

Abstract

Production of astaxanthin by sequential heterotrophic-photoautotrophic cultivation of a green alga, *Haematococcus pluvialis* was investigated. This involved cultivating the cells heterotrophically to high cell concentration, followed by illumination of the culture for astaxanthin accumulation. The optimum pH and temperature for heterotrophic biomass production were 8 and 25 C, respectively. There was no significant difference in the specific growth rate of the cells when acetate concentration was varied between 10 mM and 30 mM. However, cell growth was inhibited at higher acetate concentrations. A pH stat method was then used for fed-batch heterotrophic culture, using acetate as the organic carbon source. A cell concentration of 7 g L⁻¹ was obtained. Higher cell concentration could not be obtained because the cells changed from vegetative to cyst forms during the heterotrophic cultivation. However, by using repeated fed-batch processes, the cells could be maintained in the vegetative form, leading to more than two times increase in cell number output rate. When the vegetative cells were transferred to photoautotrophic phase, there was a sharp decrease in the cell number and only very few cells encysted and accumulated astaxanthin. On the other hand, when the shift from heterotrophic to photoautotrophic condition was done when most of the cells had encysted, there was still a decrease in cell number but astaxanthin accumulation was very high. The astaxanthin concentration (114 mg L⁻¹) and productivity (4.4 mg L⁻¹d⁻¹) obtained by this sequential heterotrophic-photoautotrophic cultivation method are very high compared to the data in the literature.

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