Abstract

Haematococcus pluvialis is unicellular green alga (Chlorophyceae, Chlamydomonadales), which can be found in ephemeral rock pools and birdbaths. It is the best natural producer of strong antioxidant astaxanthin, red secondary carotenoid used as coloring agent in aquaculture and poultry breeding. Astaxanthin also has various positive effects on human health. *Haematococcus pluvialis* has quite complex life cycle consisting of four life stages, biflagellated zoospores, non-motile round palmella stage, thick-walled akinetes (aplanospores, cysts) with high content of astaxanthin and small biflagellated gametes. Akinetes, which enable *H. pluvialis* to survive desiccation in its natural habitat, are formed in response to stress conditions such as high irradiance and temperature and nutrient depletion. Cells undergo dramatic ultrastructural changes during aplanospore formation. Chloroplast volume is decreased, synthesis of high amount of astaxanthin and fatty acids results in presence of lipid droplets that spread from the center to the periphery of the cell and thick cell wall containing algaenans is formed. Cultivation of *H. pluvialis* is often performed in two subsequent stages, green stage focused on biomass production and red stage focused on astaxanthin accumulation under stress conditions. There are several different approaches to the cultivation of this alga including batch, fed-batch, perfusion and attached cultivation. Cultures of *H. pluvialis* can grow phototrophically, mixotrophically and heterotrophically in various culture media.