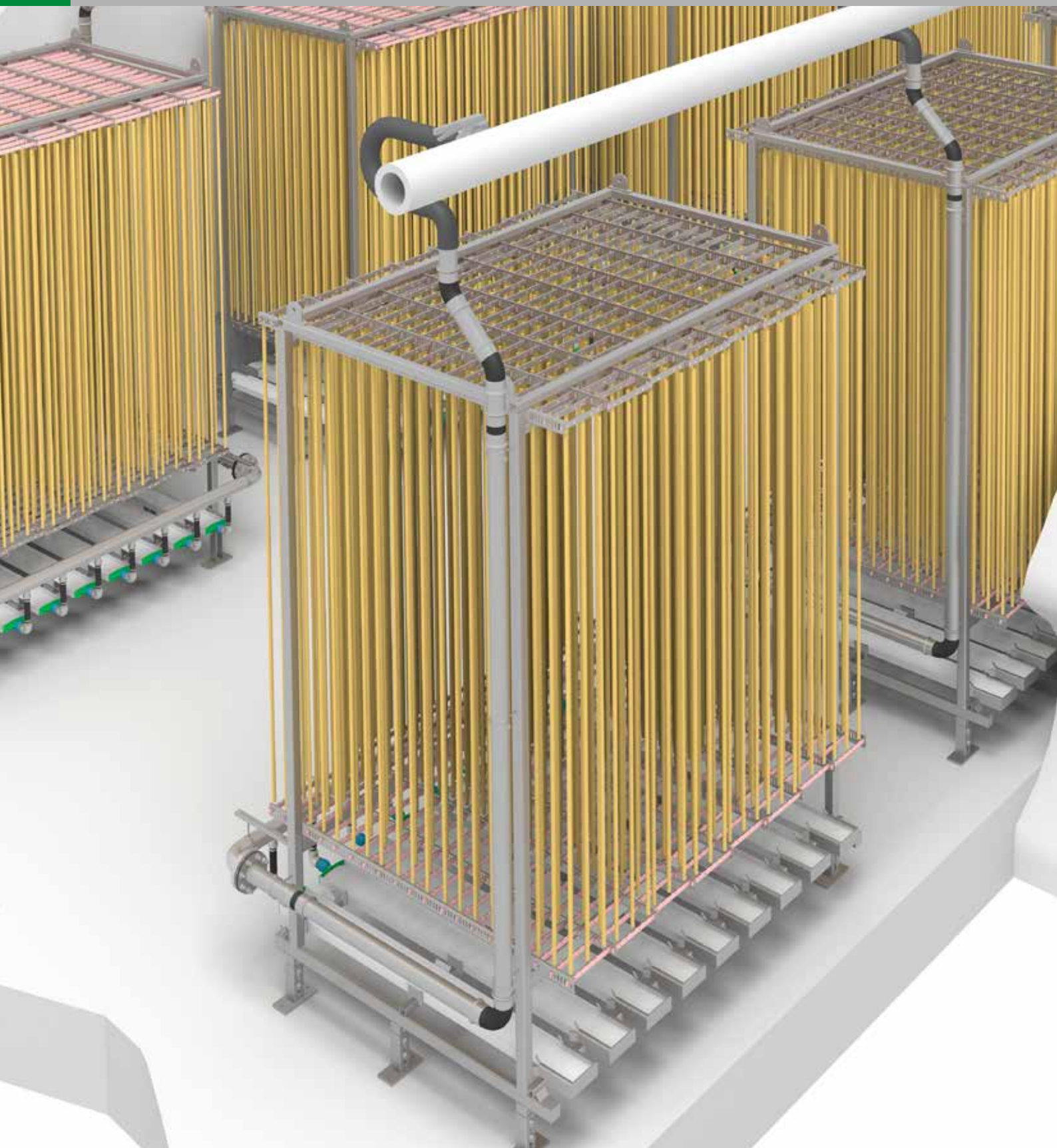


# Cleartec® textile fixed bed



# We are Jäger

## Content

We are Jäger	2-3
Material	4-5
Biological growth	6-7
System	8-9
Advantages IFAS	10-11
Fields of application	12-13
Special applications	14-15
Profitability	16-17
Selected References	18-19







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## We grew up with rubber

Since 1942, when Gummi-Jäger, the parent company of Jäger Umwelt-Technik GmbH, was founded, application-oriented advisory service, material-oriented construction and system related development are the key for the Jäger Group's success.

Our competence and efficiency continuously raised according to the customers' demands. Our success is based on continuous product innovation, consulting independent from the material as well as a friendly, competent service and zero-defect philosophy competent service.

The family business in its third generation operates worldwide and is a qualified partner in the field of automotive, environmental and agricultural industry as well as in machine and plant engineering and oil exploration. Over 1.000 employees working in more than 20 sites in Europe, the USA and China aim to ensure that.

## Our Philosophy

Thinking across departments and corporate boundaries as well as generating competitive advantages for one's own company, customers and suppliers: Due to these guiding principles the Jäger Group of Companies is a professional partner in all branches of machine and plant engineering.

### Confidence in cooperation

Successful customer relationships are based on trust. For us, this means reliability in our promises and actions, fairness in equal partnership and the trustworthiness of the Jäger entrepreneur family.

### Liability in partnership

Joint work with the most various suppliers guarantees competitive advantages for our customers.

### Understanding in problem solution

By the combination of the most different materials and the integration of various functions in a system component we guarantee our customers a lasting advantage in competition.



# Material

## Textile fixed bed



With Cleartec® Biotextil and BioCurlz the Jäger Group of Companies expands its portfolio in the field of wastewater technologies.

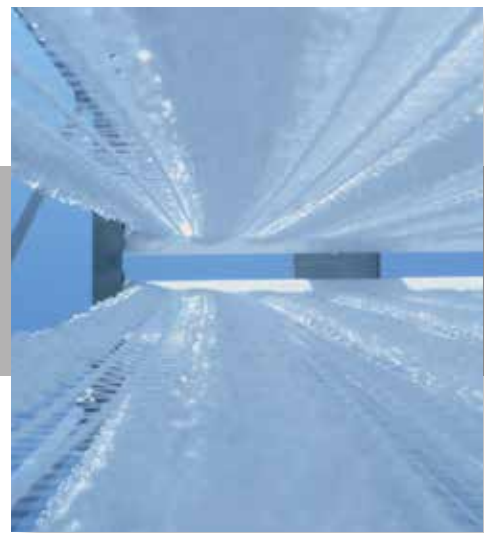
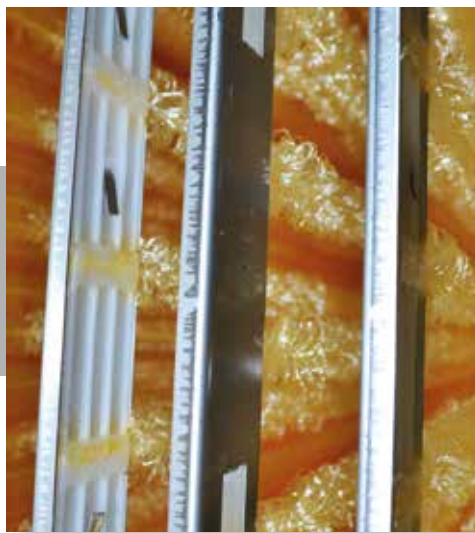
The advantages of the structured surface as well as the flexibility of textiles can be used and combined with the proved biofilm technology from wastewater treatment.

### The material

Cleartec® Biotextil is made of the material Polypropylene (PP) and used as textile media for microorganisms in municipal and industrial WWTP's as well as for special applications. BioCurlz are made of PP and Polyvinylidenchlorid (PVdC).

The highly structured growth stripes have a high surface roughness and therefore they are ideal for settlement of microorganisms. Additionally, the large specific surface provides more protection for the biofilm.





## Structure

High fabric density (growth stripes) alternates with loose structured zones in the design of textile. As standard one textile consists of 16 growth stripes with double-sided special-knitted synthetic loops and has a width of 0,96 m.

One unit Cleartec® BioCurlz consists of six strings with holding bars made of plastics with metal reinforcement. The yarns are woven around the strings and thus build a three dimensional structure. BioCurlz are variable in its length.

This structure offers ideal growth conditions for biomass and best flow conditions for wastewater and oxygen.

Biofilms are considered as the archetype of life and consist of an accumulation of different microorganisms. In the biological waste water treatment biofilms are used in several forms: suspended as flakes in the activated sludge suspension or sessile on a provided media.

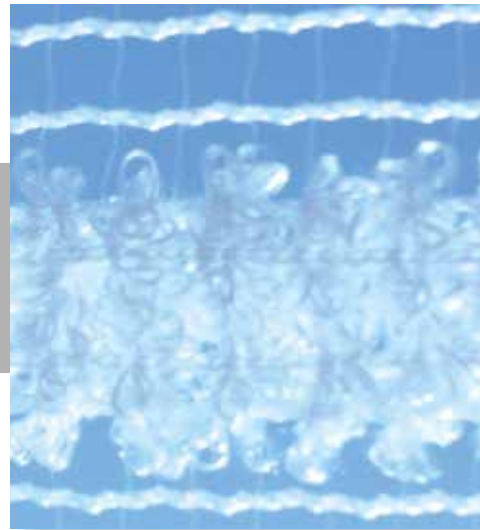
Microorganisms use pollutants from our waste water as nutrients for energy and cell metabolism. By this, they contribute to limit eutrophication of waters.





# Biological growth

## Function and process

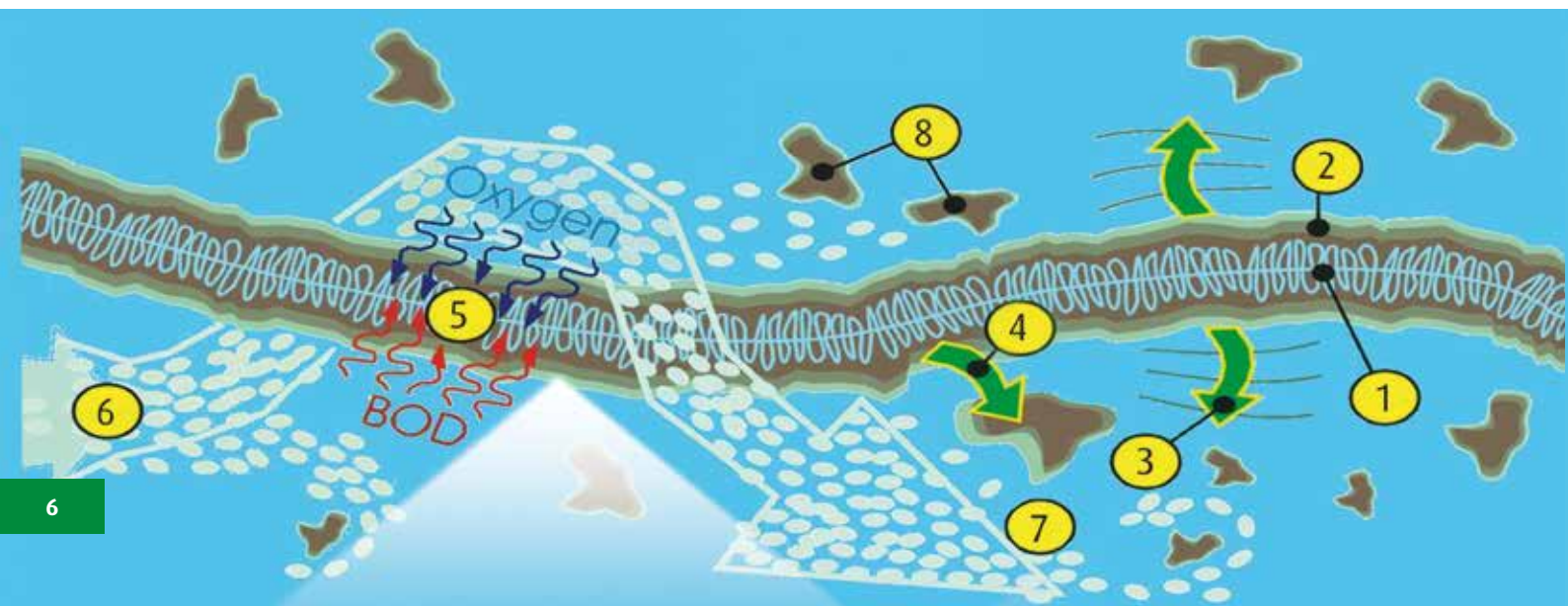


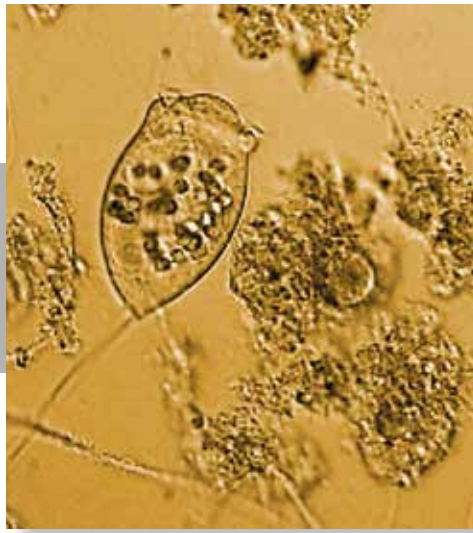
Mostly the textile media is used in combination with **suspended biomass (8)**. The **growth stripes (1)** are weaved with loop straps, which ensure an ideal habitat due to the existing high inner surface in the growth stripes. Thus, adhesion of bacteria increases.

The oxygen for biomass supplied by diffused aeration creates a vertical flow, which, due to the **flexibility (3)** of the media, regulates the thickness of the **biofilm (2)** by constant **removal of old biomass (4)**.

Abrasion of biomass occurs on the basis of **bacterial metabolism processes (5)**. As a result new active biomass grows and boundary surfaces are renewed.

Therefore, the aeration, on the one hand, ensures ideal oxygen supply for active biomass and, on the other hand, regulation of predators due to textile flexibility.



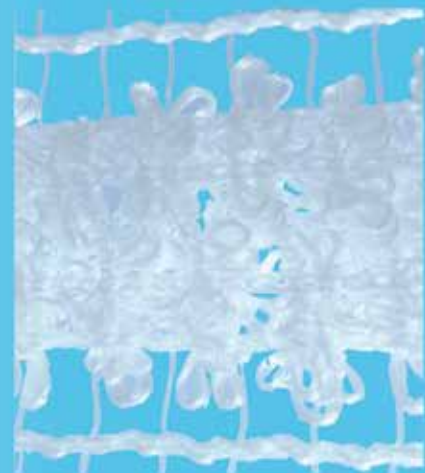


## IFAS

In conventional WWTP's the sedimentation volume in secondary clarification is the limiting factor of the content of biomass in aeration tanks. The so-called IFAS process (Integrated Fixed Film Activated Sludge) combines suspended and sessile biomass by installing a synthetic media as growth surface for additional biomass in aeration tank. This combination enables a much higher concentration of biomass and, as well, a higher sludge age compared to conventional operation. IFAS allows a performance increase of biology up to 100% and more without any constructional measurements for volume enlargement of aeration tanks and secondary clarification.

## Comparison of different types of IFAS

In contrast to other IFAS systems, Cleartec® needs no restraining measures to prevent flush-out of growth material from the aeration tank. Due to the modular structure, flushing out is impossible. Because of high mechanical resistances, replacement of fabric are rare. Additional energy input to mix up the growth material or to prevent clogging is not necessary. Aeration is required only for the biomass' oxygen supply.





# System

## The Cleartec® Module



Cleartec® is used as a system. The textile is fixed into a stainless steel cage, which can be assembled with aerators if required. A complete Cleartec® module consists of:

### 1. Stainless steel cage

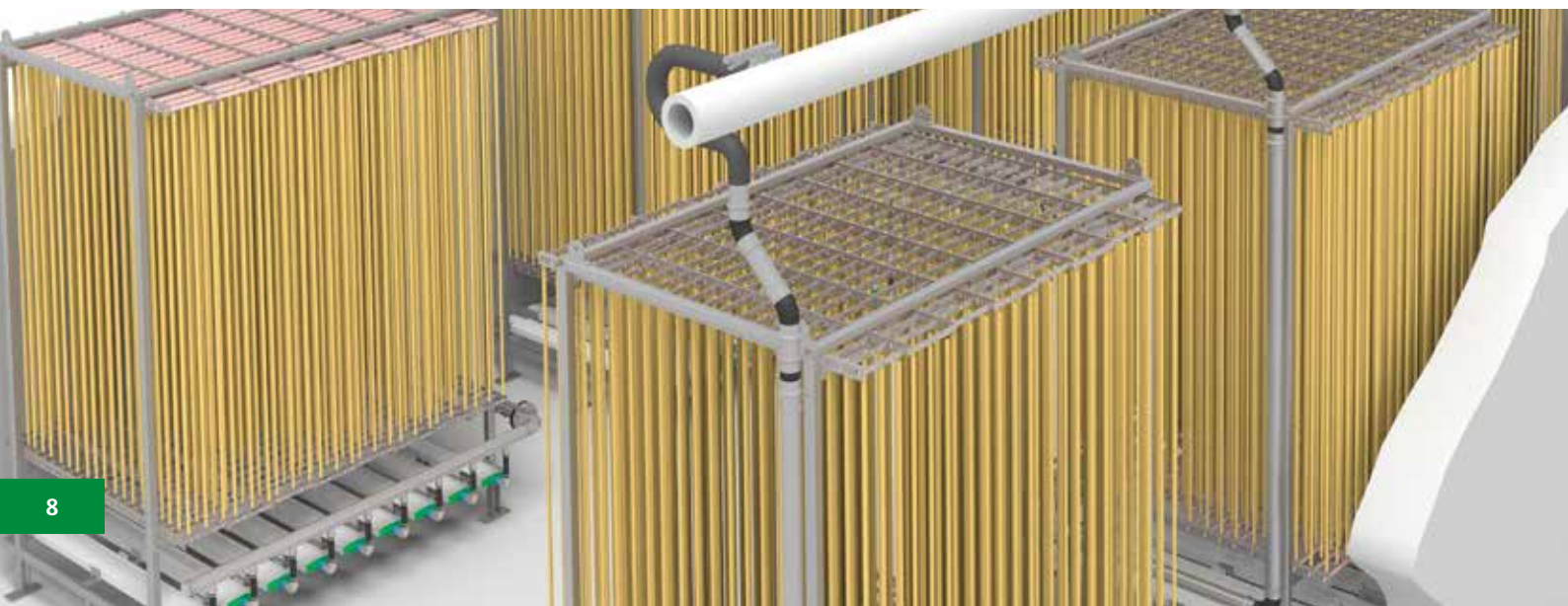
The stainless steel cage is used as holding construction for Cleartec®. Cleartec® Biotextil has up to four retaining straps – depending on the total length. Cleartec® Biotextil can be fixed into the cage by inserting pipes into retaining straps. Similarly, BioCurlz are fixed into the cage by metal reinforced holding bars. This cage construction can be hoisted out of tank even while operating.

### 2. Cleartec® growth media

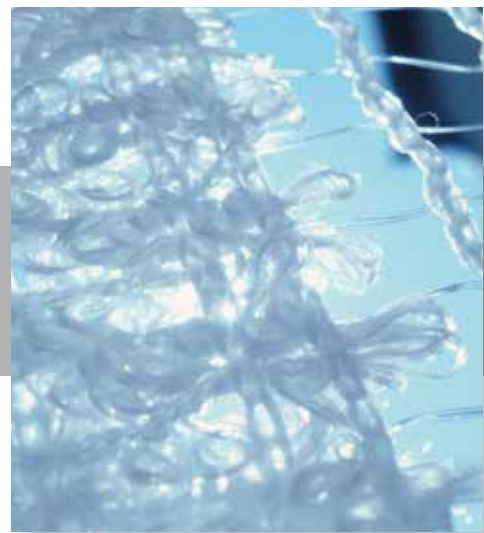
The structure of Cleartec® Biotextil and BioCurlz provides a great inner surface area and ideal conditions for the growth of biofilm. The loops are used for fixing the textile into cage construction. The textile itself can move flexibly in the flow, which provides a steady abrasion of biomass.

### 3. Diffuser

Aeration of textiles enables an optimal oxygen supply for biomass. Additionally, it provides great flow conditions to keep the flexible textile in motion and contributes to abrasion of biomass. Furthermore, clogging can be prevented.







## Advantages Cleartec® module

### ■ Optimal conditions for growth

With perfectly matching components the modular construction guarantees ideal flow conditions within the fixed bed, optimal oxygen supply for the biomass, a steady abrasion for surface renewal and control of higher microorganism concentration while operating. Thus, several advantages of diverse biofilm processes are combined.

### ■ Easy handling

During operation, single modules can be hoisted out, e.g. for diffuser maintenance. The modular construction provides a flexible application and can be customized. Furthermore, the module's structure facilitates control of the system concerning predators.

### ■ Longevity and time-saving

The textile growth media is resistant against chemical and mechanical influences and therefore maintenance-free. Cleartec® modules assure low maintenance, what is demonstrated by several reference plants processing since over 17 years. Only the time for control and maintenance of aggregates has to be considered.



# Advantages IFAS

## All advantages at a glance



### Great inner surface area

Due to the structured growth stripe, bacteria adhesion increases. In comparison to other types of fixed bed, with Cleartec® nitrification proceeds faster.

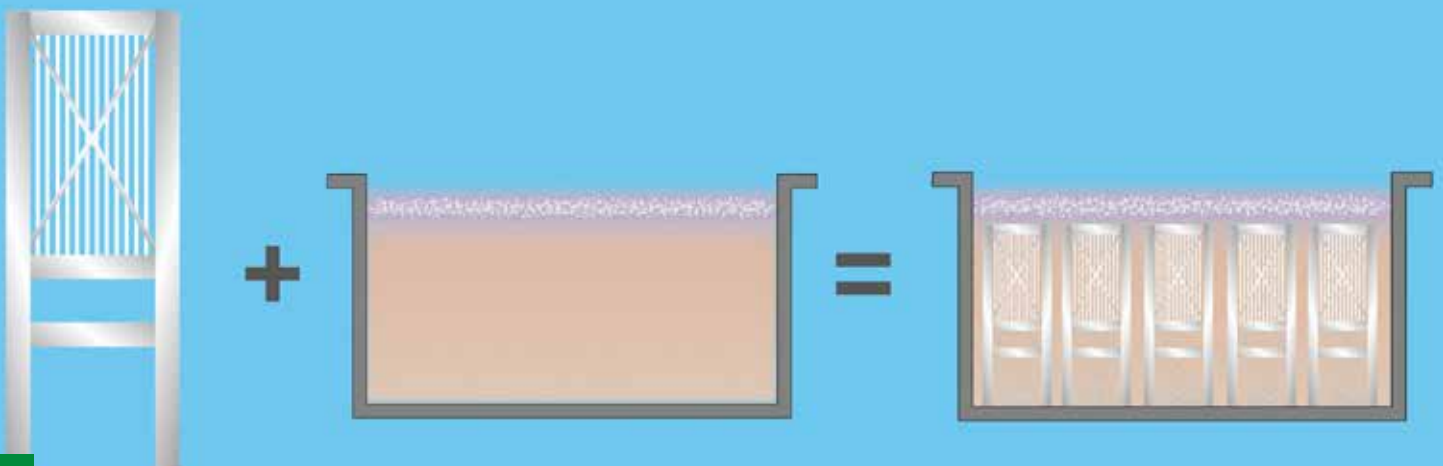
### Improved sludge characteristics

In a combined process activated sludge shows better sedimentation due to shearing biomass. With the textile fixed bed a lower sludge volume index of about 75-90 ml/g can be achieved, whereas SVI in a conventional process is 110-150 ml/g on average.

Furthermore, less bulking sludge is produced due to lower percentage of filamentous bacteria in activated sludge. Compared to other systems, applying chemicals is not needed.

### Capacity increase

It is not necessary to enlarge basin volume for performance increase, if the biological stage runs with sessile biomass. The IFAS system leads to a higher concentration of biomass, which is used to decompose pollutants. Depending on the structure, an increase of capacity of more than 100% can be reached without even loading the secondary clarification.







## Performance increase

In comparison to conventional operation the IFAS system works with suspended and sessile biomass. Along with the increase of biomass proportion the sludge age increases at the same time. Therefore, more nitrificants accumulate, which eliminate nitrogen more efficiently.

Especially, elimination of carbon and nitrogen reaches very high specific degradation rates. The number of specialists also increases due to the high sludge age. This enables the removal of persistent substances from industrial waste water.

## Operation stability in biological process

The biofilm provides the ideal basis for existence and, due to its structure, adequate protection for microorganisms with high generation times. The combination of sessile and suspended processes additionally increases the total biomass content. Thereby, a year-round nitrification performance can be achieved.

This application ensures stable effluent during hydraulic loads as well as during toxic loads and variation in pH. Peaks, such as nitrogen shocks during rainy weather and draining rainwater overflow basin, are removed without "conspicuity in effluent".



# Fields of application

## Municipality and industry



### Municipality

IFAS has been especially proved in municipal sector. Great nitrification performance and high operation stability, which are reached with IFAS, are important for municipality.

If legal requirements regarding effluent quality (e.g. nitrogen elimination) are stringent, the performance of an existing plant needs to be increased; by IFAS without conventional enlargement. That offers a special alternative in case of space shortage for plant expansion.

Due to low-maintenance or maintenance-free operation Cleartec® Systems offer a further advantage for decentral applications: The Biological process needs no complex technology and process control and still fulfills the required cleaning performance. Thus, it ensures reliability of plant.

Moreover, the process offers the possibility to operate with an entirely sessile process and is ideal for plants, which cannot facilitate return sludge.







## Industry

Industry has the choice to treat waste water as direct discharger or indirect discharger. Companies who take care of their own biological and hazardous substances in compliance with legal standards are allowed to discharge the treated waste water directly into natural watercourses.

Indirect discharger drains waste water in sewers and through a municipal WWTP into waters. However, waste water of industry contains pollutants, which are not allowed to be discharge a directly into drainage. These substances have to be removed from waste water. Municipality takes on removal of biological pollutants.

Depending on the composition of waste water, the charging rate for waste water treatment and legal requirements, it can be useful for both possibilities to run an own WWTP with a biological stage.

Cleartec® with its hybrid process of sessile and suspended biomass is suitable for this application. The defined biofilm offers optimal conditions for settlement of specialists with high generation times. Thereby, a biocenosis, adapted to specific solids, can be developed.

Cleartec® fixed bed systems are appraised for carbon elimination. Therefore Cleartec® has already been established as media in food, textile and pharmaceutical industry.



# Special applications

## Numerous applications



Due to modular usage Cleartec® growth media are flexible products, which makes it suitable for miscellaneous fields. The media are available in variable lengths and widths and thus applicable for different installations.

### Pond treatment plants

Pond treatment plants are used for waste water treatment worldwide. Cleartec® is optimal to increase treatment efficiency. Due to flexible installation options Cleartec® is ideal for applications in a limited space.

Beside a pond treatment plant Cleartec® Biotextil is also installed in a cleaning plant of a water cycle at the zoo in Zurich.

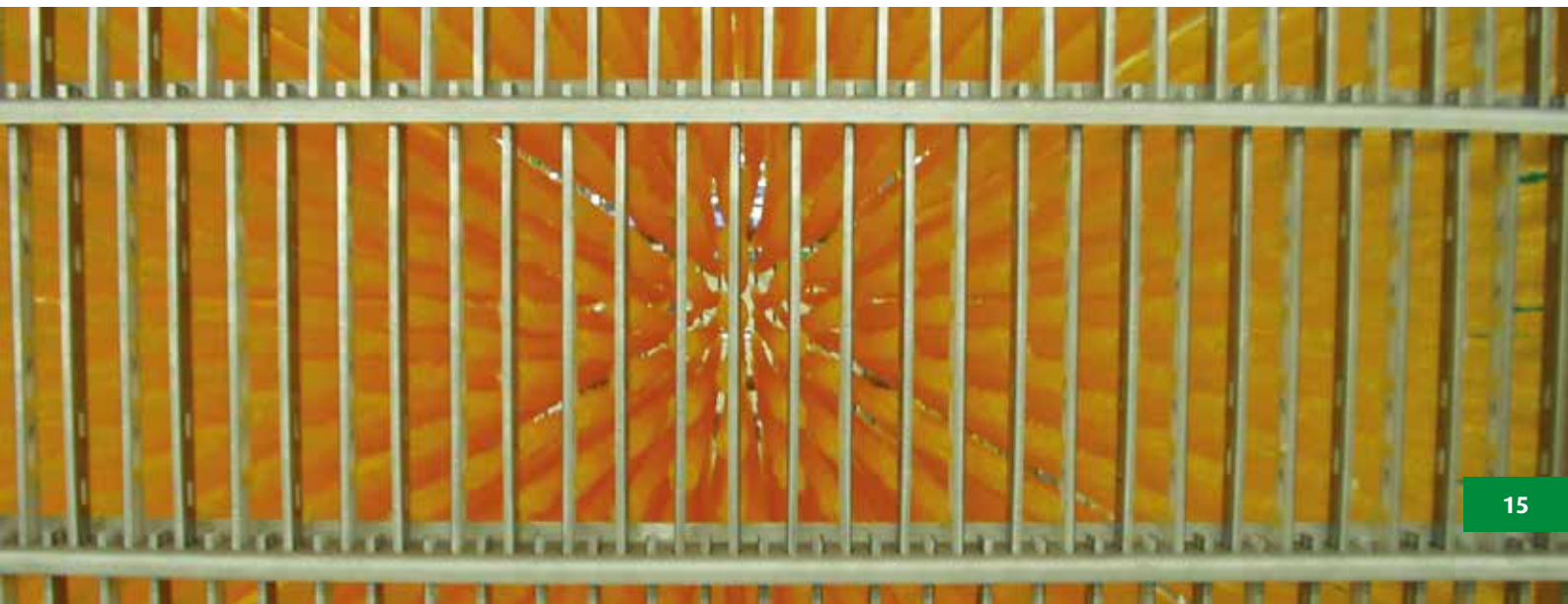






## Floating reactor

A further project with Cleartec® is the floating reactor for improving water quality in flowing and standing urban waters. Thereby, the textile is fixed in a type of swimming cage and applied into waters. The application benefits from the high performance of Cleartec® fixed bed media, which allows great efficiency with simple technology.



# Profitability

## Capacity increase



### Profitability and performance

If a performance increase of an existing plant is necessary, there is an alternative to conventionally enlarge a plant by realizing a capacity increase with Cleartec® of more than 100% without constructional measures.

In contrast to conventional enlargement, retrofitting with Cleartec® results in cost reductive performance increase.

Cost comparison of a plant targeting capacity increase by maintaining the same cleaning performance.

#### Conditions

Municipal WWTP

$V_{AB} = 2.000 \text{ m}^3$

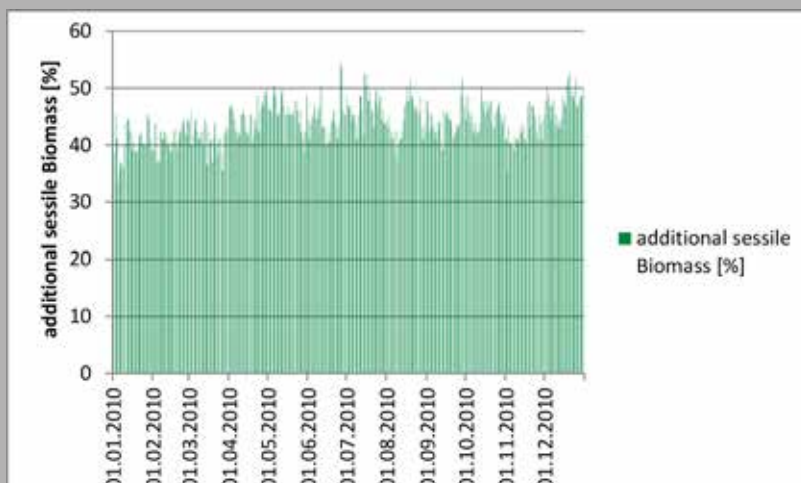
Biomass (MLSS-Content):  $4 \text{ kg/m}^3$

#### Request

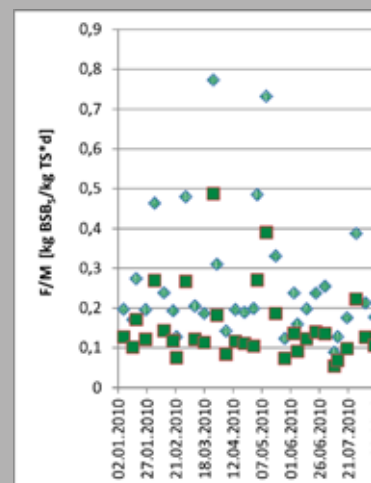
75% capacity increase of biological stage and same cleaning performance

	Cleartec® Biotextil	Conventional enlargement of 75%
Total costs	380.000,00 €	680.000,00 €
Saving in		44%

### Additional capacity by sessile biomass



### Decrease of sludge load







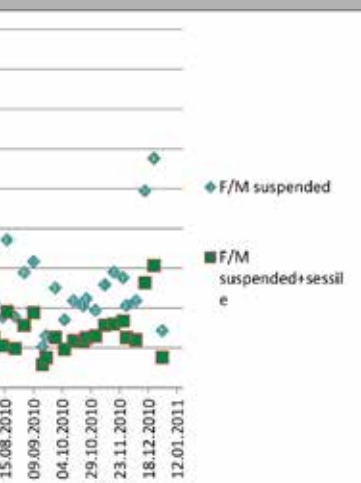
## Capacity increase of a municipal WWTP

By installation of fixed bed in aeration basins the total biomass (additional sessile and suspended biomass) has increased about 70 % in addition to suspended biomass. The increase of total biomass leads to a lower sludge load.

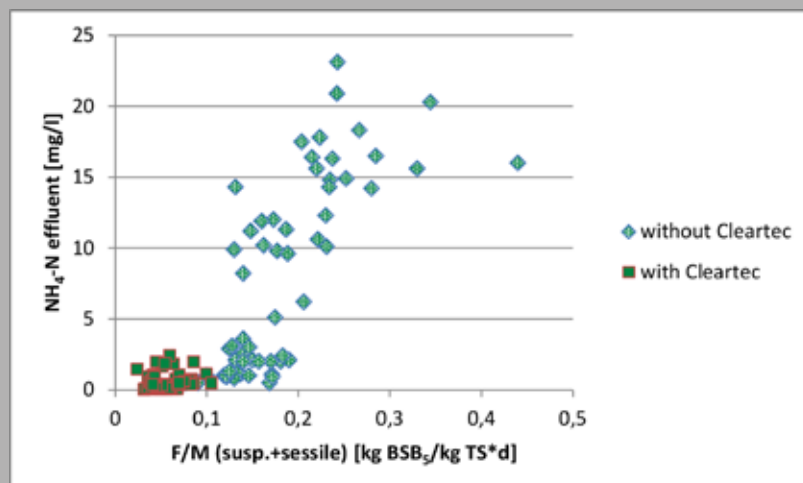
At the displayed example the aerobic sludge load has been decreased by approx. 0,1 kg BOD/kg MLSS\*d.

Due to low sludge load nitrification can proceed and on the basis of sessile biomass at the textile with considerably higher sludge age more nitrificants settle down. The biofilm ensures a high nitrification performance at low temperatures. That is also the reason for a better year-round cleaning performance with regard to  $\text{NH}_4$  degradation.

ding rate



## Excellent, stable $\text{NH}_4$ -N elimination



# Selected references



## ARA Kelleramt / Switzerland

Max. Flow	Capacity	Operation	Treatment
5.900 m <sup>3</sup> /d	21.300 PE	aerated	Nitrification, Partialdenitrification, P-precipitation



## Komarno / Slovakia

Max. Flow	Capacity	Operation	Treatment
12.500 m <sup>3</sup> /d	55.000 PE	upstream Denitrification	Complete N-Elimination, 1. configuration level



## Terrassa / Spain

Max. Flow	Capacity	Operation	Treatment
80.000 m <sup>3</sup> /d	450.000 PE	Bardenpho, C-addition	Nitrification, Denitrification, P-precipitation (Fe)







#### Geiselbullach / Germany

Max. Flow	Capacity	Operation	Treatment
80.000 m <sup>3</sup> /d	250.000 PE	upstream Denitfification, Bio-P (add. P-precipation)	Nitrification, Denitrification, Bio-P



#### Gorizia / Italy

Max. Flow	Capacity	Operation	Treatment
1.700 m <sup>3</sup> /d	8.000 PE	intermitting	Nitrification, Denitrification



#### Mukwonago / USA

Max. Flow	Capacity	Operation	Treatment
5.700 m <sup>3</sup> /d	12.500 PE	aerated	Performance increase, Nitrification



# Jäger. Diffuser. Partners. Success.



## **We are material experts.**

- For each waste water the appropriate material

## **We are specialists in aeration systems.**

- For each plant the suitable aeration technology

## **We are engineers.**

- For each customer the tailor-made product

## **We speak our customers' language.**

- All over the world competent waste water experts on site



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