitude and my deep appreciation to Dr. Mohd Asyraf Kassim, my final year project supervisor for his guidance and valuable advices throughout my research. He always shared his knowledge with me and provide suggestions, support and encouragement that really helped me in my research and thesis writing.

Other than that, I would also like to express my gratitude to the lab assistances of School of Industrial Technology, Mr Azmaizan Yaakub, Madam Najmah Hamid, and Madam Noraida Bukhari for their helps throughout my research work. I would also like to acknowledge the School of Industrial Technology for allowing me to use the facilities and equipment available. Apart from that, I also like to express my gratitude to the postgraduate's seniors, Mr Tan Kean Meng and Miss Ramizah binti Kamaludin for their elevating encouragement and inspiration for me throughout this projects.

Furthermore, I would like to thank my friends and course mate that always encourage and support me. Last but not least, sincere thanks to my parents for their moral support and love.

YEONG KAH CHUEN

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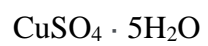
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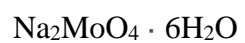
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LIST OF SYMBOLS AND ABBREVIATIONS

Symbol	Caption
%	Percentage
±	Plus minus
<	Smaller than
>	Larger than
°C	Degree Celsius
H ₂ O	Distilled Water
CO ₂	Carbon dioxide
US\$	American dollar
NaNO ₃	Sodium Nitrate
MgSO ₄ · 7H ₂ O	Magnesium sulphate
NaCl	Sodium Chloride
K ₂ HPO ₄	di-Potassium hydrogen Orthophosphate
KH ₂ PO ₄	Potassium dihydrogen Orthophosphate
CaCl ₂ · 2H ₂ O	Calcium chloride
ZnSO ₄ · 7H ₂ O	Zinc sulphate
MnCl ₂ · 4H ₂ O	Manganese chloride
CuSO ₄ · 5H ₂ O	Cupric Sulphate
Na ₂ MoO ₄ · 6H ₂ O	Sodium molybdate
KOH	Potassium Hydroxide
FeSO ₄ · 7H ₂ O	Ferrous sulphate
H ₂ SO ₄	Sulphuric acid
ZnSO ₄ · 7H ₂ O	Zinc sulphate
MnCl ₂ · 4H ₂ O	Manganese chloride



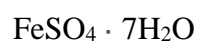
Cupric Sulphate



Sodium molybdate



Potassium Hydroxide



Ferrous sulphate



Sulphuric acid

LIST OF ABBREVIATION

Abbreviation	Caption
UN	United Nation
kg	Kilogram
g	Gram
mg	Milligram
L	Litre
mL	Millilitre
m	Meter
nm	Nanometer
h	Hours
min	Minutes
s	Second
SCP	Single Cell Protein
w/w	Weight/weight
v/v	Volume/volume
rpm	Rotation per minutes
FAO	Food and Agriculture Organization
BBM	Bold Basal Medium
OD	Optical Density

**PENGARUH pH TERHADAP PERTUMBUHAN MIKROALGA DAN
KANDUNGAN PROTEIN DALAM *TETRASELMIS SUECICA*
DAN *SCENEDESMUS PARVUS***

ABSTRAK

Pengkulturan mikroalga spesis yang kaya dengan protein dianggap sebagai satu penyelesaian untuk mengurangkan jurang protein yang diakibatkan oleh peningkatan populasi global. Walaubagaimanapun, produktiviti protein dan pertumbuhan mikroalga akan dipengaruhi oleh keadaan kultivasi. Oleh itu, projek ini dirangka untuk meneroka potensi mikroalga tempatan yang diperincikan sebagai sumber protein sel tunggal di mana *Tetraselmis suecica* dan *Scenedesmus parvus* dihidupkan dalam media dengan menggunakan pH awal yang berbeza iaitu pH 3.00 hingga pH 9.00. Profil kinetik pertumbuhan kedua-dua mikroalga tersebut telah dikenalpastikan selama 13 hari. Kandungan dan produktiviti protein biojisim mikroalga ditentukan melalui kaedah Kjeldahl. Akhir sekali, model kinetik yang bersesuaian untuk pertumbuhan kedua-dua mikroalga dalam media pH yang berbeza turut dikenalpasti menggunakan model Logistic, model Gompertz dan model Baranyi-Roberts. Maksimum biojisim bagi *T. suecica* diperolehi pada pH 5.00 dengan kepekatan $157.842 \pm 4.507 \text{ mg L}^{-1}$ manakala maksimum biojisim bagi *S. parvus* diperolehi pada pH 7.00 dengan kepekatan $154.447 \pm 3.030 \text{ mg L}^{-1}$. Produktiviti biojisim tertinggi bagi *T. suecica* diperolehi pada pH 5.00 dan *S. parvus* diperolehi pada pH 7.00 masing-masing adalah $9.767 \pm 0.003 \text{ mg L}^{-1}\text{d}^{-1}$ dan $10.132 \pm 0.239 \text{ mg L}^{-1}\text{d}^{-1}$. Selain itu, kandungan protein serta produktiviti protein tertinggi bagi *T. suecica* diperolehi pada pH 5.00 adalah $44.704 \pm 0.785 \%$ dan $4.366 \pm 0.077 \text{ mg L}^{-1}\text{d}^{-1}$ manakala kandungan protein serta produktiviti protein tertinggi bagi *S. parvus* diperolehi pada pH 7.00 adalah $36.93 \pm 1.039 \%$ dan $3.742 \pm 0.105 \text{ mg L}^{-1}\text{d}^{-1}$. Selain itu, analisis model kinetik untuk pertumbuhan *T. suecica* dan *S. parvus* pada media

nilai pH yang berbeza menunjukkan pemadanan yang tinggi bagi model Logistic masing-masing dengan nilai R^2 0.976 dan 0.982.

**DETERMINATION OF THE EFFECT OF pH ON MICROALGAL
GROWTH AND PROTEIN CONTENT IN LOCALLY
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ABSTRACT

Mass production of certain protein rich microalgae as single cell protein was considered as a possibility to minimise the protein gap due to increasing of global population. However, the protein productivity and the growth of the microalgae will be affected by the cultivation condition during the mass production. Thus, this project is to explore the possibility of the locally isolated microalgae as a single cell protein source where both microalgae *Tetraselmis suecica* and *Scenedesmus parvus* were cultivated in different initial pH cultivation medium (pH 3.00 to pH 9.00). The growth kinetic and growth profile of the microalgae over 13 day's cultivation period were determined. The protein content as well as the protein productivity of the microalgae biomass were determined using Kjeldahl method. Lastly, suitable kinetic growth model for both microalgae under different pH medium was also determined among Logistic model, Gompertz model and Baranyi-Roberts model. The maximum biomass concentration and highest biomass productivity for *T. suecica* was obtain at pH 5.00 with $157.842 \pm 4.507 \text{ mg L}^{-1}$ and $9.767 \pm 0.003 \text{ mg L}^{-1}\text{d}^{-1}$ respectively while maximum biomass concentration and highest biomass productivity for *S. parvus* was obtain at pH 7.00 with $154.447 \pm 3.030 \text{ mg L}^{-1}$ and $10.132 \pm 0.239 \text{ mg L}^{-1}\text{d}^{-1}$ respectively. The maximum protein content and highest protein productivity of *T. suecica* was obtained at pH 5.00 with $44.704 \pm 0.785 \%$ and $4.366 \pm 0.077 \text{ mg L}^{-1}\text{d}^{-1}$ while maximum protein content and highest protein productivity of *S. parvus* were obtained at pH 7.00 with $36.93 \pm 1.039 \%$ and $3.742 \pm 0.105 \text{ mg L}^{-1}\text{d}^{-1}$ respectively. The results of the kinetic model analysis of both microalgae strain growth at different

initial pH medium fitted well to the Logistic model with average R^2 value of 0.9759 and 0.9842, respectively.