Waste water treatment

PURECO

THE PURE ECO

Waste water treatment

Responsible water management means the treatment and disposal of the generated waste water, for which suitable and effective wastewater treatment plants and systems are needed. Based on our expert knowledge and our products, we offer not only the reconstruction of old, outdated sewage treatment plants, or the construction of new systems, but our engineering, consulting and construction works are accompanied by a professional-consciousness throughout the various fields of waste management as well.

Municipal wastewater treatment technologies:

- mechanical cleaning (mechanical grid, sand trap, grease trap, primary clarifier, equalization)
- biological treatment (activated sludge technology, SBR, fixed -film systems, membrane bioreactors)
- tertiary treatment
- surplus aerobic sludge treatment (sludge stabilization, sludge thickening and dewatering)

For a higher efficiency:

- the BIOCOS (Combined Biological System) technology is the improved version of the aerobic activated sludge process, combining the benefits of traditional flow systems and the SBR basin (compared to conventional sludge separation processes it is significantly better, with a minimal mechanical demand, reduced energy consumption and maintenance requirements).

Industrial wastewater treatment (alchoholic and non-alcoholic bewarage; dairy, slaughterhouse – meat processing, rendering, eddible oil, sugar industry, paper, textile, chemical, petrochemical industry) **technologies**:

- mechanical cleaning (mechanical grid, sand trap, grease trap, primary clarifier)
- physical- chemical purification (coagulation, flocculation and flotation) anaerobic high rate reactors (UASB, EGSB)
- aerobic reactors (SBR, Continious, Active sludge flotation, MBR, MBBR)
- membrane technologies (UF, NF, RO)
- activated sludge treatment (sludge thickening and dewatering, aerobic sludge stabilization)
- anaerobic sludge digestion

Pureco provides wide variety of aerob waste water treatment technologies. Aerob systems use micro-organism to remove dissolved organic substances from waste water. Total flow systems are well known as conventional waste water treatment technologies.

PURE – SBR®

Pure-SBR® systems have been installed at project of municipal WWTP in Sarkad, Hungary (with the PE of 2000 and the capacity of 200 m³/d) and at industrial WWTP in Sopronhorpács, Hungary (with the capacity of 100 m³/d)

Field of application

PURE-SBR® as other aerobicic technology is working with microorganisms to remove dissolved organic substances in wastewater.

The sequentially operating PURE-SBR® as a modular system is a solution with small footprint; the four main purification processes are done in the same basin sequentially:

1. filling / nitrification and denitrification
2. nitrification and denitrification
3. decanting
4. purified water removal

This biological wastewater treatment technology is offered by PURECO as a compact solution for both municipal and industrial waste water treatment. PURE-SBR® is one of the most cost-effective methods among aerobicic systems.

Advantages and parameters

- all purification processes take place the same basin
- there is no need for secondary clarifier
- efficient nitrogen and phosphorus removal
- easy to operate
- the variable hydraulic and pollutant loads can be managed easily

		Design data for raw water	Influent raw water	Effluent treated water	Limits
Q	m^3/day	100	120	120	–
F/M	kg BOD / kg sludge × day	0,18	–	–	–
Sludge age	day	7	–	–	–
COD_{Cr}	mg/l	2800	3600	280	500
BOD_5	mg/l	1400	1800	110	200
TSS	mg/l	65	55	7	100
Suspended solids	mg/l	60	75	48	300
Total - P	mg/l	5	43	1	20

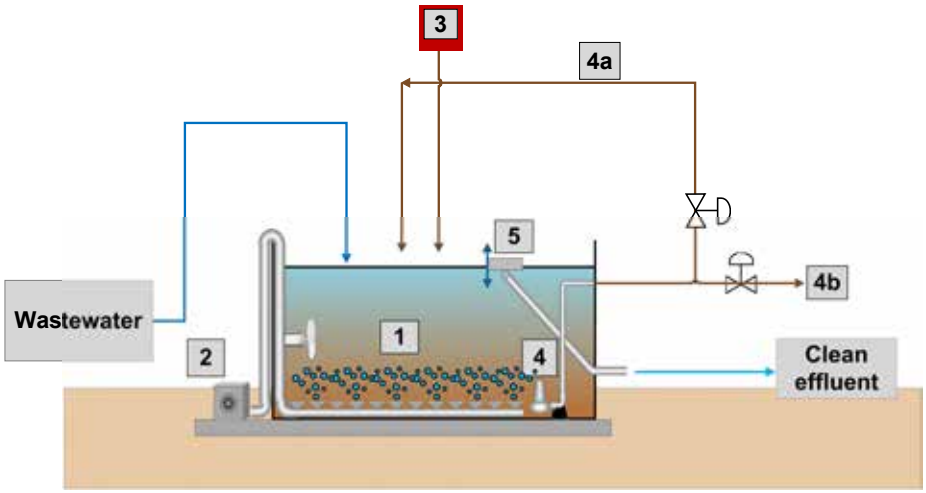
Table 1.: Operational efficiency of industrial WWTP in Sopronhorpács

Description of the technology

The dissolved organic materials in the wastewater are transformed into carbon dioxide, water and biomass by microorganisms. The technology consists of the following steps:

- selector (optional) is the anaerobic space where the recirculated sludge first meets the raw waste water
- biological (aeration) tank for the following sequences:
  - loading raw water / nitrification and denitrification
  - nitrification and denitrification (mixing)
  - sedimentation
  - decanting (purified water removal)

Intermitted aeration is required for this technology. This is achieved with the help of a surface aerator or with a fine bubble deep aeration unit. The quantity of the input oxygen can be controlled via measurements by an oxygen probe; aeration is programmable for denitrification and for lowest energy consumption.



Technological flow chart of PURE-SBR®

Components of the PURE-SBR® technology:

1. **SBR tank** – The organic material and nitrogen removal takes place in the same basin after the four before mentioned subsequent purification cycles. The phosphorous content of the waste water integrates partially into excess sludge.

2. **Fine bubble, deep aeration unit (blower)**

3. **Chemical dosing for phosphorus removal purposes** – In case of strict effluent limits for total phosphorous, besides partial biological phosphorous removal more $FeCl_3$ is added to further reduce phosphorous concentration.

4. **Sludge removal**
   a. Sludge recirculation into the selector
   b. Excess sludge removal, further concentration and / or dewatering may be required

5. **Purified water removal, with a so called floating decanter**

PURE – DN®

Pure-DN® has been used in Pécel, Hungary at municipal WWTP construction with the PE f 22 000 and the capacity of 200 m³/d)

Field of application

The specialty of the PURE-DN® technology is that after biodegradation in isolated anaerobic, anoxic and oxic units, phase separation is done in a round secondary sedimentation basin. This two or multi-lined technology is recommended for WWTPs where maximum hydraulic capacities exceed 1500 m³/d.

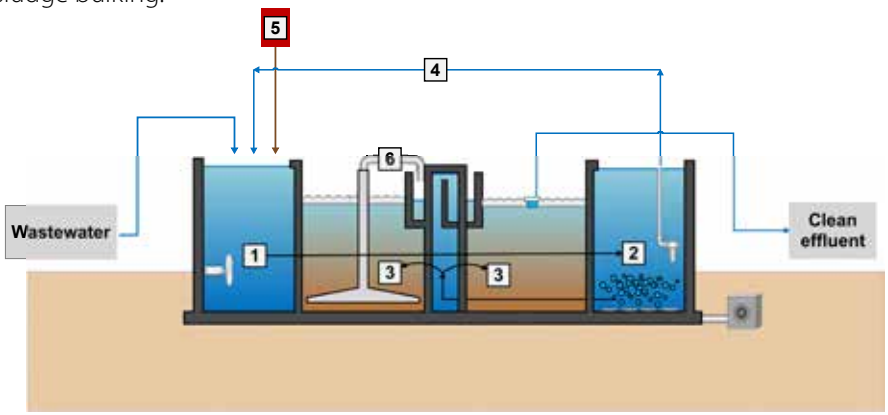
Advantages and parameters

- continuous flow
- continuous treated water discharge
- clarifier with scraper bridge
  - floated sludge is skimmed by the traveling bridge, this prevents increasing concentration of effluent suspended solids
  - large space requirements

		Design data for raw water	Influent raw water	Effluent treated water	Limits
Q	m³/day	2000	1800	–	–
F/M	kg BOD / kg sludge × day	0,06	–	–	–
Sludge age	day	20	–	–	–
COD_{Cr}	mg/lv	1048	972	36	125
BOD_5	mg/l	524	537	<10	25
TSS	mg/l	98	75,1	7,5	35
Suspended solids	mg/l	601	445	11	35
Total - P	mg/l	16	14,6	1,04	5

Description of the technology

The dissolved organic materials in the wastewater are transformed into carbon dioxide, water and biomass by microorganisms. Continuous aeration is required for this technology via fine bubble deep aeration units. The quantity of the input oxygen can be controlled via measurements by an oxygen probe; aeration is programmable for denitrification and for lowest energy consumption.
This two or multi-lined system is easy to operate and provides technological flexibility and operational safety. Thus the system and WTTP can easily and effectively manage increased hydraulic capacity demands due to growing population and sewerage connections. More lines mean higher operational security in case of sludge bulking.

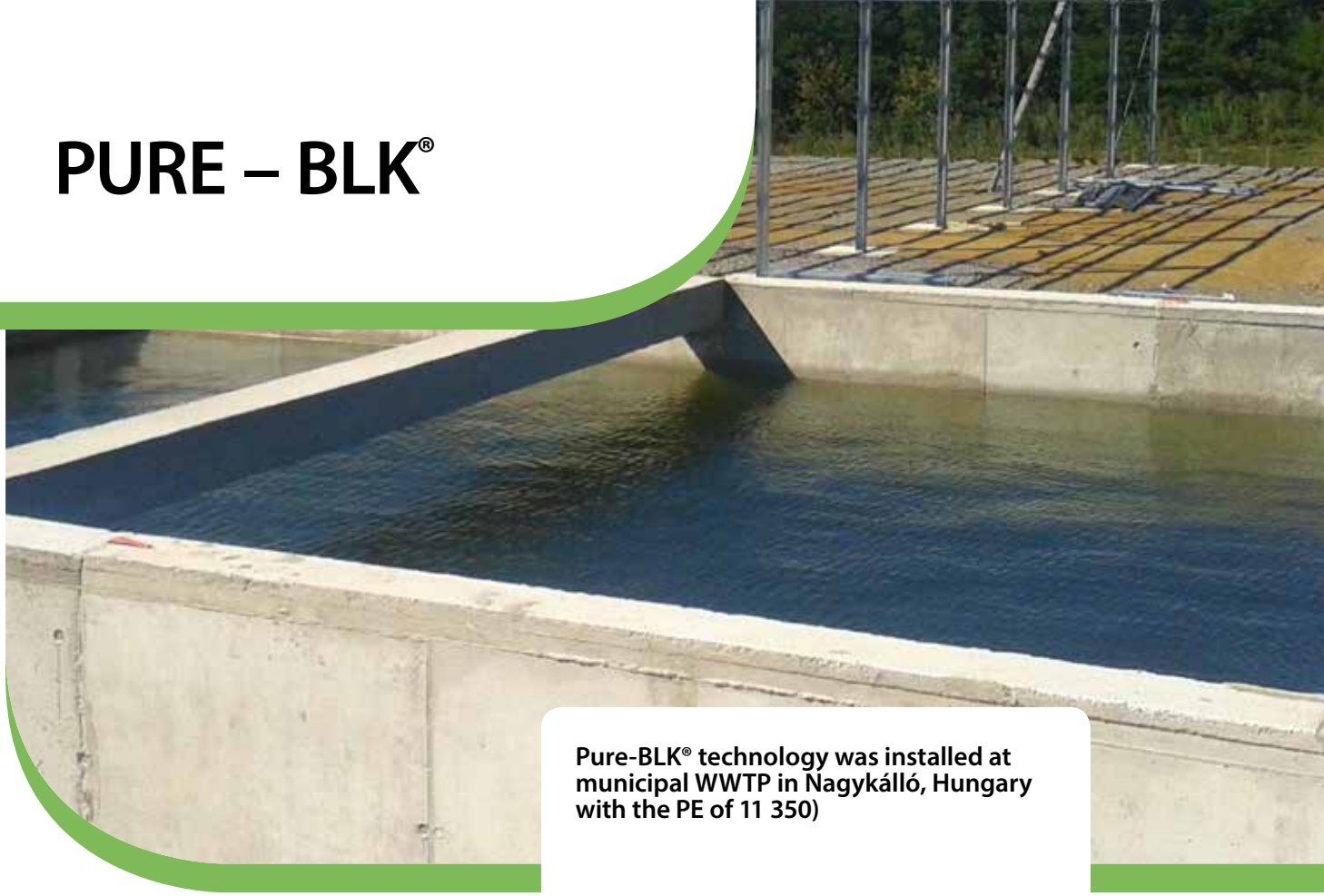


Continuous flow biological unit with clarifier with scraper bridge

Components of the technology:

1. **Anoxic basin**– For denitrification processes.
2. **Aerobic basin** – In the aeration basin the dismantlement and the removal of organic materials and ammonia takes place.
3. **Treated water and sludge separation: secondary clarifier** – Separation of excess sludge and recirculated sludge from treated water takes place in this basin. The settled sludge is accumulated at the bottom of the circular designed secondary sedimentation unit. The settled sludge is continuously compressed by a scraper.
4. **Nitrate recirculation** – The product of nitrification (the nitrate) is lead back from the aerobic space to the anoxic one to facilitate denitrification.
5. **Chemical dosing for phosphorous removal purposes** – In case of strict effluent limits for total phosphorous, besides partial biological phosphorous removal more $FeCl_3$ is added to further reduce phosphorous concentration.
6. **Sludge removal**

PURE – BLK®



Pure-BLK® technology was installed at municipal WWTP in Nagykálló, Hungary with the PE of 11 350)

Field of application

The specialty of the PURE-BLK® technology is that after biodegradation in isolated anaerobic, anoxic and oxic units, phase separation is done in a longitudinal designed secondary sedimentation basin. This two or multi-lined technology is recommended for WWTPs where the maximum hydraulic capacity is between 500 – 1500 m^3/d.

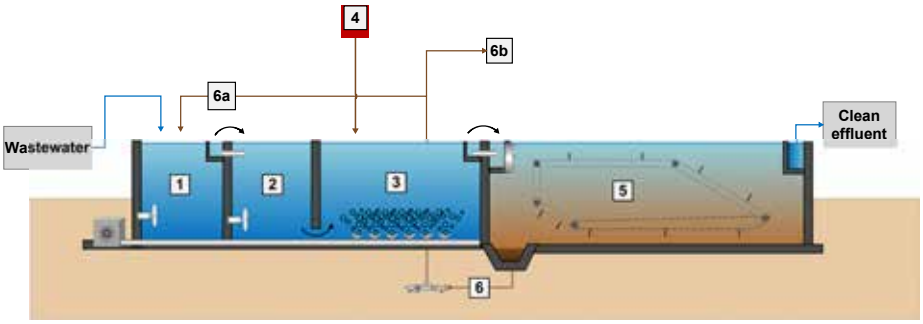
Advantages and parameters

- continuous flow
- continuous treated water discharge
- longitudinal designed secondary sedimentation basin
  - optimal space requirements
  - easy to operate
  - sludge removal with settled sludge and effluent top scraper

		Design data for raw water	Influent raw water	Effluent treated water	Limits
Q	m^3/day	1500	985	985	–
F/M	kg BOD / kg sludge × day	0,06	–	–	–
Sludge age	day	18	–	–	–
COD_{Cr}	mg/lv	953	820	24	125
BOD_5	mg/l	454	480	<15	25
TSS	mg/l	97	100	8,6	15–25
Suspended solids	mg/l	97	418	<5	35
Total - P	mg/l	18	17,9	0,32	2

Description of the technology

The dissolved organic materials in the wastewater are transformed into carbon dioxide, water and biomass by microorganisms. Continuous aeration is required for this technology via fine bubble deep aeration units. The quantity of the input oxygen can be controlled via measurements by an oxygen probe; aeration is programmable for denitrification and for lowest energy consumption.
This two or multi-lined system is provides scaling opportunities and technological flexibility. Thus the system and WTTP can easily and effectively manage increased hydraulic capacity demands due to growing population and sewerage connections. More lines mean higher operational security in case of sludge bulking.



Graphic Continuous flow biological unit with with longitudinal secondary clarifier

Components of the technology:

1. **Anaerobic** – The anaerobic unit is used for the removal of the surplus phosphorus. In anaerobic environment the sludge releases phosphorus into the wastewater. However phosphorus accumulating bacteria can use this released quantity later on in the anaerobic unit better. This results in the bacteria removing phosphorus from the waste water more efficiently.

2. **Anoxic basin** – For denitrification processes.

3. **Aerobic basin** – For biodegradation and removal of organic material and NH_3.

4. **Chemical dosing for phosphorous removal purposes** – In case of strict effluent limits for total phosphorous, besides partial biological phosphorous removal more $FeCl_3$ is added to further reduce phosphorous concentration.

5. **Treated water and sludge separation: longitudinal designed secondary sedimentation** – Separation of excess sludge from treated water takes place in this basin. The settled sludge is accumulated at the bottom of the longitudinal designed secondary sedimentation unit. The settled sludge is continuously compressed and gathered by a scraper into the sump. This then gets transferred into the biological treatment process. A part of the activated sludge as a byproduct of the cleaning process is removed from the treatment system as excess sludge.

6. **Sludge remova**
   a. Sludge recirculation into the biological basin
   b. Excess sludge removal, further concentration and / or dewatering may be required

PURE – MBR®

Pure-MBR® was designed for a project in Yekaterinburg, Russia at a municipal WWTP with the PE of 100 000 and the capacity of 15 000 m³/d

Field of Application

The continuous-flow systems as conventional wastewater treatment technologies are widely known. The membrane bioreactor version of this, called the PURE-MBR®, is coupled with a highly efficient phase separation. The advantage of the membrane separation is that there is no need for the construction of a secondary-clarifier unit. Moreover excellent effluent quality parameters are ensured.

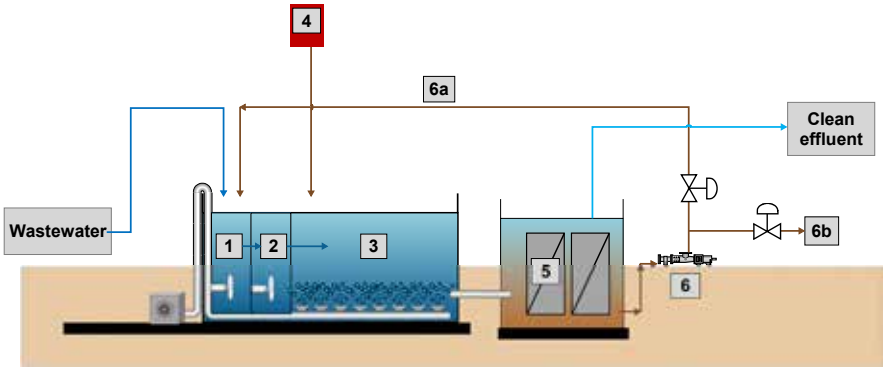
Advantages and parameters

- continuous flow
- continuous treated water discharge
- small space requirements due to its load capacity
- purified water concentration of suspended solids negligible
- there is no need to construct secondary clarifier
- the system can be expanded further, outer membranes can be built in if necessary
- the membranes are outfitted with cleaning systems

		Design data for raw water	Limits of recepient
Q	m^3/day	15000	–
F/M	kg BOD / kg sludge × day	0,06	–
Sludge age	day	15	–
COD_{Cr}	mg/lv	700	
BOD_5	mg/l	400	3
TSS	mg/l	73	
Suspended solids	mg/l	350	3
Total - P	mg/l	20	0,2

Description of the technology

The dissolved organic materials in the wastewater are transformed by the microorganisms into carbon dioxide, water and biomass under suitable nutrient and oxygen supply. After the nitrification and denitrification - which can take place in the same pool or in separate spaces - the purified waste water is removed from the system through the membranes. Regarding the placement of membranes there are two options; they are placed in separate basins or in the biological basin.
Continuous or intermittent aeration is required for this technology via fine bubble deep aeration units. The quantity of the input oxygen can be controlled via measurements by an oxygen probe; aeration is programmable for denitrification and for lowest energy consumption.



Process of the PURE-MBR® technology

Components of the technology:

1. **Anaerobic basin** – The anaerobic unit is used for the removal of the surplus phosphorus. In the anaerobicice environment the sludge releases phosphorus into the wastewater. However phosphorus accumulating bacteria can use this released quantity later on in the aerobice unit better. This results in the bacteria removing phosphorus from the waste water more efficiently.

2. **Anoxic basin** – For denitrification processes.

3. **Aerobic basin** – The aeration units provides space for the dismantlement and removal of organic materials and ammonia.

4. **Membrane modules** – The filter membranes are responsible for the highly efficient separation of the treated wastewater and the activated sludge. Due to this the treated water is almost free of suspended solids.

5. **Chemical dosing for phosphorous removal purposes** – In case of strict effluent limits for total phosphorous, besides partial biological phosphorous removal more $FeCl_3$ is added to further reduce phosphorous concentration.

6. **Sludge removal**
   a. Sludge recirculation into the biological basin for the provision of the appropriate sludge age
   b. Excess sludge removal, further concentration and / or dewatering may be required

PURE – DNS®

Pure-DNS® technology has been applied at municipal WWTP project in Pilisszántó, Hungary (with the PE of 2 600 and the capacity of 350 m³/d)

Field of application

PURE–DNS® technology, as other aerobicic technologies, uses microorganisms for the removal of dissolved organic substances in wastewater. PURE–DNS® belongs to the group of aerobicic continuous-flow systems. PURE–DNS® is a space-saving solution, because the basins are designed in a block. The secondary clarifier is funnel-shaped, the outer ring of which is the aerobicic basin. The wastewater is dispatched in the outside, aeration tank, where after the intermittent aeration and denitrification it goes into the secondary clarifier unit. The sludge is removed from the lower third and the purified water is removed from the surface of the secondary sedimentation unit. We recommend the Pure-DNS® for municipalities with a hydraulic capacity of less than 400 m³ / day of waste water.

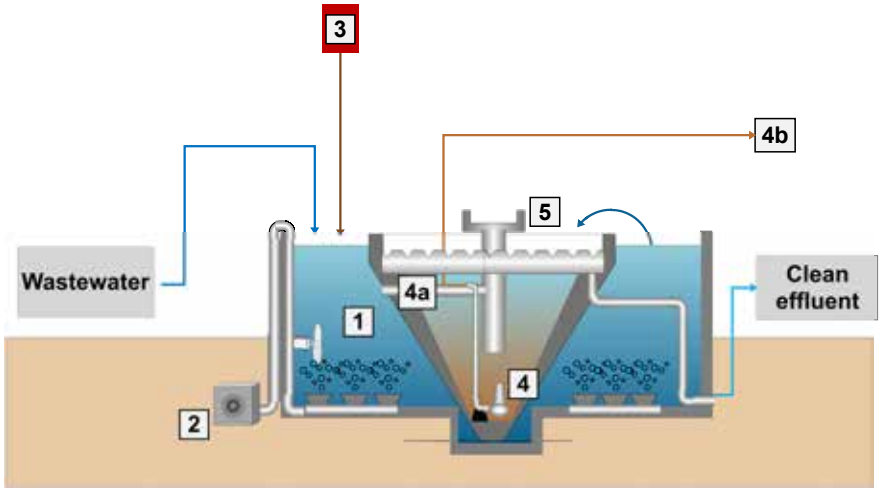
Advantages and parameters

- continuous flow
- continuous treated water discharge
- biological objects
  - biological and secondary clarifier basin will be located in one object
  - intermediate sedimentation funnel
  - small space requirement/compact design

		Design data for raw water	Influent raw water	Effluent treated water	Limits
Q	m³/day	350	350	350	–
F/M	kg BOD / kg sludge × day	0,063	–	–	–
Sludge age	day	15	–	–	–
COD_{Cr}	mg/lv	892	1391	30	75
BOD_5	mg/l	446	623	10	25
TSS	mg/l	82	118	8	25
Suspended solids	mg/l	520	450	10	50
Total - P	mg/l	13,4	15	1,5	5

Description of the technology

The dissolved organic materials in the wastewater are transformed into carbon dioxide, water and biomass by microorganisms. Continuous or intermittent aeration is required for this technology via fine bubble deep aeration units. The quantity of the input oxygen can be controlled via measurements by an oxygen probe; aeration is programmable for denitrification and for lowest energy consumption. Phosphorus is removed via biological as well as chemical processes. $FeCl_3$ is added to the aeration basin to precipitate phosphorous further reducing its concentration. The precipitated phosphorus is removed in the secondary sedimentation unit from the treated wastewater.



Flowchart of the PURE–DNS® technology

Components of the technology:

1. **Aeration and denitrification basin** – PURE–DNS® technology is a compact, space-saving solution, in which the biodegradation - nitrification and denitrification – happens in an intermittent aeration basin. Some of the wastewater's phosphorus content fuses with and becomes part of the excess sludge.

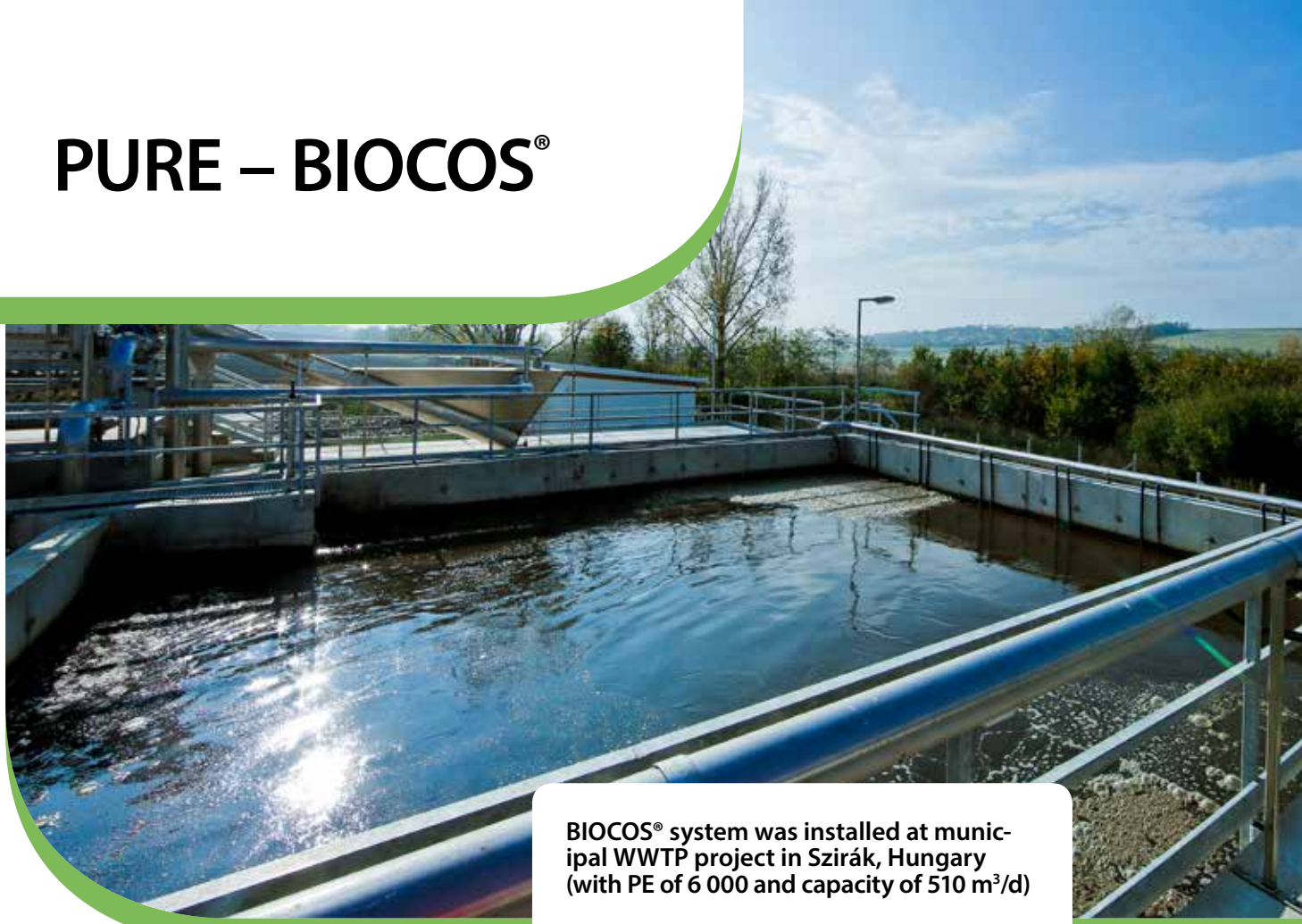
2. **Blowers** – The blowers necessary for the aeration of the nitrification-denitrification basin ensure adequate levels of oxygen for the activated sludge.

3. **Chemical dosing for phosphorous removal purposes** – In case of strict effluent limits for total phosphorous, besides partial biological phosphorous removal more $FeCl_3$ is added to further reduce phosphorous concentration.

4. **Sludge removal** – The accumulated sludge on the bottom of a funnel-shaped secondary sedimentation is pumped the sludge reservoir basin.
   a. recirculated sludge
   b. excess sludge

5. **Secondary clarifier** – The special secondary clarifier funnel for space-saving purposes will be built in the biological basin.

PURE – BIOCOS®



BIOCOS® system was installed at municipal WWTP project in Szirák, Hungary (with PE of 6 000 and capacity of 510 m³/d)

Field of application

PURE-BIOCOS® is based on the combination of continuous-flow technologies and the SBR system. The nitrification and denitrification process is in an intermittent aeration basin, while the phase separation occurs in two parallel secondary sedimentation basins.

It is typical to the technology that the whole system operates with compressed air, and there are no rotating devices. The removal of the recirculated sludge and bio-uptake of excess sludge is managed by a compressed air driven mammoth pump.

We use PURE-BIOCOS® for systems with the capacity of 500 m³/d or more.

Advantages and parameters

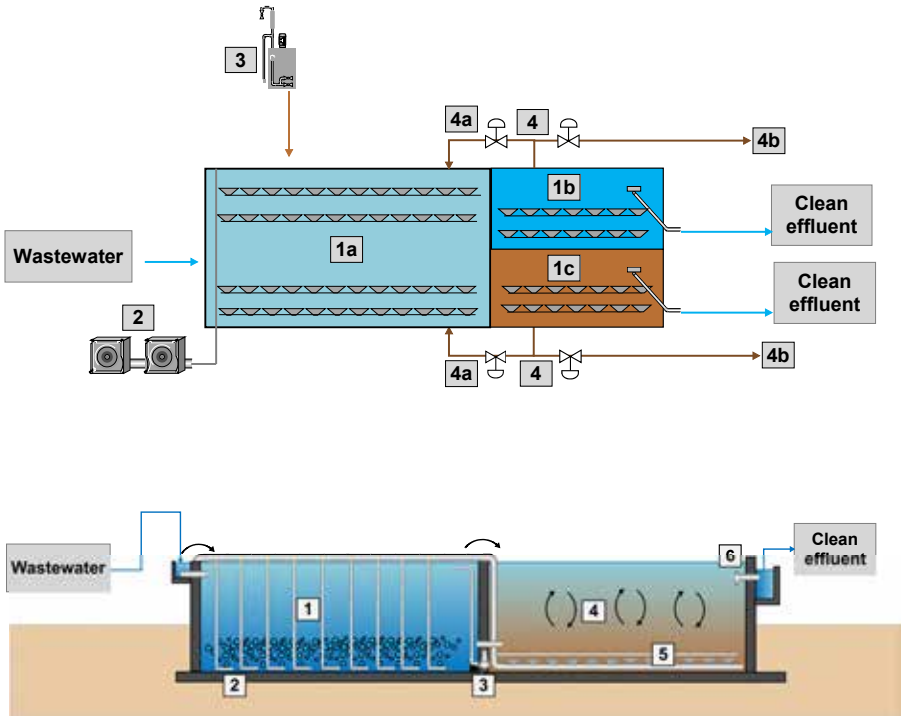
- continuous flow
- continuous purified water discharge
- favourable specific energy needs
- no need for a scraper bridge
- less space required compared to other conventional technologies

Description of the technology

The dissolved organic materials in the wastewater are transformed into carbon dioxide, water and biomass by microorganisms. The technology consists of the following steps:

- aeration tank with the following cycles:
  - loading raw water / nitrification
  - denitrification (stirring)
- secondary sedimentation units (placed parallel to each other)

Intermittent aeration is required for this technology via surface or fine bubble deep aeration units. The quantity of the input oxygen can be controlled via measurements by an oxygen probe; aeration is programmable for denitrification and for lowest energy consumption.



Flow chart of the BIOCOS® system

Components of the technology:

1. basins
- **a.** the aeration basin
- **b.** secondary sedimentation basin I.(SU)
- **c.** secondary sedimentation II. (SU)

2. slugde mixing with blowers

3. chemical Dosing System

4. sludge removal
- **a.** recirculated sludge
- **b.** excess sludge