

CE 702

Anaerobic water treatment



The illustration shows: supply unit (left) and trainer (right)

Description

- anaerobic degradation of organic substances in the stirred tank and UASB reactor
- three different operation modes

CE 702 demonstrates the biological anaerobic water treatment. The trainer consists basically of two units:

- stirring tank with secondary clarifier
- UASB reactor

Both units can be used separately or in combination. This allows both a single stage and a dual stage operation mode. In the dual stage operation a pump first transports the raw water into a stirred tank. In this tank the acidification of the organic substances dissolved in the raw water takes place. Here, anaerobic microorganisms convert the long-chain organic substances into short-chain organic substances. In a secondary clarifier the biomass discharged from the stirred tank is separated from the water. The separated biomass is pumped back into the stirring tank.

From the secondary clarifier the raw water pretreated in this manner reaches a UASB reactor (UASB: Upflow Anaerobic Sludge Blanket). Here the final step of the anaerobic degradation takes place.

The previously formed short-chain substances are converted by special microorganisms into biogas (methane and carbon dioxide). Flow through the UASB reactor is from the bottom to the top. At the top of the UASB reactor there is a separation system. This separates the generated gas from the treated water. It also ensures that the biomass remains in the reactor. The gas can be discharged externally or collected. The treated water exits at the top end of the reactor and is collected in a tank.

To adjust the flow velocity in the UASB reactor a of the treated water can be recirculated.

The temperatures in the stirred tank and the UASB reactor can be controlled. The pH value in the stirred tank is measured. In addition, the pH value in the UASB reactor can be controlled. A software and webcam are available for data acquisition and visual inspection.

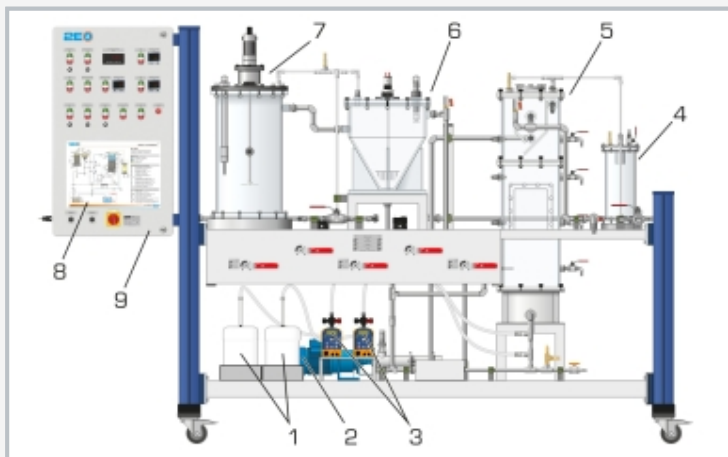
Anaerobic biomass and analysis technology are required to perform the experiments. Recommended parameters are: COD (chemical oxygen demand), nitrogen and phosphorus.

Learning objectives/experiments

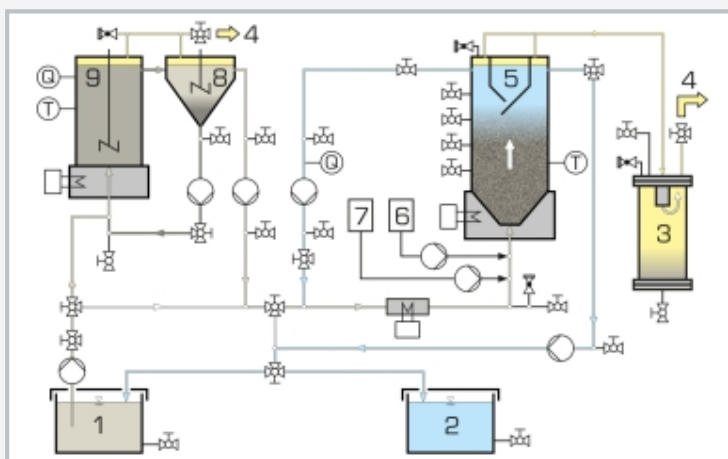
- familiarisation with anaerobic water treatment
- effects of temperature and pH value on anaerobic degradation
- functional principle of a UASB reactor
- comparison of single stage and dual stage operation mode
- monitoring and optimisation of the operating conditions
- identification of the following influencing factors
 - ▶ sludge loading
 - ▶ volumetric loading
 - ▶ flow velocity in the UASB reactor

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1 chemical tanks, 2 circulation pump, 3 metering pumps, 4 foam separator, 5 UASB reactor, 6 secondary clarifier, 7 stirred tank, 8 process schematic, 9 switch cabinet



1 raw water, 2 treated water, 3 foam separator, 4 gas, 5 UASB reactor, 6 acid, 7 caustic, 8 secondary clarifier, 9 stirred tank; T temperature, Q pH value



UASB reactor during experimental operation

Specification

- [1] anaerobic degradation of organic substances
- [2] stirred tank with secondary clarifier
- [3] UASB reactor with separation system
- [4] separate supply unit with tanks for raw water and treated water
- [5] single stage or dual stage operation mode
- [6] temperatures in the stirred tank and the UASB reactor can be controlled
- [7] control of the pH value in the UASB reactor
- [8] GUNT software for data acquisition via USB under Windows 10
- [9] visual inspection with webcam

Technical data

Tanks

- stirred tank: 30L
- secondary clarifier: 30L
- UASB reactor: 50L
- tank for raw water: 180L
- tank for treated water: 180L

Flow rates (max.)

- raw water pump: 10L/h
- return sludge pump: 10L/h
- circulation pump: 100L/h
- metering pumps: 2x 2,1L/h

Measuring ranges

- pH value: 0...14
- temperature: 0...100°C

400V, 50Hz, 3 phases

400V, 60Hz, 3 phases

230V, 60Hz, 3 phases

UL/CSA optional

LxWxH: 1550x790x1150mm (supply unit)

LxWxH: 2830x790x1900mm (trainer)

Total weight: approx. 520kg

Required for operation

water connection, drain, sewage sludge, pellets from an UASB reactor, substances for preparation of artificial wastewater, caustic soda, hydrochloric acid, pH calibration solutions, potassium chloride solution
PC with Windows recommended

Scope of delivery

- 1 trainer
- 1 supply unit
- 1 set of accessories
- 1 GUNT software + USB cable
- 1 set of instructional material