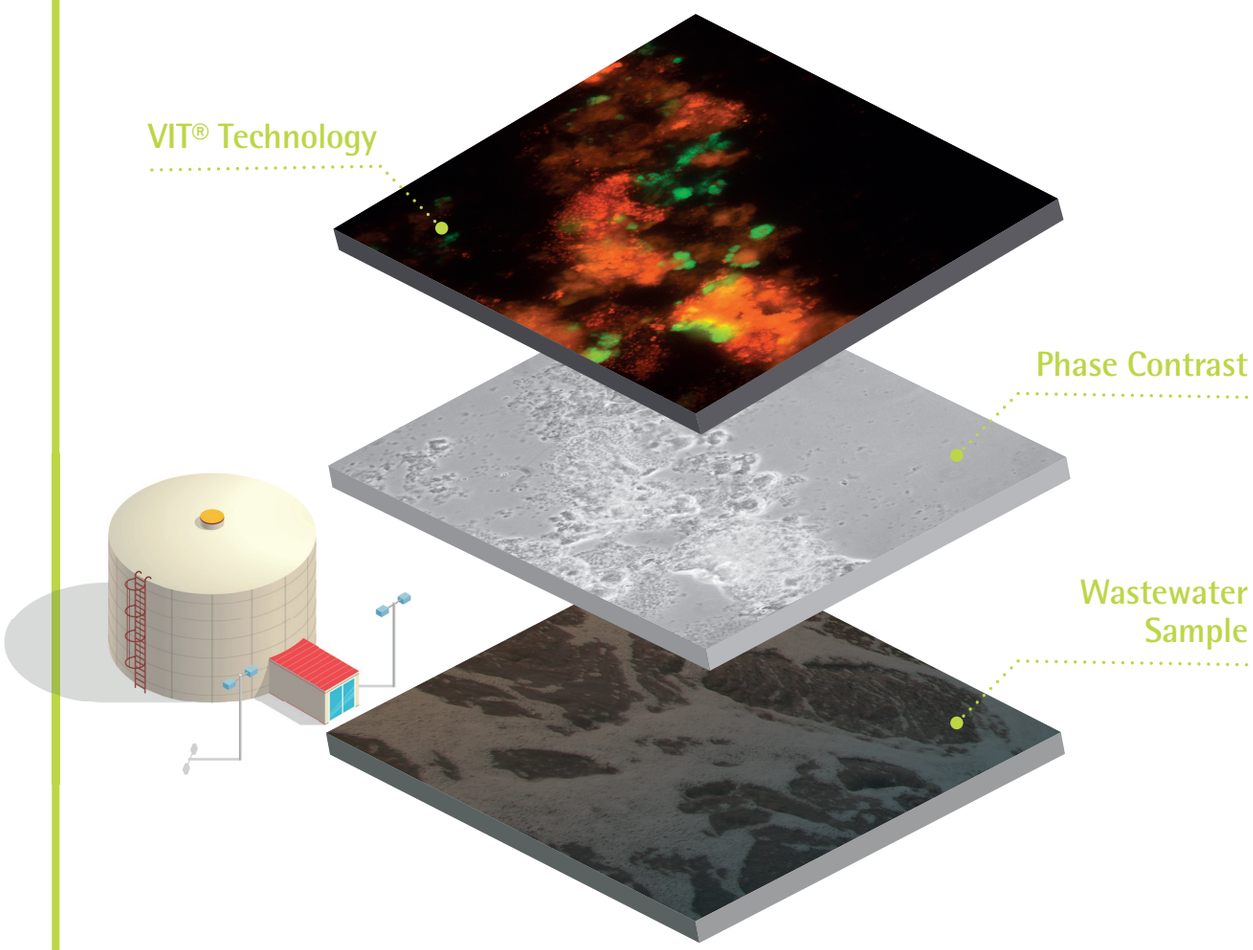
vermicon
solutions for microbiology

Wastewater Biology

Insight | Analysis | Control



Prevention of Disturbances

Thanks to continuous and systematic monitoring
of the biocenosis of the plant.

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Microbiological Wastewater Monitoring

With our expertise and technologies, it is possible to integrate a systematic, direct monitoring of the microorganisms in wastewater into the operational analytics of the plant. The monitoring of the biocenosis eliminates uncertainties, favors target-oriented action and promotes sustainable process optimization.

ADVANTAGE

- ✓ ANALYTICAL ADVANTAGE
- ✓ COST & RESOURCE EFFICIENCY
- ✓ ENERGY EFFICIENCY

SAFETY

- ✓ QUALITY ASSURANCE
- ✓ OPERATIONAL SAFETY
- ✓ RELIABILITY

WATER QUALITY

- ✓ EXCELLENT PURIFICATION PERFORMANCE
- ✓ PROCESS OPTIMIZATION
- ✓ IMPROVED DISCHARGE VALUES
- ✓ WATER QUALITY IMPROVEMENT

ENVIRONMENTAL PROTECTION

- ✓ WATER PROTECTION
- ✓ SUSTAINABLE WATER MANAGEMENT
- ✓ ENGAGEMENT

72 TRILLION BACTERIA per 40.000 m³ activated sludge

1,8 BILLION BACTERIA per 1 mL activated sludge

10 BILLION **m³** wastewater treated annually in public wastewater treatment plants in Germany

COMMUNITY OF **MICROORGANISMS**

Biocenosis

take care of the **ALTERATION, DEGRADATION & SYNTHESIS** of old and new substances.

594.000 km long is the sewer network in Germany

13 times around the earth

70% of the energy demand of the plant is used for **BIOLOGICAL CLEANING**

FILAMENTOUS BACTERIA can as well support the **FLOC FORMATION**

Preface

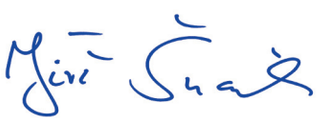
Dr. Jiri Snaidr

Founder and CEO of vermicon AG

Biological wastewater treatment would not be possible without microorganisms. Wastewater treatment plants are gigantic microbiological power plants in which microorganisms are responsible for the conversion of chemical compounds and the breakdown of harmful substances. The biocenosis of wastewater treatment plants is thus the essential "engine" responsible for the treatment performance. If it starts to sputter, malfunctions can occur. Individual bacteria are rarely responsible for a disturbance, even if their presence ultimately leads to problems such as the formation of bulking sludge. In nearly all cases, a change in the biocenosis precedes the disturbance. An isolated analysis of individual parameters falls short of the mark. A comprehensive view is essential for the success of maintenance measures.

However, the monitoring nowadays concentrates mainly on the discharge values and less on the (micro)biological processes. As a result, important sub-processes and the associated optimization possibilities remain unconsidered. The reason for this: a direct and comprehensive analysis of the bacteria in the wastewater has been considered impossible. But the reality is quite different! The VIT® gene probe technology enables a direct and highly specific detection of the living bacteria directly in the wastewater sample. The bacteria can be visualized, identified and quantified.

Action instead of reaction - the direct insight into the wastewater treatment plant and the monitoring of bacterial populations allow quick intervention and action before problems within the process actually occur. Disturbances in the operating process can thus be prevented and the degradation performance massively increased. The effectiveness of the plant is optimized from an economic point of view as well and the environment is sustainably protected.



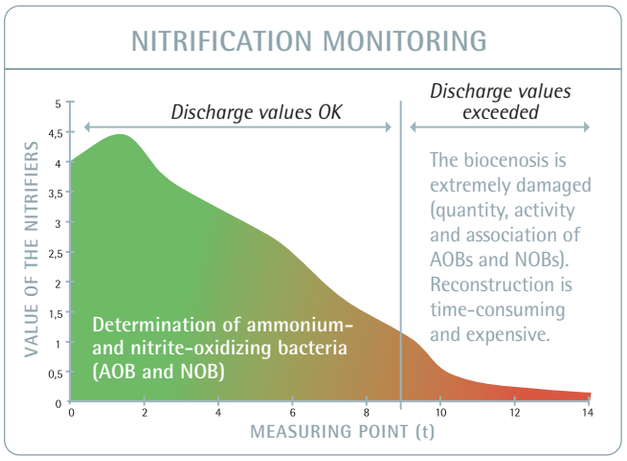
Dr. Jiri Snaidr
Hallbergmoos, May 2023

Disturbances at the Wastewater Treatment Plant

Functional disturbances as part of everyday operational routine

Biological wastewater treatment plants are generally prone to disturbances under the influence of internal and external factors. Three types of disturbances are known: **Operational disturbances** (mostly due to a technical impairment), **functional disturbances** (mostly caused by microbiological factors) and **incidents** (mostly caused by external factors). The latter can quickly and unexpectedly have catastrophic consequences for the environment, but are extremely rare. Technical failures, on the other hand, occur frequently, but failure analysis and repair are nearly completely automated. But what about functional disturbances?

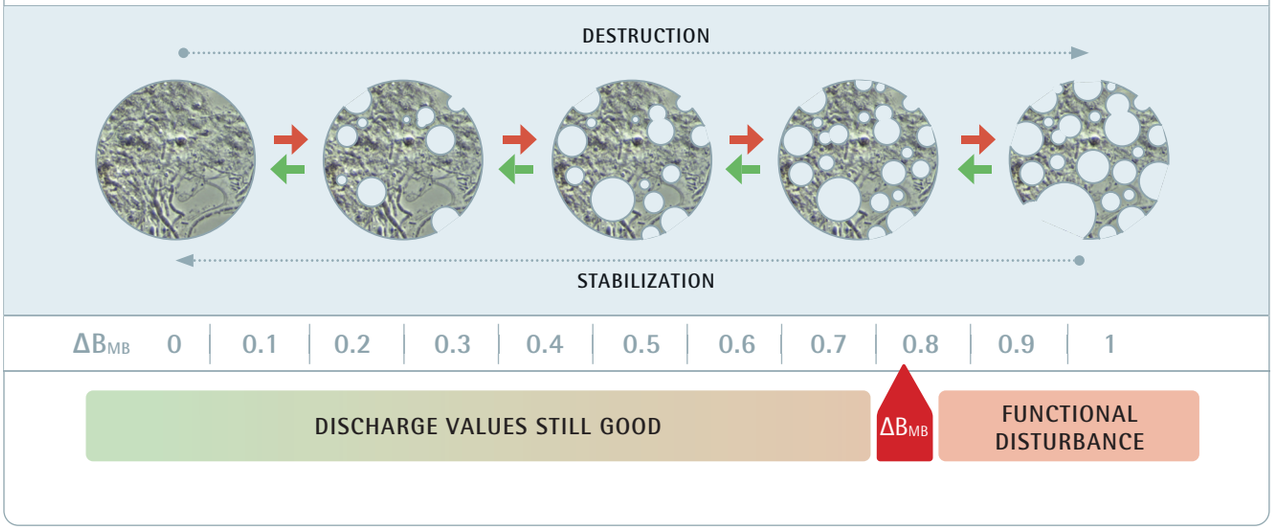
Functional disturbances are the most complex among the three types. Why? A key characteristic of this type of malfunction is that a failure or shortfall in the cleaning process occurs with a delay. For example, in the case of disturbed nitrification, deterioration of discharge values does not occur until the minimum quantity of nitrificants, and thus a minimum degradation rate, has not been reached.



Therefore, the gradual deterioration of the condition of the nitrificants remains unnoticed for a long time. It is then almost impossible to determine the cause in retrospect, because there was no continuous monitoring of the microbiological measured values prior to this.

ΔB_{MB} BIOCENOSIS ALTERATION LEVEL

Population shifts should be continuously monitored in order to initiate appropriate countermeasures in a timely and efficient manner. This is done with the ΔB_{MB} parameter, which illustrates the destruction and stabilization of the biocenosis.



Role of biocenosis stability

The biocenosis is the totality of all bacteria in wastewater. In this process, the bacteria have numerous inter-relationships and interdependencies with each other, thus establishing an ecological balance.

The bacteria

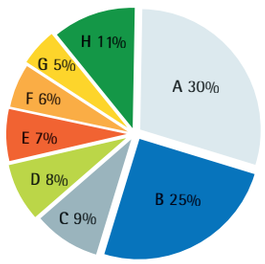
- protect themselves from predators,
- form symbioses,
- supply each other with nutrients and
- remove toxins.

If the biocenosis is intact, it can " buffer" environmental influences as a whole. Thus, biological wastewater treatment also functions properly. However, if individual bacterial populations are permanently damaged by internal or external factors, the biocenosis becomes unbalanced, which in turn leads to dysfunction.

EXAMPLE: POPULATION ANALYSIS

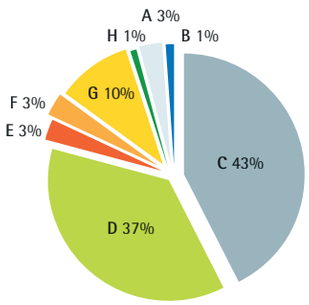
- All populations of the biocenosis are in balance with each other.

DISCHARGE VALUES: NORMAL



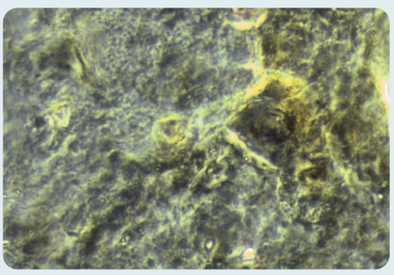
- The original relationship of populations to each other has been altered. Certain populations dominate and displace others. The cooperation of the bacteria for effective degradation is disturbed.

DISCHARGE VALUES: EXCEEDED



Why is microbiology not monitored?

Conventional detection of microorganisms today is still based on the cultivation of microorganisms and is not suitable for the analysis of complex samples, such as wastewater samples. Studies show that up to 99.9% of all bacteria in wastewater cannot be cultivated. Simple staining methods are also inadequate due to their lack of specificity and the morphovariability or Gram variability of bacteria. In order to get a realistic picture of the microbiological conditions in a wastewater treatment plant, it is necessary to analyze the bacteria directly in the sample, without any detours.

WASTEWATER SAMPLE	CULTIVATION	MICROSCOPY
		
Wastewater is complex. The biocenosis cannot be analyzed with conventional methods.	Cultivation is unsuitable for wastewater microbiology because most bacteria cannot be cultivated.	A clear identification of the bacteria based on their morphology is not possible.

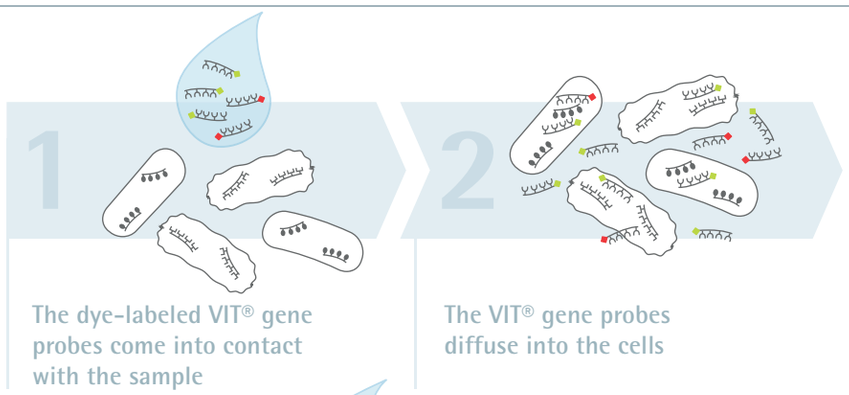
Microbiological Wastewater Monitoring

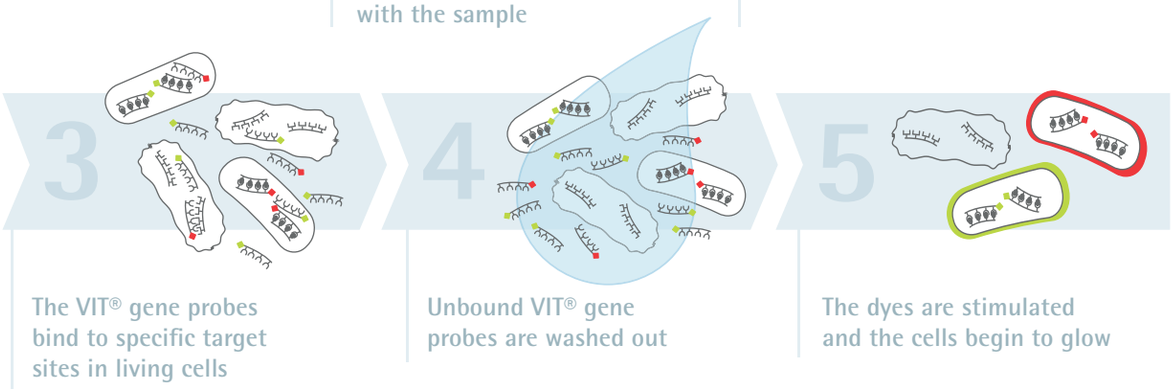
Direct analysis with VIT®

The VIT® gene probe technology allows for the analysis of the biocenosis composition directly in the process and thus for the evaluation of the actual state of the plant. The microorganisms can be **identified**, **quantified** and **visualized** directly in the wastewater sample. Independent of cultivation, the complexity of the sample matrices and the measurement of metabolic products. VIT® (vermicon identification technology) is the further development and the industrial standard of the FISH technology (fluorescence in situ hybridization) for the detection of microorganisms. Dye-labeled and specifically programmed VIT® gene probes penetrate the sample and bind highly specifically to the individual, living microorganisms. In the evaluation, the shining and completely morphologically intact microorganisms can then be visually detected and quantified quickly and reliably.

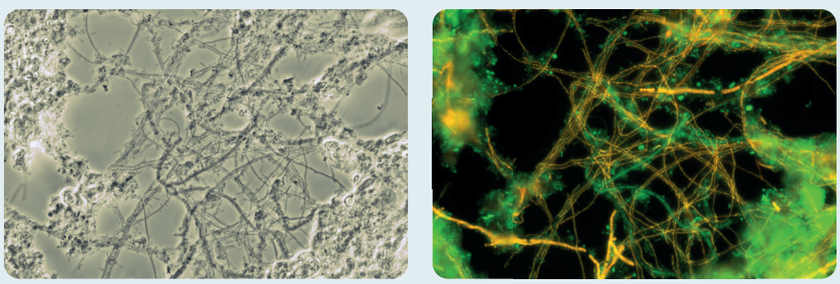
PRINCIPLE OF THE VIT® GENE PROBE TECHNOLOGY

- Only living cells
- Specific
- Reliable
- Fast





EXAMPLE ANALYSIS WITH THE VIT® GENE PROBE TECHNOLOGY



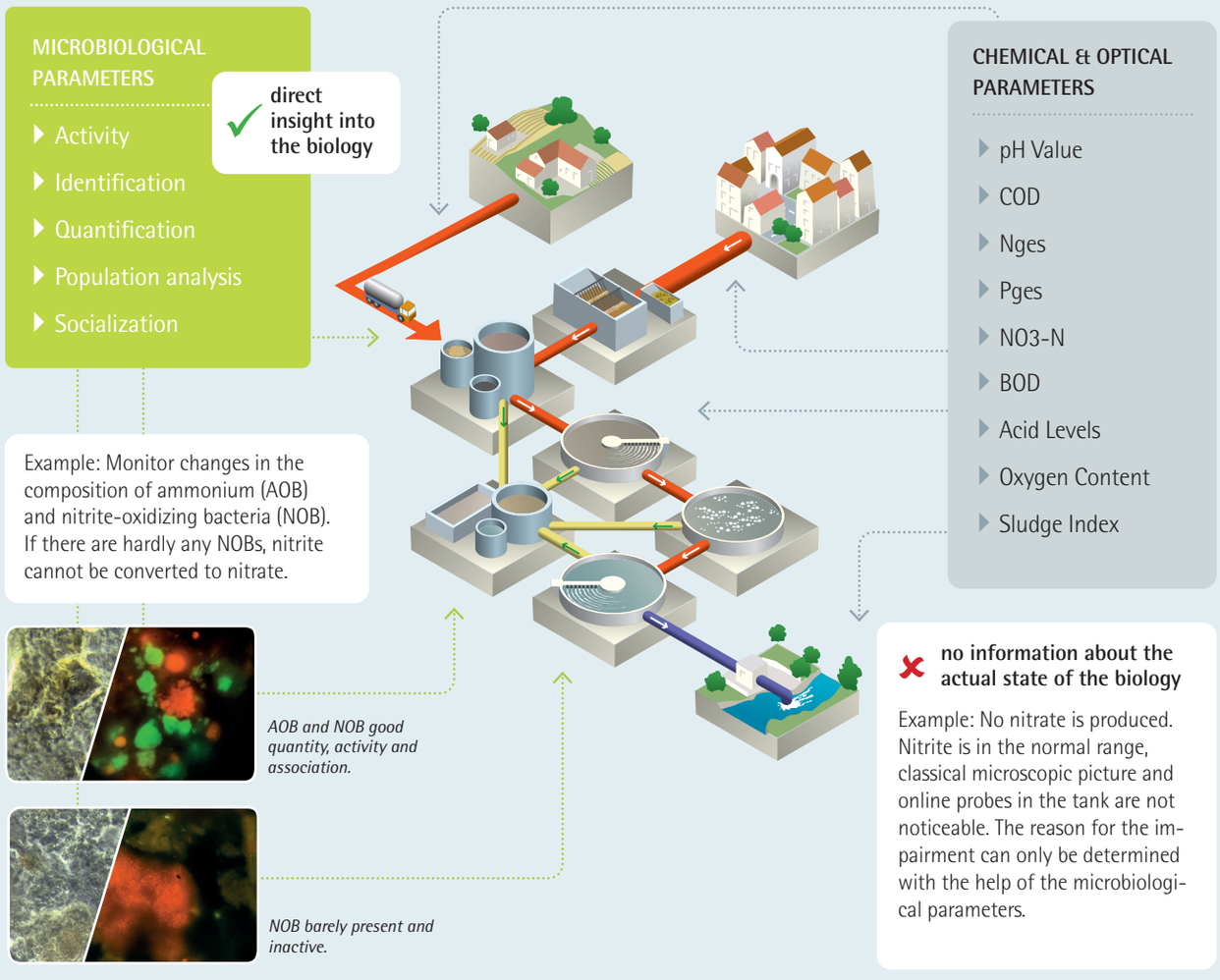
Identical microscopic image after analysis with VIT® gene probe technology from vermicon AG: phase contrast (left), *Chloroflexi* filamentous bacteria shine green, Eikelboom type 1851 shine red-yellow (right).

Necessity of integrating biocenosis into operational analytics

Every wastewater treatment plant monitors a number of routine parameters to ensure a sufficiently high treatment performance. Due to a lack of methods and knowledge, operational analytics usually focus on chemical and biochemical values. Therefore, mainly only substances that are converted by the bacteria in the wastewater or released as intermediate or end products of their metabolism are measured. However, the (micro)biological processes behind this are not taken into account. In this case, the entire bacterial biocenosis is treated as a "black box" that cannot be looked into. Therefore, the cause of the biological problem causing changes in the chemical parameters can only be determined to a limited extent, and the problem can also only be solved to a limited extent. However, thanks to VIT® gene probe technology, the biology of the wastewater treatment plant is no longer a "black box"!

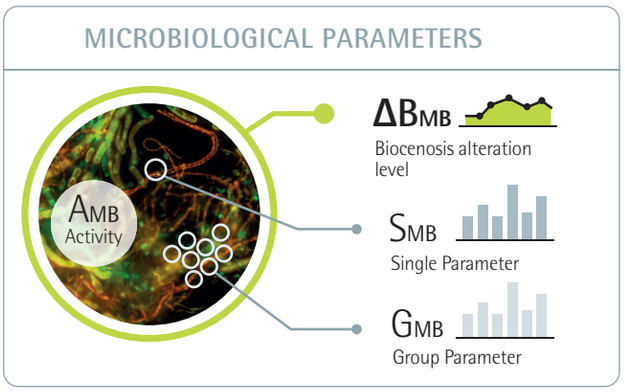
The integration of direct microbiological wastewater monitoring consequently favors target-oriented action and provides information on the effectiveness of the measures applied.

MEASURED VALUES OF THE BIOLOGICAL WASTEWATER TREATMENT



Microbiological measurement parameters

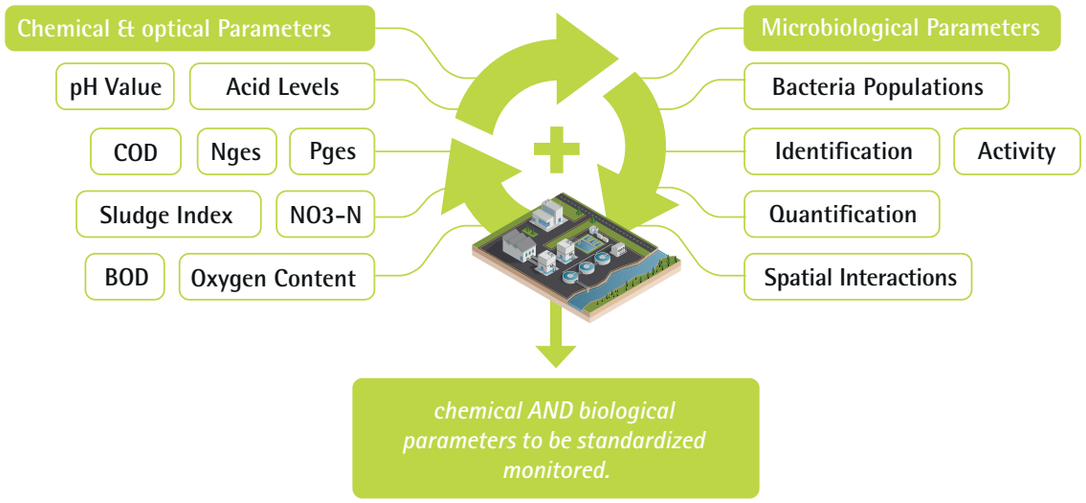
The biocenosis can essentially be characterized by four parameters - S_{MB}, G_{MB}, A_{MB} and the meta-parameter ΔB_{MB}. Sampling data is obtained by using the VIT® gene probe technology directly in the sludge sample and based on whole bacterial cells.



Consistency of microbiological wastewater monitoring

If analyses are only carried out selectively, e.g. when a problem has occurred, they provide insufficient data to achieve sustainable process optimization. This is especially true when monitoring sensitive and complex systems such as the biocenosis of a wastewater treatment plant.

Continuity and consistency in the analytical monitoring of microorganisms significantly improves the data quality, thereby eliminating uncertainties and enabling targeted action. This promotes sustainable optimization of the entire process.



ADVANTAGES OF THE MICROBIOLOGICAL WASTEWATER MONITORING

- The current state of the biology can be directly measured and evaluated
- Plant stability can be determined and predicted
- Only living bacteria are detected
- Specific identification of bacteria regardless of their morphology
- Optimized economic efficiency (resources, costs, energy)
- Early detection and prevention of disturbances
- Sustainable improvement of discharge values
- Optimized purification performance
- Proactive environmental protection

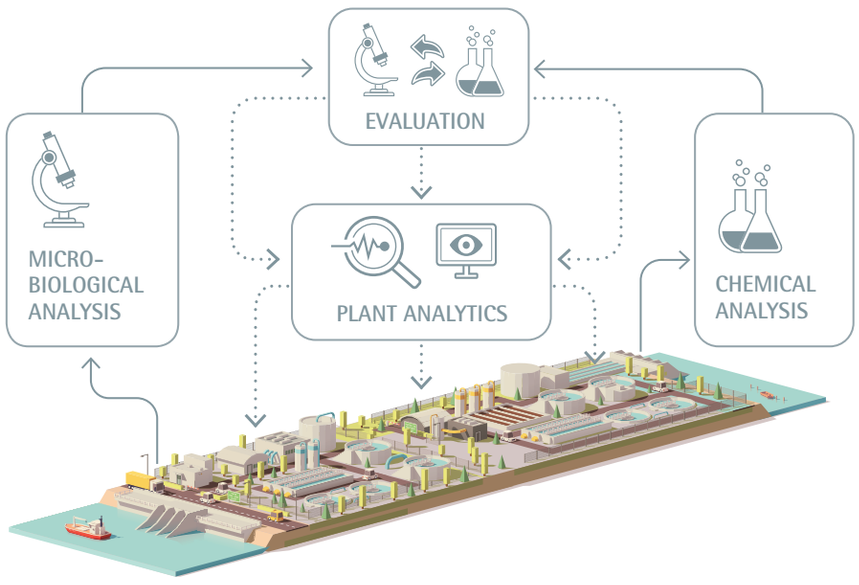
The Modern Wastewater Treatment Plant

Process optimization and disruption prevention

Advantage, safety, water quality, environmental protection - these are our guiding principles for modern wastewater management. Our mission: to establish a sustainable biological wastewater treatment that includes a systematic and continuous data collection, evaluation and process optimization by taking into account the real biocenosis.

By including the (micro)biological measurement data and the comparison with the (bio)chemical and biological-optical parameters of the plant analytics, an early warning system can be established, which informs about the stability of the plant at any time. Unwanted developments in the biology can be detected before the discharge values are exceeded and serious malfunctions occur.

MEASUREMENT PARAMETERS OF THE BIOLOGICAL WASTEWATER TREATMENT



CONTINUITY
of the monitoring of the biocenosis

SUSTAINABILITY
economic efficiency, safety, environmental protection

PARTNERSHIP FOR SUSTAINABLE DEVELOPMENT

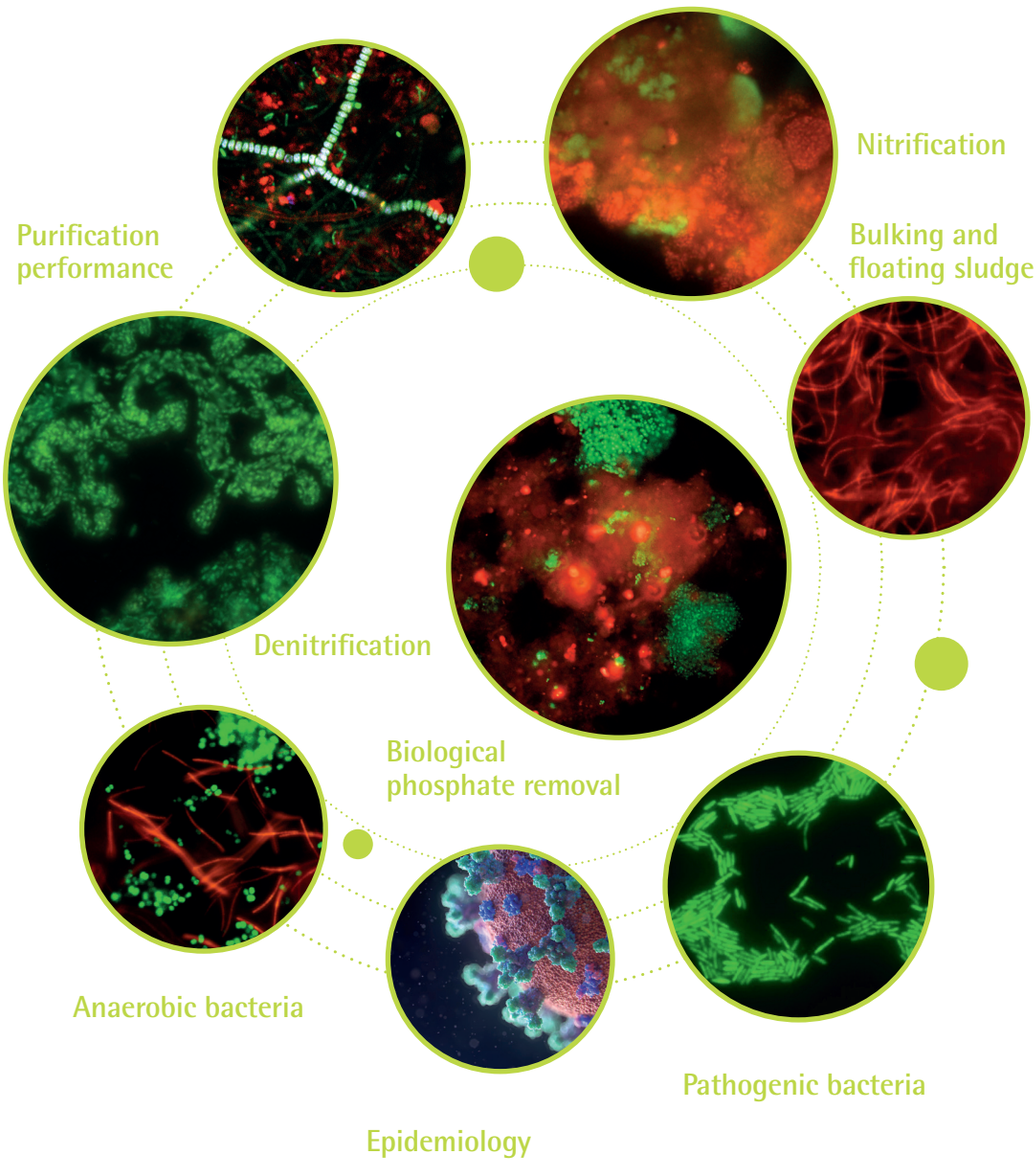
We are involved in research projects and collaborate with institutions and companies from all over the world to develop optimization potential for industrial microbiology.

Mitglied der DWA
Klare Konzepte. Saubere Umwelt.

UM WELT PAKT BAYERN

UmweltCluster Bayern

Application Examples



The direct microbiology of vermicon AG is used daily in many areas of wastewater treatment. In the following please find some anonymized examples. Reference customers can be named on request.

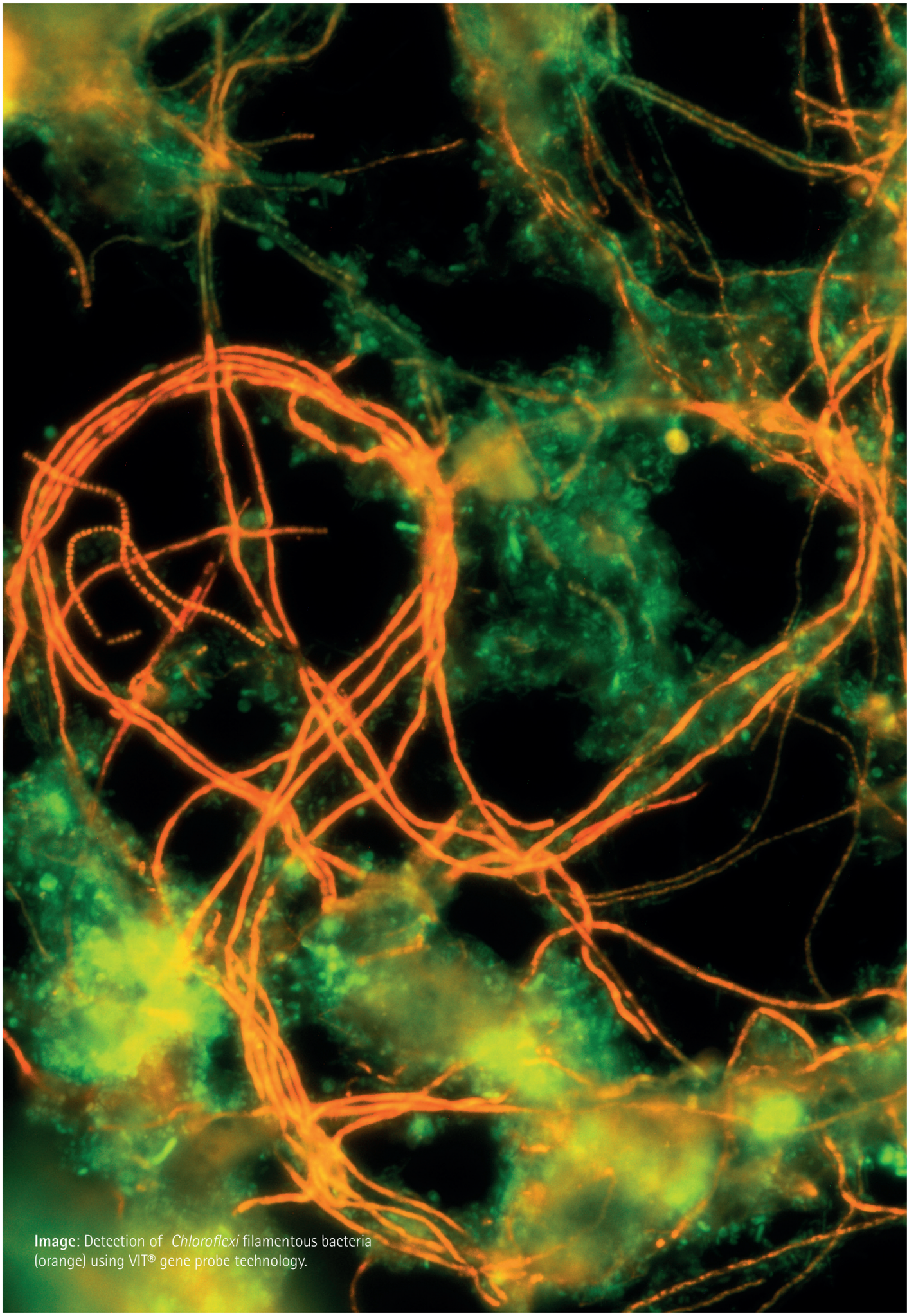
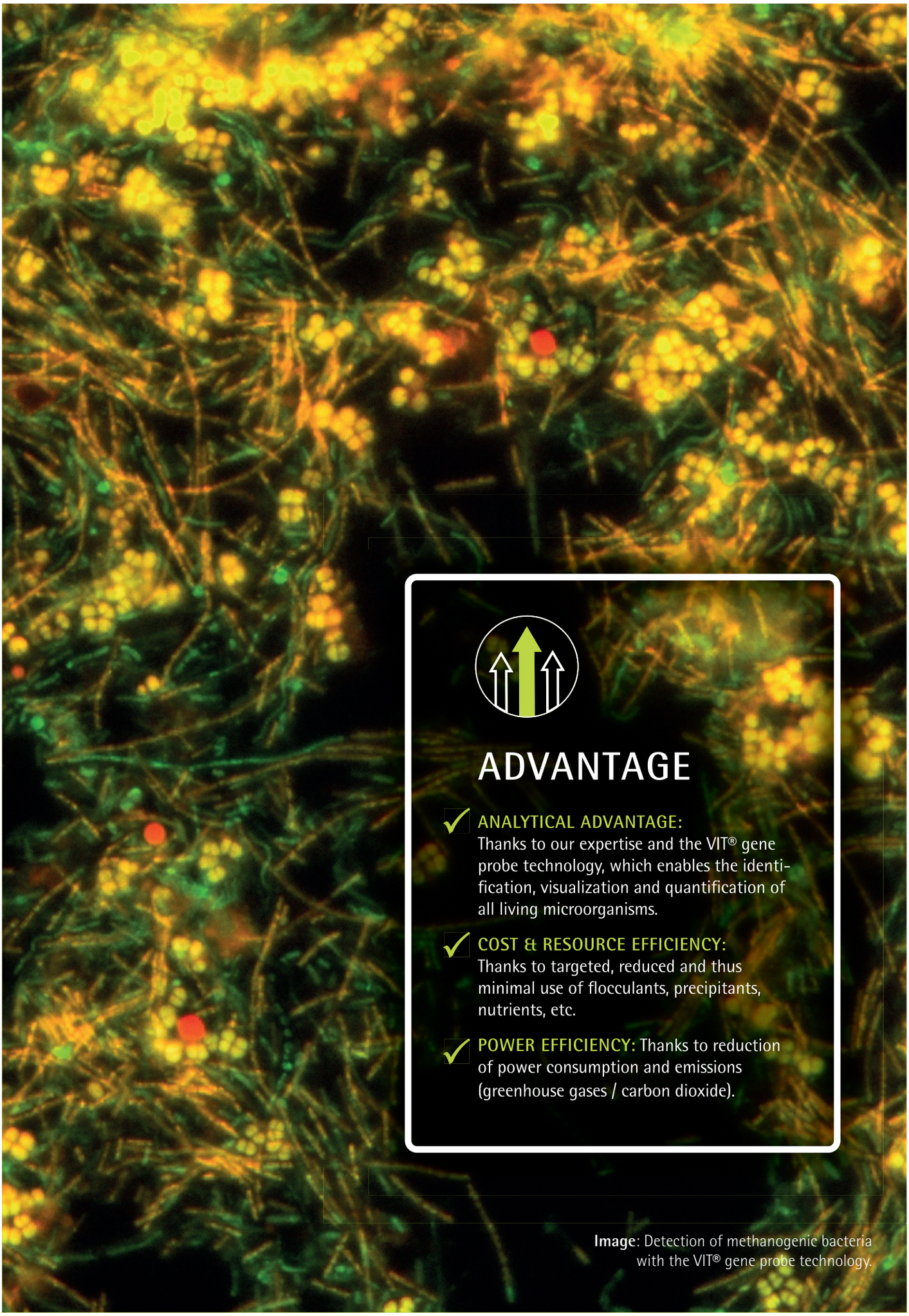


Image: Detection of *Chloroflexi* filamentous bacteria (orange) using VIT® gene probe technology.



ADVANTAGE

- **ANALYTICAL ADVANTAGE:** Thanks to our expertise and the VIT® gene probe technology, which enables the identification, visualization and quantification of all living microorganisms.
- **COST & RESOURCE EFFICIENCY:** Thanks to targeted, reduced and thus minimal use of flocculants, precipitants, nutrients, etc.
- **POWER EFFICIENCY:** Thanks to reduction of power consumption and emissions (greenhouse gases / carbon dioxide).

Image: Detection of methanogenic bacteria with the VIT® gene probe technology.

Improvement of the Nitrification Performance

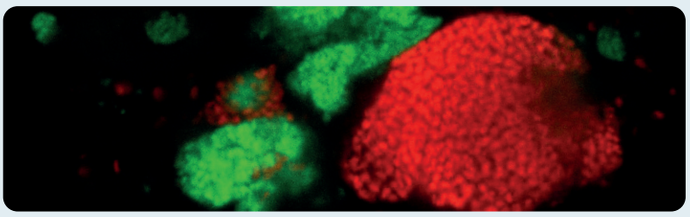
The nitrification step in the wastewater treatment process is very sensitive to external influences like oxygen limitation, fluctuations in temperature and pH value or the presence of toxic substances in the wastewater. For a stable nitrification, the groups of bacteria responsible for this process have to be present in sufficient amounts in the sludge and have to be able to interact appropriately with each other. Essential requirements in this respect are a sufficent supply of oxygen and also the maintenance of a minimum required sludge age, as nitrifying bacteria grow only slowly. Accordingly, nitrification breakdowns and reduced degradation performances are not uncommon.

PREVIOUSLY

- No insight into the population development
- Sudden malfunctions due to external influences
- Unexpected nitrification breakdowns
- Increased N-values in the discharge

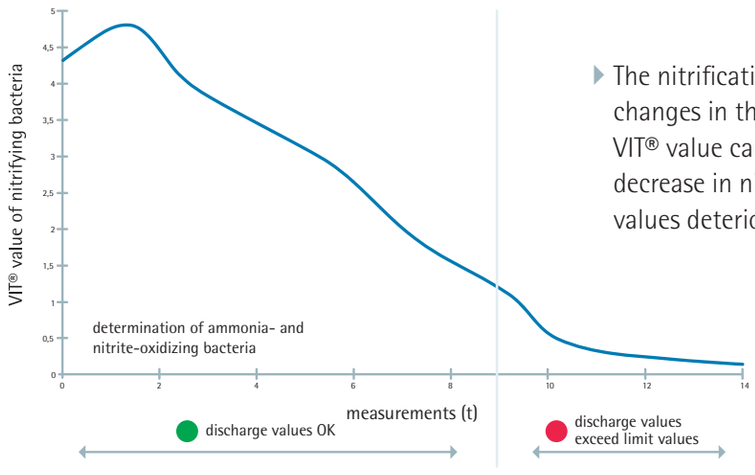
WITH THE VIT® GENE PROBE TECHNOLOGY

A monitoring system based on VIT® gene probe technology helps to recognize changes in the composition of ammonia- and nitrite-oxidizing bacteria, before a serious malfunction occurs.



Fluorescence image of nitrifying bacteria after analysis with VIT® (ammoniaoxidizing bacteria shine red, nitrite-oxidizing bacteria shine green)

ADVANTAGES OF WASTEWATER MONITORING

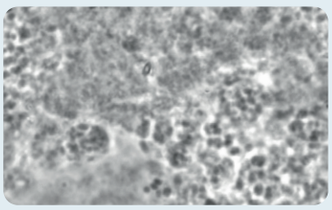


- The nitrification monitoring makes even small changes in the bacterial population visible. The VIT® value can therefore be used to detect a decrease in nitrificants even before the effluent values deteriorate.

Stabilization of the Anammox Process

The **an**aerobic **amm**onia **ox**idation process (abbr.: anammox) is only possible if both, an appropriate process management and the anammox bacteria populations, have been established. In order to grow, these bacteria require anaerobic conditions, but also depend on nitrite, the metabolite of ammonia-oxidizing bacteria, while at the same time, nitrite-oxidizing bacteria should not be allowed to accumulate in the system. Consequently, the entire process and especially the start-up of an anammox reactor is technologically demanding. Being able to monitor the bacteria involved in the process directly at their site of action offers the crucial advantage of being able to control the process in an optimal way.

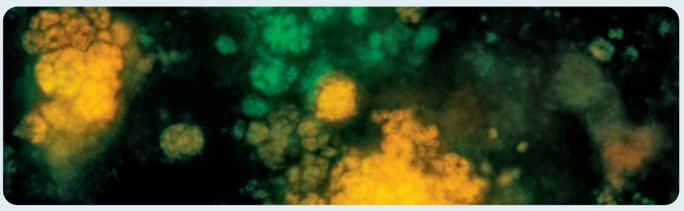
PREVIOUSLY



Phase contrast

- Differentiation between aerobic nitrifying bacteria and anammox bacteria is not possible
- No direct control over the anammox process

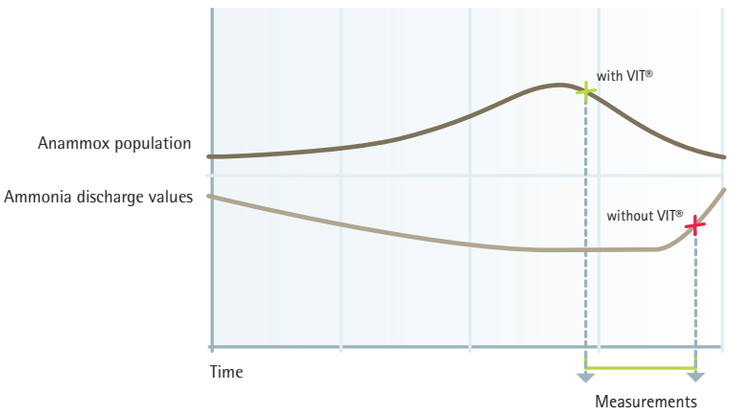
WITH THE VIT® GENE PROBE TECHNOLOGY



Fluorescence image after analysis with VIT®: all living bacteria shine green and anammox bacteria shine orange.

- Process-stabilizing measures can be taken at an earlier stage
- Direct view into the anammox reactor
- Identification and quantification of the bacteria responsible for the anammox process (AOB, anammox)
- Surveillance of bacteria impairing the anammox process (NOB)

ADVANTAGES OF WASTEWATER MONITORING



- The decline of the anammox population detected by VIT® indicates process disturbances at a much earlier stage than the ammonia discharge values.

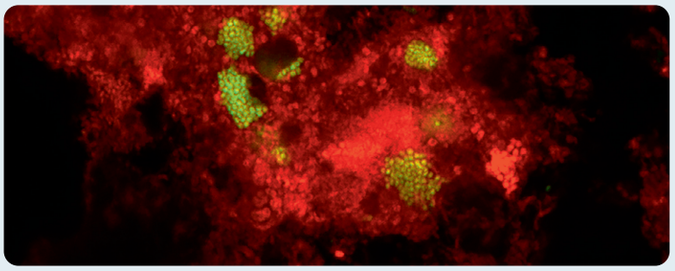
Insight into the Denitrification Process

Denitrifying bacteria can also survive without the presence of soluble oxygen in the water. Under anaerobic conditions, their metabolism shifts to nitrate respiration, which is reflected by a reduced generation of energy and a slower growth of the bacteria. As a consequence, even slight shifts in the composition of bacteria can cause long-lasting disturbances of the denitrification process. With VIT®, an exact profile of the most important populations of denitrifying bacteria can be created and their percental shares on the total vital bacteria flora can be provided.

PREVIOUSLY

- No insights into the bacteria populations
- Unexpected process disturbances
- The cause of a process disturbance cannot be determined

WITH THE VIT® GENE PROBE TECHNOLOGY



Fluorescence image of nitrifiers after analysis with VIT® (ammonium oxidizers glow red, nitrite oxidizers green)

- Specific identification of bacteria groups: *Paracoccus* spp., *Hyphomicrobium* spp., *Azoarcus-Thauera-Cluster, Saprospiraceae* and many more
- Quantification (determination of percental shares in relation to the vital bacterial flora)
- Sludges of different plants can be compared

ADVANTAGES OF WASTEWATER MONITORING

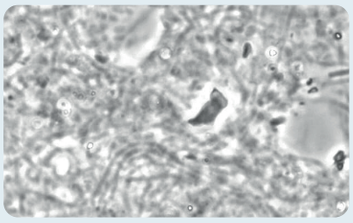
1. Identification and quantification of denitrifying bacteria directly in the wastewater sample
2. Determination of the ratio of nitrifying bacteria to denitrifying bacteria
3. Monitoring of population shifts, even before discharge limit values are exceeded

Prevention of Bulking and Floating Sludge

In many cases, filamentous bacteria pose a problem for wastewater treatment plants. Their presence leads to the development of bulking and floating sludge and to a contamination of the water, caused by an impaired sludge settling. The occurrence of problematic filamentous bacteria is particularly common during seasonal changes around wintertime.

In order to take targeted countermeasures and thus prevent problems with sludge flotation, relevant filamentous bacteria should be monitored specifically.

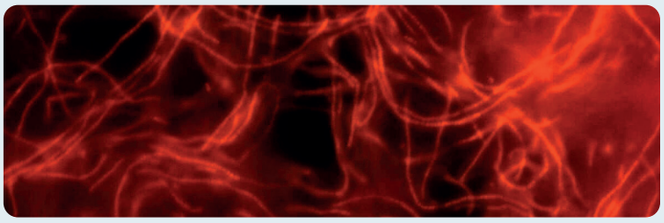
PREVIOUSLY



Phase contrast

- Filamentous bacteria are difficult to identify
- Morphological changes and gram-variability of filamentous bacteria prevent correct identification
- No view into the sludge flocs
- Identification of "new", unknown populations is not possible

WITH THE VIT® GENE PROBE TECHNOLOGY



Fluorescence image after analysis with VIT®, specific detection of Microthrix parvicella.

- Specific identification and quantification of filamentous bacteria
- Detection independent on morphological features
- Detection even in dense flocs
- Only living filamentous bacteria are detected
- Supervision of control measures
- The activity of filamentous bacteria is determined

ADVANTAGES OF WASTEWATER MONITORING

1. Specific identification and quantification of known and unknown filamentous bacteria
2. Establishment of plant-specific limit values for problematic filamentous bacteria
3. Continuous monitoring allows to recognize undesirable developments at an early stage
4. Allows for a swift check / supervision of the effectiveness of control measures
5. Provides insight into the plant's stability
6. Allows for predictions regarding the plant's susceptibility to malfunctions

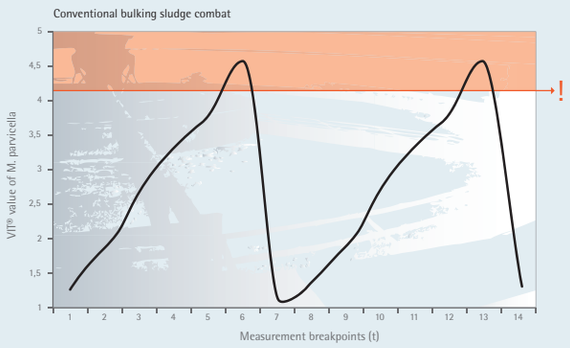
Control of Filamentous Bacteria

In wastewater treatment, the cost factor plays an important role. An economically sound management of the plant is vital. Wastewater monitoring helps to recognize potentials for cost savings and to make use of them. In the following sections, this will be demonstrated using the control of bulking and floating sludge as an example. The ability to recognize the potential danger of filamentous bacteria in time is the basis for a successful and targeted treatment.

APPLICATION OF PRECIPITANTS (E.G. PACS)

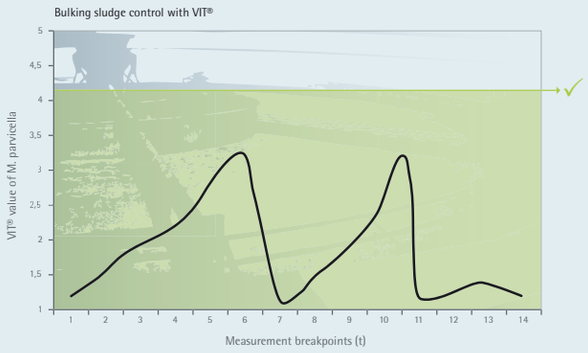
Conventionally, in cases of problematic increases of the sludge volume index (SVI), expensive precipitants (like e.g. PACs) are applied either continuously or intermittently in large amounts.

However, in many cases it is not even clear which filamentous bacterium is actually responsible for the current settling problems in the plant and whether it is susceptible for the applied precipitant. Also, a continuous application of these precipitants represents a major cost factor. And thirdly, resistances and adaptations of the filamentous bacteria against the precipitant can occur.



Development of bulking sludge, large amounts of PACs are added.

WITH THE VIT® GENE PROBE TECHNOLOGY



No development of bulking sludge, small amounts of PACs are added.

Due to the specific monitoring of problematic filamentous bacteria, an assessment of the developing situation and the correlated potential danger is easy and tangible. A plant-specific limit value, e.g. for *Microthrix parvicella*, can be established, so that precipitants, if added in a timely and targeted manner, can completely prevent the development of bulking and foaming. The cost savings generated by a targeted, reduced dose of expensive precipitants are enormous.

Analysis of Population Profiles

The cultivation-independent microbiological status of a working wastewater treatment plant cannot be assessed with conventional methods. In case of problems at the plant, this reference can be extremely valuable, as it allows to determine the differences in the microbial composition. The effects of process modifications can also be directly observed with the help of an analysis of the plant's microbiological profile.

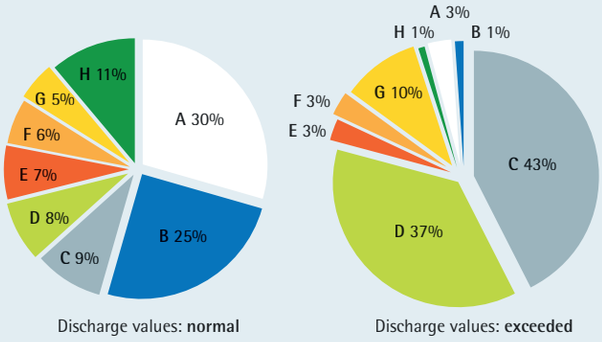
If microbiological wastewater monitoring has been established, changes in the biology and concurrent disturbances that are arising, but not yet visible, can be recognized at an early stage by use of the population profiles. Likewise, the knowledge which microbiological composition is required for an optimal performance also comes in handy for the start-up of new plants.

PREVIOUSLY

With conventional methods, a plant's microbiological status / population profile cannot be determined by any means.

WITH THE VIT® GENE PROBE TECHNOLOGY

- By use of a set of different gene probes, individual bacteria populations can be identified and quantified: a population profile is established
- With the help of this reference, a swift analysis of population changes can be performed in case of malfunctions
- Countermeasures can be taken at an early stage and can be supervised continuously



Discharge values: **normal**

Discharge values: **exceeded**

- *With VIT®, population shifts in a plant can be illustrated in an optimal way*

ADVANTAGES OF WASTEWATER MONITORING

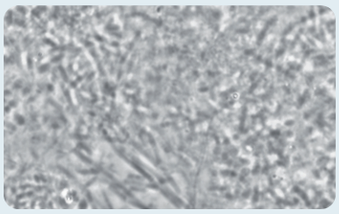
1. Specific detection of pathogenic bacteria in effluent and activated sludge
2. Comprehensive risk assessment
3. Only viable bacteria are detected
4. Short time to result
5. Maximum specificity even in difficult sample matrices

Optimal Results for Biogas Production

With conventional methods, anaerobic microorganisms can hardly be detected or can only be detected with difficulty.

For an unbiased analysis, the direct path has to be taken. An analysis of the methanogenic bacteria in anaerobic reactors and also of the bacteria of the upstream steps of the anaerobic degradation process can provide valuable information about the plant's production performance.

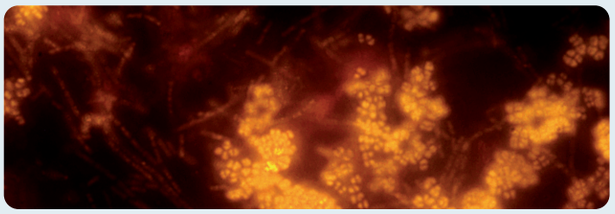
PREVIOUSLY



Phase contrast

- A specific and conclusive analysis of methanogenic bacteria is not possible

WITH THE VIT® GENE PROBE TECHNOLOGY



Fluorescence image after analysis with VIT®: living methanogenic bacteria shine orange.

- Methanogenic bacteria are detected as a group by the VIT® gene probes
- Alternatively, an analysis of the composition of individual methanogenic bacteria can be performed
- Conclusions regarding the biogas production performance can be drawn

ADVANTAGES OF WASTEWATER MONITORING

1. Identification and quantification of methanogenic bacteria as a group
2. Differentiation of individual populations of methanogenic bacteria
3. Population profiling of the bacteria of all degradation steps
4. Early warning in case of disturbances

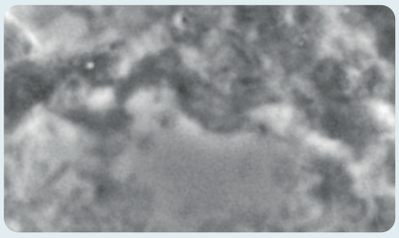
Pathogenic Bacteria in the Effluent

Pathogenic bacteria in the effluent and in the aerobic basin can pose a danger for the wastewater treatment plant's environment as well as for the plant's staff. Due to the high number of microorganisms and the complex composition of the wastewater, pathogens cannot be analyzed with conventional methods.

In order to identify a potentially hazardous situation due to pathogens in the wastewater at an early stage, the wastewater has to be analyzed regularly and with reliable methods.

With VIT® gene probe technology, pathogenic bacteria in the effluent and in the aerated phase of wastewater treatment plants can be identified and quantified swiftly and reliably.

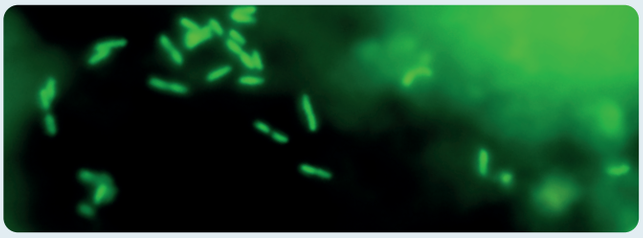
PREVIOUSLY



Phase contrast

- Pathogenic bacteria enter the effluent and remain undetected
- A detection with conventional methods is virtually impossible, as the sheer amount and diversity of microorganisms in the sample material is too high

WITH THE VIT® GENE PROBE TECHNOLOGY



Fluorescence image after analysis with VIT®: Legionella shine green.

- Pathogenic bacteria in wastewater treatment plant effluents are identified and quantified quickly and reliably
- Fast and comprehensive risk assessment for the plant

ADVANTAGES OF WASTEWATER MONITORING

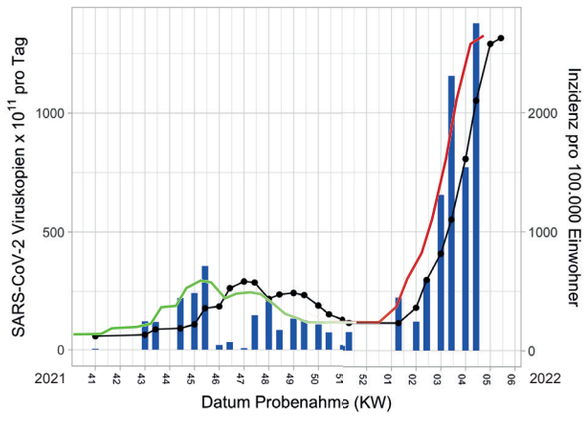
1. Specific detection of pathogenic bacteria in effluent and activated sludge
2. Comprehensive risk assessment
3. Only viable bacteria are detected
4. Short time to result
5. Maximum specificity even in difficult sample matrices

Wastewater-based Epidemiology

Wastewater analysis of SARS-CoV-2 provides area-wide and anonymous population testing and is much faster, less expensive, and more efficient than single-person medical testing. Wastewater monitoring can be used as a Corona early warning system and thus as part of a wastewater-based epidemiological system. The collected data can be used for the early identification of a potential need for action on the part of municipal or industrial decision makers, as well as for the preparation of an adapted catalog of measures. The real-time data thus guarantee timely action adapted to the actual infection situation.

PREVIOUSLY	SARS-COV-2 WASTEWATER MONITORING
▸ Monitoring of individual persons (testing and diagnostics) ▸ Lack of systematics and variability in data collection ▸ Burden and limitation of individuals ▸ No area-wide overview of the true incidence of infection ▸ Social resentment	▸ Systematic and standardized data collection ▸ Reliable, reality-based results ▸ Comprehensive monitoring ▸ Early detection of infection waves ▸ Less effort (costs and manpower) in determining the scope of infection ▸ Contribution to safe and reliable Healthcare management ▸ No social resentment

ADVANTAGES OF WASTEWATER MONITORING



- Total virus load in the influent (24 h)
- 7 days incidence
- Actual forecast of wastewater monitoring

Forecast up to two weeks earlier (green) for delta and up to one week earlier (red) for omicron viral mutation.

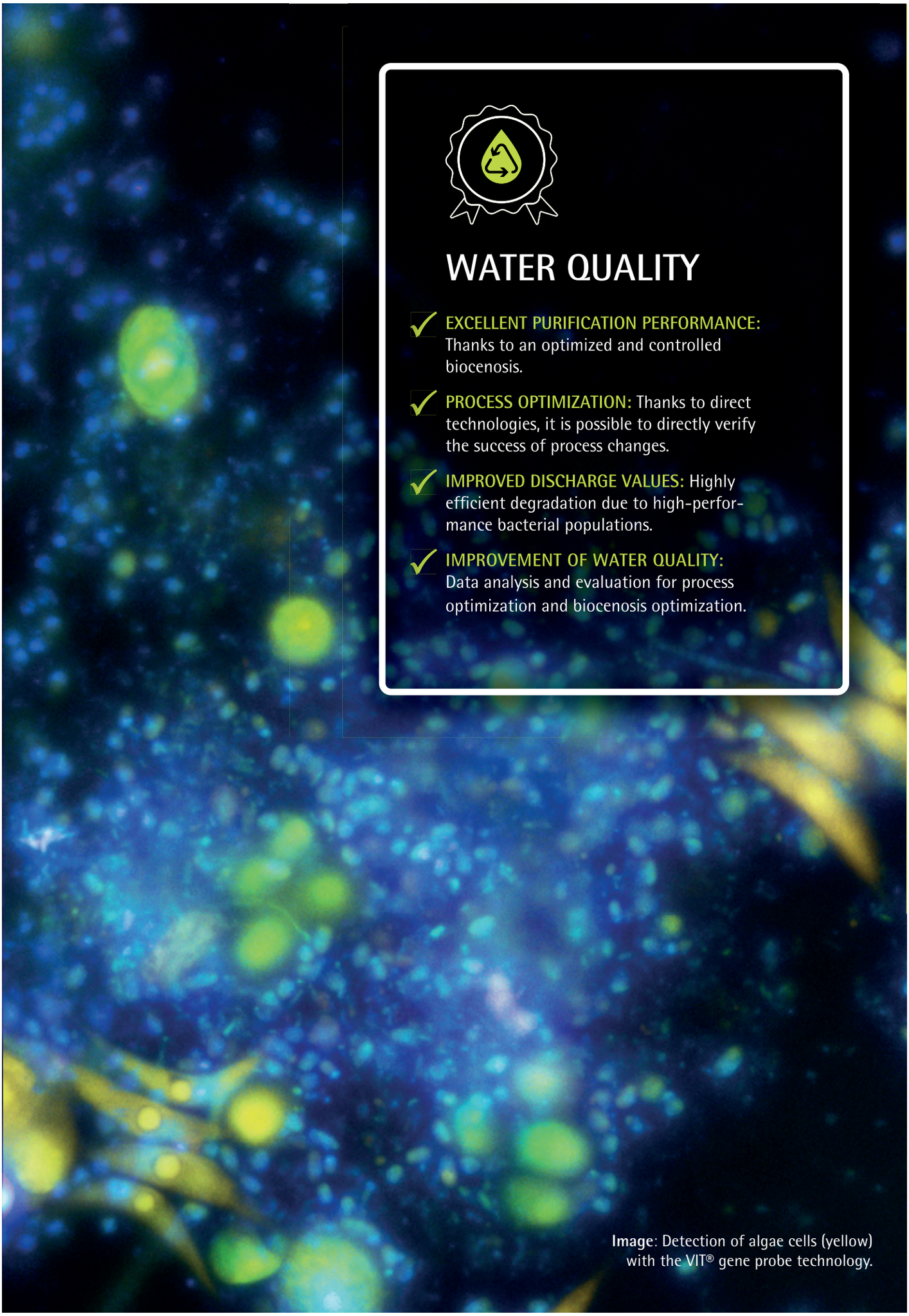
Consulting & Laboratory Analytics

Please address any price enquiries directly to: sales@vermicon.com
We will be happy to provide you with individual support.

SAFETY

- **QUALITY ASSURANCE:** Thanks to in-house control of the plant, which includes systematic and continuous data collection, evaluation and process optimization, taking into account the real biocenosis.
- **RELIABILITY OF ACTION:** Thanks to fast cause identification..
- **RELIABILITY:** Thanks to effective measures to stabilize the biocenosis.

Image: Detection of the filamentous bacterium type N021 (orange) with the VIT® gene probe technology.



WATER QUALITY

- **EXCELLENT PURIFICATION PERFORMANCE:** Thanks to an optimized and controlled biocenosis.
- **PROCESS OPTIMIZATION:** Thanks to direct technologies, it is possible to directly verify the success of process changes.
- **IMPROVED DISCHARGE VALUES:** Highly efficient degradation due to high-performance bacterial populations.
- **IMPROVEMENT OF WATER QUALITY:** Data analysis and evaluation for process optimization and biocenosis optimization.

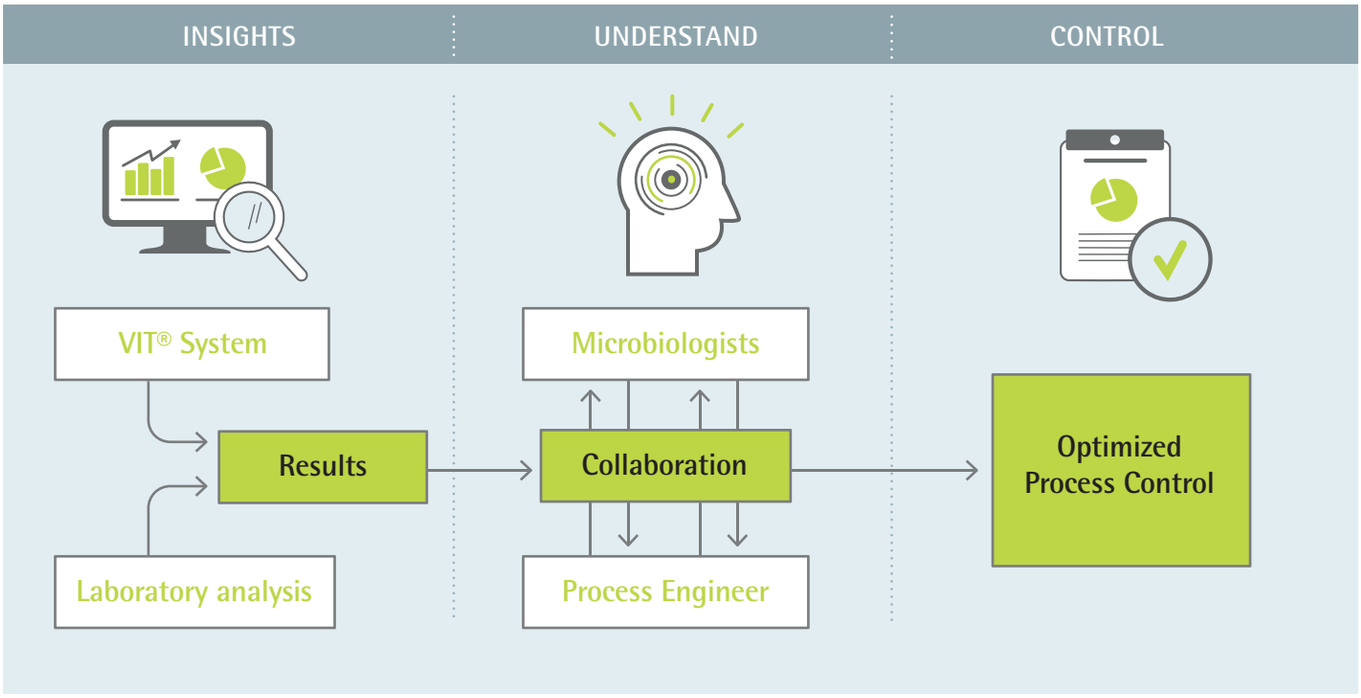
Image: Detection of algae cells (yellow) with the VIT® gene probe technology.

Prevention of Disturbances

Thanks to targeted continuos wastewater monitoring

The future of modern and sustainable wastewater management lies in the integration of the biocenosis into the plant's operational analytical in-house control. This is the only way to make process disturbances visible at the earliest possible stage and to enable efficient determination of the cause.

We support you in successfully integrating the monitoring of (micro)biological processes into the plant's operational analytics. Our microbiologists work closely with certified engineers to continuously align microbiological and chemical values and to determine the resulting recommendations for action.



ADVANTAGES OF WASTEWATER MONITORING

+ direct monitoring of the microorganisms
+ early detection and prevention of disturbances
+ no exceeding of the discharge values
+ optimized purification performance
+ environmentally conscious
+ sustainable
+ economically efficient

✓ *for the prevention of disturbances*

✓ *for more sustainability*

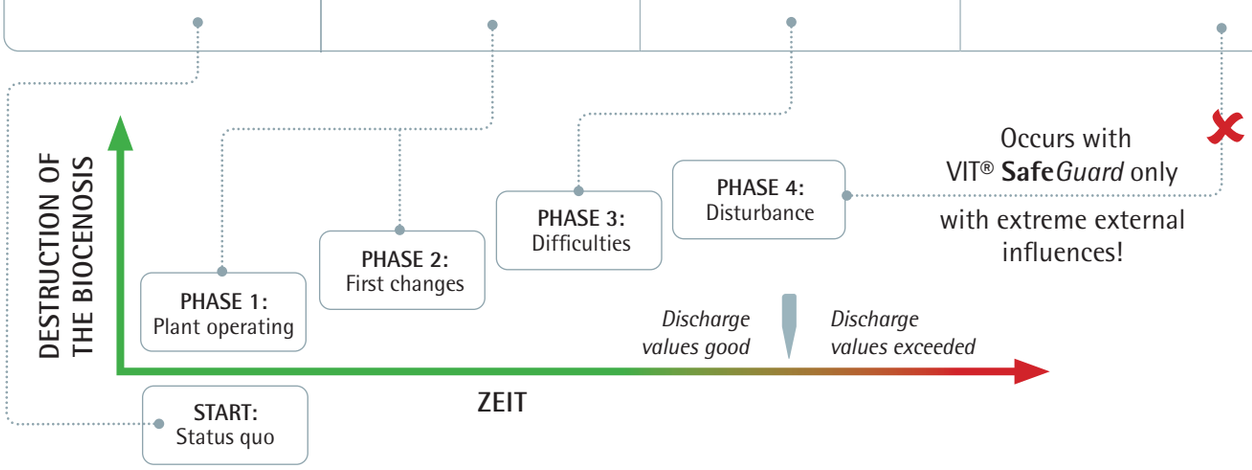
✓ *for a stable and safe wastewater treatment plant*

Practice: VIT® Safe*Guard*

VIT® SafeGuard is the monitoring system for biological wastewater treatment. It has a modular design and thus allows flexible adaptation to the individual needs of municipal and industrial wastewater treatment plants. Measures are implemented depending on the degree of change or destruction of the biocenosis. The cycle of analysis - evaluation - measures takes place at regular intervals and is individually adapted to the plant. The pursuit of economic efficiency and a high ecological standard are our constant companions.

DISRUPTION PREVENTION — **DISTURBANCE MANAGEMENT**

ADAPTION/CALIBRATION	MONITORING	MODULATION	INTERVENTION
			
Detailed analysis of the biocenosis. Qualitative and quantitative recording of the composition of essential population groups. Status quo analysis is performed once a year or after interventions.	Individual bacteria or entire groups of bacteria that are required for the plant are selected. These indicator organisms are regularly determined directly in the sample.	If changes in the biocenosis are detected, certain measures must be taken. By intervening in the process control, the biocenosis is pushed back into the optimal grid. It is necessary that the biocenosis is monitored closely and holistically so that the causes can be determined and the measures can be controlled efficiently.	Even regular monitoring does not protect against externally caused disturbances. In this case, immediate measures must be taken. The cause of the problem is determined, analyzed and eliminated. It should be noted that without prior continuous monitoring of the microbiology, it is hardly possible to determine the cause..

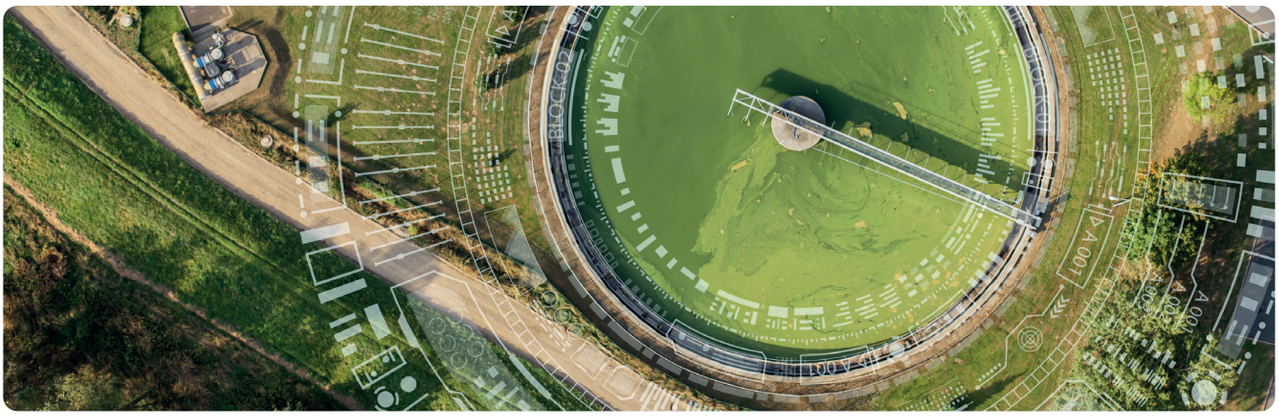


VIT® Vision Software

Data collection and overview

With the VIT® Vision software, the entire biology of the wastewater treatment plant can finally be scanned and analyzed. The subsequent implementation of the results in the operational analytics allows on the other hand to establish a sustainable prevention of disturbances in the purification process.

In addition to a locally installed version for on-site use (see page 48), there is also a web-based dashboard that provides an accurate visual overview of the current biocenosis situation.



Laboratory Analytics Overview

Practical implementation

For each laboratory analysis, you will receive a detailed report and a comprehensive photo documentation illustrating the results obtained. Depending on the effort involved, the results are available after 1 to 5 working days.

In the following you can see an overview of the analyses carried out by us as standard.

SIMPLE WORKFLOW

Request a quote → Sampling-vessels received → Perform sampling → Ship sample back to vermicon AG → Report received → Implement results into operational analytics

Lab Service	Description
Population profiles	
Main group population analysis **Item no.** 01120009	Creation of a cultivation-independent profile of the bacteria populations in a sample. Present populations are grouped according to their affiliation to the main bacteria groups. This approach allows to detect up to 98% of all bacteria in an environmental sample. Individual groups are quantified as percental share of the total viable population. In addition, total cell counts (living and dead) per ml sample are determined, which means that total values per ml sample for individual populations are provided.
Premium population analysis **Item no.** 01120001	Creation of a cultivation-independent profile of the bacteria populations in a sample. Present populations are grouped according to their affiliation to the main bacteria groups. This approach allows to detect up to 98% of all bacteria in an environmental sample. Individual groups are quantified as percental shares of the total viable population and, based the total cell counts determined, absolute values per ml sample for individual populations are provided. In addition to the main bacteria groups, the following key functional groups are analyzed in particular: ▸ Filamentous bacteria are classified and quantified ▸ Aerobic nitrifying bacteria are analyzed as groups (AOB and NOB) ▸ Denitrifying bacteria are analyzed and quantified

Lab Service	Description
Detection of filamentous bacteria	
VIT® for Filaments Screening **Item no.** 01130015	By use of specific gene probes, the most important problematic filamentous bacteria are analyzed in wastewater samples, with their respective quantities being determined with the help of the VIT® key: *Microthrix parvicella*, nocardioform Actinomycetes, *Chloroflexi*, Type 1851, *Haliscomenobacter hydrossis*, the sulfur bacteria Type 021N and *Thiothrix* as well as the segmented filamentous bacteria *Nostocoida limicola* II and *Alysiosphaera*. Only living bacteria are detected. The report contains advice regarding control strategies.
Filaments PLUS **Item no.** 01120003	Creation of a complete profile of the filamentous bacteria in wastewater samples. The sample is examined by use of a large variety of group- and species-specific gene probes. Thus, in addition to known bacteria, even previously unknown filamentous bacteria can be classified and control strategies can be deduced on the basis of their relation to known representatives. Quantitative results are given as percental shares of the total living population and as absolute cell counts per ml sludge. In addition, the total cell count and the total viable count per g sludge are determined. The report contains advice regarding control strategies.
***Thiothrix* spp. / Type 021N** **Item no.** 01130003 also available as test kit	Identification and quantification of the filamentous sulfur bacteria Type 021N and Thiothrix. Results for both parameters are provided quantitatively as VIT® values. Filamentous sulfur bacteria serve as indicator organisms for the presence of hydrogen sulfide or fouling processes in wastewater treatment plants.
***Chloroflexi* spp. / Type 1851** **Item no.** 01130020 also available as test kit	Specific detection of the group of *Chloroflexi* filaments and identification of Type 1851 in parallel. Most representatives of the *Chloroflexi* filaments are unknown. Examples for known members are Types 0041, 0092, 0803 and 1851. Some members of this group promote flocculation and are viewed as the flocs' "backbone", others can cause problems with sludge settling. In anaerobic pellet sludges, *Chloroflexi* are essential for pellet cohesion. Known as well as unknown members are detected by a gene probe specific for the *Chloroflexi* group and are quantified directly in the wastewater sample via VIT® key.
Haliscomenobacter hydrossis **Item no.** 01130005 also available as test kit	Identification and quantification of the filamentous bacterium *Haliscomenobacter hydrossis* in wastewater samples with our test kit VIT® Haliscomenobacter. Quantitative results are given as VIT® values.
Microthrix parvicella **Item no.** 01130002 also available as test kit	Identification and quantification of *Microthrix parvicella* with the test kit VIT® Microthrix in wastewater samples (from the aeration tank, but also e.g. from the digester). Quantitative results are provided as VIT® values. *Microthrix parvicella* is considered as the most important microbial cause for floating sludge and foaming in municipal wastewater treatment plants.

Lab Service	Description
Detection of filamentous bacteria	
Nocardioforms Actinomycetes **Item no.** 01130006 also available as test kit	Identification and quantification of nocardioform Actinomycetes in wastewater samples with our test kit VIT® Nocardia. Conventionally, only the typically branch-forming nocardioform Actinomycetes can be detected via microscope. However, some nocardioform Actinomycetes can also occur as single cells, remain undetected and consequently, are not recognized as a potential hazard.
***Nostocoida limicola* II** **Item no.** 01130007 also available as test kit	Identification and quantification of the gram-positive Nostocoida limicola II and the gram-negative Alysiosphaera filaments with our test kit VIT® Nostocoida limicola II. Both segmented filaments can hardly be distinguished by conventional methods, but respond to different control strategies.
Detection of nitrifying bacteria	
Nitrification analysis **Item no.** 01130001 also available as test kit	Identification and quantification of aerobic ammonia- and nitrite-oxidizing bacteria (AOB, NOB) as groups in activated sludge samples. The AOB group mainly consists of *Nitrosomonas* species, while *Nitrobacter, Nitrospira* and *Nitrotoga* are analyzed within the NOB group. Both groups are quantified via VIT® key and populations are evaluated regarding possible spatial interactions.
Nitrification analysis *plus* identification of NOBs **Item no.** 01130022	Identification and quantification of aerobic ammonia- and nitrite-oxidizing bacteria (AOB, NOB) as groups in activated sludge samples, similar to Nitri-VIT® Rapid Analysis. Additional identification of NOB on genus level: the NOB genera *Nitrobacter, Nitrospira* and *Nitrotoga* are identified individually by specific gene probes and their percental shares in relation to the total living population are determined.
Nitrification detail analysis **Item no.** 01120002	A detailed "profile" of the composition of ammonia- and nitrite-oxidizing bacteria in wastewater samples (also biofilms and carriers) is created. The bacteria are analyzed in detail with genus- and species-specific gene probes and quantified as percental share of the total viable population.
Denitrification analysis **Item no.** 01120017	A detailed "profile" of the denitrifying bacteria populations in wastewater samples is created. The individual bacteria groups are identified directly in the sample via specific gene probes and are quantified as percental share of the total viable population.
Anammox analysis **Item no.** 01120008 also available as test kit	Identification and quantification of the bacteria responsible for the anaerobic ammonia oxidation process (anammox). Individual genera of anammox bacteria are identified as group directly in the sample material and quantified as percental share of the total viable population.

Lab Service	Description
Detection of nitrifying bacteria	
Anammox *plus* **Item no.** 01120035	Identification and quantification of the bacteria responsible for the anaerobic ammonia oxidation process (anammox). Individual genera of anammox bacteria are identified as group directly in the sample material and quantified as percental share of the total viable population. In addition, aerobic ammonia- and nitrite-oxidizing bacteria (AOB, NOB) are identified as groups and quantified as percental shares of the total viable population.
Anaerobic reactors	
Methanogenic bacteria **Item no.** 01120006 also available as test kit	Identification and quantification of the group of methanogenic Archaea (methanogenic bacteria) in samples from the anaerobic sludge treatment process. By use of specific gene probes, these process-relevant microorganisms are identified directly in the sample material and are quantified as percental share of the total viable population.
Methanogenic bacteria Detail analysis **Item no.** 01120033	Identification and quantification of individual genera of methanogenic bacteria in samples from the anaerobic sludge treatment process. By use of specific gene probes, these process-relevant microorganisms are examined individually and quantified as percental share in relation to the total viable population.
Population profiling in anaerobic reactors **Item no.** 01120018	Establishment of a cultivation-independent profile of all bacteria populations in anaerobic reactors, including methanogenic bacteria. Present populations are grouped according to their affiliation to the main bacteria and archaea groups. This approach allows to detect up to 98% of all bacteria in an environmental sample. Individual groups are quantified as percental shares in relation to the total viable population. In addition, total cell counts (living and dead) per ml sludge are determined, which means that absolute values per ml sludge for individual populations are provided.
Detection of phosphate-eliminating Bacteria	
Bio-P analysis **Item no.** 01120014 also available as test kit	Identification and quantification of the bacteria responsible for the biological phosphate-elimination process (Bio-P) in wastewater samples. Via specific gene probes, phosphate-eliminating bacteria (PAO) as well as their antagonists, glycogen-accumulating bacteria (GAO), are detected. The obtained results are quantified as percental shares of the total viable population.

Lab Service	Description
Detection of pathogens	
Monitoring of viruses in wastewater	Identification and quantification of SARS-CoV-2, RSV, Influenza and its viral mutations by RT-qPCR method. The Ct value is used to determine the virus concentration in wastewater.
Clostridium perfringens **Item no.** 01130017	*Clostridium perfringens* is one of the bacteria that, due to their ability to form spores, are able to survive even unfavorable environmental conditions for a long time. They can be found everywhere in the environment, predominantly in soil, but also in human and animal intestinal tracts. For this laboratory analysis, we identify and quantify *Clostridium perfringens* spores in sludge samples. Results are absolute and provided in CFU / g.
Escherichia coli **Item no.** 01130018	Identification and absolute quantification of *Escherichia coli (E. coli)* in sludge samples. The exact amount of this indicator organism in sludge samples is determined absolutely as CFU / g sludge.
***Legionella* in effluent samples** **Item no.** 01130025	Fast and specific analysis of *Legionella* spp. and *Legionella pneumophila* in effluent samples. Analysis is performed via cultivation and absolute results are provided in CFU / ml.
***Legionella* in activated sludge samples** **Item no.** 01130016	Fast and specific analysis of *Legionella* spp. and *Legionella pneumophila* in activated sludge or other wastewater samples. Analysis is performed via VIT® gene probe technology on a single-cell basis and is cultivation-free. Results are available within a few hours. By use of specific gene probes, the total viable count per ml is provided for *Legionella* spp. as well as for *Legionella pneumophila*.
Salmonella in wastewater samples **Item no.** 01130021 (qualitative) **Item no.** 01130019 (quantitative)	Identification and absolute quantification of *Salmonella* spp. in sludge samples. Qualitative (presence/absence) and quantitative analyses can be performed, with results of the latter being given absolutely as CFU / g sludge.

THE ADVANTAGES OF VERMICON'S LAB ANALYTICS

- **Fast** and **specific** results
- **Comprehensive reports**
- Analysis of a wide variety of sample material (e.g. activated sludge, sludge sludge, samples from anaerobic reactors, wastewater treatment plant effluent)
- Use of **high-tech** microbiology
- Access to the microbiological know-how of vermicon
- **Individual** and **personal consulting** and support by the experts of vermicon AG

Ordering a Lab Service / Specifications for Sample Submission

Sampling: Please request either our sampling kit or our simple fixation protocol for wastewater samples and stabilize the sample according to this procedure prior to shipping.

Biofilms: Please request our sampling protocol for biofilm samples.

Sample Submission Form: Please enclose a completed sample submission form in the sample parcel and send it in advance via email to: support@vermicon.com.
You can also download the sample submission on our website: www.vermicon.com/support or request it from our Support Team at support@vermicon.com.

Sample Shipping: Please make sure that your samples are dispatched in break-proof containers that are properly sealed. If necessary, seal them once more with parafilm. Every sample should be labeled clearly and unambiguously.

Send your samples to this address:
vermicon AG
Service Department
Zeppelinstr. 3
85399 Hallbergmoos

Sample Receipt: All samples that have been received after 3 PM are automatically counted as sample receipts for the next working day.

Report: By default, reports are sent via email. In case you prefer a different shipping method, please make sure to specify it on the sample submission form.

Confidentiality: All data are treated as strictly confidential. Formal, contractual agreements of confidentiality can be provided upon request.

For any further information or instructions you require, please contact us directly:
support@vermicon.com

CERTIFICATION AND QUALITY

Microbiological analysis is a highly sensitive area. To provide our customers with the highest possible level of safety, our company is certified according to ISO 9001:2015. Our services are continuously tested and evaluated in independent international studies. This ensures that our customers receive exactly the solution they need to meet their specific requirement.

ISO 9001
Zertifiziertes Qualitätsmanagementsystem
www.tuev-sued.de/ms-zert

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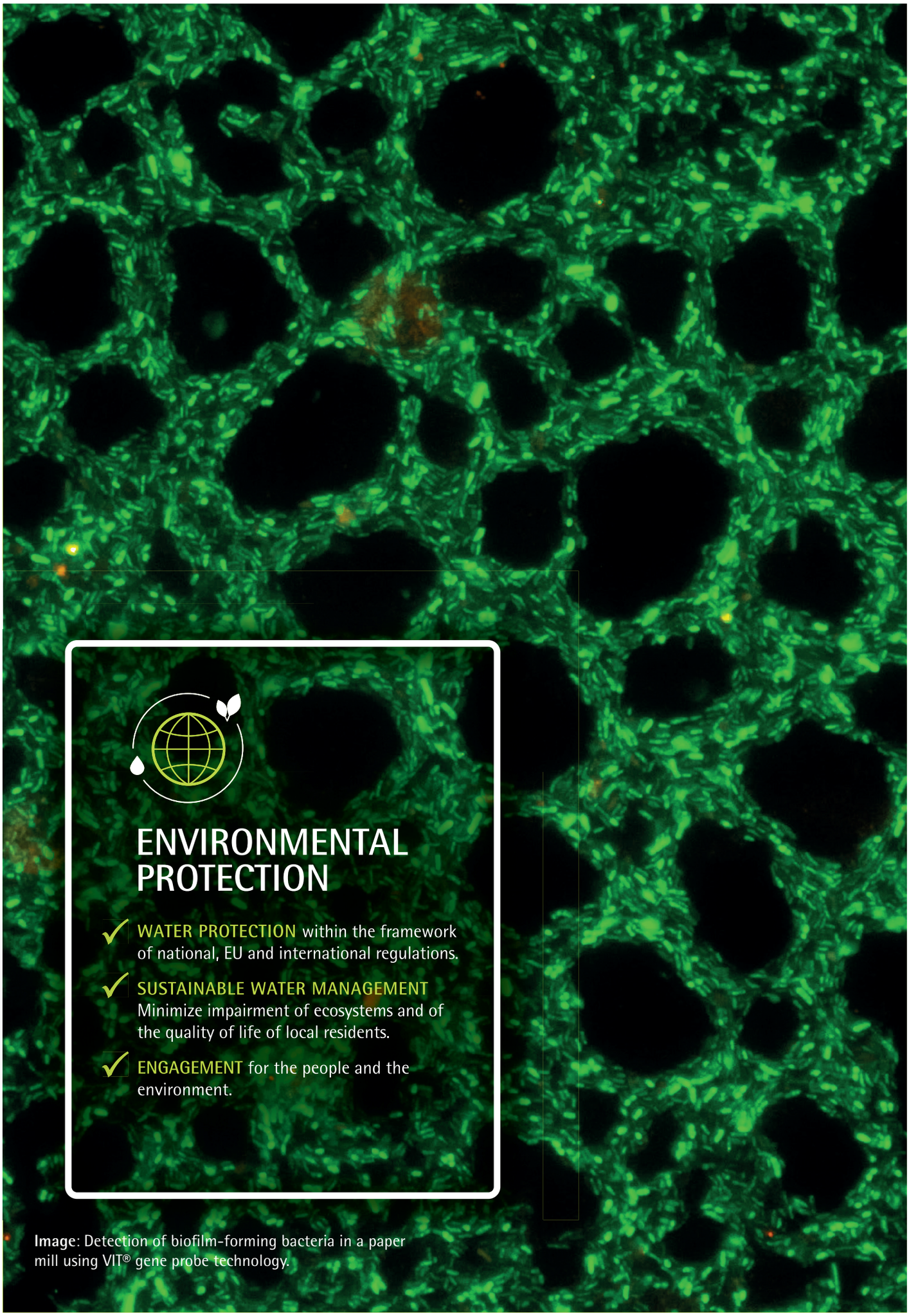
Contact us for more information and
individual offers: support@vermicon.com



ENVIRONMENTAL PROTECTION

- **WATER PROTECTION** within the framework of national, EU and international regulations.
- **SUSTAINABLE WATER MANAGEMENT** Minimize impairment of ecosystems and of the quality of life of local residents.
- **ENGAGEMENT** for the people and the environment.

Image: Detection of biofilm-forming bacteria in a paper mill using VIT® gene probe technology.

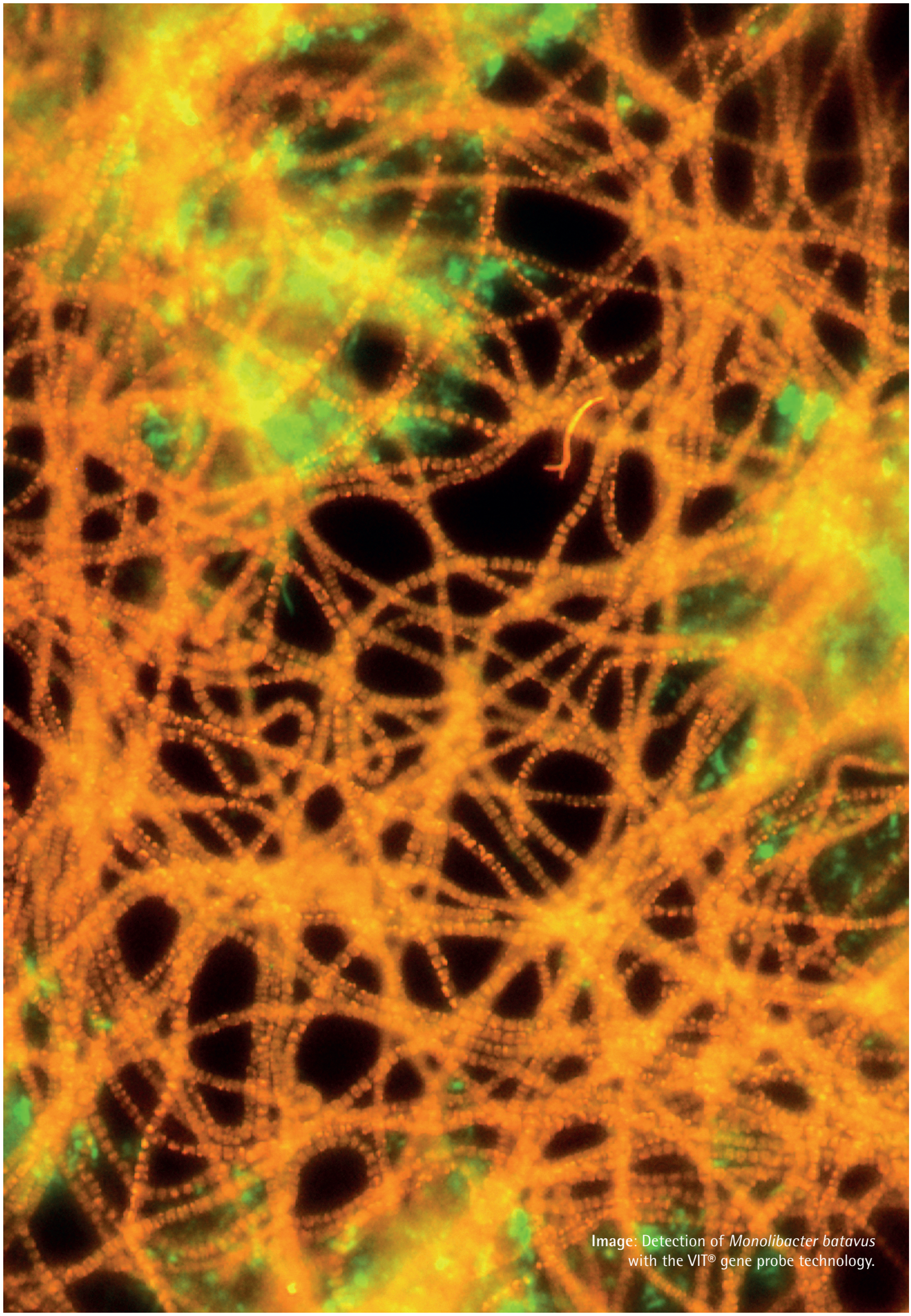


Image: Detection of *Monolibacter batavus* with the VIT® gene probe technology.

VIT® System

For the on-site analysis

Analysis, visualization, documentation and evaluation of microbiological samples: The VIT® system enables highly specific, innovative and state-of-the-art analysis of microorganisms in all areas of industrial microbiology.

VIT® TEST KIT

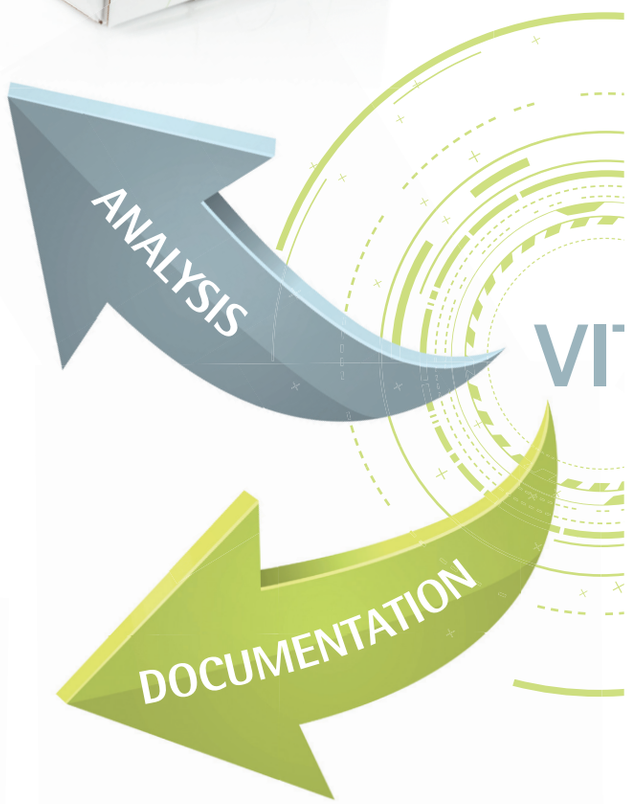
- Results are available within 3 hours
- Easy handling and workflow

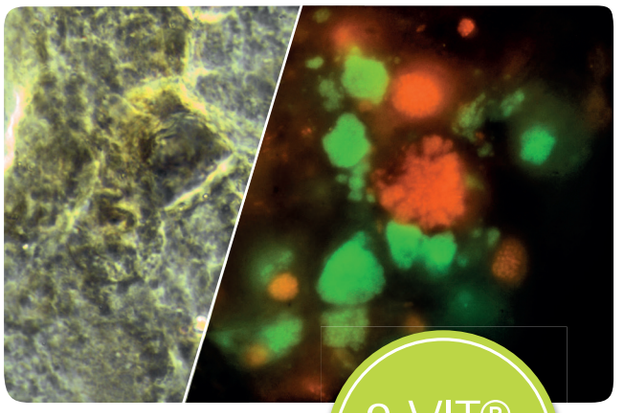
1. VIT® TEST KITS

VIT® VISION

- Image recording, video recording, statistical value determination
- Data import, flexible storage of the evaluation, simple documentation thanks to PDF reports

4. VIT® SOFTWARE





2.VIT®
MICROSCOPE

VIT® MICROSCOPE

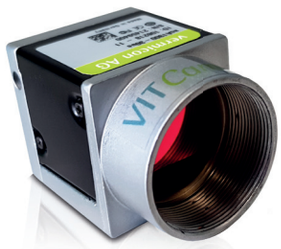
- Excellent price-performance ratio
- Individually optimized for customer-specific requirements

EVALUATION

VISUALIZATION

VIT® CAM

- Easy handling and compact format
- Excellent image quality



3.VIT®
CAM

MICROBIOLOGICAL MONITORING WITH THE VIT® SYSTEM

+ **Matched components and interlocking technologies**
+ Intuitive handling
+ User-oriented functionality
+ We will support you with advice and assistance in your everyday work

We will be happy to provide you with an individual non-binding quotation. Get in touch with us: sales@vermicon.com

VIT® Test kit

1. VIT® TES TKITS

For analysis directly at the wastewater treatment plant

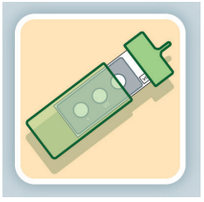
Analyze your samples directly at the wastewater treatment plant - promptly and without much effort. The VIT® test kits contain the VIT® gene probe technology in an easy-to-use form. Getting started with the system is uncomplicated, a simple laboratory is sufficient. Even for small facilities, the VIT® test kits are a valuable contribution to plant control and safety.

- **Easy** handling of the VIT® test kit
- The system is **very robust**
- The results are available within a **very short time**

1. Fixation
Sample material is fixated on the supplied slide.

2. Contact
The VIT® solution is added.

3. Incubation
For a reaction, put the object slide into the supplied VIT® Reactor.



4. Washing

5. Evaluation
With a VIT®-adapted microscope.

THE ADVANTAGES OF THE VIT® TEST KIT

- **Relevance** only living bacteria are detected
- **Workload:** only a few minutes
- **Evaluation:** by using a fluorescence microscope (e.g. VIT® microscope)
- **Quantification:** using the VIT® key
- **Results:** are available within 3 hours
- **Consumables:** included in the kit
- **Packaging unit:** 25 analyses

FAST | SPECIFIC | RELIABLE | CULTIVATION-INDEPENDENT | ROBUST

Test kit	Description/Application
Detection of nitrifying bacteria	
Nitri-VIT® **Item no.** 01110001	Aerobic nitrifying bacteria populations are analyzed easily and directly in wastewater samples. Due to separate labels, both groups, ammonia-oxidizing and nitrite-oxidizing bacteria, are detected in parallel in a single analysis and are quantified separately.
VIT® Anammox **Item no.** 01110016	Specific detection of the bacteria responsible for anaerobic ammonia oxidation (anammox). Anammox bacteria are detected directly in wastewater samples and quantified via VIT® key. In addition, the percental share of anammox bacteria in relation to all viable bacteria in the sludge sample can be determined.
Anaerobic reactors	
VIT® Methanogenic bacteria **Item no.** 01110015	Specific detection of methane-producing *Archaea* (methanogenic bacteria) in samples of the anaerobic sludge treatment, biogas reactors and pellet sludges. The methanogenic bacteria are detected directly in the sample material. Quantification is provided as percental share of methanogenic bacteria in relation to the total viable flora in the sample.
Detection of pathogens	
VIT® Clostridium perfringens **Item no.** 01210029	*Clostridium perfringens* is one of the bacteria that, due to their ability to form spores, is able to survive even unfavorable environmental conditions for a long time. It can be found everywhere in the environment, predominantly in soil, but also in human and animal intestinal tracts. VIT® Clostridium perfringens identifies these undesirable microorganisms quickly and specifically.
Detection of filamentous bacteria	
VIT® 021N/Thiothrix **Item no.** 01110007	Specific and unambiguous identification of the filamentous sulfur bacteria Eikelboom Type 021N and *Thiothrix*. Due to their separate labels, both filamentous bacteria are identified in parallel in a single analysis and are quantified separately.
VIT® Chloroflexi **Item no.** 01110022	Specific detection of the group of *Chloroflexi* filaments and in parallel also identification of Eikelboom Type 1851. Most members of the *Chloroflexi* group of filamentous bacteria are unknown. Known members are, among others, Types 0041, 0092, 0803 and 1851. Some members have beneficial effects on flocculation and are viewed as the flocs' "backbone", while others can cause problems with sludge settling. With a gene probe specific for the *Chloroflexi* group, known as well as unknown members are identified and are quantified directly in the wastewater sample via VIT® key.

Test kit	Description/Application
Detection of filamentous bacteria	
VIT® Haliscomenobacter **Item no.** 01110006	Specific detection of *Haliscomenobacter hydrossis* directly in wastewater samples. The gram-negative filament *Haliscomenobacter hydrossis* causes problems like bulking and floating sludge as well as foaming in biological wastewater treatment. The bacteria can be quantified with the help of the VIT® key.
VIT® Microthrix **Item no.** 01110010	Specific identification and quantification of living *Microthrix parvicella* filaments. *Microthrix parvicella* is regarded as the main cause for bulking and floating sludge in municipal wastewater treatment plants. This test kit allows you to monitor the amount of *Microthrix* present in the plant and, in case a plant-specific limit value is exceeded, to initiate appropriate countermeasures and to supervise their efficiency directly. Via VIT® key, living *Microthrix* filaments can be quantified in activated sludge, but also in digesters.
VIT® Nocardia **Item no.** 01110009	Specific and unequivocal detection of nocardioform Actinomycetes directly in wastewater samples. Nocardioform Actinomycetes encompass several species of branch-forming, gram-positive filamentous bacteria, but also single cells belonging to the genera *Nocardia, Gordona, Rhodococcus, Skermania* and *Tsukamurella*. In many wastewater treatment plants, these bacteria act as a cause of floating sludge and contribute to foaming problems. With the help of the VIT® key, living nocardioform Actinomycetes are quantified in the sludge sample.
VIT® Nostocoida limicola II **Item no.** 01110008	Specific and unambiguous identification of the segmented filamentous bacteria *Nostocoida limicola* II and *Alysiosphaera*. These two species of filamentous bacteria respond to different control strategies, but can hardly be distinguished by their morphology. Due to the use of different labels, both filaments are identified in parallel in a single analysis and are quantified separately.
Biological phosphate-elimination	
VIT® PAO/GAO **Item no.** 01110020	Specific and unambiguous identification of bacteria contributing to the biological phosphate elimination process (Bio-P) in wastewater samples. Polyphosphate-accumulating bacteria, known as PAO, as well as their antagonists, glycogen-accumulating bacteria (GAO) are detected in parallel in a single analysis due to their different labels. The specific VIT® gene probes allow for an identification verified by molecular genetics as well as an examination of the current ratio of both groups, as the ratio can influence the efficiency of the Bio-P process.

VIT® Fluorescence microscope

2. VIT® MICROSCOPE

Evaluation of the VIT® test kits

The VIT® Microscope is the evaluation tool that has been specifically tailored to VIT® test kits. In combination we offer a complete system for an easy and trouble-free analysis of microbiological samples. And all of this at an absolutely fair price.

THE CONFIGURATION OF THE VIT® MICROSCOPE:

- Trinocular microscope with 30W Halogen Koehler illumination including 5 position nosepiece
- Objectives Plan achromat 4x/0,10; 10x/0,25; 20x/0,40; 40x/0,66; 100x/1,25
- Eyepieces WF 10x20
- Condenser for brightfield mode
- 2 VIT®-adapted filter systems mounted on the filter module
- 100W HBO Epi Fluorescence unit, 5 position filter wheel incl. centering objective
- 2 mercury vapor short-arc lamps HBO 100

THE ADVANTAGES OF THE VIT® MICROSCOPE

+ **High optical quality:** reliable evaluation
+ **Easy handling:** no training effort
+ **Robust and durable:** suitable for everday routine
+ **Attractive price:** high cost effectiveness

VIT® Microscope and VIT® Cam

Product	Description	Item no.
VIT® Microscope		
	▸ Trinocular microscope with 30W Halogen Koehler illumination incl. 5 position nosepiece ▸ Objectives Plan achromat: 4x/0,10; 10x/0,25; 20x/0,40; 40x/0,66; 100x/1,25 ▸ Oculars WF 10x20 ▸ Condenser for bright field mode ▸ 2 VIT® adapted filter sets, mounted on a filter module (red and green or red and dual band) ▸ 100W HBO epifluorescence unit with 5-position filter wheel incl. centering objective ▸ 2 mercury vapor short-arc lamps HBO 100	00990001
VIT® Cam		
	VIT® Cam S1c For technologically up-to-date, high-quality visualization of analysis results. Images are transmitted directly from the microscope to a connected monitor.	01991001

Microscopes by Zeiss and Leica

In addition to the VIT® Microscope, we offer microscopes by Zeiss and Leica as an authorized specialist dealer. If desired, they can also be specifically adapted to our VIT® test kits. In any case, you can choose between a variety of different configurations. Select the components of your high-quality microscope according to your individual requirements.

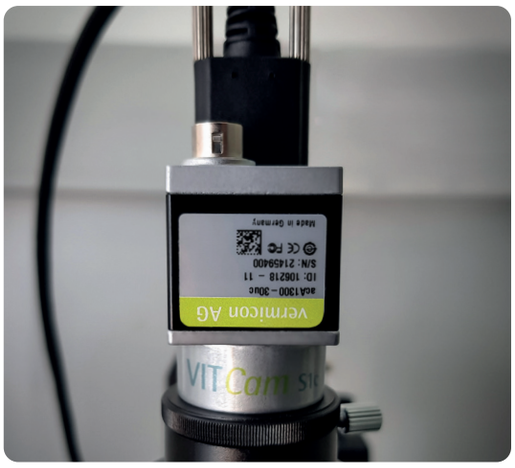
Product	Description	Item no.
Zeiss Microscope		
ZEISS	**e.g. Axiolab 5 with LED Fluorescence** Can be equipped with the following extra features: ▸ Fluorescence ▸ Bright field ▸ Phase contrast ▸ Dark field	01990002
Leica Microscope		
Leica MICROSYSTEMS	**e.g. Leica DM750** Can be equipped with the following extra features: ▸ Fluorescence ▸ Bright field ▸ Phase contrast ▸ Dark field	01990003

VIT® Cam

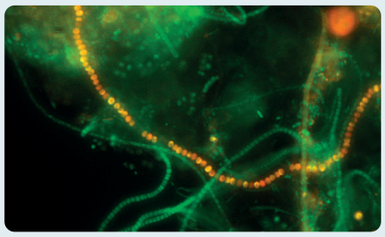
3.VIT® CAM

The vermicon camera

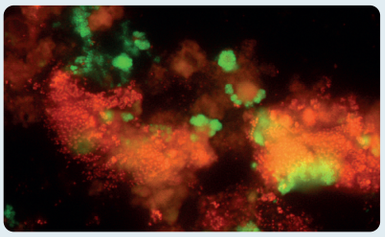
Visualize the results in a modern way and with high quality – directly from the microscope to a connected monitor. With the VIT® Cam, imaging becomes even easier and more comfortable. The extremely fast transmission of live images allows for a continuous visual control of the analysis directly on the monitor.



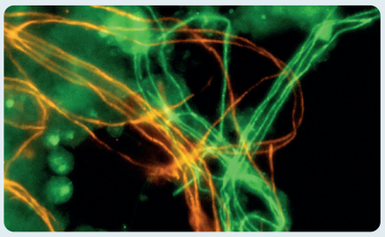
EXAMPLE FLUORESCENCE IMAGES WITH THE VIT® CAM



All living bacteria shine green, Nostocoida limicola II filaments shine specifically red



Nitrite-oxidizing bacteria shine green, ammonia-oxidizing bacteria shine red



Chloroflexi filaments shine green, Eikelboom Type 1851 shines orange

THE ADVANTAGES OF THE VIT® CAM

- An excellent price-performance ratio
- Image material in high quality
- Combining it with vermicon's proprietary analysis software VIT® Vision makes for uniquely fast live imaging
- Easy handling
- Compact size
- Perfectly matched to the other components of the VIT® System

VIT® Vision Software

4. VIT® SOFTWARE

For analysis and data acquisition directly at the wastewater treatment plant.

With VIT® Vision we provide a tool to monitor the entire biological treatment stage and use it as a data basis for more effective analysis, control and process optimization of the wastewater treatment plant. The development of VIT® Vision is based on our experience and the requirements of modern biological wastewater treatment plants. Here, the focus is on the continuous development of the software to best meet the needs of our customers.

FEATURES AND MODULES

IMAGING

Ingenious algorithms ensure highest image quality. Automatic image enhancement and extremely fast live imaging. Quick adjustment of exposure parameters.

QUANTIFICATION

Quantitative evaluation with the help of the automated VIT® key. Product-based monitoring for bulking and floating sludge, as well as the nitrification & denitrification process..

VIDEO CAPTURE

Recording of video sequences for efficient monitoring of e.g. ciliates. No limitation of the video length. Display of the currently recorded video as a live image.

MEASUREMENTS

Length and size measurements for live and previously captured images. Scale and magnification details can be customized.

DOCUMENTATION

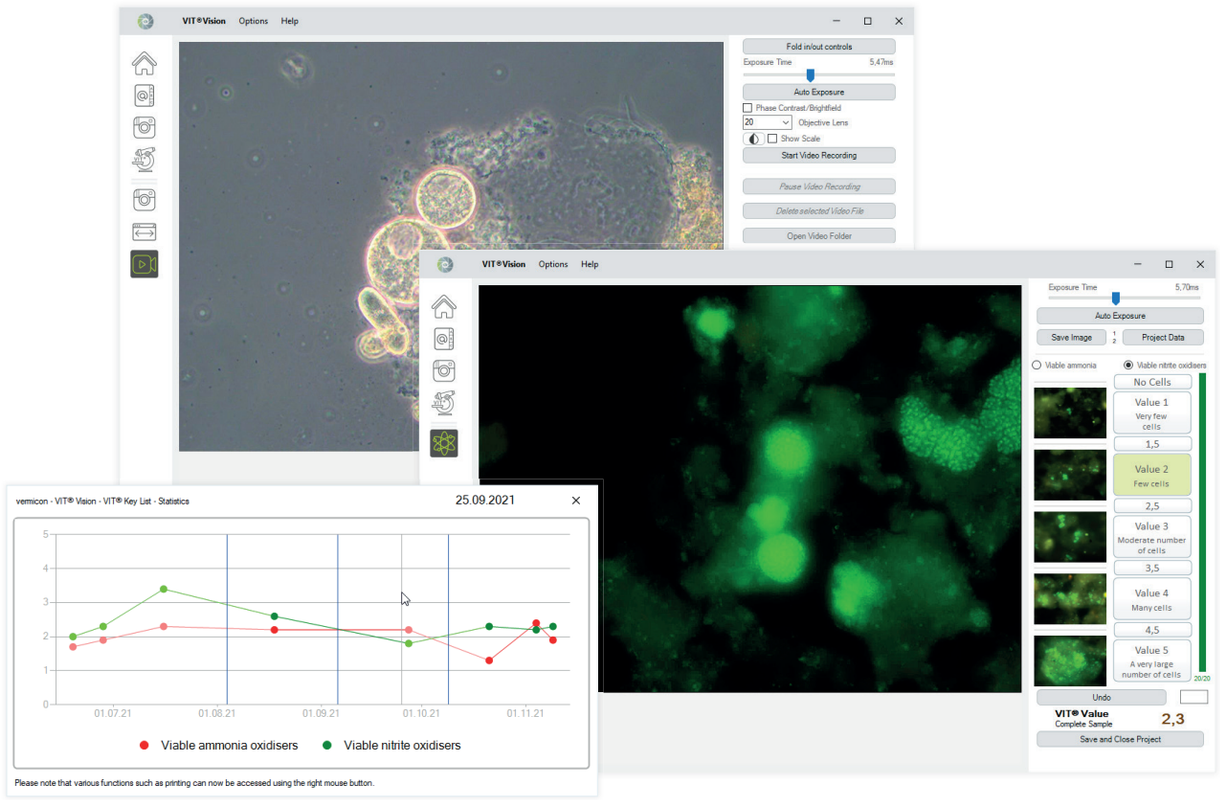
Flexible storage and customizable documentation of the evaluations possible. PDF short report export for the standardization of the measured values.

SUPPORT

Personal and telephonic support service. Regular software updates for an optimal performance.

THE ADVANTAGES OF VIT® VISION

- Intuitive user interface
- Simple **quantification** of the microorganisms
- **Direct contro**l of process changes and their effects on biology
- Determination of plant **stability**
- **Efficiency** and **cost savings**
- **Data management**: data import, flexible storage of evaluation, simple documentation thanks to PDF reports
- Detect changes at an early stage
- **Process optimization:** Thanks to holistic and continuous analysis and evaluation of microbiological and biological measurement data



VIT® Software

Product	Description	Item no.
VIT® Vision		
	This evaluation software's practical features allow for image overlays, object measurements and optical optimization for a conclusive documentation. For an easier evaluation of obtained results and a continuous monitoring of the microscopic image. Allows to compare different results in their chronological sequence.	01992001

SYSTEM REQUIREMENTS

HARDWARE

RAM: at least 4 GB (recommended: 8 GB)

CPU: Intel Core i5-6400, recommended Intel Core i7-7700, Core i9 or higher

Monitor: Minimum resolution XGA 1280 x 1024px, reccomended WSXGA 1600x1024px

Disk Space: at least 100 GB free hard disk space

SOFTWARE

Windows 10 (64-Bit)

User authorization for installation of drivers and software (in case of multi-user systems)

CAMERA

The VIT® Cam is controlled by the VIT® Vision Software

vermicon AG – Your Partner for Wastewater Microbiology

The vermicon Principle

Since its founding in 1997, vermicon AG has broken new ground and has developed unique solutions with a single goal: to help our customers out of the bottleneck. To take paths just because they have "always been used before" is not an option for us.

Our partners value this problem-oriented approach. For us, however, it is essential. It defines who we are.

The vermicon principle consists of four fundamental pillars that have enabled us to not only take the risk of being different, but to make a success out of it:

Passionately different...

... and that is a good thing. For microbiology is a conservative business. Based on Robert Koch's standards, for more than 100 years, bacteria have been cultured on artificial nutrient media in order to detect them. And all this in spite of the fact that up to 99% of all bacteria are not cultivable at all! 25 years ago, we had already reached the conclusion that this approach cannot be right. We wanted to strike out on a different path, a path that leads to the resolution of a client's problem, regardless of any paths that have been tread in microbiology before.

25 YEARS OF EXPERIENCE

1. DIRECT MICROBIOLOGY

- As up to 99% of all bacteria cannot be detected with conventional methods, a new way of identifying microorganisms had to be found.

2. THINKING OUT OF THE MICROBIAL BOX

- Thinking differently and treading non-conventional paths too, is the best way to find new and successful solutions in microbiology.

3. PROBLEM-ORIENTED APPROACH

- Resolving our client's problem is our primary concern. It doesn't matter what the recommended microbiological approach would be. We want an optimal result that helps.

4. PEOPLE WITH PEOPLE

- Even in microbiology, real people are talking to real people. We have committed ourselves to a friendly and open-minded co-operation with our partners that is based on mutual trust.

For over 25 years, we have been pioneers in wastewater microbiology.
We are looking forward to continuing down this path with you!

Visit us at: www.vermicon.com

Visit our website for more information about our continuously updated portfolio or just request further information about our products and services. On our website, you will also find current microbiology-related articles as well as studies and scientific papers we are providing for you.

Visit us and immerse yourself in the world of microbiology – vermicon's world!

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