

CE 705

Activated Sludge Process



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

Description

- wastewater treatment plant in laboratory scale
- aerobic biological degradation of organic substances
- nitrification and pre-denitrification

The activated sludge process is the most important biological process in water treatment. CE 705 enables this process to be demonstrated.

A pump delivers raw water contaminated with dissolved organic substances (organic matter) into the aeration tank. Aerobic microorganisms (activated sludge) in the aeration tank use the organic matter as a source of nutrition, biodegrading it in the process. Since aerobic microorganisms need oxygen, the raw water is aerated in the aeration tank. The activated sludge is mixed with the raw water by stirring machines. In the secondary clarifier the activated sludge is then separated from the treated water by sedimentation. A portion of the activated sludge is returned to the aeration tank (return sludge). The treated water is collected in a tank.

It is also possible to convert ammonium into nitrate (nitrification) and nitrate into nitrogen (denitrification). For denitrification a zone without aeration can be created in the aeration tank by installing a partition wall.

The following flow rates are adjustable: raw water, return sludge, internal recirculation for pre-denitrification and air. Oxygen concentration, pH value and temperature can be controlled.

A software program is provided to display the operation states and measure data. A process schematic shows the current operating states of the individual components and the measured data.

Samples can be taken at all relevant points. Activated sludge from a wastewater treatment plant and analysis technology are required for the experiments. Recommended parameters are:

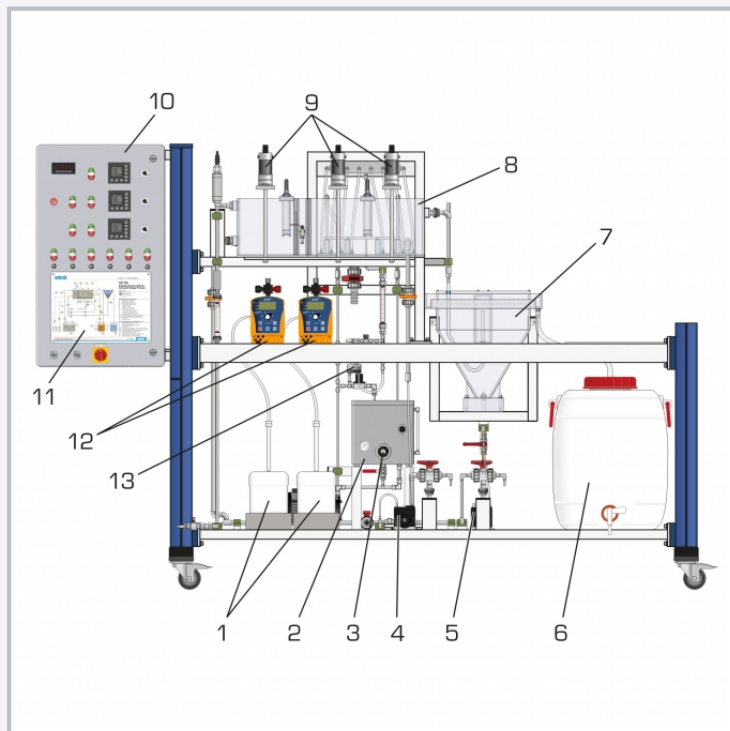
- BOD₅ (biochemical oxygen demand)
- COD (chemical oxygen demand)
- NH₄ (ammonium)
- NO₃ (nitrate)

Learning objectives/experiments

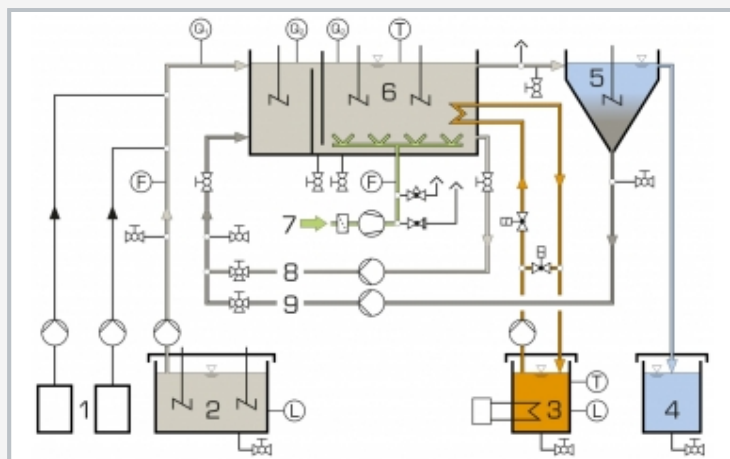
- learning the fundamental principle of the activated sludge process
- functional principle of nitrification and pre-denitrification
- creation of a stable operating state
- identification of the following influencing factors
 - ▶ return sludge ratio
 - ▶ return ratio of the internal recirculation
 - ▶ sludge age
 - ▶ sludge loading
 - ▶ volumetric loading
 - ▶ oxygen concentration, pH value and temperature
- efficiency of the pre-denitrification

CE 705

Activated Sludge Process



1 tanks for acid and caustic, 2 heating water tank, 3 heater, 4 circulation pump, 5 return sludge pump, 6 treated water tank, 7 secondary clarifier, 8 aeration tank, 9 stirring machines, 10 switch cabinet, 11 process schematic, 12 metering pumps, 13 compressor



1 acid and caustic, 2 raw water, 3 heating water, 4 treated water, 5 secondary clarifier, 6 aeration tank, 7 air, 8 internal recirculation for pre-denitrification, 9 return sludge; F flow rate, L level, Q_1 pH value, Q_2 oxygen concentration, T temperature

Specification

- [1] biological wastewater treatment
- [2] aeration tank with 3 stirring machines
- [3] secondary clarifier
- [4] nitrification and pre-denitrification
- [5] separate supply unit with 2 stirring machines
- [6] all relevant flow rates adjustable
- [7] control of temperature, pH value and oxygen concentration
- [8] measurement of flow rate, temperature, pH value and oxygen concentration
- [9] GUNT software for data acquisition via USB under Windows 7, 8.1, 10
- [10] GUNT software with display of the operation states
- [11] visual inspection with webcam on PC

Technical data

Aeration tank

- capacity nitrification zone: approx. 34L
- capacity denitrification zone: approx. 17L

Tanks

- secondary clarifier: 30L
- raw water tank: 200L
- treated water tank: 80L

Flow rates

- raw water pump: max. 25L/h
- return sludge pump: max. 25L/h
- circulation pump: max. 25L/h

Speeds (stirring machines)

- secondary clarifier: max. 45min^{-1}
- all others: each max. 600min^{-1}

Measuring ranges

- flow rate:
 - ▶ 2...25L/h (raw water)
 - ▶ 50...550L/h (compressed air)
- temperature: 0...40°C
- pH value: 0...14
- oxygen concentration: 0...10mg/L

230V, 50Hz, 1 phase

230V, 60Hz, 1 phase; 120V, 60Hz, 1 phase

LxWxH: 1550x790x1150mm (supply unit)

LxWxH: 2830x790x1900mm (trainer)

Total weight: approx. 450kg

Required for operation

water connection, drain, activated sludge, substances for preparation of artificial wastewater, caustic soda, hydrochloric acid; PC with Windows recommended

Scope of delivery

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