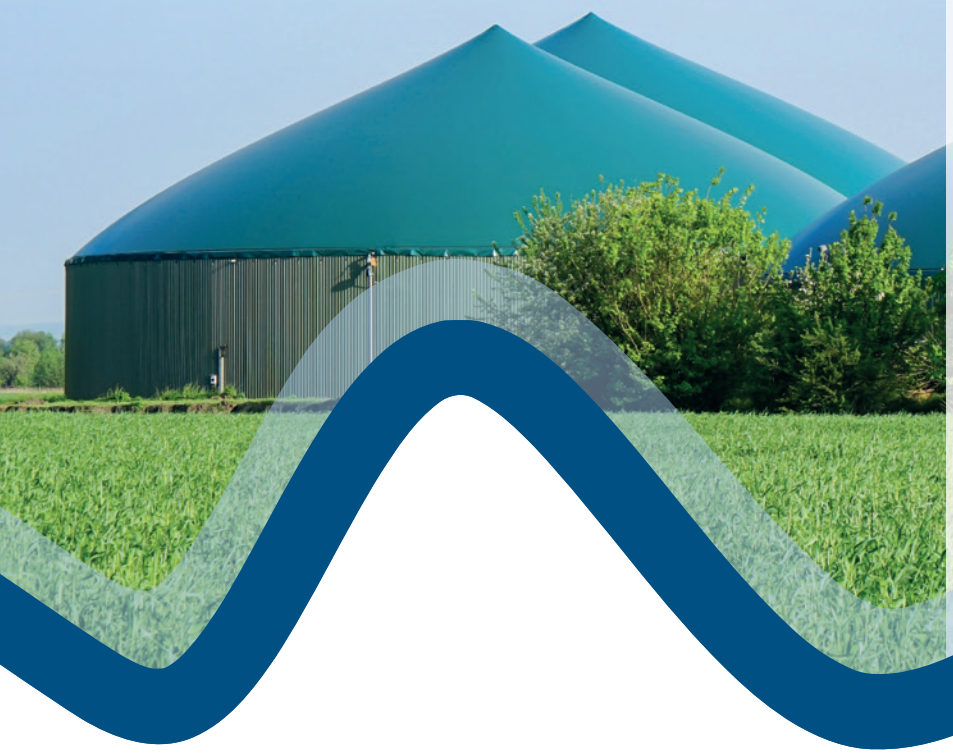
BIOSONATOR

More biogas

- The recent generation of high-power ultrasound technology
- Practical guarantee: 10 % more efficiency
- Reduction of viscosity
- Useable also for difficult substrates
- Fast amortisation



ULTRAWAVES
WASSER & UMWELTTECHNOLOGIEN GMBH

BIOSONATOR

Plug and play system for more biogas

We have made our high-power ultrasound technology even better and can now provide our customers a more efficient device: the BIOSONATOR.

The BIOSONATOR is our new complete system consisting of a modular high-power ultrasound system, upstream a macerator and an eccentric screw pump as well as an intelligent control and automation technology with remote maintenance. As a plug and play system, the BIOSONATOR can be quickly and easily integrated into existing biogas plants.

Which biogas plants are suitable?

- **Biogas plants from 300 kW**
  With the new development of the BIOSONATOR, we have succeeded in reducing investment costs by 25 – 30 %. The BIOSONATOR is thus also economically interesting for small biogas plants from 300 kW upwards. The amortisation period is approx. 3 – 4 years.
- **Nawaro plants – also for alternative fibrous substrates**
  The technology is particularly suitable for biogas plants in which hard-to-digest, fibrous, and rough substrates (e.g. grass and manure) are fed. This makes them independent of easily fermentable substrates (e.g. maize).
- **Co-digestion plants**
  In co-digestion plants, there is also a high potential for increased plant efficiency.
- **Plants with dry matter up to 15 %**
  Hard cavitation is possible for the digestion of organic substances which are difficult to degrade and have a dry matter content of maximum 15 %.
- **Mesophilically or thermophilically driven plants**
  No matter whether a biogas plant is operated mesophilically (37 – 42 °C) or thermophilically (50 – 57 °C), in both cases our high-power ultrasound technology can be used successfully.
- **Plants that shift to alternative substrates**
  By replacing expensive substrates, more favourable substrates or residues from agriculture treated with ultrasound, the substrate costs of the biogas plant can be significantly reduced.

"Because of the economical design of the BIOSONATOR, the medium is optimally treated with ultrasound on all types of systems".

High-power ultrasound technology

Better digestion of biomass through hard cavitation.

What is necessary in order to be able to disintegrate substrates?

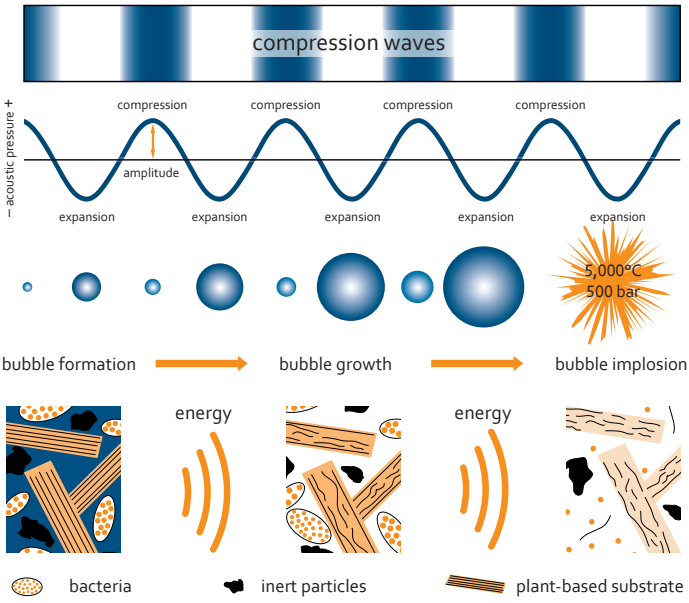
To disintegrate biomass by ultrasound, a hard cavitation is required. This can only be achieved by the use of rod oscillating units, which work at high amplitudes (approx. 20 µm). The cavitation bubbles generated implode at large diameters, thereby creating high shear forces.

Competing ultrasound technologies based on flat oscillators work at max. 2 µm and trigger only soft cavitation. The bubbles are much smaller and the energy released during the implosion is not sufficient to disintegrate cells. This inexpensive technology is therefore only used for cleaning (e.g. in the ultrasonic bath). The flat oscillators are often only glued to the pipe wall from the outside so that the pipe cavitates. Thus, a considerable amount of energy is lost when the cavitation bubbles are generated.

Measurements show: Our rod transducers are approx. 10 times more efficient and are immersed directly in the medium. Thus, all power released also goes into the treated suspension, and a true cell disintegration is achieved.

What is disintegration by hard cavitation?

Ultrasound is sound beyond acoustic sound (i.e. from 20 kHz to the megahertz range). In aqueous media, ultrasound waves cause periodic compression (pressure) and expansion (tension, negative pressure) of the medium treated with ultrasound. In the negative pressure range, high-intensity ultrasound leads to expansion of the aqueous phase, which leads to the formation of microscopic voids in the liquid. These bubbles fill with steam or gas. They grow in tension phases and shrink in pressure phases until they implode. This event is referred to as cavitation, a process under extreme (adiabatic) conditions. In the frequency range from 20–100 kHz particularly large cavitation bubbles are generated; these cause extreme mechanical shear forces during collapse. This results in pressures of 500 bar and a temperature of 5,000 °C on a micro-scale. These ultrasonic forces are capable of destroying any surface, no matter how robust it is.



Disintegration of biomass in biogas plants

How does this affect biomass?

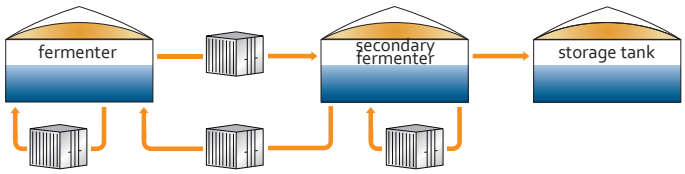
By treating a biomass suspension with high-power ultrasound, organic material and enzymes are brought into solution. The substrate is thus more bio-available for active micro-organisms and can be better utilized in the bio-degradation process. This intensification results in a greater biogas yield with the same amount of input materials or less input materials are required for the same output.

"Of all plant technologies for disintegration with ultrasound available on the market, only the high-power ultrasound systems of Ultrawaves are able to generate a hard cavitation. Only through hard cavitation biomass agglomerates are disintegrated and an intensification of the fermentation achieved".

Optimised operation in practice

Increased plant efficiency with effective ultrasound

In practice, it has proven useful to take a partial stream from the secondary fermenter, to sonicate this and return it to the fermenter or several fermenters. Other installation methods are possible and can be designed individually for each biogas plant.



Possible integration of the BIOSONATOR into biogas plants

A container solution was developed as a plug and play solution for the turnkey construction. In house (e.g. if there is sufficient place in the pump room), the system technology is mounted on a frame construction.

Ultrawaves guarantees at least 10 % increased economic benefits and guides the customers from the beginning to success! You can count on over 15 years of practical experience and over 200 successfully completed projects worldwide as well as a serious technology that is continuously being further developed.

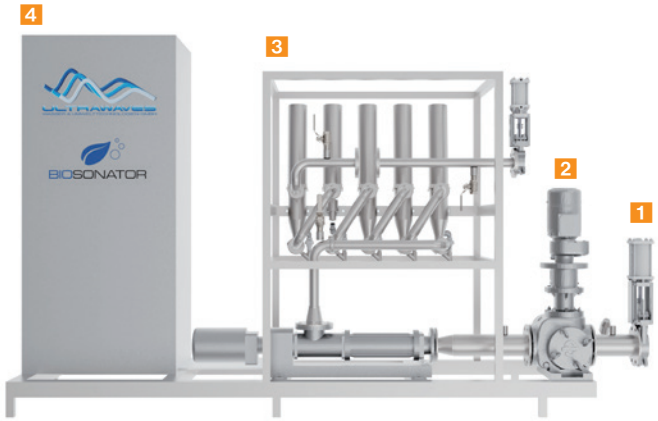
Detailed descriptions of case studies and our reference list are given on our website.

What our customers say:

"The substrate now comes out of the secondary fermenter like liquid water."
Hartwig Koop, Koop Biogas Plant (Haren, Germany) July 2015

"With the Biosonator, we have increased electricity generation in our biogas plant by 10 % for the same amount of substrate".
Hans-Joachim Deter, Wulkow Biogas Plant (Neuruppin, Germany), 2017

Which components does the BIOSONATOR have??



1. Eccentric screw pump
2. Macerator
3. High-power ultrasound system with new design (modular construction; depending on the performance of the biogas plant, 3 – 12 high-power ultrasound units)
4. Regulation and automation with remote maintenance

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