AlgaeToximeter II

The all-rounder for the determination of toxic substances in water

Universal application area
Proven bbe measurement technology
Checking the Use of proven Algae fluorescence Measurement process Detection of Integration in is part of basic human rights. Classic evaluation methods Detection of, which develops its damaging Sample processing Automated Registration (picture). The inhibition is determined by comparing the algae in sample above a Quantum yield -

How does AlgaeToximeter II measure toxicity?
Fluorescence is the emission of light after the excitation of molecules. In algae, it is a natural process that takes place immediately upon exposure to sunlight or artificial light and results in a release of unused or excess energy. The light-collecting Photosystem II emits red light in the wavelength range from 685 - 700 nm. The intensities are recorded in the AlgaeToximeter and are a measure of the physiological state of the algae. The maximum efficiency or quantum yield of the radiation, which contributes to photosynthesis, is determined. This is closely linked to photosynthetic metabolism in algae and decreases under the influence of pollutants.

An algae sample mixed with sample water is compared with a reference algal sample in reference water (unloaded sample). The standardized algae come from an integrated photobioreactor in the AlgaeToximeter. After dark adaptation, algae and sample water are pumped into a sensor which measures the fluorescence. The measurement begins with a dark incubation, during which the algae are converted into a basic state. With low light irradiation, the idle performance of photosynthesis is measured as fluorescence (F0 light). Saturating strong light forces the maximum excitation and release of excess energy as Fm light. The ratio Fm/F0 gives the maximum quantum yield that can be used for photosynthesis. This value is also referred to as activity and is between 0 and 1, usually written as a percent. Productive green algae from the fermenter like Chlorella vulgaris achieve an activity of 65%. Small amounts of pollutants significantly reduce this activity (picture). The inhibition is determined by comparing the algae in sample water to the algae in reference water. The activity of those algae which naturally occur in the sample water is taken into account. The resulting activity value is a measure for the toxicity of the sample water. Fresh algae from the fermenter are used for each measurement. The measuring operation is quasi-continuous. A complete measuring cycle lasts about 45 minutes and is adjustable. All measurements are temperature controlled.

Suitable organisms include all organisms that are viable in water and whose reaction to the effects of pollutants can be clearly detected. Microalgae have these properties and have therefore been used in biosensor for decades. These tests evaluate the rate of microalgae reproduction after a predetermined period of 24 or 48 hours in previously collected discrete water samples. In the case of flowing water or water distribution systems, there are other requirements: continuous monitoring must be conducted in order to promptly identify sudden pulses of pollutants and take measures.
Additional data from AlgaeToximeter II

What are the additional properties of AlgaeToximeter II?

The AlgaeToximeter II is robust in construction and operation: the integrated fermenter ensures a consistently high activity and quality of algae thanks to optimized growing conditions. For this purpose, both the algal concentration and activity are checked constantly and the nutrient supply is adjusted accordingly. The recommended microalgae (Chlorella vulgaris) are easy to grow and are proven toxicity indicator organisms according to the ISO 8692: 2012 standard. Alternatively, other algal species can be used and thus adapted to local requirements.

The AlgaeToximeter II takes into account the naturally occurring algae in the sample water and corrects the determined activity values. The correction enables a high level of accuracy that cannot be achieved by other algae toximeters. The AlgaeToximeter II can be used with both freshwater algae and marine microalgae. This allows for effective monitoring of freshwater, coastal, and marine systems.

CHARACTERISTICS
- Algae are stored directly in the device
- Suitable for fresh and sea water
- Algae class detection
- Blue-green algae detection
- Sample grinding
- Reference poison measurement
- Automatic cleaning of measuring chamber

Maintenance of AlgaeToximeter II

Weekly: takes about 2 hours
- Check the inlets and outlets for blockages
- Replenish nutrient solution and reference poison
- Maintenance of algae culture, if necessary replacement with fresh algae
- Cleaning the hose system
- Exchange sample loops (depending on version)

For periodic maintenance work (1/3 or all year round) maintenance contracts are available with bbe Service.
Components, software and background

The components of AlgaeToximeter II

- Touchscreen PC
- Nutrient pumps
- USB ports
- Algae pump
- Sample pump
- Switching valves drain
- Sensor cleaning device
- Fermenter
- Air valve

The software and alarm detection

The automatic alarm detection in the AlgaeToximeter is carried out with the installed software and provides decisive advantages in the event of incidents involving toxins. Mathematical algorithms are used to continuously and automatically detect variability in the measured values. The software determines jumps in the measured value curve that lie outside the normal variability. Several of these deviations in succession verify the alarm threshold has been exceeded. However, changes are drift-compensated, so that a false alarm is prevented by simply exceeding a threshold value. This process guarantees reliable and timely alarm detection.

A calibration is not necessary because the measured value curve is continuously recorded and evaluated. The sensitivity of the toxicity measurement can be monitored periodically using a poison sample (e.g. herbicide).

Background: what does an algal toximeter II detect?

Extensive studies on the toxicity of dangerous substances are recorded in the EU’s “New Chemicals Database”.

When compared to other test organisms, algae were very sensitive overall, albeit this statement says nothing about human toxicity. AlgaeToximeter II primarily records all substances that have a direct or indirect influence on Photosystem II. It is therefore understandable that the sensitivity to certain herbicides that act on photosynthesis is most pronounced (see picture below).

Microalgae are also acutely affected by cell-damaging toxic substances. Compared to daphnia and fish as test organisms, microalgae often show a higher sensitivity to aromatics, halogenated aromatics, chlorinated hydrocarbons, substituted organic acids, some heavy metals and surfactants. These are all substances that would hardly cause a reaction in other toxicity tests. The AlgaeToximeter II is designed to detect the toxicity of a very wide range of different substances and their mixtures. The type of chemical substance cannot be recognized with the AlgaeToximeter II. A sample collector in connection with the AlgaeToximeter II is recommended for further analysis.

Inhibiting influence of various toxins on the algae in the AlgaeToximeter II.
Technical details of AlgaeToximeter II

### Measured variables
- Inhibition of photosynthesis, Total chlorophyll [µg Chl-a / l], Green algae concentration [µg Chl-a / l], Blue-green algae concentration [µg Chl-a / l], Diatom concentration [µg Chl-a / l], Cryptophyceae concentration [µg Chl-a / l], Yellow substances, Photosynthetic activity (Genty), Transmission (at 5 wavelengths)

### Measuring range
- 0.3 - 500 µg Chl-a/l

### Measurement method
- Spectral fluorometry

### Temperature
- 0 - 50°C

### Weight
- 160 kg

### Dimensions (H x W x D)
- 1100 x 600 x 680 mm

### Degree of protection
- IP54

### Voltage
- 110 - 240 V 50/60 Hz

### Power
- 600 W

### Sample temperature
- 5 - 30°C

### Sample volume
- 30 ml

### Internal PC
- HD, LCD display, DVD, USB

### Maintenance interval
- > 7 days

### Outputs
- Modem, LAN, 2 x analog output 4 - 20 mA, 2 x relay output, RS232

### SCOPE OF DELIVERY
- AlgaeToximeter II
- Syringe and tool
- Algae starter set
- Spare tubes
- Supply canister
- Dissolving nutrient
- USB keyboard
- Software
- 2nd independent plankton reactor

### Optional:
- Sample loops
- Measurement with reference toxins
- 2nd independent plankton reactor

### BENEFITS
- Broad, high sensitivity
- Established pollutant indicator
- Proven technology
- Long service life
- Low maintenance effort
- Autonomous fermenter
- Variable location
- Remote access and network capability

Sample water is mixed with the algae test solution and then analyzed.