

Comparative studies of cell growth of freshwater microalga *Chlorella* sp. in photoautotrophic, heterotrophic and mixotrophic cultures

Abstract

Lately, research on biodiesel production as a renewable and sustainable energy has become increasingly apparent due to the fact that fossil fuel is decreasing and the concern of global warming issues. The third generation of biofuel, which is microalgae-based biodiesel, has gained interest over the last decade. The ability of microalgae to grow in various conditions is one of its advantages as the potential and promising feedstock for biodiesel. Microalgae can be cultivated in three modes such as photoautotrophic, heterotrophic and mixotrophic culture mode. Unlike photoautotrophic mode where light is required, the heterotrophic mode mainly utilizes carbon compounds to grow. On the other hand, the mixotrophic mode is the condition where light and carbon compounds are supplied for microalgae culturing. This paper investigates the cell growth of *Chlorella* sp. cultivated in photoautotrophic, heterotrophic and mixotrophic culture mode. It was found that *Chlorella* sp. was capable of producing the highest cell concentration of $6.67 \pm 0.56 \times 10^6$ cell mL⁻¹ in the photoautotrophic mode for 23 days of cultivation period. This was 1.3 times and 3.2 times greater than the cell concentration in mixotrophic ($5.02 \pm 0.49 \times 10^6$ cell mL⁻¹) and heterotrophic ($2.03 \pm 0.29 \times 10^6$ cell mL⁻¹) culture, respectively. On the contrary, the highest specific growth rate obtained in the study was from heterotrophic mode (0.32 ± 0.04 day⁻¹) followed by photoautotrophic and mixotrophic mode with 0.26 ± 0.05 day⁻¹ and 0.20 ± 0.04 day⁻¹, respectively. *Chlorella* sp. cell grew well under the photoautotrophic and mixotrophic mode. However, the insufficient glucose level had contributed to lower cell productivity in the heterotrophic culture. Therefore, the mixotrophic mode could also be an alternative pathway in microalgae cultivation for biodiesel production if the glucose supplied was adequate and at the suitable level.