

## ABSTRACT

Aisyah Hasna Hanifah, 24020222120010. **Optimization of *S. maxima* Microalgae Cultivation with Zinc Mineral Addition to Increase Protein, Carbohydrate, Lipid, and Carbon Dioxide Absorption.** Under the guidance of Wijanarka and Nur Faiizah Aqilah Firman.

*Spirulina maxima* has the potential to be developed as a functional food source due to its high protein, carbohydrate, and lipid content, especially in protein, as well as its ability to absorb carbon dioxide. This study aims to determine the effect of zinc (Zn) addition on growth patterns, morphology, carbon absorption, and protein, carbohydrate, and lipid content of *S. maxima*. The study was conducted through the stages of Zarrouk media preparation, pre-culture, main cultivation with control and variation of  $\text{ZnSO}_4 \cdot 7\text{H}_2\text{O}$  concentration (5, 10, 15 ppm), morphological analysis of *S. maxima*, and analysis of optimum zinc to support growth, increase protein, carbohydrate, lipid content, and carbon dioxide absorption. The zinc content in biomass was analyzed using nitric acid digestion and measured by Atomic Absorption Spectrophotometers (AAS). Analysis of protein content was carried out using the Lowry method, carbohydrates with the phenol-sulfate method, and lipids with the Bligh & Dyer method. The results of the study of zinc addition to *S. maxima* cultivation for 14 days showed that the optimum growth phase and the best harvest time occurred on the 8th day, with the highest biomass in the 5 ppm Zn treatment (2.813 g/L) which also produced a maximum  $\text{CO}_2$  fixation rate of 0.291 g/L/day. Increasing the Zn concentration to 15 ppm caused a decrease in biomass, but significantly increased the biochemical content of the cells, namely protein (61%), carbohydrates (20%), and lipids (11%) as an adaptive response to stress. Overall, the 5 ppm concentration is the most optimal condition for growth and produce biomass, while higher concentrations are toxic, diverting metabolism from growth to cell defense mechanisms.

**Keywords:** *Spirulina maxima*, zinc, carbon dioxide absorption, lipid, carbohydrate, protein.