



**WEBER
ENTEC**

INCREASE OF BIOGAS YIELD THROUGH ULTRASOUND

ANTING GRAMS

TECHNICAL DIRECTOR

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**EIGENVERSORGUNG MIT ERNEUERBAREN ENERGIEN IN DER INDUSTRIE MIT SCHWERPUNKT
BIOENERGIE**

RIGA, 13. OCTOBER 2020





APPLICATION OF ULTRASOUND DISINTEGRATION

BIOGAS PLANTS



- ▣ Increase of biogas production
- ▣ Reduction of feed stock at equal performance
- ▣ Acceleration of organic degradation
- ▣ Consistent decrease of viscosity
- ▣ Reduction of pump- and stirring energy demand

WWTPs



- ▣ Increase of biogas production
- ▣ Reduction of sludge to be disposed
- ▣ Consistent decrease of viscosity
- ▣ Improved decanting
- ▣ Elimination of foam / fibrous bacteria

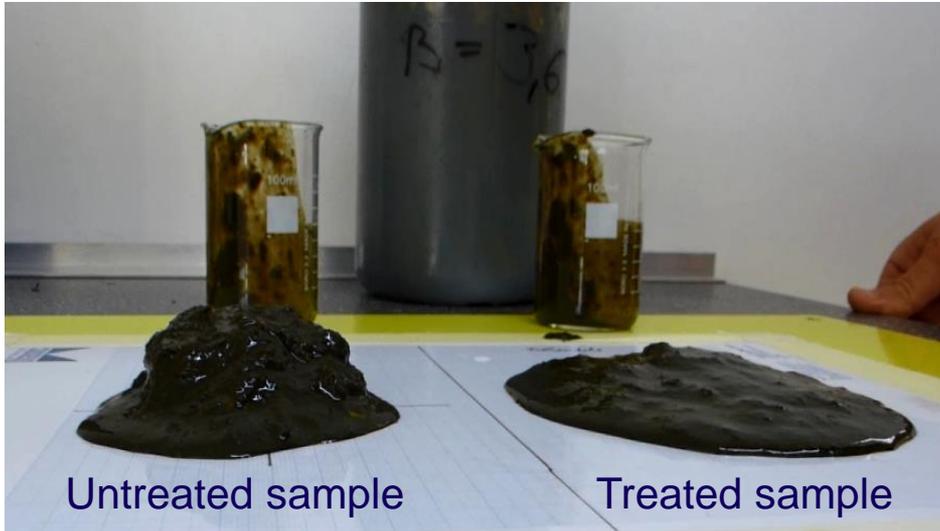


EFFECTS OF THE ULTRASOUND DISINTEGRATION





IMPROVED FLOW PROPERTIES



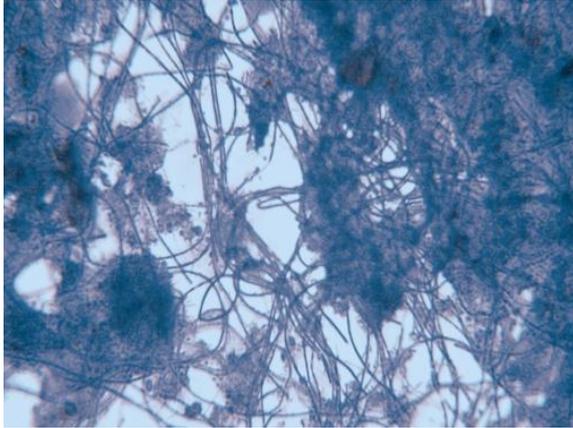
Direct comparison of the untreated and treated sample just after operation of the disintegration machine

After BioPush Treatment:

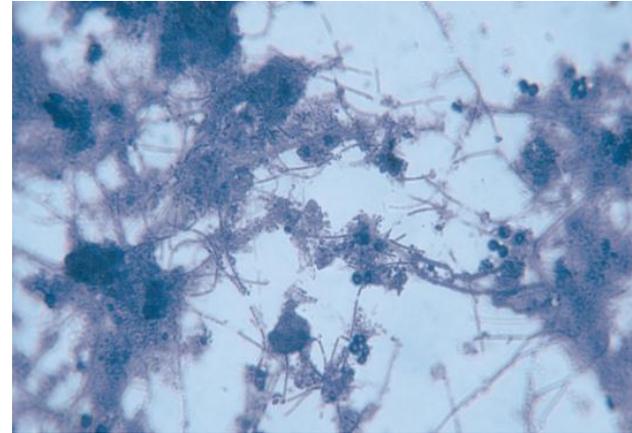
- ▣ Reduced viscosity
- ▣ Improved flow properties
- ▣ Decrease of energy consumption (pumping, stirring)
- ▣ More stable biology
- ▣ Higher proportion of difficult substrate usable (grass, manure,...)



ELIMINATION OF THE FIBER BACTERIA



Before ultrasound treatment



After ultrasound treatment



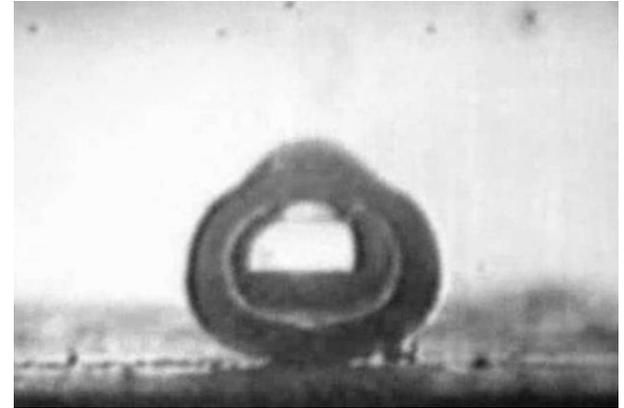
PHYSICAL PRINCIPLE – CAVITATION

Ultrasound liberates enzymes and shears up the substrates

Physical principle: Cavitation

Short term local μm -radius

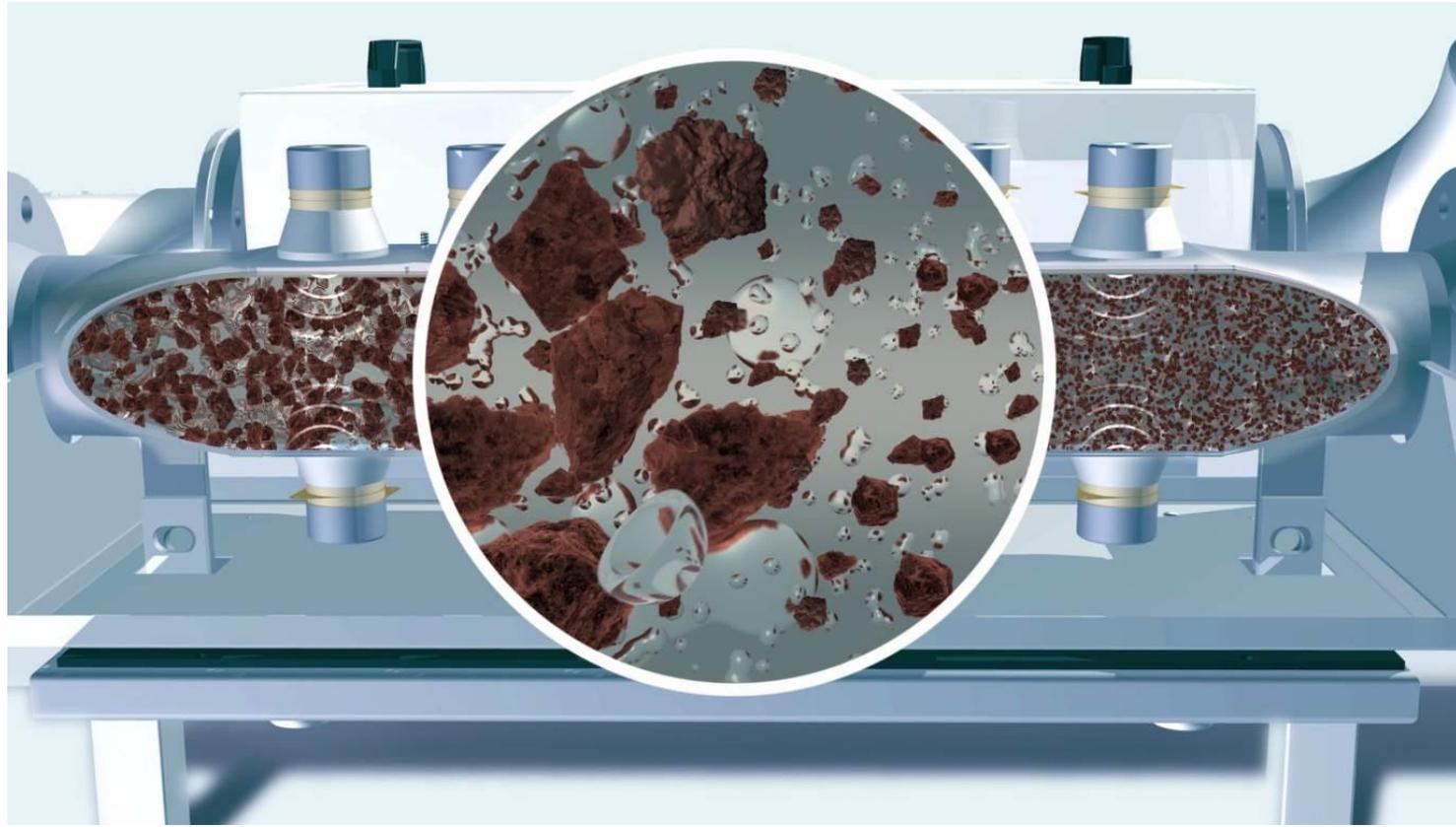
- ▣ Extreme high temperature (up to 5.000 C°)
- ▣ Extreme high pressure (up to 1.000 bar)
- ▣ Extreme high acceleration \longrightarrow Shear forces



Cavitation bubble prior to implosion



ULTRASOUND REACTOR BIOPUSH – THE NEXT GENERATION ULTRASOUND





GENERAL MACHINE DESIGN – DESIUS

1 Ultrasound unit

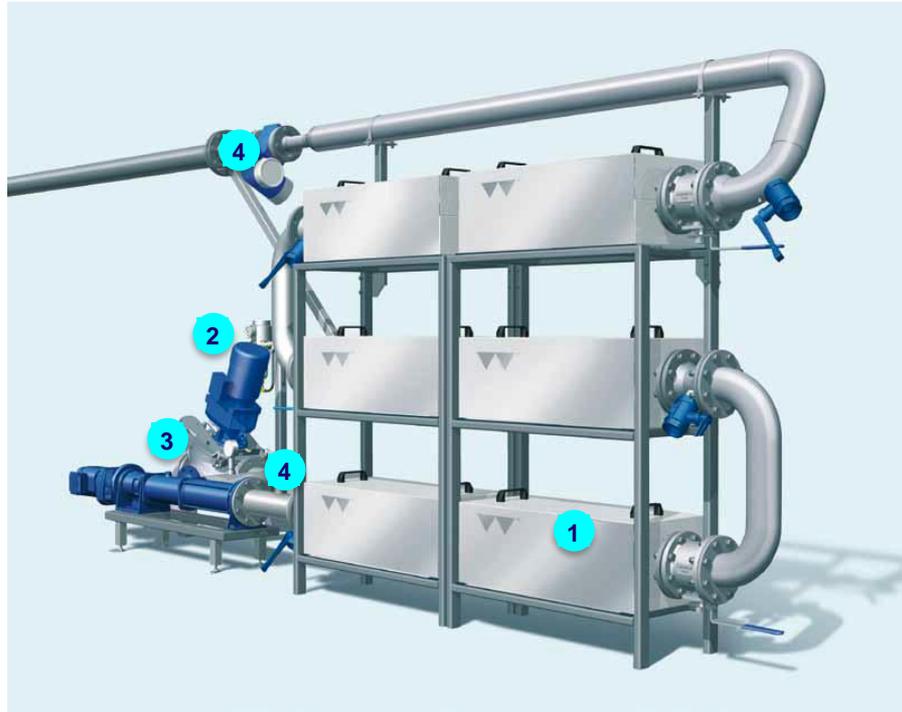
Cell rupture and surface
augmentation

Mobilization of
Exo-Enzymes

Sustained decrease
of viscosity in fermenter

Ultrasonic power
2 kW per unit

High durability –
up to 3 years and more



2 Mechanical Pre- treatment

Improved sound efficiency
and machine protection
RotaCut

3 Feeding pump

Excentric screw pump
0.5 to 2.6 m³/h

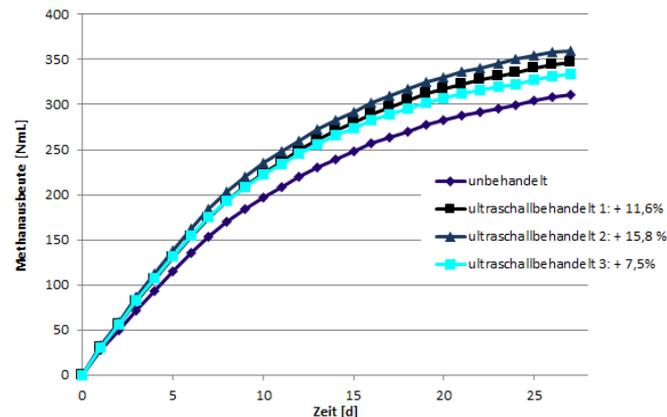
4 Sensors

2 x pressure gages,
2 x temperature sensor,
1 x flow meter



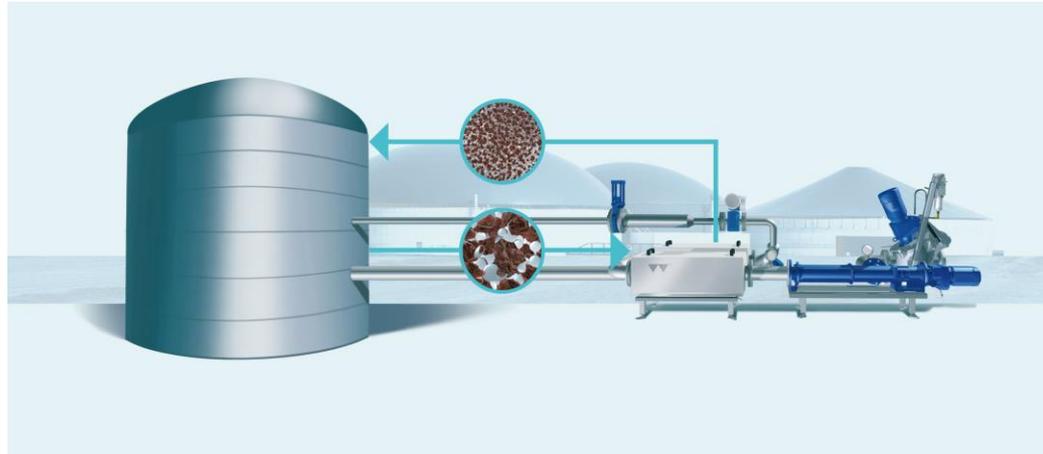
BATCH TEST WITH AMPTS II

- ▶ Sampling of various specific energy levels to identify „sweet spot“ and process window
- ▶ Sampling of untreated material (control)
- ▶ The substrate mixed with inoculum will be digested until no more significant gas production will occur (approx. 30 days)
- ▶ Comparison of treated and untreated samples





POSSIBLE INTEGRATION EXAMPLES IN BIOGAS PLANTS



Main digester

Ultrasound unit



POSSIBLE INTEGRATION EXAMPLES IN WWTP



TWAS

Ultrasound unit

digester



WWTP KAUNAS, LITHUANIA

Aim: More biogas, decrease of disposal costs (less sludge), reduction of the fiber bacteria

Location	LTU-Kaunas
Population equivalents	900.000
Ultrasound power	28 kW

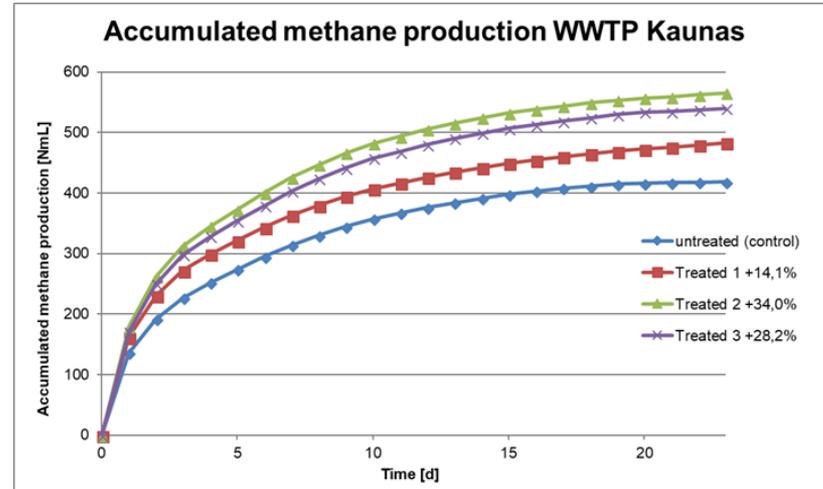


Customer wanted to improve his plant. Decision for ultrasound disintegration. Weber Entec won the tender for delivery of the turn key machine.



WWTP KAUNAS, LITHUANIA

Result: A laboratory carried out tests. An increase up to 34 % of the gas yield of the ultrasound treated samples was confirmed. Filamentous bacteria were significantly reduced.



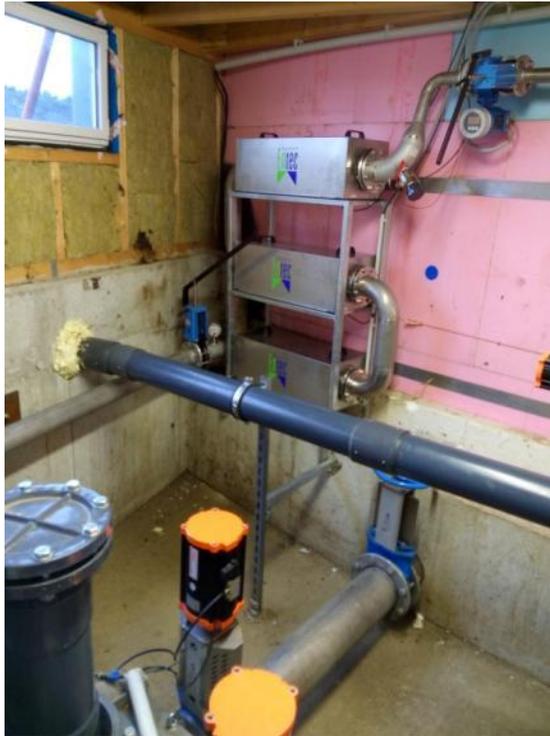


OVER 100 MACHINES CASE STUDIES AND REFERENCES WORLDWIDE







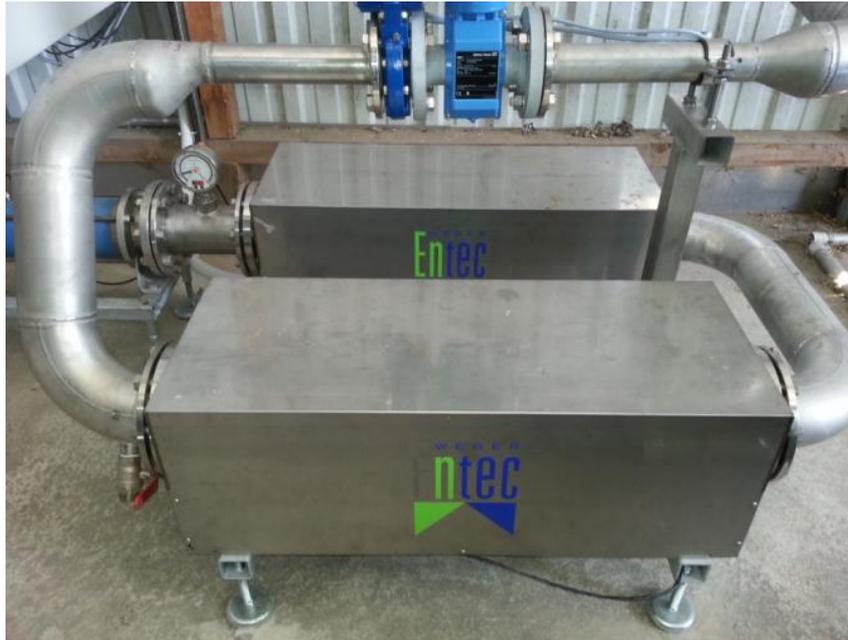
































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Thank you!

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