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Industry Leader in RO Expertise and Membrane Applications since 1983™

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The Company



Just 20 nanometers. That is the size of the pores of the high-tech membranes that water passes through during ultrafiltration: 3,000 times smaller than the diameter of a human hair.

Health and purity beyond the visible: **inge** ultrafiltration membranes provide a reliable means of removing suspended solids, bacteria, germs and viruses from polluted water. A sophisticated, proven technology that enables water treatment on an industrial scale. Providing pure water for people everywhere.

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1. A Thirsty World

Providing people all over the world with clean water is one of the key challenges of the future.

By combining our sense of social responsibility with our superb ultrafiltration and water treatment technologies, we strive to face up to this challenge while making sustainable use of the business opportunities it represents.

Currently, around 2.4 billion people live in regions that have scarce water supplies. That is almost a third of the world's population. Meanwhile, 1.1 billion people do not even have regular access to clean drinking water. On top of these basic needs, water as a raw material also has vital industrial uses. Few production sectors are as dependent on precious drops of the world's limited fresh water resources as agriculture, which accounts for around 70 % of total water consumption. And even the energy sector depends on water, with the production of an 80-litre tankful of biofuel requiring the input of 320,000 litres of water, while coal-fired power plants and nuclear power stations require large quantities of specially treated and cleaned water to use as cooling and process water.

It is, of course, true that there is an abundant supply of water on our planet: even though 98 % of global water supplies take the form of salt water, the remainder of fresh water could comfortably cover the world's water requirements of around 7,500 cubic kilometres per year. Yet the problem is that this fresh water is unevenly distributed and is available in varying degrees of quality. Apart from generally encouraging people to save water, the only solutions are the various technologies that can be used to purify water.

As one of the world's leading ultrafiltration companies, this is where we see tremendous opportunities. And that is why we are intensifying our technology development efforts, expanding our capacity and developing ultrafiltration into a superior alternative in the realm of water treatment. The superb reliability of our uniquely designed products opens up brand new applications for ultrafiltration in combination with other water treatment methods, ranging from seawater desalination and waste water purification to the treatment of industrial and process

Our unique products provide reliable and economical water treatment solutions:

Multibore® Membrane

The patented Multibore® membrane technology combines seven individual capillaries in a highly robust fiber – an arrangement that significantly increases the membrane’s stability and eliminates the risk of fiber breakage.

The membrane provides a secure barrier against suspended solids, bacteria, viruses and other microorganisms and supplies a consistently high level of filtrate quality, even in cases where the composition of the original water varies.

dizzer® Modules

Compact and high-capacity ultrafiltration. Thanks to an optimum hydrodynamic design combined with the top-notch treatment efficiency of the Multibore® membrane, the dizzer® module sets new standards in ultrafiltration technology.

T-Rack®

Space-saving and efficiency-boosting: the T-Rack® is an integrated, ultra-compact rack system that is equipped with dizzer® XL ultrafiltration modules. The inlet and outlet lines are already integrated in the end caps – a design feature that makes the system’s footprint considerably smaller.

Tailor-Made Solutions

Developed, tested and launched in collaboration with the customer. Long-term partnerships creating customised solutions for situations that lie beyond the scope of standardised modules.

2. Letter from the Board

To all the clients, friends and partners of inge GmbH,

In our view, the importance of water treatment technologies is set to increase significantly over the next few years. Even today, people's access to clean drinking water on a global scale is severely limited, and experts suggest that this situation will only get worse. Meanwhile, water as a key commodity continues to be a vital factor in many industries, whether as a raw material with specific quality requirements, a component that supports production processes, or simply in the form of industrial waste water that requires purification. Effective water treatment has a vital role to play in all these cases.

The Perfect Mix of Efficient Solutions

The best water treatment solutions generally seek to utilise the right mix of different technologies for each specific application. Take the case of sea water desalination, for example. Ultrafiltration is the perfect method for the initial cleaning of the sea water, allowing removal of all the suspended solids. Reverse osmosis is then employed as the next stage to take the salt out of the water. The big advantage of this is that it makes operation of the reverse osmosis much more efficient. The plants can be designed to be smaller, and therefore cheaper, and fewer chemicals are required because cleaning intervals are spaced significantly further apart. That means that the regular downtimes often associated with such systems cease to be an issue. This approach makes it both possible and financially feasible to replace the much more energy-intensive thermal treatment that still prevails today.

Sand filtration continues to be the most widely used technology for water treatment, just as it has been for hundreds of years. But, nowadays, there are numerous cases where sand filtration could be replaced or, where appropriate, supplemented by ultrafiltration. After all, ultrafiltration is clearly superior when it comes to removing pathogens such as germs, bacteria and viruses from water, more than anything because it is not dependent on the quality of the water used and always provides equally good results. Our method takes up less space, the filters are easy to clean and the initial investment is generally recouped very quickly.

Our Key Performance Promise: 100 % Reliability

Our patented Multibore® membrane is so durable and stable that we have not experienced a single case of fibre breakage over the last years. That makes us the world's only ultrafiltration manufacturer to have achieved such extraordinarily high levels of reliability. inge offers standardised modules in a range of sizes, which are employed in industrial and municipal water treatment facilities. Superbly engineered, tried-and-tested solutions that can be combined in modular fashion to fit each customer's precise requirements. In addition, inge provides customised and tailor-made ultrafiltration solutions, which are primarily deployed

at the point of use or point of entry. These are smaller, standardised water treatment devices of the kind that can be used in homes, restaurants or hotels. We have already acquired partners and reference customers for this segment, including Midea in China for the Asian market and Pentair in the USA. The modules we produce for these companies are precisely tailored to their specifications and requirements, while obviously incorporating the superb level of quality that characterises our membrane and our technology.

German Innovation with a Global Presence

In August 2011 inge became part of BASF, the world's leading chemical company. Our customers and business partners stand to benefit from this development in a number of ways. As well as boosting inge's innovative capabilities, working with BASF ensures we stay at the cutting edge of UF membrane technology. This safeguards our ability to offer high-performance products of exceptional quality and reliability. As a global corporation, BASF can help us to achieve worldwide growth and systematic expansion of our market position. A strong market position is one of the keys to protecting our customers' investments – and it forms the perfect basis for long-term partnerships

inge supplies an environmental technology that encapsulates all the benefits of being "Made in Germany", with the research, development and production of the membrane taking place at the company's headquarters in Greifenberg near Munich. We also have a strong base in China as well as sales offices in Western Asia and the Middle East. We aim to continue expanding our global presence.

The specific ultrafiltration technology promoted by inge represents a cross-section of numerous different skills and disciplines: nanotechnology for the production of the ultrafine-pored membrane, chemical technology to ensure the right choice of materials, mechanical engineering to put together our specially-developed production line and, perhaps most importantly, the unique, specialist techniques that we employ in producing the Multibore® membrane itself with its seven capillaries.

It is the combination of all these skills that makes our membrane into what we consider to be the most durable and resistant on the market, a product that can significantly boost the significance of ultrafiltration in the realm of water treatment technologies.

We greatly enjoy meeting all the challenges this involves and we hope you can join us in pushing forward this exciting and unique technology!

inge GmbH Executive Board



3. The Multiple Talents of Ultrafiltration in the Water Treatment Technology Mix

Efficient and effective water treatment generally requires a combination of different methods and technologies. This combination depends on the intended purpose of the cleaned water (e.g. drinking water, industrial process water for power plants) as well as on the quality and degree of contamination of the original water. Thanks to its unique advantages, ultrafiltration can play a central role in this mix of physical, chemical and mechanical processing methods.

Mechanical	Physical	Chemical
Vacuum filtration	Aeration	Oxidation
Sieving	Vacuum processes	Flocculation
Screening	Sedimentation	Adsorption
Pressure filtration	Thermal processes	Disinfection
Reverse osmosis	Atomization	Ion exchange
Membrane filtration	Flotation	
Ultrafiltration		

How does Ultrafiltration Work?

In comparison to conventional water treatment processes, the advantage of ultrafiltration as a filter technology is its outstanding ability to remove germs and microorganisms from water. At around 20 nm, the pores of the membrane are small enough to prevent even viruses from passing through them. The process itself is simple and safe to perform and does not require the addition of any further chemical disinfectants. One of the most critical requirements is that the membrane fibers do not break, since otherwise viruses and bacteria could escape and re-enter the water. It was precisely this issue of fiber breakage that was frequently seen as a problem when employing ultrafiltration technology in the past, since it led to corresponding downtimes in the operation of the water treatment plants and high operating costs. Now, however, the company inge GmbH has managed to successfully develop and produce its own membrane, which is capable of stabilizing the fibers to an extent that practically rules out the possibility of fiber breakage.

Ultrafiltration systems are designed for fully automatic operation. A control mechanism is used to control the various operating modes of the ultrafiltration process: filtration, cleaning and backwashing.

Advantages of Ultrafiltration

The deployment of ultrafiltration offers significant advantages over conventional water treatment methods:

- Removal of germs, bacteria, viruses and all types of suspended solids
- No addition of chemicals
- The quality of the treated water remains the same regardless of the degree of contamination of the original water
- Simple and safe to operate and manage

Ultrafiltration is characterized by sustainably cost-effective operating concepts. These can also have knock-on benefits for other water treatment technologies when ultrafiltration is used in combination with these methods in order to exploit its advantages.

Recommended Areas of Application

Ultrafiltration is the ideal choice for a whole host of applications:

- Purification of surface water, groundwater and spring water to make drinking water and process water
- Treatment of waste water
- Pretreatment in sea water desalination plants in combination with reverse osmosis or thermal treatment
- Water for industrial use to close water cycles

Saying Goodbye to Sand Filtration

Sand filtration has been “state-of-the-art method” in the world of water treatment for many hundreds of years. Similar to the natural water cycle, in which water flows through layers of rock and sand, this method involves trickling the water through beds of sand in order to clean it. It was truly a revolution of its time in newly developing cities and continues to be the principal method used in many communities. But genuinely revolutionary technology nowadays goes under a different name: ultrafiltration with nanoscale membranes. There are now numerous applications where ultrafiltration can replace or effectively supplement sand filtration. It achieves better results in filtering out pathogens, takes up significantly less space and is renowned for being easy to manage and simple to integrate in complex water treatment systems as either an upstream or downstream stage. But its biggest advantage is the fact that, regardless of the degree of contamination of the original water, the filtered water always maintains the same superb level of quality and purity. Sand filtration simply cannot match this process. Heavy rainfall, floods or contamination in the water supply can mean that the sand is no longer capable of retaining all the dirt particles. In contrast, ultrafiltration is not dependent on outside influences, which allows it to provide a consistent supply of top-quality water.

Water for the People: Drinking Water as a Scarce Resource

Drinking water is one of the scarcest and most valuable resources in the world. According to a study conducted by the WHO and UNICEF, around 1.1 billion people currently have no access to clean drinking water. By the year 2025, it is estimated that half of the world's population will lack access to clean drinking water. Of course, these predictions apply in particular to developing and newly industrialized countries. So does that mean that the industrialized countries in the northern part of the globe can breathe a sigh of relief, the countries that have essentially always had enough water at their disposal? Unfortunately not: this apparent abundance of water is steadily being endangered by contamination with industrial and biological pollutants.

So what are the stringent requirements that water has to meet to be considered as drinking water? To be considered perfect, drinking water must be free from pathogens, have a neutral taste and color and contain a minimum concentration of minerals. All too frequently, water obtained from groundwater or surface water does not fulfill these stipulations. That is why physical or chemical methods must be employed to turn it into drinking water. Ensuring the availability of adequate amounts of clean water is set to be global issue number one in the future, and the market for the technologies required to process drinking water is one of the fastest-growing markets worldwide.

Water in the Desert: Sea Water Desalination

Oceans and seas are the largest reservoirs of water on the Earth, making up 97 % of the total amount of water worldwide. In order to exploit this enormous potential to obtain drinking water and water for industrial use, worldwide efforts are underway to find new processes and methods. According to the German Desalination Society (Deutsche MeerwasserEntsalzung e.V.), there are around 12,000 major sea water desalination plants in

Water Treatment in Switzerland: inge on Lake Zurich

- *inge GmbH supplies the technology to treat drinking water for the town of Männedorf on Lake Zurich*
- *17,600 m³ of water is processed each day*

The Multibore® membranes developed by inge GmbH have been deployed at Lake Zurich in Switzerland as an ultrafiltration barrier for surface water. The plant ensures that the stringent quality requirements for the treated water are met. The ultrafiltration process keeps out viruses and bacteria, thereby fulfilling Switzerland's strict water standards.

operation, which in total produce approximately 36 million cubic meters of drinking water each day, and a sharp upward trend continues to be evident.

The Gulf states, in particular, suffer from an extreme lack of water and have long been unable to obtain sufficient supplies from their groundwater reservoirs. They have therefore been using sea water desalination to produce drinking water and industrial water for decades. Desalination works according to standard thermal principles: sea water is heated until it reaches boiling point and evaporates, at which point the salt ions dissolved in the water such as sodium and chloride are left behind in the brine. The hot steam is then cooled and condensed into fresh water. However, this process has some significant disadvantages, not least the fact that it uses so much energy. Despite a whole host of recovery technologies, it is often simply not financially viable, especially for countries that lack energy resources. That is why a combination of ultrafiltration and reverse osmosis is an excellent alternative for the future. The initial cleaning of the sea water is efficiently performed by means of ultrafiltration, while the actual desalination process is effected using reverse osmosis. According to information from the German Desalination Society (Deutsche MeerwasserEntsorgung e.V.), the falling cost of this technology and the low amounts of energy it requires mean that reverse osmosis is set to represent a proportion of around 80 % of sea water desalination in around 15 years time, with the corresponding potential for ultrafiltration that this implies. And it is not only existing plants that will be upgraded: for many countries, the combination of ultrafiltration and reverse osmosis will represent their first opportunity to carry out sea water desalination.

Water with Certain Properties: Engineered Water for Industrial Use

Water is not as simple as it seems. It is often required to have, or specifically to not have, certain properties, especially when it comes to industrial applications. The properties of water are therefore deliberately altered to fulfill the technological requirements of industrial processes. For example, certain constituents of the water may be removed using methods

Beijing's Olympic Airport Makes Use of Inge Ultrafiltration Technology

- *10,000 m³ of waste water treated each day*
- *Ultrafiltration used as preliminary stage for desalination plant*

Inge has installed its Dizzer® modules in the water treatment plant at Beijing Capital Airport. The ultrafiltration system is employed to treat Beijing's municipal waste water, which is then directed into a desalination plant. The treated water is used to supply two office buildings at the airport and the toilets in the airport hotel. This so-called "grey water" is also used as cooling water, as well as for car washes, irrigation works and street cleaning.

such as de-icing, softening and demineralization, while other constituents may be added. Alternatively, the water's parameters, such as its pH value, may be modified. The fact is that some components of water can have a significantly damaging effect on systems and processes in certain industrial applications. For example, cooling water must be modified so that it is suitable for the refrigeration units, while the water for steam turbines must be completely desalinated to prevent corrosion from damaging the boiler.

Among other uses, ultrafiltration is employed to recover industrial water, to remove oils, fats and pigments, to treat highly concentrated electrolytic acid baths, and to soften water. Ultrafiltration is particularly useful for processes that constantly recur, since it always delivers the same level of quality.

Just like New: Waste Water Treatment

Waste water is water that has become contaminated through use. It includes household sewage, municipal waste water, industrial effluent, collected rainwater and water that flows off paved surfaces. Waste water treatment is generally conducted in three to four stages in centrally located sewage works. The task of the mechanical first stage is to separate out large components, sand and settleable solids by means of screening, grit chambers, settling tanks or primary clarifiers. The biological second stage brings the remaining readily soluble waste water components into contact with bacteria and other microorganisms. The purpose of the third, chemical purification stage is primarily to remove contaminants such as phosphorus from the waste water. However, to ensure that the water that leaves the sewage works is really clean, a fourth stage is then necessary to remove pathogenic germs and viruses. This is where ultrafiltration technology comes into its own as a means of purifying the waste water without using chemicals.

But it is not only municipal sewage works that use ultrafiltration technology: there is also an increasing tendency for industrial concerns that purify their waste water on site to switch to this treatment technology. The membrane method not only enables the removal of products from complex material streams, but it also allows other useful substances or "pure" water to be separated out. Recirculation techniques can then be employed to re-insert these materials into the production process to enable them to be reused.

The number of people who have no access to adequate waste water treatment currently stands at 2.9 billion, 80% of whom live in the developing and newly industrialized countries of Asia. The WHO estimates that investments of 180 billion US dollars each year are required if drinking water purification and waste water treatment are to meet worldwide demand. These figures refer solely to increases in capacity and do not include the renovation or modernization activities that will be needed over the coming years, primarily in industrialized countries, in order to adapt sewage works to the latest technologies. The volume of business this will create for ultrafiltration technology is considerable and is set to increase sharply on a global level in the years ahead.



4. Technology at Its Best: inge's Methods, Products and Solutions

Setting Standards for Stability and Reliability: The Multibore® Membrane

The Multibore® ultrafiltration technology patented by inge represents a revolution in the world of water treatment. The membrane combines seven individual capillaries with an inside diameter of 0.9 mm into a highly resistant support structure. The support structure significantly increases the stability of the membrane and virtually rules out the possibility of fiber breakage. It was precisely these fiber breakages that used to cause downtimes for plants and incur higher operating costs, which was one of the reasons why ultrafiltration had not yet succeeded in replacing conventional treatment methods. The company inge has now managed to successfully develop and produce its own membrane, which is capable of stabilizing the fibers to such an extent that not a single breakage has occurred in seven years. The result is significant cost savings and maximum operating reliability when it comes to investment and replacements.

“Stability As the Key to Further Market Penetration”

A membrane fiber structure, which the developers modeled on the honeycomb structure found in beehives, has proven to be an essential ingredient in this new technology's recipe for success. The Multibore® membrane produced by inge is considerably superior to conventional single-fiber capillary membrane products. The membranes are bundled together in plastic housings (so-called dizzer® modules), thereby ensuring optimum hydraulic properties, extremely high durability and a clean and safe treatment process. Used as a pretreatment stage for additional treatment methods (e.g. reverse osmosis), the Multibore® membrane removes pathogens, particles and suspended solids and supplies a consistently high level of filtrate quality.

Ultrafiltration with inge modules is controlled by means of a fully automatic control system. All that is required to clean the membrane is simply a backwashing process at regular intervals, which serves to detach and remove any contaminants. A control unit is used to switch between the various operating modes of the ultrafiltration process, namely filtration, cleaning and backwashing. The filtration cycles themselves take between 30 and 120 minutes

inge Supplies Russian Power Plant

- *Integrated system of water treatment unprecedented in Russia*
- *Successful treatment of surface water despite difficult local water conditions*

The company inge GmbH is equipping a Russian power plant with Multibore® membranes. The power plant uses ultrafiltration as a pretreatment stage for reverse osmosis, the only solution to the changeable surface water conditions at the site. The first project of this kind in Russia, it heralds both a reduction in operating costs and improved reliability.

depending on the level of contamination of the water. This sophisticated control system ensures optimum filter performance and high durability of all the components, thereby minimizing the operating costs.

“Certification in Key Water Markets”

The products made by inge have been certified in the key markets of the USA, China, Germany and additional European countries and comply with the regulations on drinking water treatment applicable in the various markets. Comprehensive tests and procedures are undertaken by independent institutes to ensure that the membrane and the modules pose no health risks whatsoever. This is the best way of ensuring that our customers and the end consumers obtain maximum protection combined with top-class reliability.

inge has already deployed its intelligent module concepts in numerous projects all over the world, including industrial water treatment in China, power plant demineralization in Italy, cooperation agreements with an international technology company in America, Australia and New Zealand and tap water purification for the world's leading manufacturers of water purification devices. In addition, many local municipalities in Germany have now equipped their water treatment facilities with products made by inge. This all goes to show how ultrafiltration technology is not only being employed in large-scale water treatment plants, but also increasingly in consumers' homes across the globe.

Optimized Effects: Modules and Racks

With its intelligent module concepts, inge represents the future of ultrafiltration technology. Many years of experience in developing, producing and operating membranes and membrane modules provided the perfect basis for designing the dizzer® module. The

Recycling of municipal waste water for a petrochemical complex in China

- *Municipal waste water successfully treated using UF*
- *Waste water reclamation offers a viable alternative solution for industrial water requirements*

Huge industrial growth in China has prompted companies to seek out alternative water sources to meet rising demand. The plant operator decided that the best option for supplying water to their refinery would be to reclaim treated secondary municipal waste water using a reverse osmosis (RO) system. UF pretreatment prior to RO is often specified for boiler feed water projects in China due to its excellent technical performance and competitive cost structure. The 416 dizzer®5000plus modules provided by inge GmbH were put into operation at the company's site in Dalian, China, in May 2009.

structures within the module guarantee optimum throughflow, thereby ensuring consistently high filtration performance. The latest state-of-the-art technique involves vertical assembly of the modules. This arrangement cuts back on space requirements, which makes it easier and quicker to carry out assembly and maintenance. Another advantage is the fact that the dizzer® modules do not require the use of pressure pipes: that means a reduction in piping, valves, fittings and installation work, together with the corresponding savings when it comes to investment costs.

The combination with the dizzer® modules allows the benefits of the Multibore® membrane to really come to the fore. Optimum flow distribution, top-notch purification efficiency and variable operating modes even at low pressure ensure consistently high quality. Thanks to the reduction in piping, fittings and installation work, dizzer® modules are able to get by with much less space and lower investment and operating costs. That makes the products supplied by inge equally appealing to municipal waterworks and large industrial concerns.

“Cutting Down On Operating Costs with the New T-Rack®”

The unique T-Rack® design by inge represents a revolution in ultrafiltration technology. As well as the structure and set-up of the membrane and modules, the other crucial element in an ultrafiltration system is the rack design. inge is the ultrafiltration supplier responsible for developing a rack design with integrated headers in the end caps. The T-Rack® is an integrated, compact ultrafiltration system, which is equipped with dizzer® XL modules. The system is provided with vertically mounted modules, in which the feed lines and outlets are already integrated in the end caps, thereby reducing complexity and saving space. The T-Rack® is made from durable and resistant PVC, and a steel frame is no longer required. Another advantage over conventional rack designs is the fact that it requires up to 50 % less space. The vertical arrangement of the modules makes them easily accessible for maintenance and repairs, and the smaller footprint and durable materials significantly reduce investment costs. This can mean a saving of up to 5 % of the UF system costs, depending on the scale of the project. The T-Rack® from inge is a truly innovative solution for water processing, encompassing a compact design, durable PVC materials and minimal maintenance costs thanks to the “Rack-and-Ready” installation.



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