LAR
PROCESS ANALYSERS AG

ToxAlarm

TOXICITY

Online Toximeter for Drinking Water and Surface Water Monitoring

Simple. Fast. Cost Effective.

WATER NEEDS PROTECTION.

It is our most precious resource, which cannot be replaced.
Worldwide, it is becoming ever more scarce in supply.

Due to its scarcity, in 2010, the United Nations declared clean water as a basic human right. This right can only be enforced, worldwide, through the strict regulation of water markets and the constant control of quality.

Whether by accident, negligence or with intention – it only takes a small amount of a harmful substance to pollute a large amount of water. The surface water in rivers, lakes, dams, as well as, drinking water reservoirs and the drinking water network can be affected. Therefore, it should be continually monitored. At the same time, water is home to innumerable animal and plant species, which must also be protected and conserved.

**Requirements on the Measurement System.
High, but fulfillable.**

A measurement system must operate continually and reliably. So that pollutants can be identified in good time and countermeasures are promptly introduced. Otherwise there is a real threat to humans and the environment.

The system should also be sensitive to numerous toxic substances. For example, phenols, halogenated hydrocarbons and different heavy metal compounds. Substances such as cyanide pose the greatest challenges as they are highly poisonous even at low concentrations.

Past test methods have been limited in their suitability for monitoring drinking and surface water.

Last but not least, reproducibility and reliability are deciding factors: The toxic substances, once present, should not be able to damage the measurement system.

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What Toxicity is and how it is determined.

Toxicity is described as the direct harmful effect of a substance on organisms. These effects can already occur at low concentraions of toxic substances and are dependent on the incubation period and the dosage.

Some test methods that are available on the market can detect toxicity. They do not, however, identify exactly which toxins are present. By using fish, daphnia, algae or luminous bacteria, they test whether a water sample has a toxic effect on the organisms.

The problems with the methods: Many organisms are difficult to attain and cultivate. For example, daphnia can be cultivated in a laboratory, but are only suitable for testing at a particular point in their lifespan. Moreover, many of the organisms named are not sensitive enough to be used for testing, or they are only sensitive to particular substances. Algae react strongly to pesticides, for example, but do not, unfortunately, react so strongly to other substances.

Additionally, organisms can develop a tolerance to toxins, which of course falsifies the test results. Just as problematic are long incubation times because of slow reactions to pollutants.

Once a toxin appears, the whole measurement system is often impaired, meaning that the complete replacement of the test organisms is

necessary. As a consequence, these methods have a limited suitability for continuous online monitoring.

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The answer from LAR: An online measurement method with an early warning system.

With 25 years experience in the field of water analysis, LAR has developed an online method that considerably reduces cost, maintenance and operational expenditure: ToxAlarm. This measurement system contains a highly sensitive, self-regenerating bacteria culture, which can be continuously used to test the toxicity in water samples within 5 minute intervals. The determination is in accordance to DIN EN ISO 9509:2006.

On the following pages, you will read about the many advantages of ToxAlarm and its simple operation.

AT A GLANCE

- The qualitiy of water is sensitive.

- Worldwide, water supplies are shortening.

- Pollution can massively endanger humans and the environment.

- The requirements for the measurement method are high.

- Previous test methods have had limited suitability for water monitoring.

THE ANALYSER.

We have something against water pollution: ToxAlarm.
The early-warning system.

No more 'should haves, would haves, could haves'. ToxAlarm warns you in good time.
With the ToxAlarm, measurements can be taken within 5 minute intervals. Thus allowing enough time to introduce countermeasures after the occurance of pollution. What's more, the ToxAlarm offers three warning levels, which can be individually set.

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The bacteria are self-reproducing.
In this case a huge advantage.
ToxAlarm contains a bacteria culture, which constantly and independently produces Biomass. This means that there is enough bacteria at all times for each new measurement. As every water sample is tested with a fresh amount of bacteria, the risk of the fermenter being contaminated is ruled out (↗Fig.1). Subsequently, the measurement cell is rinsed out with a cleaning solution so the memory-effect, the falsification of test results through remaining traces from previous measurements, can be prevented.
Any toxic event can be followed with ToxAlarm from start to finish, without interference to the test organisms through the appearance of a high level

toxicity. Not only can the appearance of harmful substances be determined, but the decrease in the toxicity concentration can also be identified.

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Robust Analyser. Sensitive test organisms.
The bacteria are extremely sensitive to a multitude of toxins. Through their reaction to the harmful substances in the water sample, toxicity can be reliably determined. For example, a reaction already starts at a Cyanide concentration of less than 0.10 mg/litre.

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Reduced maintenance. No further purchase necessary.
Firstly, it is not necessary to purchase or cultivate test organisms, such as fish or daphnia, externally. Secondly, the analyser is extremely low in maintenance because the bacteria mass constantly proliferates on its own for months at a time. Its only requirement is the feeding of a nutritional solution every two weeks.

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With its sensitive touch screen ToxAlarm responds to your needs.
By way of its touch screen, the ToxAlarm is comfortable and easy to operate. With a 10.4" character size display, the measurement results are optimally presented. Of course, they can also be transferred to a PC. Moreover, the analyser can be controlled by remote.

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With ToxAlarm, the electronic compartment is separated from the analytical compartment.

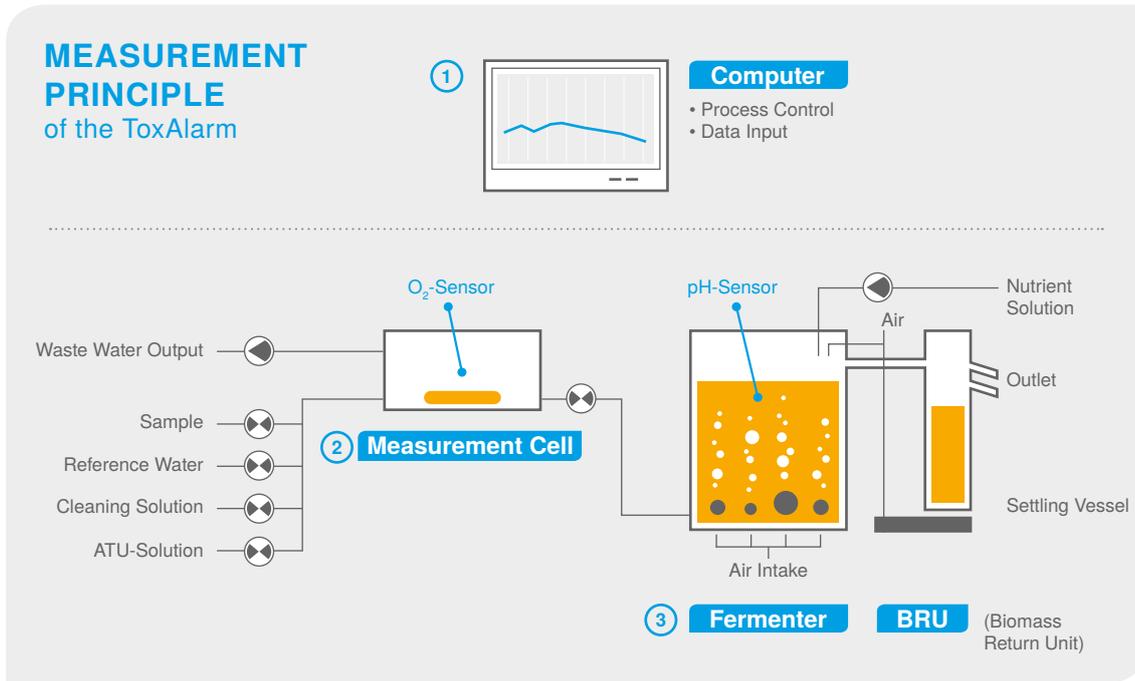The separated compartments are easily accessible.

MEASUREMENT PRINCIPLE
of the ToxAlarm

① **Computer**
- Process Control
- Data Input

O₂-Sensor

pH-Sensor

Nutrient Solution

Air

Waste Water Output

Outlet

Sample

② **Measurement Cell**

Reference Water

Cleaning Solution

Settling Vessel

ATU-Solution

Air Intake

③ **Fermenter**   **BRU** (Biomass Return Unit)

Fig. 1

1) Process control, measurement results display, interface diagram of periphery analysers

2) Sample intake and feed of nitrifiers-consumption rate measurement

3) Constantly self-regenerating bacteria culture

THE PRINCIPLE.

Actually it runs by itself.
Nevertheless, we are happy to explain it.

The nitrification respiration inhibition test. Simpler than its name.

The bacteria live on (consume) oxygen from the conversion of ammonia into nitrate, which is why they are described as nitrifiers. ToxAlarm measures this oxygen consumption. Toxic substances in the sample contents can inhibit the respiration of the bacteria, which leads to a lowering of the oxygen consumption. Thereby the nitrifiers' oxygen consumption enables us to draw conclusion about the toxicity of a sample.

The construction. Memory-effect removed.

The container for the Biomass (fermenter) is separated from the measuring cell (↗ Fig.1). Thus, the Biomass cannot be contaminated by the sample. Furthermore, the analyser has an extremely user-friendly construction, so that without much effort, all areas within the analyser are accessible. The electrics are optimally isolated from the wet chemical area, so that even with leakages they cannot be damaged.

The measurement process. In less than 5 minutes.

In the first phase, the sample is sucked into the measurement cell, which is followed by the measurement of its consumption rate. Microorganisms which are insensitive to harmful substances could already be present in the sample and affect the oxygen consumption. The actual toxicity measurement, which follows thereafter, is based on the initial oxygen concentration. Therefore, in the second phase, a small amount of bacteria is added and the oxygen consumption is measured anew.

At a higher rate of consumption, the curve sinks noticeably, which means that there is no toxicity in the sample (↓ Fig.2). In contrast, a flatter curve shows the bacteria to have consumed only a small amount of oxygen. Hence, the inhibition in their respiration. This indicates that toxins are present in the sample.
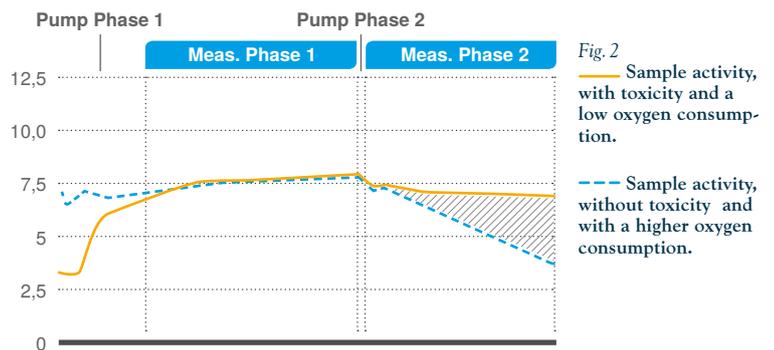
Pump Phase 1   Pump Phase 2

Meas. Phase 1   Meas. Phase 2

12,5

10,0

7,5

5

2,5

0

Fig. 2
Sample activity, with toxicity and a low oxygen consumption.

Sample activity, without toxicity and with a higher oxygen consumption.

ToxAlarm AN OVERVIEW

Online Toximeter for Drinking and Watercourse Monitoring

ToxAlarm continually checks drinking and surface water for pollutants. Additionally, the reaction of highly sensitive bacteria to potential toxins in water is determined. The measurements follow at intervals of less than 5 minutes.

Highly sensitive bacteria
in a robust analyser.

ADVANTAGES AND FEATURES

✓ continuous monitoring of toxicity

✓ self-regenerating bacteria within the analyser

✓ response time in less than 5 minutes

✓ highly sensitive bacteria

✓ no memory-effects

✓ low operational costs

✓ high reproducibility

✓ low maintenance

✓ no purchase of test organisms necessary

TECHNICAL DATA

Measurement Technique and Sample Preparation

Measurement Method	Determination of toxicity through the measurement of oxygen conversion
Bacteria Culture	Nitrifiers
Measurement Range	0 – 100 % Toxicity
Response Time	5-10 Minutes (application dependent)
Sample Preparation	Maintenance-free particle cutter

Dimensions and Weight

Housing	IP 54
Dimensions	W 600 x H 1165/1265 x D 558 mm
Weight	70 kg approx.

Electric and Hydraulic Specifications

Inflow and Outflow	20 mm ID tube, 6 x 1 mm and 4 x 1 mm
Power Supply	230 / 115 V~, 50 / 60 Hz, 100 VA
Analogue Output	0/4 – 20 mA
Serial interface	RS 232, Combined alarms, Life-Zero, USB
Remote Control	Through TCP/IP Protocol (Internet)

Equipment Devices and Data Output

High resolution and backlit TFT touch screen graphic display, 10.4"

Autostart function

Self-explanatory software and service checklist

Standard data interfaces, e. g. office PC

ALL cLeAR?

LAR Process Analysers AG: Water is our Element.
We do everything for its protection.

We are the leading manufacturer of water analysers for industrial and municipal waste water treatment, process monitoring, as well as for pure water analysis. Further products in the areas of environmental technology and industrial processing complete our product portfolio.

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Unique and state of the art.
LAR's Ultra High Temperature Method at 1,200°C!

LAR formed in 1986, gained prominence through their TOC and COD analysers. LAR is the only company worldwide that, using a high temperature method at 1,200°C, can completely oxidise a sample to accurately determine sum parameters. Particularly when measuring the TRUE TOC with differing concentrations.

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LAR is only satisfied once the customer is.

We offer application specific analysers developed by our research and development team. In addition, we maintain close contact with our clients and continually analyse the exact problem areas of every application.

Since the availability of our devices is a deciding criteria, they are constructed in a very user-friendly way. All important areas require little effort

to be accessed and the protective housing offers additional safety.

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After Sales. A familiar word to us.

Servicing is carried out by our qualified partners worldwide. Technical support, via telephone or e-mail is available at all times. Additionally, we offer practically orientated seminars and trainings, operator meetings and workshops, that leave no questions unanswered.

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We always take a closer look.

Setting ourselves the highest quality standards, we closely cooperate with our partners to fulfill the customers expectations throughout the world. Thus, we regularly evaluate our distributors and when necessary, introduce measures to improve our collaboration with them.

LAR has established its own system for guaranteeing its standards of quality. Not only do we fulfill the requirements of the ISO 9001, but we also work continually on improving our standards of quality. To enable this, we collect information about all applications in our database that are subsequently analysed and evaluated. Regular meetings are held to address every issue guaranteeing highest quality standards.

TOC-ANALYSIS	COD-ANALYSIS	BOD/TOXICITY	TNb/TP-ANALYSIS	FURTHER PRODUCTS
From complex industry waster water to phamaceutical pure water, our TOC analysers determine the parameter quickly and precisely.	With our analysers, the chemical oxygen demand is cleanly and safely determined online, without using hazardous chemicals.	We detect the BOD with the plant's own biomass and determine the toxicity with highly sensitive bacteria, fast and reliably.	TN_b and TP are important parameters for waste water treatment. We are the only ones who offer a combination of these with TOC and COD in one system.	LAR offers a specific solution for nearly all applications. With our protective housings, you are always on the safer side. Learn more about our product range at **www.lar.com.**

TOXICITY

ToxAlarm

AREAS OF APPLICATION

ENVIRONMENT / **MUNICIPAL FACILITIES** / INDUSTRY

INDUSTRIES

ENVIRONMENTAL MONITORING / WASTE WATER TREATMENT / WASTE PROCESSING / PHARMACEUTICAL / LABORATORY / PETRO-CHEMICAL / REFINERIES / CHEMICAL / COAL AND STEEL / POWER / AIRPORTS / AUTOMOBILE / PAPER MANUFACTURE / BREWERIES / FOOD MANUFACTURE / DRINK MANUFACTURE/ MILK PROCESSING

TYPES OF WATER

GROUNDWATER / **SURFACE WATER** / **DRINKING WATER** / WATER INFLUENT / WATER EFFLUENT / DISCHARGE CONTROL / INDUSTRIAL WASTE WATER / DE-ICING WATER / PROCESS WATER / HIGH SALT CONCENTRATION / OIL-IN-WATER / COOLING WATER / PURE WATER / BOILER FEED WATER / CONDENSATE RETURN / PHARMA HPW / PHARMA WFI