

The bbe *Daphnia Toximeter* for Water Pollution Control at Waste Water Treatment Plants



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Introduction

The bbe DaphniaToximeter is an instrument designed for the monitoring and protection against pollutants and contaminations in water systems.

Living water fleas (*Daphnia magna*) are permanently exposed to a sample water flow and are continuously monitored by a camera inside of the toximeter.

If an acute poisoning occurs (e.g. caused by pesticides or heavy metals), the swimming behaviour of daphnia changes considerably and an alarm is triggered.

Biomonitors are more sensitive than static tests and results are provided in real-time .

Test Runs in the Effluent of the WWTP in Bülk (North Germany)

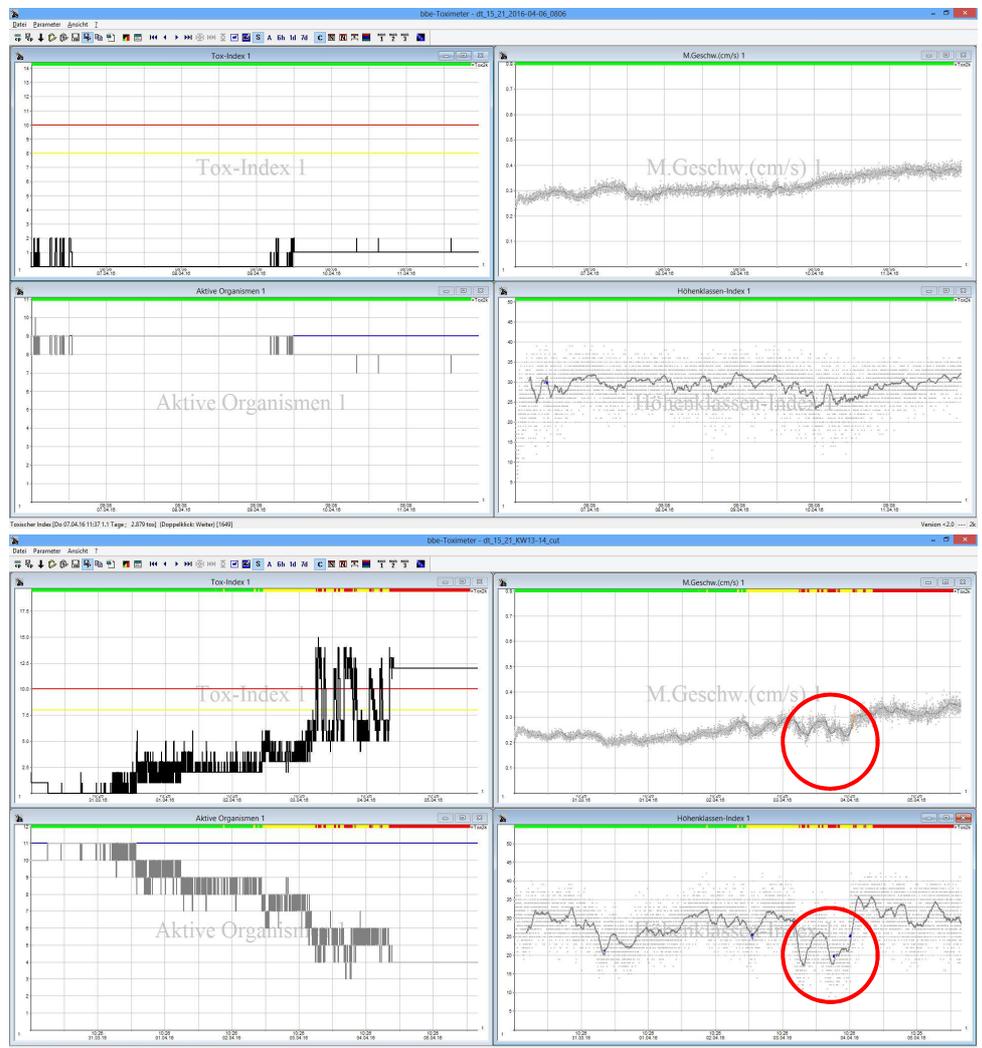
Both figures show a screenshot of the data output of the DaphniaToximeter in the effluent of the waste water treatment plant (WWTP) in Bülk for one week.

The toxicity index (sum of tox.-points; window top left), the number of living organisms (down left), the average velocity (top right) and the height class index (down right) are represented exemplarily.

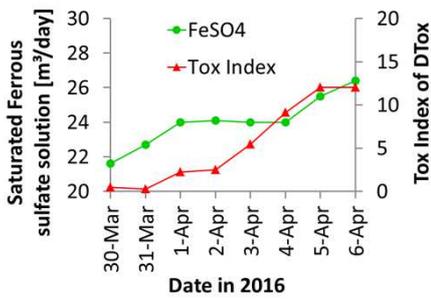
Toxicity points are a measure of deviations of typical swimming behaviour and mortality, and thus a measure of water pollution.

The upper figure displays a week without toxic pollution of the treated waste water. The number of living organisms is stable and the swimming behaviour of daphnia shows just the typical fluctuations.

In the following week – illustrated in the lower figure – the toxicity points increase, because of changing swimming behaviour and mortality. An alarm is triggered exceeding 10 toxicity points (red line at the toxicity index).

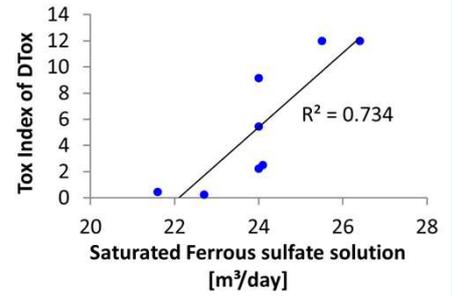


Relation between Ferrous Sulfate and Fitness of Water Fleas



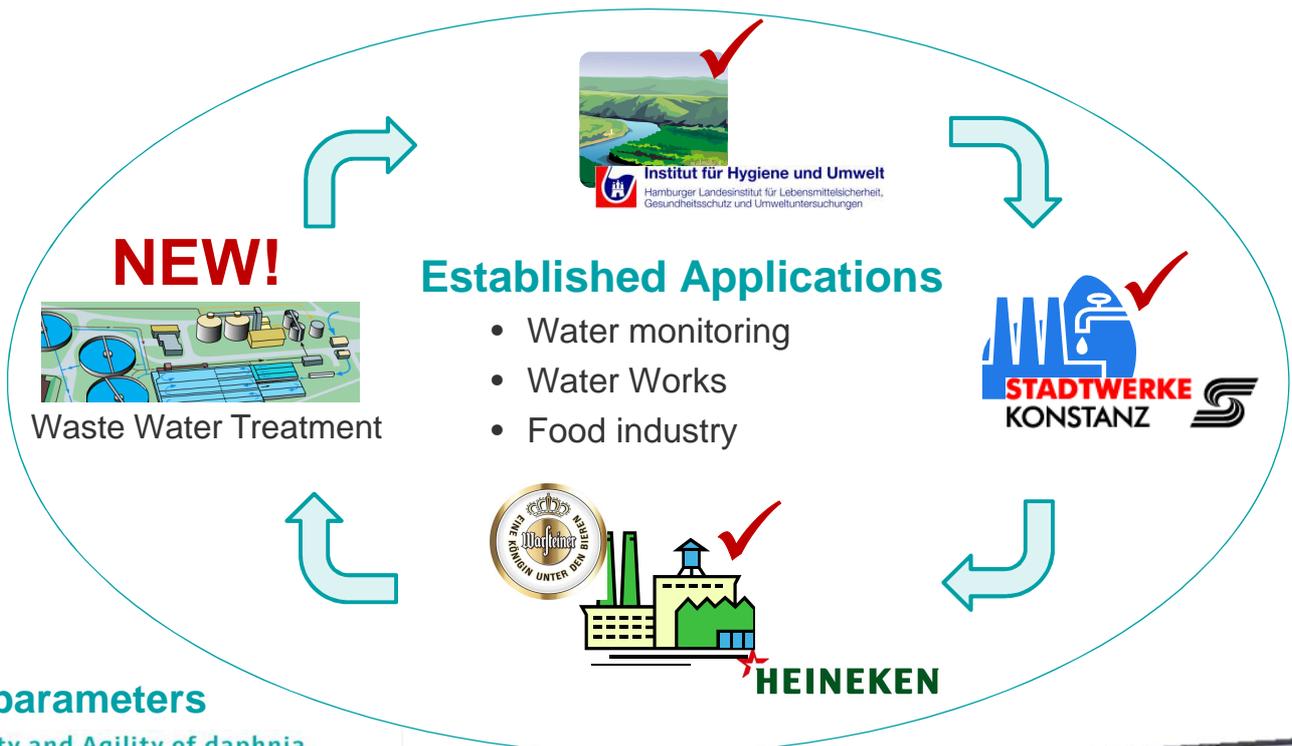
An increased use of ferrous sulfate as flocking agent for phosphate is suspected as the cause for the rising toxicity index of the Daphnia-Toximeter (s. left diagram).

The toxicity index correlates fairly with the used amount of ferrous sulfate (s. right diagram).



Summary

- The bbe DaphniaToximeter is approved for quality control of waste water treatment (mixed water from household and industry).
- The DaphniaToximeter provides excellent sensitivity for a wide range of toxic substances, especially those which are also harmful to human being.
- The simple arrangement enables a continuous and reliable monitoring of water quality.



The parameters

Mobility and Agility of daphnia

Speed: average velocity and distribution

Fractal dimensions: curviness and angle $D=1.09$

Distance and grouping

Swimming height

Daphnia growth

Shading: time index and distribution

