Nitrogen Dependent Regulation of Amylase and Protease Production in Marine Microalgae from Coastal and Hypersaline Environments of Sri Lanka

S.M.A.S. Samarakoon*, I.V.N. Rathnayake
Department of Microbiology, Faculty of Science, University of Kelaniya, Sri Lanka
*Anupama.samarakoon20@gmail.com

Marine microalgae are microscopic, photosynthetic organisms. They are promising sources of industrially important enzymes. Despite Sri Lanka's extensive coastline, the diversity and biotechnological potential of microalgae remain poorly documented. This study aimed to isolate, purify, identify, and evaluate microalgal strains for intracellular amylase and protease production under different nitrogen conditions. Three microalgal strains were isolated and identified preliminarily based on their morphology. Two pennate diatoms, morphologically identified as *Nitzschia* sp. (isolate 22) and *Navicula* sp. (isolate 7) from the class Bacillariophyceae, and *Chlorella* sp. (isolate SG) from the class Chlorophyceae were identified. Isolates were evaluated for intracellular amylase and protease production by harvesting cells grown under three nitrogen conditions (12.35 mg L^{-1}, 6.18 mg L^{-1}, and 0 mg L^{-1} chosen to represent standard, moderate nitrogen limitation and complete nitrogen starvation) on F/2 medium by centrifugation, cells were disrupted by sonication and amylase and protease activities were determined in triplicate using standard colorimetric assays (580 nm and 660 nm respectively) and expressed as U per 10^6 cells after normalization to hemocytometer cell counts. Nitrogen reduction significantly induced amylase and protease activities in all three isolates (one-way ANOVA followed by Tukey's HSD test, $p < 0.05$), with mean activities increasing from standard to nitrogen-free conditions. These results suggest that nitrogen limitation is an effective strategy for inducing enzyme production in marine microalgae, particularly the isolated pennate diatoms. Under nitrogen stress, microalgae redirect resources to produce degradative enzymes to recycle internal nitrogen. These organisms can be a cost-effective and environmentally friendly alternative to conventional microbial sources for sustainable enzyme production with applications in food, detergent, and pharmaceutical industries, supporting the blue bioeconomy and contributing to ocean resource sustainability.

Keywords: *Marine microalgae, Amylase, Protease, Nitrogen limitation*

Acknowledgement: This work was supported by the University of Kelaniya research grant RP/03/02/03/02/2023