Nutrient Enrichment of Marine Microalgal Cells by Utilizing CO_2 and Their Prevention of Marine Environment

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Summary

Marine phytoplankton play an important role in reduction of atmospheric carbon dioxide (CO_2), a critical factor for global warming, by CO_2 fixation because of their vast resources in the oceans. In addition, they also contribute to the prevention of marine ecosystems as live feeds for various aquatic animals. In this study, we studied marine microalgal CO_2 reduction and its cellular nutrients by using marine diatom *Chaetoceros gracilis*, which is widely used as incipient feed in a culture farm.

Atmospheric CO_2 reduction by *C. gracilis* was estimated by measuring CO_2 concentration in the headspace gases of the culture bottle, and nutritive changes in fatty acids including EPA and DHA, protein, and photosynthetic pigments accumulated in the cells were also investigated. *C. gracilis* reduced significant amount of atmospheric CO_2 during the culture periods examined, even at the late stationary growth phase. This suggests that microalgal living cells require atmospheric CO_2 for biosynthesis of the cellular indispensable organic compounds even though they are cytostatic state. *C. gracilis* showed different growth rates and nutritional levels, depending on the culture temperatures. *C. gracilis* cultured at 30°C reached the stationary growth phase rapidly, while the cells could not survive for long period compared to those cultured at 10 and 20°C. *C. gracilis* were found to accumulate all nutrients tested after reaching the stationary growth phase, and the accumulation levels were significantly and consistently increased in the cells cultured at 10 and 20°C. However, the accumulation was not so large at 30°C, because the cells could not survive longer under this culture condition. These results indicated the relationships between utilization of atmospheric CO_2 by marine phytoplankton and their accumulation of cellular nutrients and that *C. gracilis* should be harvested at the late stationary growth phase but not at the usual exponential growth phase for the preparation of the nutrition-enriched cells.