Abstract

Phosphorus is frequently a limiting factor for phytoplankton in freshwater ecosystems, because algae and cyanobacteria are able to incorporate it only in a dissolved inorganic form. Phytoplankton evolved several mechanisms to overcome phosphorus limitation. One of them is the production of extracellular phosphatases. These enzymes are excreted on the surface of cells or released to the environment. They hydrolyze organic molecules containing phosphorus, which can be then incorporated by cells. This mechanism can influence the competitiveness of algae living in environments that are characterised by long-term phosphorus limitation (that is caused e.g. by the effect of low pH).

In this study the influence of phosphorus concentration and form on extracellular phosphatase activity under laboratory conditions was investigated. The two experimental strains of the genus *Coccomyxa* (Chlorophyta) were isolated from acidified localities with different phosphorus availability – Plešné Lake and Hromnické Lake. Extracellular phosphatase activity on a single-cell level was measured using the FLEA technique and fluorescence microscopy. The FLEA technique allows direct visualization of phosphatases on the cell surface by incubating the samples with the artificial substrate ELF®97 phosphate.

Extracellular phosphatase activity in cultures was induced by cultivation in media both with organic and inorganic phosphorus. Experiments showed the influence of phosphorus concentration and form on extracellular phosphatase activity, which was higher in the phosphorus limited cultures and also in samples cultivated in media with organic form of phosphorus. Cells within one population differed in their phosphatase activity. Comparison of the two strains showed that their extracellular phosphatase activity was independent on the locality from which the strain was isolated. The ability to produce extracellular phosphatases together with low pH and metal tolerance enabled the dominance of the genus *Coccomyxa* in the phytoplankton of Plešné Lake and Hromnické Lake.

Key words: *Coccomyxa*, phosphorus limitation, extracellular phosphatase activity, FLEA technique, ELF®97 phosphate, acidified lakes, Plešné Lake, Hromnické Lake.