



# BIOSONATOR



Illustration: High-performance ultrasonic system  
(example shown with five oscillating units as a reactor model)

The complete system for more efficient energy generation in sewage treatment and biogas plants using high-performance ultrasonic technology

- + New design with optimized flow control
- + Modular design and flexibly expandable
- + High performance generators for even greater effectiveness
- + More powerful oscillating units with longer operational lifetime
- + Plug & play solution for quick and easy installation
- + Control and automation with remote maintenance

Of all the plant technologies available on the market for disintegration by ultrasonic, the high-performance ultrasonic systems from SONOTRONIC and its subsidiary Ultrawaves are the only ones that are capable of creating hard cavitation.

Hard cavitation is the only means of achieving the breakdown of biomass agglomerates and an intensification of the fermentation process.



**SONOTRONIC GmbH**  
Becker-Goering-Straße 17-25  
76307 Karlsbad, Germany  
Phone.: +49 7248 91 66-0  
Fax: +49 7248 91 66-144  
info@sonotronic.de  
www.sonotronic.de



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## Use in sewage treatment plants

The high-performance ultrasonic system (HLUS) is the product of many years of development work at Hamburg University of Technology (TUHH). Since 1995, an internationally renowned group of researchers has been working on the development of the innovative ultrasonic technology for use in sewage treatment plants. Since 2002, the high-performance ultrasonic system has been marketed internationally by the Ultrawaves company (now in 20 countries) and used for the treatment of sewage sludge.

Ultrasonic is a chemical-free process for breaking down sewage sludge. Ultrasonic waves generate local underpressure and overpressure phases in the sewage sludge suspension. Cavitation is generated at sufficiently high acoustic intensities (due to the pressure falling below the local water vapor saturation pressure in the underpressure phase of the oscillation), i.e. microscopic bubbles filled with gas and vapor are generated. In the following implosion phase these bubbles generate enormous mechanical shear forces on the biomass suspended in the sewage sludge: Within short reaction times (approx. 1 to 2 minutes) this results in the complete disintegration of the sludge flakes and filamentous sewage sludge structures and the breakdown of the biomass cells. The consequence is a lowering of sludge viscosity, particle size reduction, decomposition of micro-organisms, generation of an increase in dissolved organic substrate and release of active enzymes from the cell matrix. The digestion of the sewage sludge which has been pre-treated with ultrasonic is stimulated and intensified, which leads to increased biogas production and a reduction in the residual sewage sludge to be disposed of.

The high-performance ultrasonic system is the only ultrasonic system on the German market today which was specifically developed for the treatment of sewage sludge. The right ultrasonic configuration to be suitable for sewage sludge treatment was developed at TUHH: The patented high-performance ultrasonic system (German Patent No. 10 2013 206 492) works with an ultrasonic frequency of 20 kHz and a high acoustic intensity of 25 to 50 W/cm<sup>2</sup>. With this low-frequency, high-intensity ultrasonic configuration, sewage sludge cells are broken down using short sonification times (just 1 to 2 minutes) and with very low energy consumption. SONOTRONIC is the only manufacturer of ultrasonic devices to produce this specialist ultrasonic technology. Today, these high-performance ultrasonic systems are used in sewage treatment plants in many countries around the world (from Australia to Brazil), with proven low-maintenance operation. (e.g. at the sewage treatment plant in Bamberg, population 300,000, since 2002).

The innovative and highly efficient high-performance ultrasonic system was awarded the Innovation Award of the Federation of German Industries (Environmental Engineering Category) in 2006 and the Innovation Award of the Land of Baden Württemberg (Dr.-Rudolf-Eberle Prize) in 2007.

## BIOSONATOR high-performance ultrasonic system

### Technical characteristics:

- Flow system for continuous operation
- Reactor volumes of 20 to 50 l  
(depending on the number of oscillating units and reactor chambers)
- Number of oscillating units: 3 to 10
- Constant power output approx. 3 kW to 10 kW
- Frequency: 20 kHz
- Automatic amplitude control for amplitudes between 12 and 20 μm
- Intensity: 25 to 50 W/cm<sup>2</sup>
- Sonification time: 1 to 2 minutes
- Sonification dose: 2 to 5 kWh/m<sup>3</sup>
- Direct sonification of the biomass suspension, i.e. the oscillating units are immersed in the biomass suspension and generate so-called transient ("hard" = water vapor) cavitation as a result of the high amplitude, resulting in a rate of biomass breakdown which is around ten times that achieved by indirect sonification (oscillating unit fixed to a reactor wall) with comparable sonification doses.

### What are the components of the BIOSONATOR?

- 1 Eccentric screw pump
- 2 Macerator
- 3 High-performance ultrasonic system in new design: Modular design with 3 to 12 high-performance ultrasonic units
- 4 Control and automation with remote maintenance

