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TECHNICAL DESCRIPTION
VTA – GSD

Reverse flow disintegration for the treatment of sewage sludge with ultrasound

VTA Technologie GmbH, Umweltpark 1, A-4681 Rottenbach
Tel.: +43 7732/4133, E-Mail: technologie@vta.cc,
www.vta.cc

Introduction:

Generally disintegration means the reduction of sewage sludge to small pieces by effect of external forces. This happens e.g. by mechanical, thermical or chemical processes. The use of ultrasound (mechanical sewage sludge disintegration) has proven to be very successful – in a scientific way as well as in practice. It is save, economic and easy to integrate in the sewage process.

The reverse flow disintegration unit (VTA - GSD):

The disintegration effect with the reverse flow disintegration unit developed and patented by VTA Technology GmbH is achieved by ultrasound (fq 25kHz). The thickened sludge continuously flows bottom-up through the disintegration reactor. The ultrasonic transducers are located in this reactor. By means of an agitator the sludge suspension is treated by continuously being passed through the ultrasonic elements. Depending on the residence time of the sludge in the reactor, the flow rate, the rotation speed of the agitator and the energy input of the integrated ultrasonic elements, the degree of disintegration (A-COD, release of enzymes) can be selected. The treated sludge is subsequently transferred to the digestion process.

Further possibilities of ultrasonic disintegration are:

- Disintegration of thickened sludge to increase the organic degradation in the digestion
- Disintegration of filamentous bacteria (bulking sludge) to control foam in digesters
- Disintegration of anaerobic digested sludge to increase dry matter drain system
- Disintegration of bulking sludge to improve the settling behaviour

Effects caused by the use of a VTA - GSD:*

- reduction of organic substances in the digested sewage sludge (oTR) up to 25%
- increase of biogas quantity up to 30%
- increase of electricity production up to 30%
- reduction of total sewage sludge production and therefrom deriving disposal costs up to 20%
- foam-control in the digestion tank if caused by filamentous bacteria
- increase of dry matter in the discharge of the dewatering-system up to 15%
- decrease of the employed auxiliary products (polymers) for the sludge dewatering up to 20%
- a more stable digestion is accomplished
- sustainable process-improvements in the biological sewage plant operation by control of filamentous bacteria (floating / bulking sludge, settling behaviour of the activated sludge, etc)

* Alll information relates to achievable improvements/optimizations and can't be regarded as a guaranteed value.

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Why a GSD installation from VTA?

- High flexibility of the installation through freely selectable setting of the degree of disintegration (low up to high energy mode of operation), upgrading of the installation can be done very easy
- Optimum utilization of the applied energy (freely selectable residence time in the reactor, agitator speed and energy absorption / output of the oscillators are infinitely variable)
- Trouble free operation without blockages, no pre-treatment to homogenise the sludge with macerator
- Extensive and deep know-how in all areas of sewage plant technology
- Europe-wide comprehensive service network
- Modular construction of the ultrasonic systems enables simple repairs instead of cost-intensive renewals
- Unpressurized autonomous operation – this allows a simple integration in nearly all sewage plants
- Low-maintenance components only from well-known producers with long term parts supply

Components and description:

1. Mechanical components:

- **Reactor:**
  - Material: 1.4571 stainless steel (stained and glass-bead blasted)
  - Material thickness: 4 mm
  - Pressure rating: 3 bar
  - Installation height: 1800 mm
  - Diameter: 800 - 1500 mm
  - Volume: 0.3 – 2.5 m³
  - Pipe connections: Flange connection for charging and discharging, Ultrasonic oscillators, agitator and cleaning purposes and inspection work,
  - Threaded connections: for pressure monitoring and level measurement,
  - Entlüftungsstutzen (ball valve, Storz C-coupling)
  - Connection for rinsing purposes and complete draining (ball valve, Storz C-coupling)

- **Ultrasonic oscillation system:**
  - Quantity: 1 to 12 units
  - Model: Push-Pull (two headed)
  - Manufacturer: Martin Walter Ultraschalltechnik AG, Germany
  - Material: Titanium alloy
  - Output: max. 2000 Watt
  - Frequency: 25 kHz

- **Agitator:**
  - Power: 3 or 4 kW
  - Voltage: 400 V/50 Hz
  - Gears: Hollow shaft gears by Siemens/Flender
  - Revs. per minute: 30 – 120 rpm – frequency transformer controlled
  - Seal: Metal bellows - Axial face seal

- **Charging pump for reactor:**
  - Manufacturer: eccentric screw - according to the customers' request
  - Type: eccentric rotor pump
  - Power and flow rate: depending on model
  - Control: frequency transformer controlled
  - Scope of supply: Pump with drive and the base is made of stainless steel

2. Electro-technical components

- **Control cabinet:**
  - Voltage: 3 x 400 V AC, 50Hz, PE
  - Fuse protection: depending on the size of the disintegration plant
  - Design: Vertical switch cabinet
  - Manufacturer: Rittal, steel plate (RAL 7035 gray)
  - Dimensions: 2000 x 1200 x 800 mm (standard size)
  - Protection category: IP54
  - Others: Ventilator with dust filter and temperature monitoring or air condition

- **Controller:**
  - Manufacturer: Siemens
  - Modell: SIMATIC S7 - 1500
  - Digital input group: 24 V DC – potential separated
  - Digital output group: 24 V DC – potential separated
  - Control – Assembly: 4 – 20 mA – potential seperated
  - Automatic mode: Sämtliche Anlagenkomponenten werden automatisch ein- und ausgeschaltet bzw. entsprechend geregelt
  - Manual mode: manueller Betrieb unter Einbeziehung der Sicherheitseinstellungen
  - Service mode: Test einzelner Anlagenkomponenten durch Umgehung der Sicherheitseinstellung

- **Operator device:**
  - Manufacturer: Siemens HMI
  - Model: TP1200
  - Description: 12" colour display with touch screen function

- **MID (Magnetic inductive flow measurement)**
  - Manufacturer: E&H
  - Model: Promag compact microprocessor transmitter/controller
  - Nominal width: DN 25-50
  - Outlet: 4 - 20 mA, impulse output is programmable
  - Function: Flow volume rate regulation and dry-running protection of the pump

- **Pressure control:**
  - Pressure control: E&H Precont
  - Level measuring: E&H Vibrocont

3. Engineering:

- **Pre-delivery:**
  Preliminary tests with WWTPs sludge in pilot plant installation (if necessary). Preparation of the layout (constructive and energetic) of the GSD. Chemical and microscopic analysis (before and after handling with ultrasonic). Support during the integration of the GSD into the present process technology and the WWTPs pipe work.

- **Delivery / assembling / start up:**
  One-time delivery of all installation components completely factory assembled. Final assembly and start up by VTA fitter and engineer.

- **Briefing / Training:**
  Repeated briefing and training of the staff at the installation.

- **Process optimization:**
  Fine tuning of the GSD installation and the immediate surroundings in a technical and process-technical respect (especially the constraints of the sludge digestion installation), preparation of an optimum operating regime under consideration for the existing sewage plant facilities and their operating situation.

- **Evaluation:**
  Evaluation of operating and cost-effectiveness relevant parameters such as CSB, P, N, gas production, energy production, organic matter of the digested sludge, total amount of excess sludge etc. (system-specific definition).

- **Maintenance:**
  To ensure long sustainable functionality and effective operation, a maintenance contract is offered. This contract is necessary during warranty period.

- **Guarantee:**
  There is a 24 – month guarantee for the whole installation from the date of start up.

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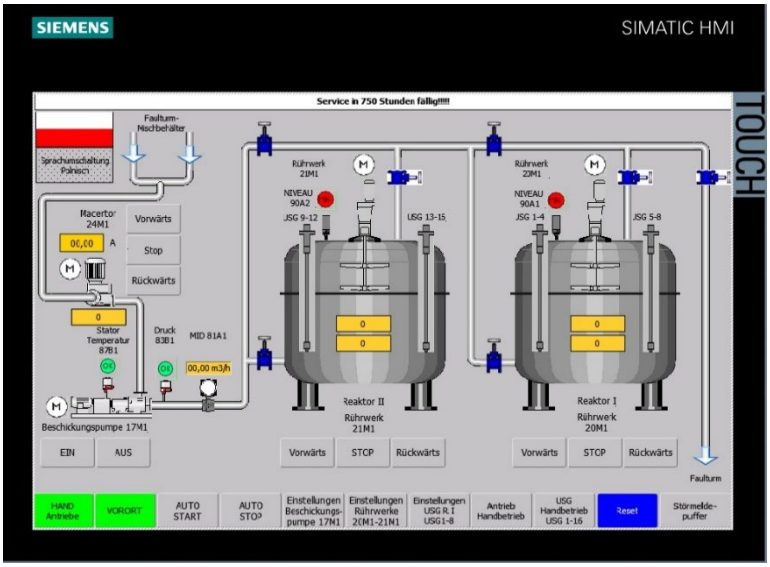
Realised projects

Pilot plants: full scale and lab scale

Control cabinet with controller



Siemens HMI TP1200-12" colour touch screen panel

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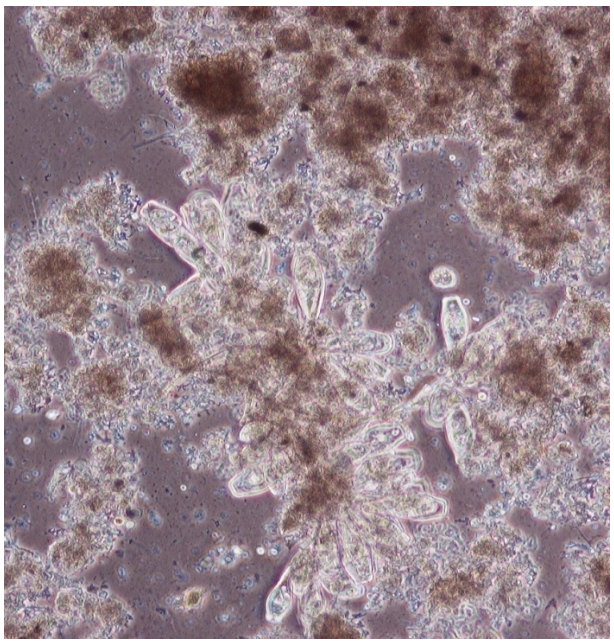
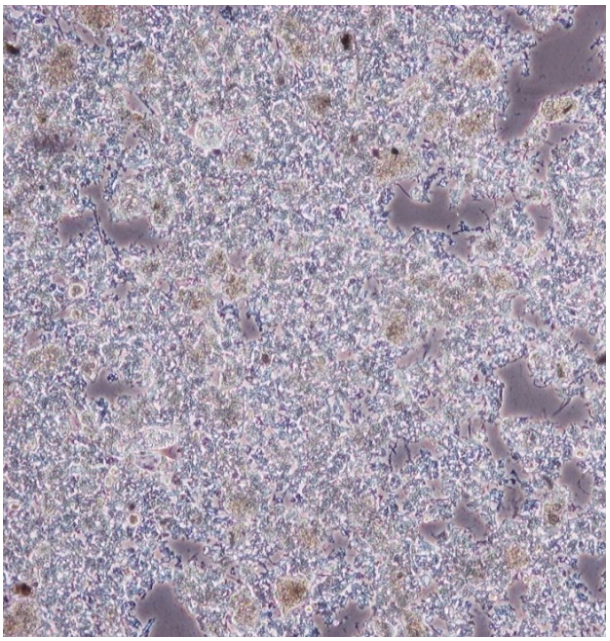
Microscopic analysis of sludge

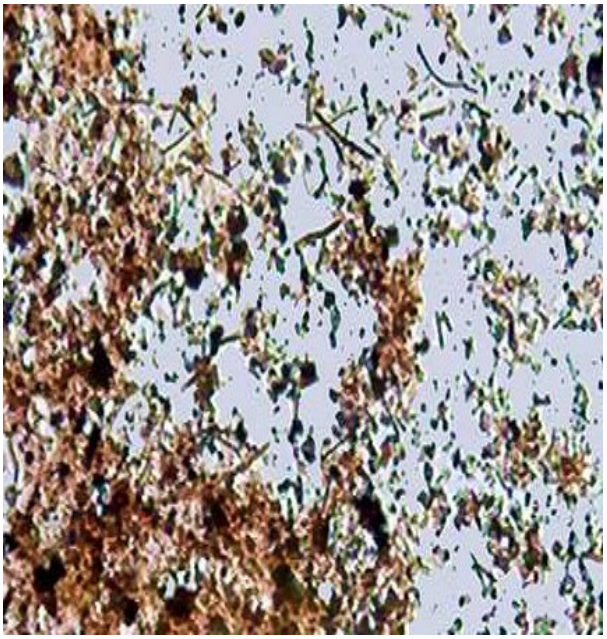


Intact flocs ans organisms
(here: Opercularia)
before disintegration;
100x magnified



Destroyed flocs and organisms:
here destroyed Arcella;
after disintegration;
100x magnified

Intact filamentous organisms
before desintegration



destroyed filamentous organisms
after desintegration

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