Abstract
Effects of hydrodynamic stress, dissolved oxygen (DO) concentration and carbon sources on heterotrophic α-tocopherol production by Euglena gracilis were investigated. In a jar fermentor without baffle plates, increasing the agitation speed up to 500 rpm had no significant effect on cell growth and α-tocopherol production. However, in a jar fermentor equipped with baffle plates, both the cell growth and α-tocopherol production were highly suppressed at 500 rpm. At high hydrodynamic stress, the cells secreted nucleic acid-related substances to the culture broth and the shape of the cells shifted from elongated toward spherical. High DO concentration had adverse effects on both cell growth and α-tocopherol production, the optimum DO concentration being below 0.8 ppm. In comparison with glucose, the growth rate was lower but the α-tocopherol content of the cells was almost four times higher when ethanol was used as the organic carbon source. In a fed-batch culture with ethanol, a very high cell concentration of 39.5 g L-1 was obtained with α-tocopherol content of 1200 μg g-cell-1. This α-tocopherol content is very close to the values reported for photoautotrophic and photoheterotrophic cultures. A very high α-tocopherol productivity of 102 μg L-1 h-1 was obtained, indicating that heterotrophic cultivation of E. gracilis has a very high potential as a substitute for the current method of extraction from vegetable oils.