

WSB[®] clean pro – the fully biological treatment solution for municipal and commercial wastewater.

Modular design, flexible scalability and long-term reliability.



The benefits of WSB® clean pro for the treatment of municipal and commercial wastewater.

WSB® clean pro functions according to the so-called fluidised floating-bed principle which

- ... ensures optimum utilisation of the existing and introduced oxygen.
- ... significantly reduces the energy consumption for aeration.
- ... promotes a diverse community of microorganisms in the biofilm.

WSB® clean pro functions on the principle of a gravity flow, which

- ... eliminates pumps between the individual treatment stages.
- ... avoids choking and backpressure in the system.
- ... enhances the year-round operational stability and long-term reliability.

WSB® clean pro is a pure biofilm process which

- ... operates without returning sludge to the biological stage.
- ... adapts flexibly to the properties of the wastewater.
- ... masters hydraulic and organic shock loads with ease.



Application possibilities for WSB® clean pro.

The adaptation to individual requirements means that every WSB® clean pro system is a uniquely designed project. Thanks to the flexibility of the process, it is also possible to expand or upgrade existing installations.

The use of existing tanks permits a significant reduction of the investment outlay. The key to the high efficiency of WSB® clean pro is the design of the carrier media in the bioreactor, which provide for a large biologically active surface.

- New installations for municipal and commercial applications
- Upgrading of existing installations
- Expansion and replacement of existing installations
- Retrofitting of system modules for additional wastewater treatment (denitrification, phosphorous removal, hygienisation)

It goes without saying that WSB® clean pro is dimensioned for the treatment of domestic wastewater in accordance with the valid DWA rules and standards.



Biofilm carriers at the core of WSB® clean pro.

The innovative function principle of WSB® clean pro is modelled on the self-cleaning mechanisms of natural waters. In cooperation with the Universities of Technology in Dresden, Cottbus and Chemnitz, engineers of the Bergmann Group have succeeded in transferring these mechanisms to the wastewater treatment process WSB® clean.



Biofilm carriers for optimum growth conditions.

The specially developed carrier material is the most important element of WSB® clean. Optimum growth conditions on and in this material promote the development of a special biofilm matrix. The patented design of the carrier media also brings self-cleaning capabilities: There is no clogging of the inner surfaces and it is thus not necessary to clean or replace the media. The high performance of WSB® clean is based on the particular properties of the biofilm which is formed. It facilitates complex decomposition processes and achieves first-class treatment results. Even at a wastewater temperature of 4° C, as is the case on a cold winter day, the WSB® process functions with the accustomed reliability.

The layer structure of the WSB® clean biofilm.

LAMINAR BOUNDARY LAYER	The surface of the biofilm.
AEROBIC LAYER	Responsible for breaking down carbon compounds and for converting ammonium to nitrate.
ANOXIC LAYER	In the absence of dissolved oxygen, the bound oxygen of the nitrate is used for carbon conversion (denitrification).
ANAEROBIC LAYER	Responsible for breaking down sulfate.



A unique function principle: The fluidised floating-bed biofilm process **WSB®**.

Fluidised and floating beds in alternation.

To enable wastewater treatment, an intermittent stream of fine compressed-air bubbles diffuses oxygen into the biological clarification stage. During the aeration phase, the wastewater is homogenised around the biofilm carriers and a fluidised bed is formed. During the non-aerated operating phase, on the other hand, the carrier media are buoyant due to their possessing a lower density than the surrounding wastewater. The carrier media thus represent a floating bed. The wastewater to be treated flows through this floating bed, such that proper biological treatment is ensured at all times.

The benefits of the process.

Compared to other biofilm processes, for example immersed or trickling filters, the WSB® process results in a biofilm with a minimal layer thickness but high cell density. The specific properties of this biofilm, paired with an innovative process, guarantee the following benefits:

- + Full capability to handle reduced loads
- + Permanent immunity to hydraulic shocks without loss of biomass
- + Simultaneous nitrification and denitrification also at low wastewater temperatures
- + Adaptation of the micro-organisms to the wastewater to be treated
- + Maintenance-free carrier media insusceptible to erosion and clogging
- + No measuring and control systems required
- + Elimination of system components requiring intensive maintenance
- + Elimination of wear-prone mechanical parts

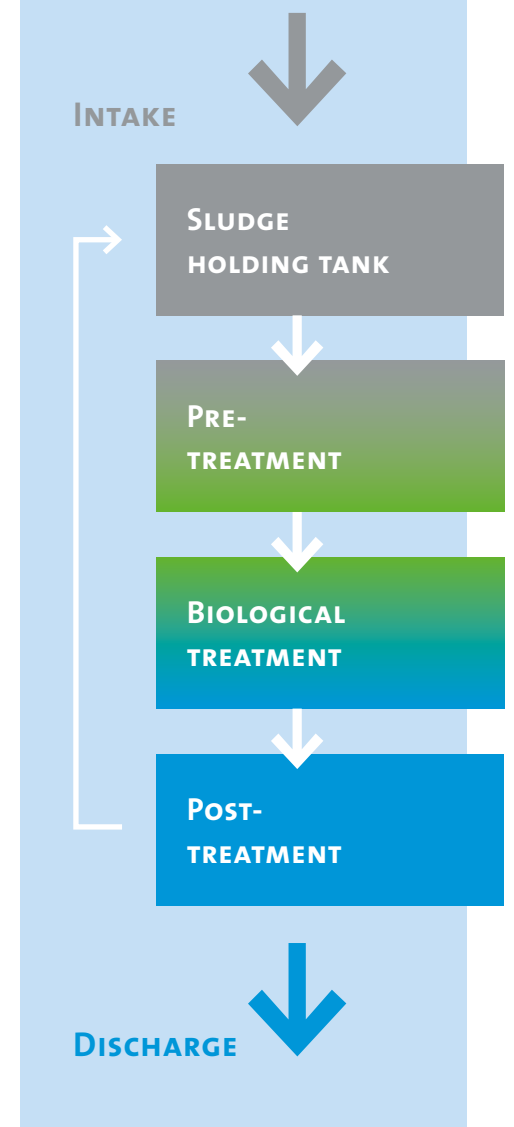
The individual treatment steps of WSB® clean pro.

The treatment process of WSB® clean pro begins with mechanical-physical pre-treatment of the raw wastewater. This task is handled by settling tanks (pre-clarification) and/or technical installations such as rakes or screens. They retain any separable matter and coarse particles present in the wastewater. Subsequently, the pre-treated wastewater passes by gravity to the biological treatment stage, the WSB® reactor. Here, the biofilm cultivated on the carrier media consumes the organic compounds in the wastewater.

Separation of biomass and biologically treated wastewater.

The process runs in an aerobic environment. To this end, compressed air is diffused into the wastewater as fine bubbles and serves as the oxygen supply for the microorganisms of the biofilm. The decomposition processes produce surplus biomass (secondary sludge). At the subsequent final clarification stage, which is similarly designed as a settling tank, the surplus biomass is separated from the biologically treated wastewater.

The secondary sludge collects at the bottom of the tank, from where it is passed to the sludge holding tank by way of immersion pumps. The sludge holding tank can be integrated at the start of the whole process or else as a separate storage tank and static secondary sludge concentrator. From the final clarification stage, the treated wastewater passes via the discharge facility into an appropriate drain feeder or the like.



Efficient operation and minimum energy consumption.

The fully automatic control system of WSB® clean pro takes care of the electrical power supply and the control of all electrical equipment, e. g. the compressor and immersion pumps, in the final clarification stage. Combination with the optional remote management system click + clean® permits permanent remote monitoring of the installation. In addition, operating parameters can be adapted at any time. Thanks to the intermittent operation of the compressor and demand-oriented control of the sludge removal pumps, WSB® clean pro is extremely energy-efficient. One typical feature of a biofilm process is the very small amount of secondary sludge produced. The provision for joint holding with the primary sludge reduces the costs for sludge disposal by approx. 50% compared to other biological wastewater treatment processes.

Overview of the basic clarification process using WSB® clean pro.

System intake
Raw wastewater is delivered to the mechanical-physical pre-treatment stage.

Biological treatment (WSB® reactor)
Cascaded breakdown of organic carbon and nitrogen compounds in the wastewater.

Post-treatment (final clarification)
Separation of the secondary sludge, which is then returned to the pre-treatment stage.

Pre-treatment (sludge holding and pre-clarification)
Retention and holding of the primary sludge and holding of secondary sludge. Separation of fine particles.

Control unit
Control of the switching intervals for the pumps and compressor. The remote management system click + clean® is also incorporated into the unit.

System Discharge
Gravity discharge of the treated wastewater into a drain feeder or pump station collector.

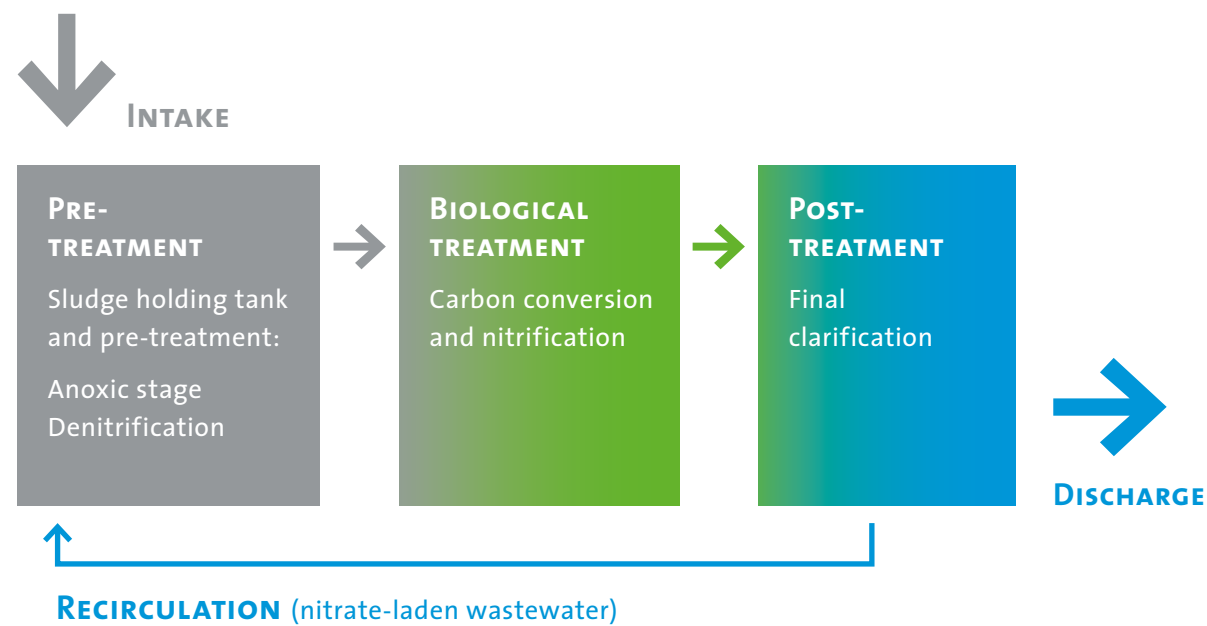
Modular clarification stages for further wastewater treatment.

In the course of the implementation of European standards, additional wastewater treatment is becoming increasingly important. This refers above all to demands for denitrification and phosphorus removal, as well as hygienisation of the wastewater. As a system technology, WSB® clean pro comprises a range of flexible treatment modules and process concepts. These modules can be retrofitted simply to an existing installation, or else integrated as expansion modules for extended wastewater treatment in new projects.



The process concept for nitrogen removal.

Nitrogen compounds are removed by way of a preceding denitrification stage. The effect is supported by processes which run simultaneously in the biofilm. To ensure an adequate denitrification performance over the whole year, an anoxic stage is placed ahead of the aerobic biofilm reactor, and the nitrate-laden wastewater is recirculated accordingly. This treatment concept can be adapted flexibly to meet individual requirements.



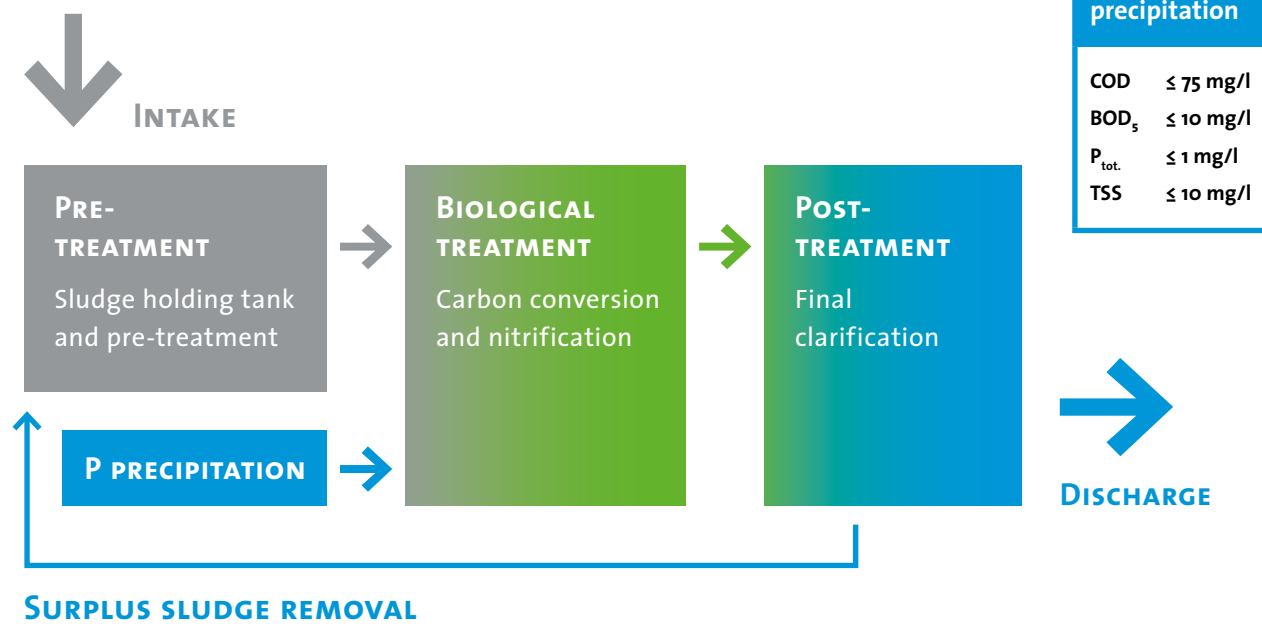
N

Parameters for the discharge quality after denitrification

COD	≤ 75 mg/l
BOD ₅	≤ 10 mg/l
NH ₄ -N	≤ 5 mg/l
N _{tot.}	≤ 25 mg/l
TSS	≤ 10 mg/l

The modular phosphorus removal stage.

Phosphorus is removed from the wastewater through chemical precipitation with the aid of metal salts, for the most part aluminium salts. They reduce the risk of re-dissolution of the phosphorus in the anaerobic sludge holding tank. This additional module can be used independently of the preceding wastewater treatment solution. Precipitation is realised either simultaneously in the biological stage, downstream at the intake to final clarification or by way of a separate precipitation reactor at the discharge from final clarification.



P+

Discharge quality after phosphorus precipitation

COD	≤ 75 mg/l
BOD ₅	≤ 10 mg/l
P _{tot.}	≤ 1 mg/l
TSS	≤ 10 mg/l

SURPLUS SLUDGE REMOVAL

The modular hygienisation stage.

WSB® clean pro offers two hygienisation processes for disinfection of the biologically treated wastewater. The choice of process depends on the further handling of the water. If the treated wastewater is to be discharged into sensitive water bodies, the module with UV radiation is used. If it to be used in the household, for example for toilet flushing, on the other hand, electrochemical hygienisation is applied. Both modules are installed in a separate external cabinet equipped with a pump. This provides for a continuous flow of treated water from the final clarification stage. Subsequently, the additionally hygienised wastewater passes directly to the discharge. Both hygienisation technologies can be incorporated flexibly, irrespective of the previous process of biological wastewater treatment.

H+

Discharge quality after hygienisation

E. coli	≤ 500 CFU/100 ml
Intestinal enterococci	≤ 200 CFU/100 ml

Remote management system click + clean® for efficient monitoring and optimum control of WSB® clean pro.



The remote management system click + clean® enables permanent, time- and location-independent access to the control system for wastewater treatment. In addition, click + clean® is itself able to send freely configurable event messages to the system operator. To this end, the system control communicate with a secure server to which only operating personnel have access. With click + clean®, you can adapt operating parameters and perform remote diagnosis at any time.

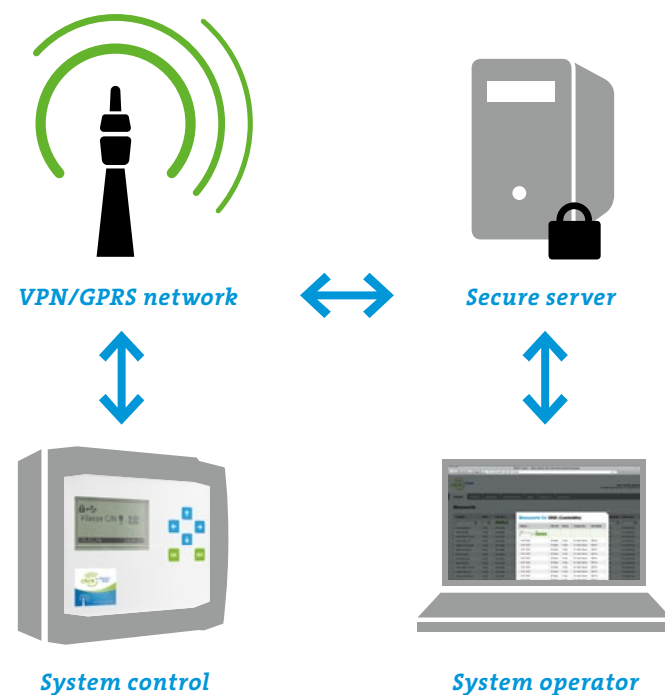
Benefits in operation.

Thanks to click + clean®, operation of your treatment system becomes even more reliable and efficient. At the same time, operating and monitoring costs can be reduced. Further benefits are:

- + Real-time messages from the system
- + Time- and location-independent adaptation of operating parameters
- + Integrated data logger for operating parameters and event messages
- + Optional system visualisation to display modules, measuring points and the values recorded at those points
- + „Live“ function for direct system operation
- + Enhanced operating stability thanks to permanent self-monitoring of the system
- + Increased reliability through improved tracking of operating processes and early intervention should any unusual events be detected
- + Remote diagnosis for all electrical functions

For new systems and retrofits.

The installation of click + clean® can be planned together with a new system. For existing systems, simple retrofit options are available. And that irrespective of the treatment process, as click + clean® also supports consistently reliable control for other technologies.



The Bergmann Group – Engineering expertise since 1929.

As an owner-managed family company, the Bergmann Group is active in the fields of environmental technology, wastewater treatment and concrete production. Our company was founded in 1929 and still has its head office in Penig near Chemnitz today. Knowledge and experience form the basis for sustainable solutions to all construction and environment-related challenges. Typical outcomes are compact, high-performance technologies such as WSB® clean pro, for which we not only conduct research, but also handle engineering, manufacture and implementation. Our portfolio is rounded off with diverse transport, assembly and maintenance services. By covering the whole chain of value creation, we are able to safeguard high quality at all levels.

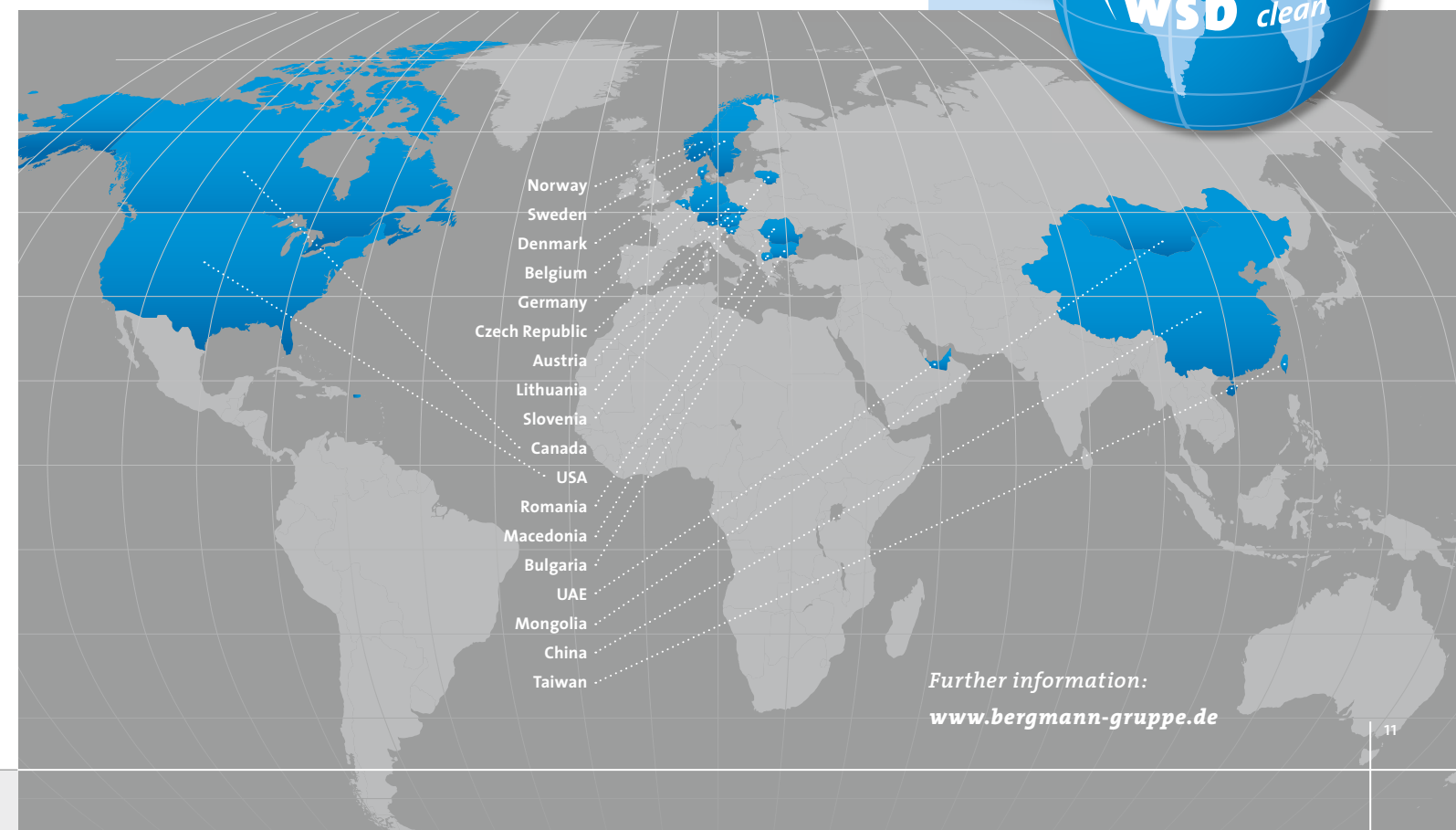
Over 45,000 installations of WSB® technology worldwide.

The focus of our work is the development of globally practicable technologies for decentralised wastewater treatment. In the meantime, these treatment solutions are in use all over Germany, as well as in many other parts of Europe, in North America, Asia and the Middle East. Over 45,000 wastewater treatment systems have already been realised – from small-scale installations to municipal treatment plants achieving the most varied discharge qualities.

Over the years, we have gathered a wealth of experience which can be put to use for each new project. Our developments, furthermore, have earned us the reputation of a company which exemplifies the innovative strength and global success of the German economy.

BERGMANN Group
Engineering expertise.

45,000 installations
worldwide.



Further information:
www.bergmann-gruppe.de

Further information
to WSB® clean pro.



→ We would be happy to advise you on our treatment solutions.
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The following additional
information can be found
on the product website:

- Current list of projects at home and abroad.
- Selected references with detailed presentation of their special aspects.
- Features and benefits of the WSB® process for your project.
- Comparison of WSB® clean pro with other processes (as download).
- Latest news and interesting technical reports on the subject of wastewater.

www.wsb-clean.de/pro

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