Abstract
Due to diurnal changes in light intensity and light/dark cycles, the number of hours in a day when the intensity of solar light energy is high enough to support photosynthetic cell growth can be very short depending on the location and season. The night biomass loss greatly reduces the productivities of photobioreactors. As a solution to this problem, cyclic autotrophic/heterotrophic cultivation, whereby an organic carbon source is added during the night was investigated, using Chlorella sorokiniana and Euglena gracilis as examples. By adding an organic carbon source at night, both cells could change from autotrophic to heterotrophic growth and vice versa, leading to cyclic autotrophic/heterotrophic growth phases under light/dark cycles. In order to maintain the cellular photosynthetic products high during the cultivation, it was necessary to add only the quantity of carbon source which could be completely consumed at night. Although glucose, acetate and ethanol were all good carbon sources for both cells, in the case of Euglena ethanol was the most efficient in terms of both cell growth and α-tocopherol accumulation. The α-tocopherol productivity in a cyclic autotrophic/heterotrophic culture of Euglena gracilis, using ethanol as the carbon source, was 2.9 and 1.8 times higher than the values obtained in autotrophic cultures under light/dark cycles and continuous illumination, respectively.