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Feasibility of Cultivating *Chlorella vulgaris* Algae on an Experimental Scale in an Aquatic Environment

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ABSTRACT

Introduction: *Chlorella vulgaris* is a microalgae species crucial to marine ecosystems, accounting for approximately 44% of global photosynthesis. Measuring 2 to 10 micrometers in diameter, this tiny organism is rich in chlorophyll and other nutrients such as proteins, carbohydrates, lipids, vitamin C, beta-carotene, and B group vitamins. Its rapid growth, adaptability to environmental changes, and straightforward cultivation techniques make this species valuable in biotechnology applications and as a dietary supplement. This study aimed to evaluate the ability to cultivate *Chlorella vulgaris* algae on a pilot scale in a water-based environment.

Methods and Materials: *Chlorella vulgaris* algae were cultivated in an N8 culture medium in a 20 x 30 cm reactor. The cultivation process occurred under consistent conditions, including a temperature of 30 °C, aeration using a pump, and illumination from a fluorescent lamp for 16 hours daily. The water level in the aquarium was carefully monitored to prevent submersion of the culture vessels. After specific periods, the morphology of the algal cells was examined using a light microscope. Additionally, the optical absorption of the algal samples was measured at a wavelength of 690 nm through spectrophotometric analysis.

Results: Results indicated that after a 30-day cultivation period, the yield of *Chlorella vulgaris* algae was determined to be 1.82 g per liter of culture medium. A detailed chemical analysis revealed that these algae contained 40.19% carbohydrates, 2.4 µg/ml of carotenoids, 22.83% protein, and 21.53% fat. Microscopic examination under light microscopy and SEM confirmed the spherical shape of the algae, characterized by irregular pores. Moreover, FTIR analysis indicated that functional groups identified within the algae include hydroxyl, amine, carbonyl, carboxyl, and phosphate. EDX analysis indicated that the primary elemental composition of the algae consists of carbon (49.03%) and oxygen (32.13%). The negative zeta potential of -15.47 mV suggests the presence of a net negative charge on the surface of the algae.

Conclusion and Discussion: Cultivation of this algae is proposed as a sustainable, eco-friendly approach for wastewater treatment and pollutant elimination from water. Additionally, *Chlorella vulgaris* is a potential food source and dietary supplement due to its nutrient-rich compounds. This investigation underscores the significance of exploring the practical applications of *Chlorella vulgaris* in various sectors, suggesting a promising avenue for future research.

Keywords: Chlorella vulgaris, Iran, Microalgae

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