



**EFFECT OF DIFFERENT NITROGEN
CONCENTRATIONS ON THE GROWTH,
PROXIMATE AND BIOCHEMICAL
COMPOSITION OF FRESHWATER MICROALGA
Scenedesmus sp.**

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Session: 2020-2021

**A thesis submitted in the partial fulfillment of the requirements for the degree of
Master of Science in Aquaculture**

**Department of Aquaculture
Faculty of Fisheries
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JUNE, 2021

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June, 2021

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This is to certify that we have examined the above Master's thesis and have found that is complete and satisfactory in all respects, and that all revisions required by the thesis examination committee have been made.

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Acknowledgements

First and foremost, I give thanks to **Allah**, who has blessed me with the ability and strength to complete my MS research project as well as the thesis on time.

My heartfelt gratitude and respects to my loving parents and siblings for their unwavering support, inspirations, moral support, kindness and blessings, forbearance, and unending love in helping me finish this study.

With great pleasure, I would like to express my sincere gratitude, profound regards, and immense indebtedness to my honorable teacher and research supervisor, **Professor Dr. Mohammed Nurul Absar Khan** (Department of Fishing and Post-Harvest Technology, Faculty of Fisheries, CVASU), to my co-supervisor **Dr. Helena Khatoon** (Assistant Professor, Department of Aquaculture, CVASU) and to my honorable teacher **Mohammad Redwanur Rahman** (Assistant Professor, Department of Aquaculture, CVASU) for their valuable suggestions, constructive criticism, and constant inspiration throughout the study and manuscript preparation. I feel extremely fortunate to have had the opportunity to work with Dr. Helena Khatoon. She is constantly supportive for me and willing to take time out of her busy schedule to advise and correct me on my study.

I am grateful to my respected teachers **Joyshri Sarker** (Assistant Professor, Department of Aquaculture, CVASU) and **Ishrat Zahan Anka** (Assistant Professor, Department of Aquaculture, CVASU) for their kind cooperation, helpful suggestions, and constructive criticism during the research period and thesis work.

I would like to express my gratitude to the **Bangladesh Fisheries Research Institute (BFRI)** for providing me the additional funding I needed to complete my research. I would like to especially thank **Chattogram Veterinary and Animal Sciences University** for granting me the laboratory facilities required for the research work.

I would like to convey cordial thanks to my friends, all laboratory attendants and well-wishers for their co-operation, cheerfulness and inspiration during the course of this study.

The Author
June, 2021

List of Publications

Publications	Status
Khatoon H., Penz K.P., Banerjee S., Rahman M.R., Minhaz T.M., Islam Z., Mukta F.A. , Nayma Z., Sultana R., Amira K.I. 2021. Immobilized <i>Tetraselmis</i> sp. for reducing nitrogenous and phosphorous compounds from aquaculture wastewater. <i>Bioresource Technology</i> . 338: 125529.	Published
Khatoon H., Leng M.Y., Rahman M.R., Sarker J., Minhaz T.M., Sultana R., Nayma Z., Mukta F.A. 2021. Efficiency of <i>Chlorella vulgaris</i> beads in improving water quality and growth of juvenile siamese fighting fish (<i>Betta splendens</i>). <i>Bangladesh Journal of Veterinary and Animal Sciences</i> . 9 (1): 74-86.	Published
Usha S.Z., Rahman M.R., Sarker J., Hasan S.J., Sultana R., Nayma Z., Mukta F.A. , Khatoon H. 2021. Cultivation of <i>Chlorella vulgaris</i> in aquaculture wastewater as alternative nutrient source and better treatment process. <i>Bangladesh Journal of Veterinary and Animal Sciences</i> . 9 (1): 43-51.	Published
Nayma Z., Khatoon H., Rahman M.R., Mukta F.A. , Sultana R., Hossain M.N., Iqbal M.Z. 2021. A comparative study on the productivity of selected tropical freshwater microalgae. <i>Bangladesh Journal of Fisheries</i> . 33 (2): 255-264.	Published
Nayma Z., Khatoon H., Rahman M.R., Mukta F.A. , Sultana R. 2022. Comparative study of growth, pigments and proximate composition of selected indigenous freshwater microalgae isolated from Bangladesh. <i>Journal of Innovation in Applied Research</i> .	Accepted (In press)
Mukta F.A. , Khatoon H., Rahman M.R., Acharjee M.R., Newase S., Nayma Z., Sultana R., Hasan S.J. 2022. Effect of different nitrogen concentration on the growth, proximate and biochemical composition of freshwater microalgae <i>Scenedesmus communis</i> . <i>Journal of Energy and Environmental Sustainability</i> . 11: 36-42.	Published
Sultana R., Khatoon H., Rahman M.R., Haque M.E., Nayma Z., Mukta F.A. 2022. Potentiality of <i>Nannochloropsis</i> Sp. As Partial Dietary Replacement of Fishmeal on Growth, Proximate Composition, Pigment and Breeding Performance in Guppy (<i>Poecilia reticulata</i>). <i>Bioresource Technology Reports</i> .	Published

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List of Abbreviations

Acronym	Definition
sp.	Species
BBM	Bold Basal Media
BG-11	Blue Green-11
N	Nitrogen
CD	Cell Density
OD	Optical Density
DO	Dissolve Oxygen
SGR	Specific Growth Rate
t_d	Cell Doubling Time
ppt	Parts Per Thousand
ppm	Parts Per Million
pH	Power of Hydrogen
°C	Degree Celcius
VP	Volumetric Productivity
LP	Lipid Productivity
AP	Areal Productivity
hr	Hour
μ	Micro
mL	Mili Liter
L	Liter
$\mu\text{Em}^{-2} \text{s}^{-1}$	Microeinsteins per Second per Square Meter
mg	Miligram
nm	Nanometer
cm	Centimeter
lbs	Pound
Rpm	Revolutions per Minute
T1	Treatment 1 (13 g/L NaNO ₃)
T2	Treatment 2 (19 g/L NaNO ₃)
C	Control (25 g/L NaNO ₃)

T3	Treatment 3 (31 g/L NaNO ₃)
T4	Treatment 4 (37 g/L NaNO ₃)
Ch-a/ C _a	Chlorophyll a
Ch-b/ C _b	Chlorophyll b
TE	Transesterification
FAMES	Fatty-Acid Methyl-Esters
GCMS	Gas Chromatography Mass Spectrometry
TAGs	Triacylglycerides
SFAs	Saturated Fatty Acids
PUFAs	Poly Unsaturated Fatty Acids
MUFAs	Monounsaturated Fatty Acids
HUFAs	Highly Unsaturated Fatty Acids
PG	Phosphatidylglycerol
n3 Fatty Acids	Omega 3 Fatty Acids
n6 Fatty Acids	Omega 6 Fatty Acids
Sl. No.	Serial Number

Abstract

Scenedesmus sp. has grabbed attention nowadays due to its nutritious constituents such as protein, lipids, carbohydrates, and other vital trace elements, as well as potential viability as bioresource for application as fish feed, supplement, human consumption and biofuel production. Nitrogen plays an important role in microalgal cell growth, lipid accumulation, as well as production of protein, carbohydrate and pigments. The aim of this study was to enrich the growth, pigment, proximate and biochemical composition of freshwater microalgae *Scenedesmus* sp. cultured under different NaNO₃ concentration. *Scenedesmus* sp. was cultured in five treatments of different NaNO₃ concentrations as 13 g/L (T1), 19 g/L (T2), 25 g/L (control), 31 g/L (T3), and 37 g/L (T4) in Bold Basal Media having stationary phases on day 7, 8, 9, 10, 11 respectively. Significantly ($p < 0.05$) maximum cell density (11.6×10^6 cells/ml), biomass productivity (0.58g/L), total chlorophyll, protein (23.58% dry weight) and carbohydrate (27.26% dry weight) were found in highest concentration (37 g/L) of NaNO₃ compared to control and lower concentration. On the contrary, lowest (13 g/L) concentration of NaNO₃ resulted in significantly highest lipid (20.92% dry weight), specific growth rate ($0.521 \pm 0.01 \text{ day}^{-1}$), monounsaturated fatty acids (28.53% of total fatty acids) and polyunsaturated fatty acids (67.37% of total fatty acids). In case of carotenoid and total phycobiliprotein content, significantly ($p < 0.05$) higher value of 6.43 mg/L and 6.14 mg/g, respectively were produced in control (25 g/L NaNO₃) compared to other concentration of NaNO₃. Significantly ($p < 0.05$) highest value of total saturated fatty acids was found (56.51% of total fatty acids) in 31 g/L concentration of NaNO₃. Therefore, higher concentrations of NaNO₃ boosted the growth and nutritional profile in *Scenedesmus* sp. Moreover, lipid production and fatty acid profile were enriched by the lowest concentration of NaNO₃ showing economic and sustainable commercial mass culture of *Scenedesmus* sp.

Keywords: *Scenedesmus* sp., Nitrogen stress, Growth curve, Pigments, Proximate composition, Fatty acid