

Abstract

Sequential heterotrophic/autotrophic cultivation method was investigated for production of high concentration of *Chlorella* biomass with high cellular protein and chlorophyll contents. By using autotrophic growth medium, which contains glucose as organic carbon source, for heterotrophic culture, the protein and chlorophyll contents of the cells could be increased by simply illuminating the culture broth and aerating with CO₂-enriched air at the end of the heterotrophic culture. A system was then constructed for continuous sequential heterotrophic/autotrophic production of algal biomass. The system was composed of the conventional mini-jar fermentor for the heterotrophic phase and a tubular photobioreactor for the autotrophic phase. The exhaust gas from the heterotrophic phase was used for aeration of the autotrophic phase in order to reduce the CO₂ emission into the atmosphere. With this system, it was possible to produce high *Chlorella* biomass concentration (14 g L⁻¹) containing 60.1% protein and 3.6% chlorophyll continuously for more than 640 h. During the steady state, about 27% of the CO₂ produced in the heterotrophic phase was re-utilized in the autotrophic phase. When the tubular photobioreactor was replaced with a 3.5-L internally illuminated photobioreactor, the productivity increased from 2 g L⁻¹ d⁻¹ to 4 g L⁻¹ d⁻¹. However, the chlorophyll content of the cells was lower due to the lower light supply coefficient of the photobioreactor.

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