

Mussel-Monitor: A Biological Warning System



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The musselmonitor - recently installed at the Budapest Water Works in Hungary - is an online biological early warning system from the Netherlands, used for the immediate detecting of some source of pollutant or toxicant in the water. The system is based on the behavior of mussels, as these animals are very sensitive to their environment.

The behavior of mussels is defined by the movement-pattern (rhythm of opening and closing) of their valves. Among normal circumstances, their valves are considerably open most of the time, in order to ensure the continuous food- and oxygen-uptake from the water, and they naturally close for some seconds once in a while.



If the mussels sense the pollution around them, the movement-pattern of its valves changes according to the type and concentration of the pollutant.

In the monitor box there are 8 mussels (for instance zebra mussels, *Dreissena polymorpha*) in a continuous watercourse. A couple of electromagnetic sensors are glued on both sides of the mussels, which measures the distance between the two valves in every moment, so that we can follow their movements with attention.

A computer can be connected to the monitor-system, which – using special software – analyses the signs and visualizes them in the form of graphs. If certain parameters (length of closure time, openings and closures per minute etc.) reach a threshold value determined by the user, an alarm sign is generated and a message about what kind of deviation caused the alarm.

The program contains four alarm-types: 1.closure for long time (to avoid contact with the pollutant), 2.decreasing average of the distance between the valves, 3.increased activity (series of rapid opening and closing to rinse the polluted water around the mussels), 4.gaping (100 % opening of the valves, caused by the death of the mussel).

An automated sampler can also be connected to the system, which takes samples regularly from the flowing water, before it reaches the monitor-box. If an alarm

Newsletter

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occurs, the polluted water can be analyzed immediately chemically.

The optimal setting of the threshold values needs much experience, because it is very important to adjust the balance between the sensibility and reliability of the system in order to avoid false alarms.



The musselmonitor has been functioning as a biomonitoring system of only freshwater and seawater in many countries until now. Budapest Waterworks started an experiment of using the system for monitoring the quality of chlorinated drinking water on certain spots of the water-net.



The free chlorine content of the water in the monitor-box is neutralized by a constant inflow of sodium-thiosulphate, and diluted algae-culture is provided for feeding the mussels.

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