

Abstract

The work concerns biological early warning systems based on the behavioural reactions of living organisms. Systems of this type are increasingly used in monitoring and control of water quality, due to the growing requirements in the treatment of water, resulting from the increasing threats to the aquatic environment. Currently, systems based on the behavioural reactions of bivalves are the most commonly used.

The results presented in the work are focused on the behavioural reactions of *Unio tumidus* to pollutants that threaten surface and underground water intakes. During the three-year study, a biological early warning system based on the behavioural reactions of *Unio tumidus* was used. This system uses the phenomenon of changing strength of the magnetic field between the magnet and the Hall sensor. Due to that, it was possible to assess the group reactions.

It has been shown that *Unio tumidus* bivalves are able to detect some of the pollutants covered by monitoring in waterworks. The behavioural reaction of the *Unio tumidus* was particularly evident in the detection of nitrates, sulphates and copper. In the case of ammonium, chloride, iron and manganese, the limit value of their concentrations provided for in national regulations was not detected. The analysis of two additional heavy metals - copper and mercury - revealed the possibility of detection of the limit concentrations of only the first of the tested elements.

One of the aim was to evaluate the effectiveness in detection inflow of water contaminants, based on the analysis of two additional behavioural variables. It has been shown that the analysis of the change in the velocity of the shell movements and changes in the shell opening level allow for faster detection of the limit concentrations of nitrates, sulphates as well as a mixture of nitrates and ammonium ion. Both variables represent a promising pollution detection indicator that can be introduced in biological early warning systems.

In addition, it has been proven that an increase in the water temperature disturbed the reaction time of the *Unio tumidus* bivalves. The analysis of three groups of individuals showed that in the range of 7 to 14°C bivalves react in the same way, by a rapid reduction in the shell opening level. In the case of 24°C the detection time was more than 3 hours longer in compare to lower temperature. Due to the significant, behavioural changes, it was pointed that the water temperature should be controlled in systems based on bivalves reactions.