



Sengbach Reservoir of the Glüder Waterworks

Quelle: Jürgen E. Fischer

Online Monitoring of Raw Water for *Planktothrix rubescens*

At the beginning of the year, **Planktothrix Rubescens** was discovered in the Sengbach Reservoir. Since these algae can develop toxins, an **online monitoring system** which continuously monitors concentrations of algae in water was introduced in conjunction with the health authority in Solingen. The cause of the algal formation was also investigated.

Planktothrix rubescens is a filamentous cyanobacteria or blue-green algae. Unusual for these algae is the red pigment phycoerythrin, which collects sunlight for photosynthesis. These blue - green algae thus appear to be red in colour (Fig. 1). The algae can also produce toxic microcystins, which can lead to fatalities. In spring this year, these algae formed in the Sengbach Reservoir of the Glüder Waterworks. The cause of this was unclear. The responsible persons at the waterworks became particularly alert. They have a close relationship with the corresponding health authority in Solingen. Since the beginning of May, laboratory tests have been supplemented by each day by continuous monitoring using an algae analyser (Fig. 2).

In contrast to microscopic analysis of daily spot sampling in the lab, the AlgaeOnlineAnalyser manufactured by bbe Moldaenke GmbH continuously monitors the algal concentration of the water in the intake of the waterworks. The measurement principle of the online instrument is

based on the fact that algae 'lose' a small part of the energy from photosynthesis as fluorescence. In the algae sensor, the sunlight is replaced by LEDs of different wavelengths.

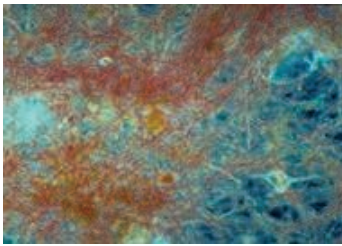


Fig. 1. *Planthrothrix rubescence*,
blood-red algae

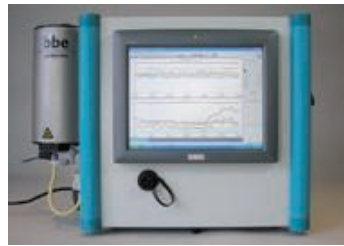


Fig. 2. AOA – AlgenOnlineAnalyser for
continuous monitoring of algae
concentrations in water

The LEDs excite the algae to photosynthesise using pulsed light. The resulting fluorescence signal is measured by a photomultiplier (Fig. 3). The total chlorophyll content and the concentration of the algal groups – and thus also blue-green algae – are measured using a mathematical optimisation from the energy input, the fluorescence and the fingerprints stored for each algal groups. The fluorometric measurement is the only method for measuring algae in real time. Comparisons between laboratory values and online measurements show considerable agreement. Indeed, they complement each other. Looking through the microscope is still important to obtain a precise overview of algae formation.

bbe Measurement Principle

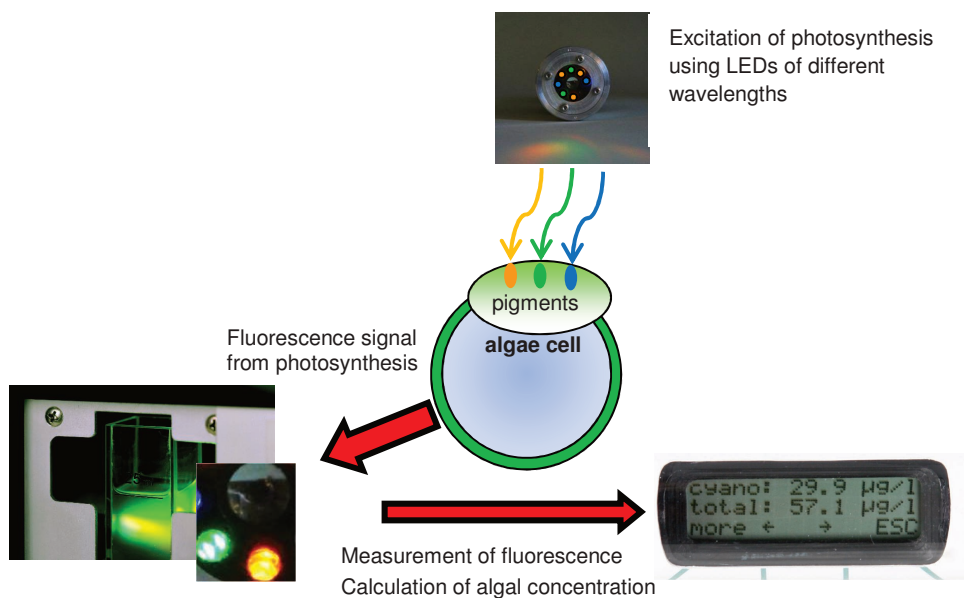


Fig. 3. Fluorometric measurement principle for the online calculation of algae concentrations

The algal concentration is far below the alarm level set issued by the WHO, whose directive recommends a blue-green concentration of 20 µg/l and 50 µg/l as an alarm threshold. Just above 20 µg/l were measured at the waterworks at peak times (Fig. 4). Since algae can reproduce very quickly, the installed monitoring system is extremely important for security and the drinking water supply. “With this instrument, we have the algae concentration at the intake of our waterworks under control and can react immediately if it becomes too high” Head of Department Norbert Kellner concludes.

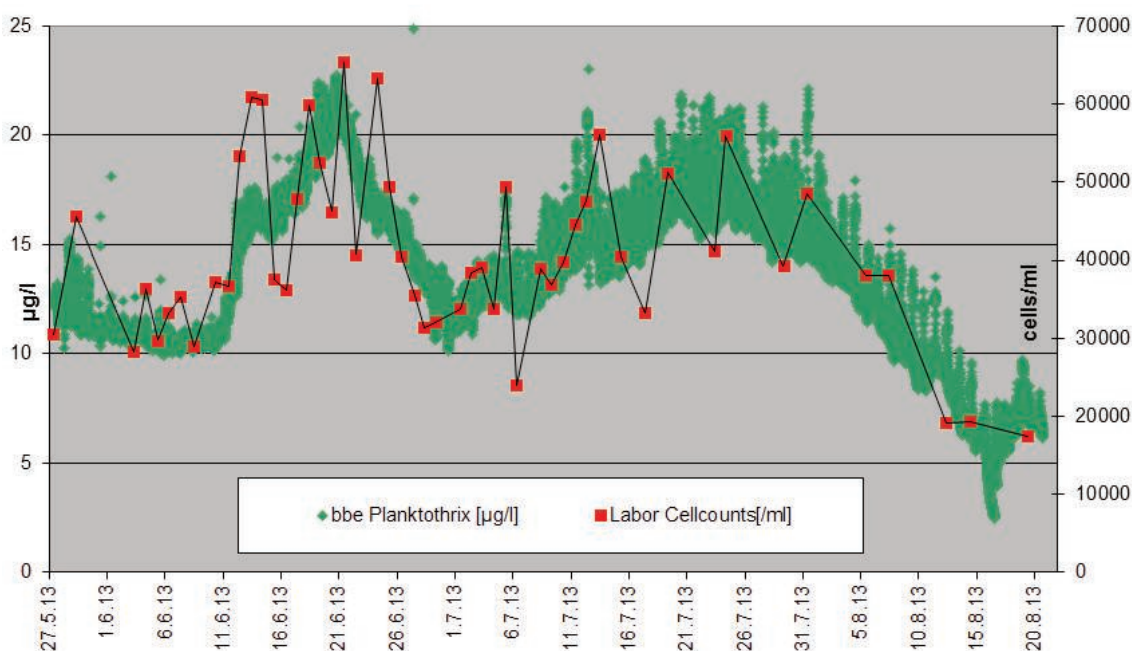


Fig. 4. Comparison of laboratory measurement values and online measurement values, May to August 2013

Additionally, those responsible would also like to find out why the algae appeared so suddenly. Nutrient influx from agriculture is often the cause of eutrophication and the production of algae in inland waters. This cause is unlikely for the Sengbach Reservoir since the agricultural use in the region is carried out in close co-operation. A limnological consultant was commissioned to investigate the possible reasons.

So depth profiles of algae distribution were taken in the reservoir. For this, a depth probe was deployed which uses the same measurement principle as the online instrument at the raw water intake of the waterworks. Initial investigations in July showed that Planktothrix forms layers at a particular depth of the reservoir. At the uptake location, which is located at 30m depth at the bottom of the western end of reservoir, the profile is less developed than in the east of the reservoir.

Profile measurements were carried out in the Sengbach reservoir on 25th July, 2013. The maximum values of Planktothrix concentrations can be seen at the measurement locations MS1 and MS5. In the west, at the uptake, the maximum values are lower than in the east. The peaks in the west are less developed (Fig. 5). The profiles at locations MS1 and at MS5 are shown as an example (Fig. 6 and Fig. 7).

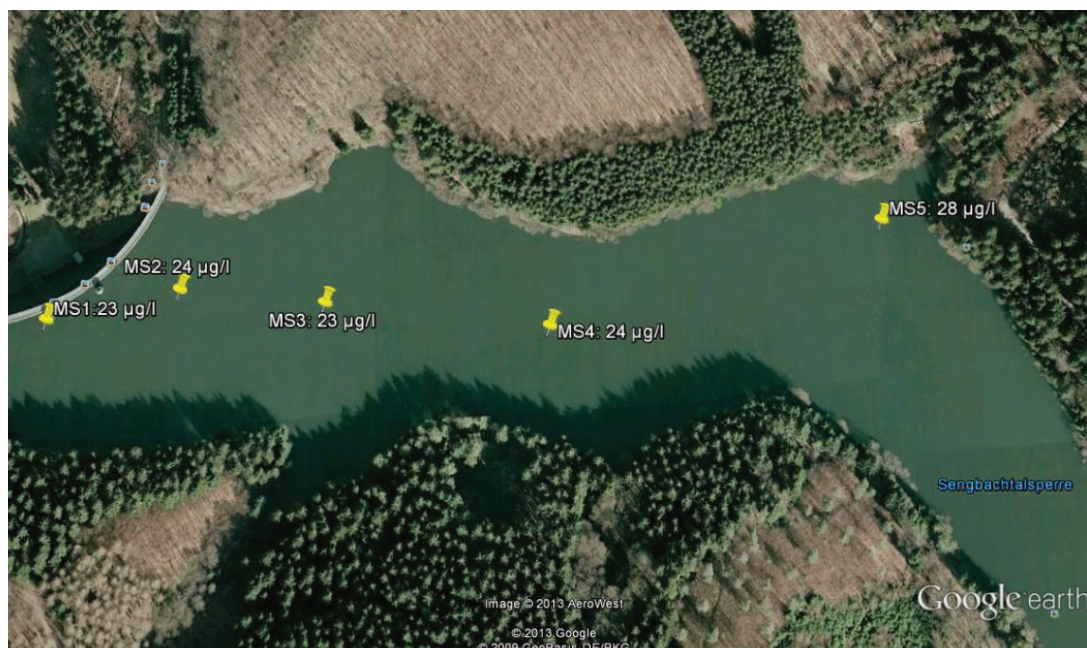


Fig. 5. Results of depth profile measurements in the reservoir on 25th July 2013

If necessary, measures to be taken for the uptake of the raw water can be derived from these and other profile measurements. In any case, they are an important foundation for the model-building and limnological research into the cause of the algal growth and distribution.

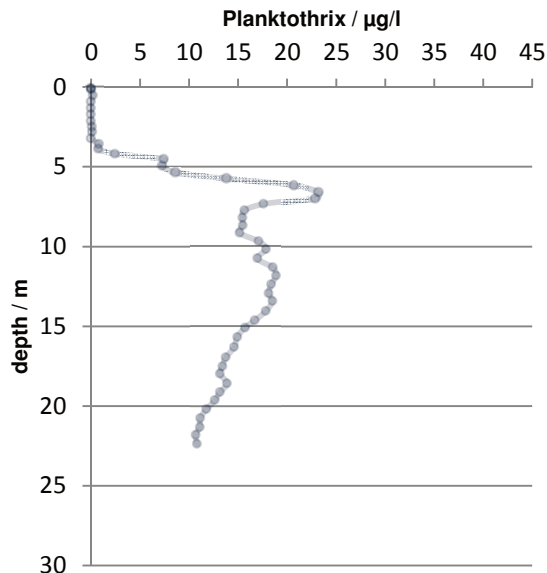


Fig. 6. Depth profile at the location MS1 on 25th July 2013

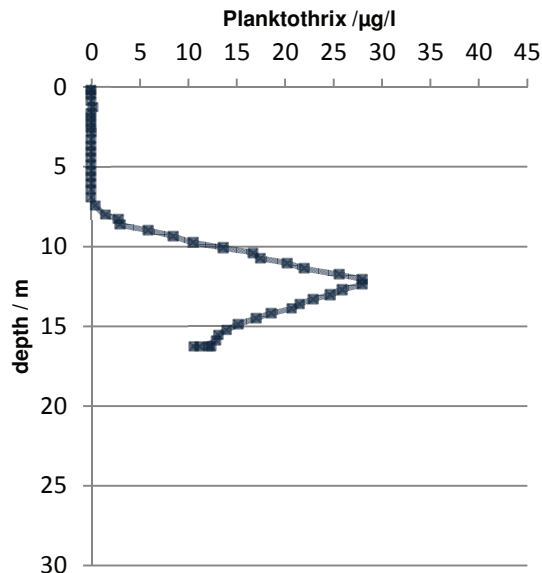


Fig. 7. Depth profile at the location MS5 on 25th July 2013

In addition to controlling the algae concentrations and the search for their cause, the waterworks is also testing further measures in water treatment. At the moment, a system is being tested which is to filter out the algae from the inflowing raw water before it reaches the next treatment stage. In this so-called discfilter system, the raw water containing the algae is caught by stacked, finely ribbed plastic thread algae without being destroyed. At regular intervals the filter discs are backflushed. The first experiments in a test plant have shown that part of the algae can be detained. "We are working with the manufacturer on optimising the disc filter system. If that is successful, we shall use this as a pre-filtering

system in our raw water treatment” explains Andreas Mokros, Technical Director of the waterworks. Overall, the situation at the Sengbach reservoir shows that strong algal growth can still occur in German waters. In the last few years and decades, a number of measures have been implemented to protect inland waters. Here, Germany stands out in international comparison. The officers of the waterworks deal with the situation very openly and progressively. Checking, investigating the cause and taking measures are the guidelines of their actions.

Authors

Andreas Mokros is Technical Director of the Glüder Waterworks.

Dipl.-Phys. Sönke Kobarg is Project- and Product Manager at bbe Moldaenke GmbH.

Contacts

Andreas Mokros
Wasserwerk Glüder
Beethovenstr. 210
42655 Solingen
Tel.: 0212 295-2725
E-Mail: a.mokros@stadtwerke-solingen.de
Internet: www.stadtwerke-solingen.de

Sönke Kobarg
bbe Moldaenke GmbH
Preetzer Chaussee 177
24222 Schwentinental
Tel.: 0431 38040-0
E-Mail: skobarg@bbe-moldaenke.de
Internet: www.bbe-moldaenke.de