



Level



Pressure



Flow



Temperature



Liquid  
Analysis



Registration



Systems  
Components



Services



Solutions

# Sequencing batch reactors

## Waste water treatment for small plants

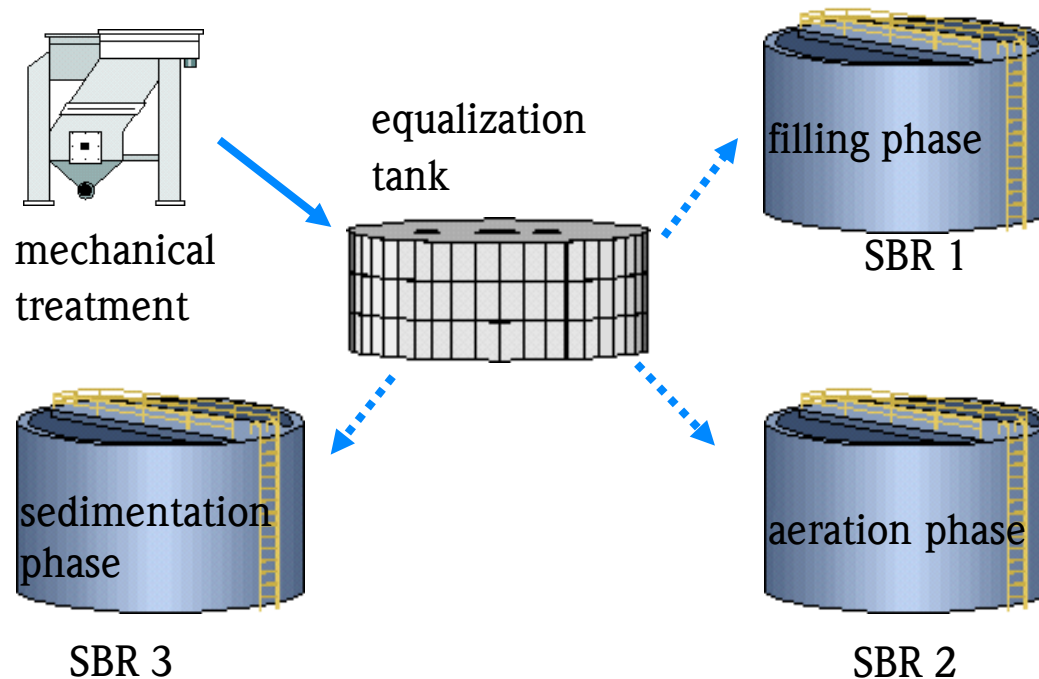


# SBR versus conventional waste water treatment

Conventional wwtp	SBR-wwtp
Continuously flown reactor	Batch reactor
Treatment steps take place in different basins	All treatment steps take place in the same basin
Water is guided through the plant - low influence to retention time	Water stays in one basin - retention time can be influenced easily
Equalization tanks are an exception	Equalization tanks are typical
All sizes are common	Size typically from 200-30,000 inhabitants

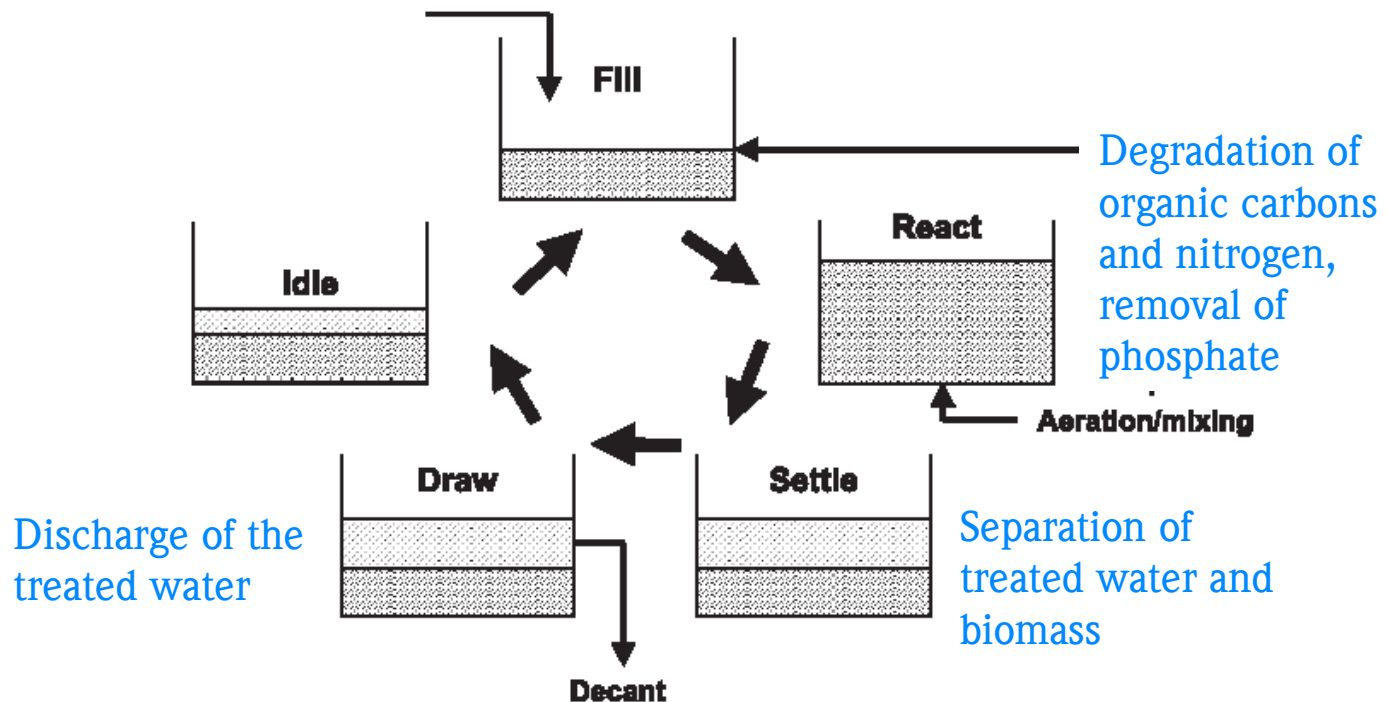
# Typical design of an SBR plant

- as the water comes in continuously, but the treatment takes place discontinuously an SBR plant consists of 2-3 reactors
- an additional equalization tank is typical to collect the incoming water
- a sequence typically needs 6-8 hours
- SBR'S are in a time shift sequence to each other



# Working principles of the reactor

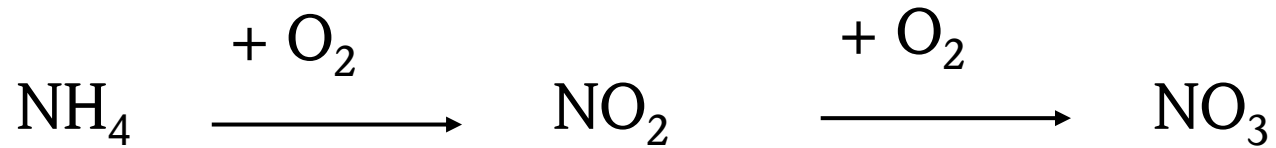
- the continuous incoming water is collected in the equalization tank
- from the equalization tank it is delivered to the SBR, which is in an idle state
- all treatment steps in the reactor take place in a defined order
- after treatment the water is separated from the sludge by sedimentation and discharged



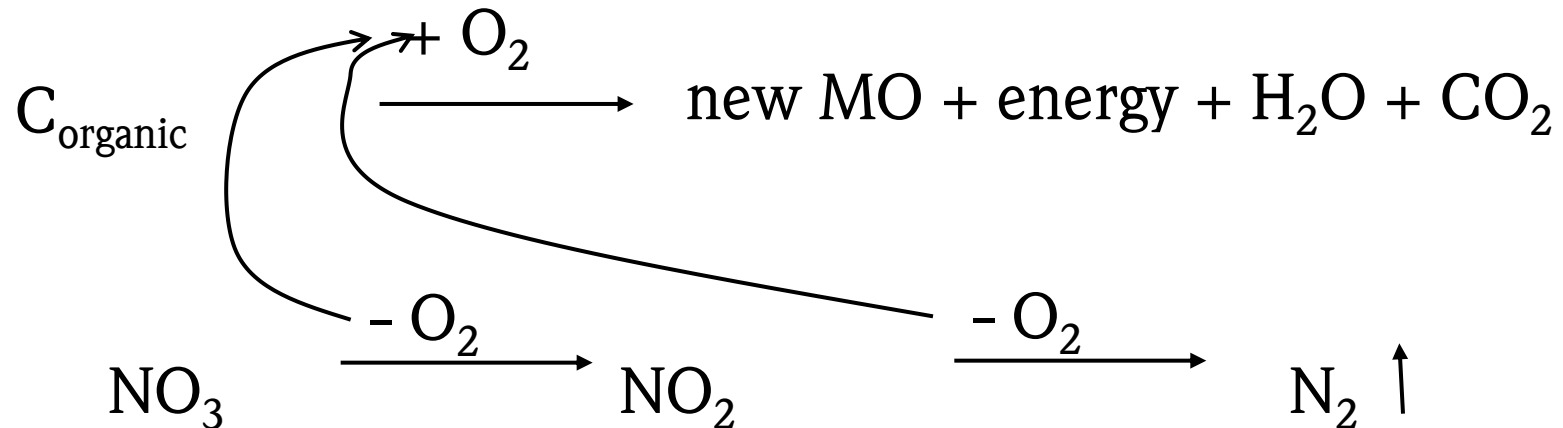
## Reaction phase: Nitrogen elimination

Removal of nitrogen takes place by biological degradation in two steps:

### Nitrification (aerob)



### Denitrification (anox)

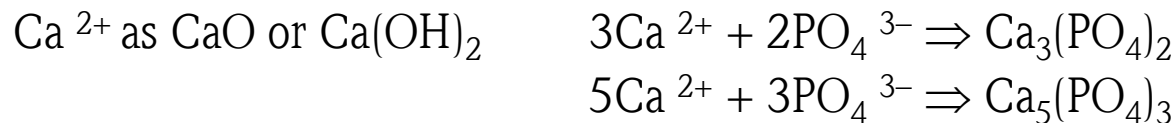
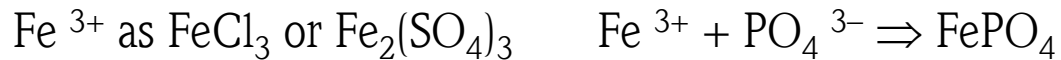


## Reaction phase: Phosphorus elimination

Phosphorus leads to algae growth (eutrophication) and therefore must be removed

Removal of phosphorus takes place by biological phosphorus degradation and / or precipitation of phosphate.

For precipitation the following chemicals are used:



Better efficiency of phosphorus removal can be achieved by dosing the precipitant after the aeration phase, because some phosphorus components are changed into phosphate by oxygen.

# Instrumentation in the SBR



## Instrumentation at inlet and outlet

- flow  
monitoring and selection of  
sequence times
- sampler\*  
monitoring
- pH  
neutralization or monitoring



## Instrumentation of equalization tanks

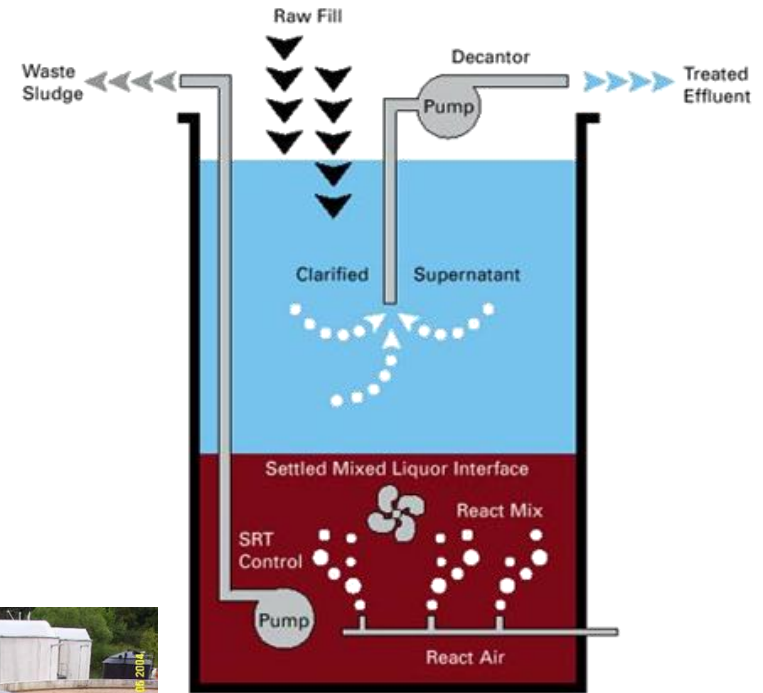
- level
- monitoring

\* = advanced instrumentation



# Instrumentation in the SBR (1)

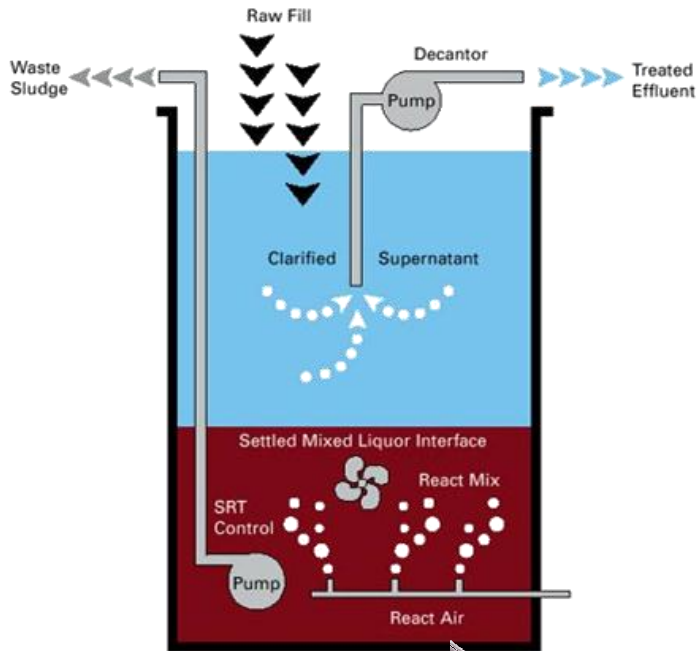
- water level  
control of filling
- sludge level\*  
monitoring of successful sedimentation
- dissolved oxygen  
control of max and min concentrations
- air flow\*  
monitoring



\* = advanced instrumentation



# Instrumentation in the SBR (2)



- suspended solids  
control of sludge removal
- ammonium\*  
control of aeration times
- phosphate\*  
control of precipitant dosage
- nitrate\*  
control of anox time (and aeration times if no ammonium analyzer is installed)



\* = advanced instrumentation

# Special conditions in an SBR

- The water **level** changes drastically
  - installation of measuring devices that must stay wet, using a floating assembly, below minimum level or wet bucket

**but keep in mind**

- difficult handling of very long assemblies
- counter pressure or suction height (e.g. for CAT430)



# Special conditions in an SBR

- The water **quality** changes drastically
    - devices have to deal with clean/ clear water up to inlet water quality
- keep in mind**
- e.g. nitrate sensors : must have a sample preparation
  - you must have cleaning devices or installation conditions to deal with inlet quality

# Special conditions in an SBR

- Continuous measurement values are **not** needed

- multi channel might be an option to save costs

**keep in mind**

- some measurement values might be needed at the same time from different basins
- triggering of the multi channel measurement should happen via the PLC and not by the instrument
- response time is essential
- sample transfer and avoiding “mixtures” are essential



# Sequence examples

SBR 1	each cell = 10 minutes										each cell = 10 minutes										each cell = 10 minutes																			
	1					2					3					4					5					6														
Filling	X	X	X	X	X	X	X	X	X	X																														
Mixing	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X																				
aeration	X	X	X	X	X	X	X	X	X	X																														
Mixing with two mixers	X	X	X	X	X						X	X	X							X	X	X																		
alternate: filling + mixing																																								
FeCl3-Dosage																					X	X	X																	
Sedimentation																																								
Dekantation																																								
surplus sludge removal																																								
NH4-N measurement	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
NO3-N measurement	X			X		X		X		X	X			X		X		X		X	X			X		X		X		X		X		X		X		X		
PO4 measurement											X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	

NH4-N measurement	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X																				
NO3-N measurement	X			X		X		X		X	X			X		X		X		X	X			X		X		X		X		X		X		X		X	
PO4 measurement											X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

NH4-N measurement	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X																				
NO3-N measurement	X			X		X		X		X	X			X		X		X		X	X			X		X		X		X		X		X		X		X	
PO4 measurement											X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

NH4-N measurement	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X																				
NO3-N measurement	X			X		X		X		X	X			X		X		X		X	X			X		X		X		X		X		X		X		X	
PO4 measurement											X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

## Special conditions in an SBR

- Smaller plants are often "stand alone plants"
  - use of **alarm contacts** should be the norm
  - SMS **messages**, in an alarm condition could be an option
  - **remote visualization** could be an option
  - **remote control** could be an option (HEIDI)



## SBR - A chance for small organisations

„European Investment Bank: **pre-selection of contractors**

... The selection of the candidates should normally be carried out following a formal pre-qualification process open to all interested firms .... Such pre-qualification exercise is usually **necessary for large or complex contracts.**

- experience and past performance on previous contracts;
- capabilities with respect to personnel, equipment and construction or manufacturing facilities;
- and financial position.“

Due to the size of SBR plants, local engineering companies have the chance to participate in projects

The project size is interesting for us, but not for our big competitors

**We have the complete basket of instrumentation for an SBR**



## SBR business – why do we go for it?

- Due to the relative small size of SBR plants, local engineering companies have the chance to participate in projects
  - local E+H organisations can participate as well
  
- The project size is interesting for us, but not for our big competitors
  - less price fighting can be expected
  
- We have the complete basket of instrumentation for SBR
  
- THIS gives us an advantage OVER other local suppliers