

CE 704

SBR process



2E

Description

- biological wastewater treatment
- Sequencing Batch Reactor (SBR)
- process controller with touch screen

The SBR process is a biological, aerobic wastewater treatment process. In contrast to the classic activated sludge process, the individual process steps are not continuous and do not take place simultaneously, but rather are carried out in batches and sequentially in one single reactor.

The reactor is equipped with a compressor for aeration and a stirring machine. The stirring machine ensures sufficient mixing of the reactor contents even in phases without aeration (denitrification). At the end, the treated water (clear water) is extracted from the reactor and collected in a tank. This is done with a floating device, as is typical for the SBR process. Above the reactor is a device for metering an external carbon source (e.g. sugar solution) if required.

Timers for the compressor and stirring machine make it possible to set the aeration phases (nitrification) and mixing phases (denitrification) individually.

The oxygen concentration, pH value and temperature in the reactor are measured. A digital process controller continuously displays the measured values and the speed of the stirring machine. The process controller has a touch screen and also functions as a controller for the oxygen concentration during the aeration phases.

Activated sludge (e.g. from a wastewater treatment plant) is required for the experiments. Table sugar (sucrose) can be used as a carbon source for the synthetic wastewater. The following parameters must be determined in order to analyse the experiments:

- total organic matter
 - BOD₅ or COD or TOC
- nitrogen concentrations
 - NH₄-N: ammonium
 - NO₂-N: nitrite
 - NO₃-N: nitrate

Learning objectives/experiments

- how the SBR process works
- elimination of nitrogen by nitrification and denitrification
- influence of cycle design on treatment results
- recording and interpretation of chronological concentration patterns
- determining conversion rates
- sedimentation properties of activated sludge

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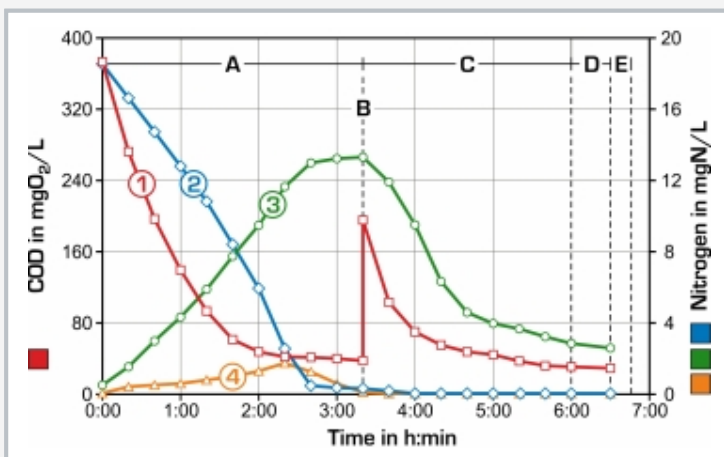
SBR process



1 control elements for the compressor and for the stirring machine, 2 process controller, 3 flow meter (air), 4 pH value sensor, 5 metering device, 6 stirring machine, 7 oxygen sensor, 8 aeration device, 9 float for clear water extraction, 10 suction bulb for clear water



Digital process controller display of process variables (left), user interface for controlling oxygen concentration (right)



Measured concentration patterns
1 chemical oxygen demand (COD), 2 ammonium ($\text{NH}_4\text{-N}$), 3 nitrate ($\text{NO}_3\text{-N}$), 4 nitrite ($\text{NO}_2\text{-N}$)

Process steps

A mix with aeration (nitrification), B metering a sugar solution (external carbon source), C mix without aeration (denitrification), D sedimentation of the activated sludge, E extraction of the treated water (clear water)

Specification

- [1] discontinuous activated sludge process
- [2] Sequencing Batch Reactor (SBR)
- [3] stirring machine with timer and continuously adjustable speed
- [4] compressor with timer for aeration
- [5] floating device for extraction of the treated water
- [6] metering device for external carbon source
- [7] flow meter for aeration
- [8] tanks for wastewater and treated water
- [9] measurement of pH value, temperature and oxygen concentration
- [10] process controller with touchscreen for displaying process variables and for controlling the oxygen concentration

Technical data

Reactor

- \varnothing 290mm
- height: 300mm
- max. capacity: 18L
- material: plexiglass

Tanks

- wastewater: 15L
- treated water: 30L
- metering vessel: 260 mL

Stirring machine: max. 330min^{-1}

Compressor: max. $15,5\text{L}/\text{min}$

Measuring ranges

- oxygen concentration: $0\text{...}20\text{mg}/\text{L}$
- pH value: $0\text{...}14$
- temperature: $0\text{...}50^\circ\text{C}$
- flow rate: $50\text{...}900\text{L}/\text{h}$

230V, 50Hz, 1 phase

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

UL/CSA optional

LxWxH: $850 \times 520 \times 480\text{mm}$

Weight: approx. 30kg

Required for operation

aerobic activated sludge, sugar, analysis technology

Scope of delivery

- 1 experimental unit
- 3 packing units of pH calibration solution (1L each)
- 1 packing unit of potassium chloride solution (1L)
- 1 packing unit of ammonium hydrogen carbonate (250g)
- 1 packing unit of dipotassium hydrogen phosphate (250g)
- 1 set of accessories
- 1 set of instructional material