

wave

Insights from Veolia Water Technologies

IFAT

We're here to set standards and drive forward ecological transformation

Hall A3
Booth 151/250

WATER TECHNOLOGIES

ENERGY DEMAND

Agricultural biogas set to expand

INDUSTRIAL WASTEWATER

Solve scaling issues, avoid downtime

DIGITALIZATION

The future of municipal water

MICROPOLLUTANTS

Hidden toxic residues

UPCOMING EVENTS

Innovations in action *Resourcing of municipal and industrial effluents*



During IFAT 2022 our experts are running a series of events on **June 1 in conference room A22**. You're welcome to join us for discussions focused on:

TIME	Topics of discussion
THE ROLE OF MUNICIPALITIES IN REACHING CLIMATE AMBITIONS	
09:45 - 10:00	Opening and refreshments
10:00 - 10:05	Welcome message
10:05 - 10:35	Secret weapons for moving toward a circular economy
10:35 - 11:05	The need for biomethane in reaching sustainable ambitions
11:05 - 11:20	Refreshments
11:20 - 11:50	Addressing new regulations with eXeno™, a biological solution for micropollutants
11:50 - 12:20	How to comply with more stringent demands for effluent quality such as nitrogen and phosphorus?
12:20 - 13:30	Refreshments
WASTEWATER CHALLENGES - A FUTURE OUTLOOK FOR INDUSTRY	
13:30 - 14:00	Opening and refreshments
14:00 - 14:30	Water reuse in industries - historical perspective, future trends and case studies
14:30 - 15:00	A real-life case study of 99% knowledge and 1% plastic
15:00 - 15:15	Refreshments
15:15 - 15:45	Thinking outside the industrial wastewater box: Biobed® EBS
15:45 - 16:15	Emerging solutions for the treatment of chemical production effluents
16:15 - ONWARDS	Closing and refreshments



INSIGHTS

On paper, IFAT is a leading trade fair for water, sewage, waste and raw materials management; however, at Veolia Water Technologies, we see it as much more. It's the coming together of minds to solve the world's greatest environmental challenges with world-class technologies that set standards and drive forward ecological transformation.

Yes, our vision — and ambition — are huge, but so is our determination, and we are already taking action. We have firmly aligned our business and committed ourselves to help our customers meet the United Nations' Sustainable Development Goals (SDGs).

Our purpose is to help our clients contribute to human progress by helping them achieve a better and more sustainable future for all. Together, we are actively fighting climate change, helping to prevent further resource depletion, protecting biodiversity and cleaning up widespread pollution.

And our customers share our purpose. Many have already set themselves ambitious sustainable targets focused on rethinking their use of water resources and reducing the environmental impact of their operations.

From industrial markets such as food and beverage, and pharmaceutical to the municipal sector, together, we are accelerating and expanding the deployment of existing solutions, while simultaneously creating the solutions of tomorrow. I truly believe that innovation will help us bridge the gap between supply and demand by helping us become smarter and more efficient in how we use and protect our water resources.

We are the leading water treatment specialist. Discover throughout this magazine both tailor-made and plug-and-play technologies for sustainable development that, together with our services, reduce your operational and resource costs, improve your operational efficiencies through digitalization and avoid costly downtime; and most importantly help you improve your environmental footprint.

At this event and beyond, we can continue to look at our differences: we work in different countries, industries and sectors but let's focus on why we are here and how, by working together, we can make a difference.

The ecological emergency demands that we go beyond changing our methods gradually. It is time for decisive, structuring choices. It is time for ecological transformation.

All that is left to say is that we cannot do it alone... so, please, join us.



Vincent Caillaud

Chief Executive Officer

Veolia Water Technologies

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Food and beverage

With more than 1,000 global references in the food and beverage industry, Veolia Water Technologies offers a large selection of solutions to produce the safest ingredient water and high-quality utility water, as well as helping customers manage their wastewater to limit water use and reduce their carbon footprint.



10th-Century BCE discovery helps fight climate change today

The history of anaerobic digestion (AD) is lengthy and can be traced back to as early as 10-Century BCE in Assyria where biogas was used to heat bath water. Then, in the 17th-Century it was first determined that decaying organic matter could result in flammable gasses. Today we know capturing this methane, a potent greenhouse gas, is important in the fight against climate change. So what's next in this continuing evolution?

Anaerobic flocculent biomass technologies are well recognized for their high efficiency in treating industrial wastewaters with high total suspended solids (TSS) and fats, oils and grease (FOG).

Sparthane™ is the latest anaerobic solution, designed to treat industrial effluents with a wide range of concentrations, at maximum removal efficiency. It is part of Biothane's Biobulk portfolio and features a unique method of operation that is designed for having a high tolerance to concentrated FOG and/or high levels of TSS.

It is currently used by customers in the food and beverage, chemical and pharmaceutical industries to treat wastewater with wide range total

chemical oxygen demand (TCOD) (seven to 50 grams per liter) and high TSS (up to 20 grams per liter) and/or high FOG (up to four grams per liter).

AD technology, with its ancient roots, is constantly being improved as it may hold the key to helping the world better meet its energy needs versus energy consumption. Biothane — a subsidiary of Veolia Water Technologies — is a leading brand in the field of anaerobic industrial wastewater treatment, and its team is on a mission to give us a more environmentally friendly way of dealing with industrial wastewater by turning sludge into a resource.

Christian Kuijlaars, Global Sales Manager, explains more about Sparthane™ Advanced, the soon-to-be-released, patented and compact solution featuring a single tank that is suitable for diluting wastewater with chemical oxygen demand (COD) 3 to 20 grams per liter.



What are the unique selling points of Sparthane Advanced?

“Sparthane is designed to treat industrial effluents and Sparthane Advanced will be able to treat the majority of streams with a high particulate COD directly without pre-treatment. This will exclude power and chemical consumption as well as difficult to operate pre-treatment steps such as dissolved air flotation. The system will be capable of achieving high loading rates and subsequently relatively small tanks with wastewaters that previously could only be treated in large volumes.”

What excites you the most about this technology?

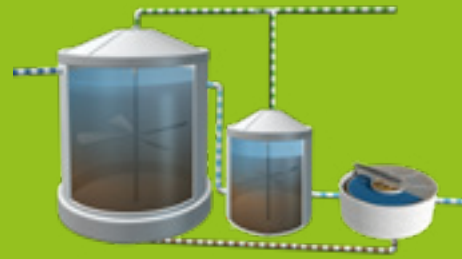
“It unleashes the maximum potential of the biomass through the approach of a feast-famine regime. This allows the biomass to really work its hardest for the client as it maximizes the potential of the process effluents into biogas. This also means more natural gas to add to our energy mix which will help us reduce our reliance on fossil fuels.”

For customers looking to invest in an AD solution, what are the biogas generator advantages Sparthane Advanced offers?

“Sparthane Advanced will enable the client to treat the majority of its streams and to convert the maximum — more than 90 percent — of its potential into burnable biogas. On top of that Sparthane Advanced removes the necessity to pre-treat the effluents meaning a significant reduction in any post-treatment processes. This results in considerable savings in terms of both power and carbon footprint.”

It’s estimated that biogas can reduce global emissions by 18 to 20 percent. What role does Sparthane Advanced play in this?

“This advanced technology is able to convert the majority of the COD in the process effluent into methane, and this methane can be used in boilers, thereby offsetting the intake of liquefied natural gas. Furthermore, COD is also converted into a vaporizable stream, whereas, previously, it would have been treated in an aerobic treatment to reach an equal removal level — which requires additional power and therefore additional emissions.” ●



Sparthane™

The ultimate anaerobic technology for the treatment of industrial effluents with concentrated fat, oil, grease and/or high levels of suspended solids without the need for pre-treatment.

Years of experience

3

Patent date

September 2017 and January 2020

Worldwide references

New technology

Applications

Industrial wastewater

Sludge treatment

Markets

Food and beverage (dairy, meat processing and wineries)

Oil and gas

Chemical

Biofuels

Size/footprint

Greater than or equal to 75 square meters, no maximum

Daily capacity

Greater than or equal to 1,500 kilograms of chemical oxygen demand per day

Benefits

No pre-treatment (such as DAF)

High tolerance to fats and/or suspended solids in feed

Self-regulated and remote optimized with Hubgrade digital solutions

Environmental benefits

Maximum biogas production

No need for pre-treatment chemical

Reduced post-treatment requirements



Korean brewer hops to global success

Building upon a remarkable local history — brewing with volcanic activity, ancient traditions, war and triumph — a local beer manufacturer in South Korea needed to expand its wastewater treatment plant following much local and international success. With a focus on maintaining environmental regulations as their business grows, they selected a plug-and-play technology to meet their wastewater treatment needs.

Maintaining environmental regulations as their business grows

The Constitution of the Republic of Korea sets out constitutional rights regarding the environment, providing the framework and guidelines for the interpretation of the environmental rights of citizens and the obligations of the state, and laying down relevant legal principles.

The constitution features 11 environmental laws including the governance of water abstraction and discharge. To ensure they met these environmental regulations, while also supporting their growing operations, the Korean beer brewer invested in a moving bed biological reactor (MBBR), designed within a standard container and a modular package solution for treating the industrial wastewater generated on their site.

Biologically treated water from the MBBR discharges to the secondary clarification step

which is a dissolved air flotation unit, in order to maintain the demanded norms before the tertiary treatment step located in the industrial complex. The solution, therefore, maintains the local regulations needed to protect local water resources and biodiversity.

The client chose MBBR Pack, owing to its modularity, which was rapidly delivered to avoid interrupting their hopping business. The project included basic process design, engineering, supply of standard package equipment, installation and commissioning on-site.

Since this initial installation in 2016, the brewer's success has grown significantly and a second MBBR Pack has been installed in 2021 to meet their continued capacity upgrades. •



MBBR Pack combines the expertise of two Veolia Water Technologies business units:

AnoxKaldnes' expertise in MBBR systems; and PMT's expertise in standard product manufacturing and related services captured within a container. The full product range includes:

- **AE-AE:** a fully aerobic model of MBBR Pack designed to deal mainly with carbon (C) and ammonium (NH_4^+) sources of pollution. The whole container is equipped with an equally distributed fine air diffuser system which ensures good repartition of oxygen.
- **AN-AE:** the main compartment is divided into two parts, which include an air diffuser system and mixers, to ensure C removal, nitrification and denitrification within one module.
- **AN-AN:** a fully anaerobic module equipped with efficient mixers specifically dedicated to nitrate (NO_3^-) removal with the help of denitrification. An ideal element at the upstream or downstream of an AE-AE in order to maintain a total nitrogen (TN) regulation.

MBBR Pack™

MBBR Pack is a moving bed biological reactor designed within a standard 40-foot high-cube container. It is an ideal packaged solution for small to medium-sized municipal and industrial wastewater projects.

Years of experience

More than 7 years

Worldwide references

20

Applications

Domestic wastewater treatment
 Industrial wastewater treatment
 Pre-treatment
 Post-treatment
 Reuse

Markets

Food and beverage
 Municipal
 Industrial

Size/footprint

25 to 35 square meters

Daily capacity

Up to 600 chemical oxygen demand per day

Benefits

Plug and play
 Automated operation
 Modular, flexible and mobile
 Small footprint
 Easy transportation (already containerized)
 Quick delivery and easy installation

Environmental benefits

Reuse of wastewater in process and ensure a more sustainable approach to industries
 Minimum power consumption



Agricultural biogas exp global energy demand g

The farmers produce organic materials that can be utilized to generate biogas which is turned into a renewable energy source thanks to cogeneration or biogas upgrading. There are currently hundreds of agricultural biogas energy projects in operation and, as global energy needs continue to grow, Marie Esteve, Sales and Tender Manager at Biothane, discusses how this should be utilized further to bridge the supply and demand gap and simultaneously reduce our reliance on fossil fuels.



Global energy demand continues to dramatically increase. In fact, between 2005 and 2030, our global energy needs are projected to expand by 55 percent, with demand increasing from 11.4 billion tons of oil equivalent to 17.7 billion.

Worryingly, fossil fuels continue to be our dominant source of energy; however, owing in part to government-backed policies and incentives,

more and more companies are switching to renewables and reaping the benefits of doing so.

This positive trend is backed by the International Energy Outlook (IEA) who also predicts this supply and demand gap can be bridged by growth in renewables.

At Veolia Water Technologies, we are committed to accelerating and expanding the deployment of existing solutions to fight climate change and champion ecological transformation. With more than 40 years' experience, Biothane — a subsidiary of Veolia Water Technologies — provides leading



The energy supply and demand gap can be bridged by growth in renewables

lands as rows

anaerobic industrial wastewater and biogas treatment solutions and their experts are sure that biogas, including that from agriculture, will expand as global energy demand grows.

In a nutshell, how is agriculture waste used to produce energy?

“Agricultural waste, predominantly crop stalks, leaves, roots, manure, etc., can be converted into environmentally friendly fuel in the biogas plant. In such a facility, biomass digesters work by transforming this matter into biogas as an efficient fuel for energy production. This can then be used to meet the site’s energy needs and/or sold back to the gas grid.”

What are the advantages to farmers of using methane produced by organic agricultural waste to generate energy?

“The energy that could be generated by treated livestock manure has the potential to meet 100 percent of the energy needs of the

agriculture industry. This is a huge opportunity to reduce energy costs to zero and increase energy security as demand grows. And any surplus energy can be exported at trade price back to the grid.”

We need to vastly reduce our reliance on fossil fuels. How can we better utilize biogas as part of the global energy mix?

“Renewable energies provide an answer to many of the environmental challenges we face today, including climate change, the depletion of resources and the collapse of biodiversity. And biogas is one of our renewable energy options that is rapidly growing on a global scale. In fact, International Renewable Energy Agency statistics on global electricity generation from biogas show that it grew 90 percent between 2010 and 2016 and this continues.

The attraction of biogas is that it equals energy independence as it is storable in the

Being close to the agricultural world, it's essential for us to develop a solution that meets their needs



network (unlike electrical energy) and it can be produced close to the consumption areas. It really is a whole circular economy system that can be set up around a mechanization project... and it should be.”

What solutions have you developed to promote the use of biogas?

“For 40 years, we have designed, installed and maintained biogas recovery units globally and so we have the know-how to design, assemble and integrate technology solutions that allow the valorization of biogas, whether in the form of electricity, heat or biomethane.

A favorite of mine is a process we call MemGas™ for ‘membrane’ and ‘gas’, which uses membranes to separate methane and carbon dioxide compounds to concentrate the methane into biomethane — this contains more than 97 percent methane of renewable origin. This can be injected into the gas network for domestic or industrial use, or used as bio-GNV, a biofuel for farm vehicles running on gas, for example, so it is also a solution for decarbonizing transport.”

What makes your MemGas™ solution stand out in this rapidly developing sector?

“Today the organic matter to produce biogas comes mainly from the agricultural world and it is an opportunity for farmers to diversify their activities. Being close to the agricultural world, it's essential for us to develop a solution that answers perfectly to their expectations and their daily life. Our solution allows them to make the most of the biogas thanks to its very high yield while avoiding the problems linked to the management and maintenance of such an installation, the objective being that they remain 100 percent available for their operations, which is their core business. MemGas is extremely reliable, robust and efficient, and because we work with pressurized gas, safety management in design and operation is a key issue.” ●



MemGas™

The ultimate valorization of biogas to biomethane with membrane technology that purifies raw biogas into suitable biomethane (more than 97 percent methane (CH₄)) to meet the requirements of its final use.

Years of experience

5

Worldwide references

20

Application

Biogas

Markets

Municipal

Agriculture

Industrial

Waste to energy

Size/footprint

Minimum 80 square meters

Daily capacity

Variable from 50 to 10,000 normal cubic meters per hour (Nm₃/h) of raw biogas

Benefits

Up to 99.5% efficiency

Low methane slips less than 0.5%

Turn key technology

Stop/start of plant within a few minutes

High flexibility for fluctuation in biogas flow and composition

Environmental benefits

One megawatt-hour of produced biomethane avoids 0.22 tons of CO₂ emissions

Compressor heat recovery for enhanced energy balance

Low energy consumption of 0.3 to 0.4 kilowatt-hour to a normal cubic meter (kWh/Nm₃) raw biogas

Possible bio-CO₂ recovery for food use or greenhouse use

Possible combination of bio-CO₂ with hydrogen to produce synthetic CH₄ making the efficiency greater than 100%

TAKE A LOOK RE-THINK TRANSFORM



Ecological transformation - this is our purpose.

▶ Hall A6, Booth 339/438
SOLUTIONS TO TURN THE TIDE

Germany is to become climate-neutral by 2045. This means, of the estimated 800 million tonnes of greenhouse gases that are released into the air every year, the bottom line has to be zero in less than 25 years. As a partner of industry and municipalities, Veolia is already providing cross-sector solutions for a climate-neutral future. www.veolia.de/veolutions

Resourcing the world





Danone achieves zero water project in Brazil

Globally, approximately 19 percent of total water withdrawals are used for industrial purposes and so the pressure is being placed on manufacturers to reduce and reuse water to protect local resources. To make a difference, Danone brought its Zero Water Project to life in 2021 to protect the water-stressed environments of Poços de Caldas, Brazil.

Water is essential to all life on Earth and to our modern economy — it is used in everything from food production and power generation to the manufacturing of paper and medicine.

Therefore, it seems somewhat inconceivable that less than three percent of our planet's water is freshwater and that most of this three percent is inaccessible to humans and animals, alike. But it is true. Of the freshwater on the planet, it is estimated that only 0.3 percent is found in surface water such as lakes, rivers and swamps that support life. And this limited resource is under serious strain.

As our population continues to grow, water scarcity has become a significant societal and environmental problem, as well as a major challenge for industry. Additionally, climate change is further accelerating this issue.

Recognizing this need for action, Danone, a multinational food-products corporation

based in Paris, France, embraced its responsibilities as a company and decided to leverage its reach as a force for good.

It set out on a mission to relieve water-stressed environments by helping to preserve and restore ecosystems, wetlands and natural water cycles and put in place concrete, circular plans for its factories to reduce its environmental footprint and impact on resources.

One such example is its specialized nutrition plant in Poços de Caldas, the State of Minas Gerais in Brazil, where they started capturing and reusing rainwater.

Danone installed a state-of-the-art rainwater collection and treatment system featuring Filtromax™ Disc to ensure the facility is self-sustaining. The process consists of collecting and treating approximately four million litres of rainwater per year, enabling

Danone put in place concrete, circular plans for its factories

Thanks to the ultra-performant filtration device with disc technology, the plant is able to harvest enough fresh rainwater each year to meet its site production needs.



the plant to avoid taking water from the soil, river or city and so become self-sufficient regarding its water consumption.

Thanks to the ultra-performant filtration device with disc technology, the plant is able to harvest enough fresh rainwater each year to meet its needs such as water used in the staff kitchen, restrooms and site cleaning.

As of June 2021, the Poços de Caldas facility was the first plant in Danone's manufacturing network to be certified by the Carbon Trust on the three environmental goals of carbon neutrality, water reduction and zero-waste to landfill. The site has helped Danone to become the first large food company in the industry to achieve B Corp certification in Brazil. Ultimately, the plant is a blueprint for Danone sites globally and is a significant step for the business as it looks to achieve net-zero by 2050.

Beyond its certification, the site is also stimulating a long-term positive impact on the local community, by working with local conservation groups like BioFílicia, to enhance community development and sustain the surrounding forests. ●



Filtromax™ Disc

Disc technology provides depth filtration with high dirt holding capacity, effective cleaning and consistent filtration results.

Years of experience

More than 10

Applications

Drinking water

Water recycling and reuse

Pre-treatment

Process water

Prefiltration UF/MF/RO membranes

Markets

General industry

Municipal

Size/footprint

0.90 - 5.30 square meters

Daily capacity

10 to 300 cubic meters per hour

240 to 7,200 cubic meters per day

Benefits

Combines surface filtration and depth filtration to ensure high contaminant removal rates

Compact, modular and highly scalable design

Automatic backwashing of individual filters based on pressure differential or time

Environmental benefits

Reduced backwash water consumption and constant production flow rates

No consumables and minimal maintenance

Minimum power consumption

Prioritizing environmental safety

On a mission to provide consumers with delicious, quality and nutritious dairy products in harmony with the natural world and strict environmental policy.

Hungary's leading dairy company has a core environmental focus

Bácsbokod is a small town and municipality in Bács-Kiskun county in the Southern Great Plain region of Hungary. It is home to Sole-Mizo Inc., Hungary's leading dairy company, which creates quality and nutritious dairy products for customers throughout eastern Europe and has a core environmental focus.

The Bácsbokod factory is one of four in its Hungarian network. This specific plant contributes to the company's range of semi-hard and processed cheeses and it required a new wastewater treatment plant (WWTP) to safely dispose of its used water in an environmentally conscious way.

When it came to building the new WWTP, Mizo prioritized safety and environmental protection to achieve its economic goals in a sustainable way owing to high business continuity risks associated with the plant's performance.

The wastewater recipient of Mizo's operations is a bordering creek to an international neighbor so exceeding discharge limits could lead to diplomatic challenges. For this reason, the effluent limit is as strict as is legally possible in the region — total suspended solids (TSS) under 30 milligrams per liter (mg/l), and total phosphorus below 0.7 mg/l.





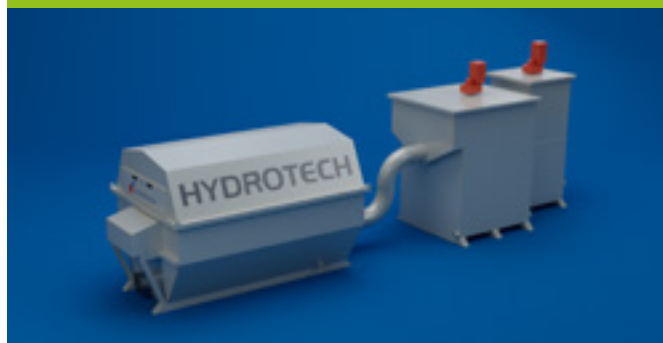
However, the factory needs to use phosphoric acid in its production process as a vital cleaning agent which can lead to high levels of phosphorus in the wastewater feed composition. And so, they required a solution that could not only significantly reduce these levels but also maintain and guarantee them.

The team used Hydrotech™ Drum filter, a form of micro screen technology. The filter is installed downstream of the coagulant and polymer addition. The coagulant is used to precipitate phosphorus while the polymer is added to increase the flocculation of solids to improve filtration performance.

Nutri-Pack™ is a plug-and-play solution using the same process line. The advantage of the package solution is that it is ready to order and it can arrive on site, in as fast as 16 weeks, without the need for extensive commissioning.

This product range is based on the proven chemical pre-treatment process design implemented by Veolia Water Technologies at over 50 sites around the world. •

Mizo's wastewater is discharged to a bordering creek and an international neighbor. Exceeding discharge limits could lead to diplomatic challenges so the effluent limit is as strict as is legally possible in the region



Hydrotech™ Nutri-Pack

The Hydrotech Nutri-Pack is a very compact and fully standardized pre-treatment package plant for chemical-physical separation using micro screen technology. It has been specifically designed for customers looking to reduce their environmental footprint while improving performance and reducing operating costs.

Years of experience

Over 20 years

Worldwide references

Over 50

Applications

Municipal and industrial wastewater treatment
Industrial makeup water

Markets

Municipal
Food and beverage
Aquaculture sludge

Daily capacity

Available in flows of up to 25 cubic meters per hour (m³/h), 60 m³/h and 120 m³/h

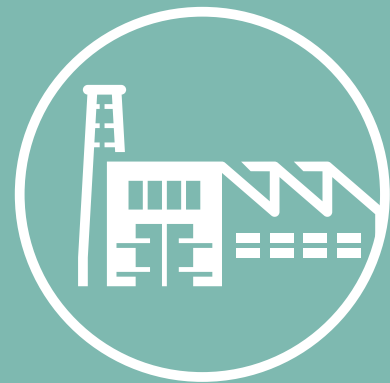
Benefits

OPEX reduction from chemical and maintenance savings due to smart control
CAPEX reduction as no civil works required
Fully standardized design: complete documentation readily available
Extremely quick delivery and start-up time

Environmental benefits

Total phosphorus reduction less than or equal to 90 percent
Total suspended solids (TSS) reduction less than or equal to 95 percent





Industry

With a vast portfolio of water technologies and services, Veolia Water Technologies works with a wide range of sectors from the automotive and chemical industries, electronics, mining, and oil and gas markets. Our experts provide specialist water treatment solutions to cover all water treatment needs while optimizing consumption, reducing downtime and helping to reduce the environmental impact of operations.



A safe solution for unsafe wastewater

Emerging contaminants such as pharmaceuticals, pesticides, per- and polyfluoroalkyl substances (PFASs) and microplastics are understandably generating public concern. As a result, industries around the world are facing tougher challenges as regulations stricken, so how do industries ensure they're not causing harm?

The United Nations has addressed this growing concern to tackle the ongoing global challenge of unsafe water and wastewater in Sustainable Development Goal six, which calls for universal and equitable access to safe and affordable drinking water free from fecal and chemical contamination.

In terms of chemical contamination, inadequate management of urban, industrial and agricultural wastewater means the

drinking water of hundreds of millions of people is dangerously contaminated or chemically polluted.

To tackle this global issue, heavy or specialized industries and those dealing with chemicals and pharmaceuticals — who often have a complex mix of contaminants in their wastewater — are now required to meet tough regulations that require higher levels of wastewater treatment prior to discharge.



However, the options for treatment remain limited.

Brandy Nussbaum, Sales Manager at AnoxKaldnes — a subsidiary of Veolia Water Technologies — shares how our clients reply on Tracer™, a family of specialized MBBR treatment solutions. This technology specializes in the removal of glycols, cyanides and selenium and other complex compounds to ensure industrial wastewater is not hazardous to human health and the environment.

Considering growing public concern, how is industry addressing the ‘invisible water crisis’ of global water pollution?

“Because dissolved pollutants cannot be seen they are often considered the invisible water crisis. Industries are constantly evolving their methods of production, whatever that is, and what is left behind is often a complex mix of

compounds that, if left untreated, are harmful to nature. These compounds are also often complex such as cyanides or perchlorates and their removal requires specialized knowledge of microbiology in order to remove them. In most cases, these challenging compounds are first brought into the lab where we can study their removal in bench-scale simulations prior to designing and building full-scale plants. We work with our clients to understand their needs and we work with nature to find the right set of conditions whereby the dangerous compounds can be transformed into something that is no longer harmful.”

When it comes to ensuring wastewater is safe, what are the emerging chemicals your customers are seeking advice on?

“Regulations are certainly helping to drive industry action but we also see that many companies, like us, are inspired by the Sustainable Development Goals and they are challenging themselves to look at ways to remove harmful compounds from their wastewater. Microcontaminants such as drug residuals and health care products are certainly getting attention as regulations are being considered in some markets. However, another growing trend is toward reuse and that means that many heavy industries are looking to reclaim their wastewater for their own use. If we are able to remove production byproducts from mining, oil and gas, and pulp and paper, then it might be possible for the plant to reuse the water in other parts of their production. Whether it’s regulatory, global-minded or self-serving interests, the ability to remove harmful compounds using biological means just makes sense.”

Challenging compounds are first brought into the lab where we can study their removal in bench scale simulations



The list of potential compounds that can fall into the Tracer family is endless



How does Tracer treat complex compounds in industrial effluents?

“The list of potential compounds that can fall into the Tracer family is endless. Tracer is based on MBBR technology which utilizes biofilm for the removal of pollutants from wastewater. The removal of complex compounds such as cyanides or selenium often requires multiple biological steps and MBBR is ideally suited for this. By creating unique treatment zones we are able to give the bacteria the correct environment for them to help us remove these harmful compounds. At AnoxKaldnes, we believe in harnessing the power of nature to help us solve our most complex wastewater treatment challenges and Tracer is a great example of that.”

Environmental experts are campaigning to move beyond regulating individual chemicals — whereby slight changes to chemical composition circumvent regulation — how do you think this will progress?

“We have already seen this happening in some markets and I think the trend will continue. However, we also see changes to the way municipalities are challenging industries to limit the volume and type of discharge that is allowed.” ●

Glycols — in its simplest form, is a colorless, odorless, viscous fluid used primarily as antifreeze and heat exchange fluid by the automotive industry. It is also a solvent, used to make polyester fibers and can be found in pharmaceutical products, resin production, and used in oil and gas production.

Cyanides — Cyanide can be a colorless gas, such as hydrogen cyanide (HCN) or cyanogen chloride (CNCl), or a crystal form such as sodium cyanide (NaCN) or potassium cyanide (KCN). In manufacturing, it is used to make paper, textiles, and plastics, it is present in the chemicals used to develop photographs and in gas form it is used to exterminate pests and vermin.

Selenium — the main commercial uses are glassmaking and pigments as it is a semiconductor and is used in photocells. Although trace amounts of selenium are necessary for cellular function in many animals, including humans, both elemental selenium and (especially) selenium salts are toxic in even small doses.



Tracer™

A moving bed biofilm reactor (MBBR) based solution for the removal of complex and harmful compounds from industrial wastewater that can easily be retrofitted into existing infrastructure as industry practices become more advanced and environmental regulations become stricter.

Years of experience

More than 20

Worldwide references

More than 30

Application

Industrial wastewater treatment

Markets

- Mining
- Pharmaceutical
- Oil and gas
- Pulp and paper
- General heavy industry

Benefits

- Customized solution with a complete set of services
- Smaller footprint compared to other biological treatment systems
- Flexible to upstream and downstream processes
- Easily upgraded for future loads

Environmental benefits

- Removal of toxic substances
- Small footprint

Smart Actiflo®

Digital innovation at the heart of the water flocculation process

Plant operators are faced with increasing demands for continuous process optimization including reducing water usage, wastewater production and chemical and energy consumption.

They must achieve this without jeopardizing the process stability and while meeting tightening regulations. For the Actiflo® process, proprietary artificial intelligence is now being used to reach the right balance between cost and compliance.

Actiflo is Veolia Water Technologies' patented high-rate clarification process. Available in standardized modular units or as a custom-designed solution, it covers all municipal and

industrial treatment applications. Benefiting from over 25 years of operational experience, Actiflo is used at more than 1,000 references around the world to treat over 50 million cubic meters of water every day.

With Smart Actiflo, we combined our extensive process knowledge and artificial intelligence to enable best-in-class operations and process optimization. By using advanced algorithms to predict effluent quality and run optimization scenarios, operating teams are able to become more proactive by anticipating and mitigating process deviations. This reduces operating costs while preserving quality and meeting production targets. •

Flocculation and sedimentation process with patented micro sand

How we respond to your needs

REAL-TIME ACTIONABLE INSIGHTS



With real-time OPEX calculation and predictive chemical stock management, be proactive, detect drifts and optimizations and save time on analysis and reporting.

RISK MITIGATION



With effluent quality prediction, anticipate process deviations and act in time to avoid non-conformities.

OPEX OPTIMIZATION



Run operating scenarios with our cost and quality balance feature to find the optimum chemical dosage.



Hubgrade makes Spanish reclamation plant smarter

Smart data can revolutionize site management and also facilitate better tertiary treatment and reuse. One of the largest oil refinery clusters in Southern Europe has done just this by investing in digital tools to make their water reuse processes more economical and sustainable.

Founded in 1965, Aguas Industriales de Tarragona Sociedad Anónima (AITASA) supplies reclaimed water for cooling to the Camp de Tarragona, a petrochemical industrial park built around one of the largest oil refineries in Spain.

To ensure business continuity, AITASA required an independent water supply owing to the water stress seen throughout the Tarragona region. Veolia Water Technologies was commissioned in 2011 to build a reclamation plant to effectively remove pollutants from the local municipal secondary effluent wastewater to produce recycled water, mainly for the cooling towers.

Since 2012, the reclamation plant has relied on Actiflo®, a high-rate clarification

technology, Hydrotech™ filtration processes, as well as two-pass reverse osmosis units to increase its water reuse.

Managed day-to-day by AITASA, the purpose-built reclamation plant receives water from the nearby Vila-Seca, Salou and Tarragona wastewater treatment plants. The treated water is then fed through a pipeline to various sites within the Camp de Tarragona petrochemical complex for alternative industrial use. This frees up freshwater for the UNESCO Ebro River Basin and local communities.

To ensure continuous best-in-class operation, AITASA also utilizes Hubgrade digital solutions.

As a complete service offering, Hubgrade can provide three separate services: **Essential**, which evaluates and continuously monitors connected equipment; **Assist**, which supports operational teams in their daily





monitoring and offers on-site support; and **Performance**, which aggregates real-time data and applies analytics and algorithms to optimize plant performance.

Christian Pitavy, Chief Digital Officer at Veolia Water Technologies, explains: *“Across the board, we are seeing a need to reuse water. Digital optimization solutions are improving water treatment facility performance in real-time, supporting both industries and municipalities in reducing their environmental footprint and carbon emissions while enhancing operational cost savings and facilitating the growing need to reuse wastewater.”*

To improve the performance of the clarification processes of the AITASA reclamation plant, Hubgrade Performance — the Insight module — was applied to the Actiflo technology.

Pitavy continues: *“With ‘Smart Actiflo®’ we use algorithms to predict the effluent quality. From this, the aim is that the team will be able to use this insight to run optimization scenarios in the near distant future. In turn, this will enable the AITASA operating teams to become more proactive and able to anticipate and mitigate process deviations, all the while reducing operating costs while preserving quality and meeting production targets.”*

Real-time and historical data are acquired on Hubgrade’s cloud platform, processed and fed to machine learning algorithms conceived by our in-house experts and data scientists.

“Additionally, thanks to the real-time operational expenditure (OPEX) calculation, operational teams can evaluate seamlessly the costs of Actiflo, by monitoring, for example, the specific energy and chemical consumption of the clarification process, and assess the impact of optimization actions,” Pitavy adds.

With the smart alarms feature, operational teams gain in reactivity time to achieve their consumption objectives: they receive notifications when an indicator exceeds a predefined targeted value. Relying on advanced algorithms, Smart Actiflo predicts the consumption of the chemicals, therefore enhancing the stock management of chemicals.

Currently under development, another machine learning algorithm predicts the effluent quality. When combined with smart alarms, the operating team can take necessary corrective actions thanks to the alerts received when there is a risk of non-conformity of the effluent.

One step beyond predictive analytics is to prescribe recommendations to the operational teams. Pitavy concludes:

“Increasingly, sustainability, especially in terms of optimization and reuse, is becoming a differentiator that is having profound impacts on businesses and operations. Our ambition is to unlock the power of digital to support sustainability which is fundamental to long-term success and resilience.” ●

Across the board, we are seeing a need to reuse water and digital optimization solutions are improving water treatment facility performance in real-time

Thinking outside the industrial wastewater box

A breakthrough innovation from Biothane, a subsidiary of Veolia Water Technologies, means operators can now solve scaling issues and avoid downtime, without building a replacement plant.

Long-term trends like the demand for increased sustainability are pushing many sectors towards increased optimization and the introduction of targets to reduce water consumption. As a consequence, wastewater is steadily reaching higher concentrations of components like dissolved solids.

Where such effluents are then treated in a high-rate anaerobic digestion (AD) process, this can cause significant problems. As concentrations of precipitants rise, they become more likely to drop out of the solution. This can lead to scaling and eventual blockage of anaerobic reactor internals.

For operators, this can mean a costly plant shut down while the affected components are cleaned, which can take several weeks. In many cases, such costs could be catastrophic.

One of the key components of a high-rate anaerobic system is the separator, which divides the liquid effluent from the solid biomass and the biogas. In the vast majority of systems, it is located inside the reactor, towards the top but submerged in biomass and effluent.

Where precipitation from the effluent does occur, it is common to see such deposits blocking the separator and to resolve the issue operators must regularly clean this component. To do so the reactor vessel is drained and purged with the valuable biomass stored in a separate holding

tank while the cleaning takes place. It is, nonetheless, possible to manage the challenges associated with higher concentrations of precipitants by adopting a novel approach to the configuration of the separator.

Within the Biobed® External Biomass Separator (EBS) the biomass is separated from the effluent outside the reactor. This process has a number of advantages.

For example, using simple valves all connections between the EBS and the digester vessel can be isolated to allow chemical cleaning in place (CIP). Locating the separator at ground level also makes it more accessible and safer for cleaning. The reactor does not need to be drained and purged and there is no requirement to access potentially gas-filled confined spaces. It allows the cleaning process to be far quicker and easier, minimizing any downtime for the plant.

One of the biggest challenges associated with an external separator is returning the biomass to the reactor without damaging it. Pumps invariably introduce mechanical shear forces which will destroy the biomass over time. If the destruction is faster than the growth rate, the costly biomass material is lost over time, impacting gas production and treatment efficiency.

This patented gas-lift system gives a high-rate performance with a relatively small footprint. In AD applications there is already



an excess of biogas that can be used to create lift without damaging the biomass pellets.

Not only is the separator easy to maintain, but a number of characteristics also reduce the risk of precipitation occurring in the first place. For instance, the full head of the reactor water column is used to pressurize the separator. Higher pressures reduce the precipitation potential by keeping CO₂ in solution and lowering the pH. Under these conditions, installing such a system may mean lower operational costs in terms of chemicals like antiscalants and biocides that are typically used to reduce precipitation.

In addition, higher pressures increase the efficiency of the separator by reducing changes in the buoyancy of the granular biomass pellets as they rise through the column. This allows separation of the biomass to take place at a much faster velocity and makes for a much smaller separator — typically about half the volume of the conventional solution located at the top of the reactor. A smaller separator equates directly to cost but in a conventional system, the separator also occupies volume within the reactor, which is dead volume.

Putting the separator outside means this space can be replaced with active biomass, significantly increasing biological capacity.

With the modular nature of this system, there is also the opportunity to install several additional separator units that can provide system redundancy. As a result, plant shutdowns can be entirely avoided during the cleaning process.

This solution means all the equipment such as the gas lift and the external separator can be installed and in place while the AD plant continues to run. The reactor is drained and cleaned only to allow the final pipework connections to be made between the separator and the reactor tank and the existing internals removed.

This is a far simpler and quicker process than a conventional approach to revamping a high-rate AD plant and can easily halve the amount of time the plant is shut down — a very significant difference for any industrial plant like a pulp and paper mill.

This makes this solution particularly attractive for the retrofit market, especially with thousands of high-rate AD plants in

There is no requirement to access potentially gas-filled confined spaces



service, with many now reaching the end of their life. Often, the tank is in good condition. However, the Biobed EBS solution makes no demands on the tank and the plant can typically be upgraded into a high-capacity unit that can match the latest generation of AD hybrid systems.

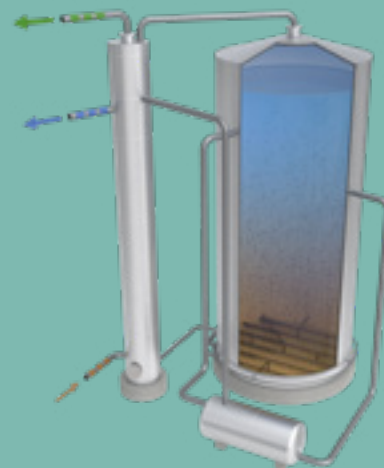
Given the ongoing drive towards greater sustainability and further water use optimization, the challenge of handling highly concentrated effluents is set to continue.

The importance of water treatment in maintaining overall plant operations makes the reliability of water treatment a critical part of the economics of many industries. Owners of high-rate AD plants should take this into account when developing their long-term strategy, especially considering the cost of shutting down.

By enabling on-site cleaning in place, Biothane's Biobed EBS brings a new dimension to the market by allowing continuous treatment of wastewater even where there is a high scaling and precipitation potential.

In wastewater, there is never one single solution, but this brings another option to the wastewater treatment toolbox. ●

This solution means all the equipment such as the gas lift and the external separator can be installed and in place while the AD plant continues to run



Biobed® EBS

The Biobed EBS technology is a unique anaerobic high-rate system with external biomass separation that is designed to treat wastewater with a high risk for precipitation.

Years of experience

2

Patent date

August 2018 and February 2020

Worldwide references

New technology

Application

Industrial wastewaters

Markets

Food and beverage

Pulp and paper

Chemical

Size/footprint

Greater than or equal to 50 square meters, no maximum

Daily capacity

Greater than or equal to 1,500 kilograms of chemical oxygen demand per day, no maximum

Benefits

Improved biomass separation efficiency

External cleaning in place (CIP) of the separation module

Simple, fast and safe maintenance

Easy capacity extension for future loads

Continuous operation of the anaerobic process

Environmental benefits

Excellent efficiency secures high water quality

Wastewater valorization through biogas recovery

Low carbon footprint in comparison with conventional aerobic treatment



**BLUE
GOLD**



**SDG: TRANSFORMING WASTE
INTO A RESOURCE**

WATER TECHNOLOGIES

Innovation is our belief, water is our expertise...

In nine podcasts

Discover real people

Working every day to protect our global water resources

Blue Gold is the story of our employees, our partners and our customers who are working together to contribute to the United Nations' Sustainable Development Goals (SDGs). Listen as they share their efforts and inspirational stories in their own words.

In this episode, focused on SDG 7: Affordable and clean energy, learn how anaerobic digestion captures biomethane from wastewater to create green energy.

*Podcast producer tootakpro.fr / Pierre Denis
Audio director Katia Grivot
Audio reporter and voice Zoe Brown*



Resourcing the world







Municipal

Municipal water treatment requires reliable and safe processes to ensure communities benefit from constant quality services. Veolia Water Technologies responds to the diverse water treatment needs of municipalities around the world with market-leading technologies and processes.



Securing drinking water resources in East Bavaria

In the face of climate change, Germany has set itself ambitious climate targets in line with the Paris Agreement — the legally binding international treaty that was signed in 2016 during the United Nations' annual climate change conference. Its purpose is to limit global warming to well below two degrees Celsius, compared to pre-industrial levels.

Germany's Climate Action Plan 2050 is the result of this agreement and it concretely details the criteria governments, industries and businesses must adhere to and what they must base their strategic decisions and growth on.

As part of this 2050 plan, the country has also set itself the target of reducing its greenhouse gas emissions (GHG) by 55 percent, compared to 1990, and this reduction has been mapped out revealing targets for individual sectors.

Even though there are no set targets for local governments, federal states are implementing their own climate protection and/or energy laws, following the Climate Action Plan 2050's requirements. They're then passing along funding to regional bodies, to advance environmental protection at all levels, including projects to secure sustainable drinking water resources.

One such project that has benefited from government back funding is Waldwasser in Moos in East Bavaria. The drinking water site near Deggendorf, Germany, began operation in 2018 and simultaneously became one of the most modern plants in Europe.

After only three and a half years of planning and construction, the waterworks in Moos, owned by waldwasser - Wasserversorgung Bayerischer Wald, a municipality union, started providing more than 80,000 private households with soft, clean drinking water, and it does so with a crystal clear conscience.

Thanks to an ion exchange process, the energy consumption of this drinking water site is reduced by 50 percent, when compared to the alternative reverse osmosis processes.

The technology at the heart of this efficiency is Carix™. It is the only ion exchange process for softening drinking water that does not require harmful regeneration chemicals and, in addition to calcium and magnesium, it

According to NASA, as of 2020, human activities have raised atmospheric concentrations of carbon dioxide (CO₂) by 47 percent above the pre-industrial levels found in 1850. This means, in 70 years, human activities have raised atmospheric CO₂ levels by more than what has happened naturally over the previous 20,000 years.

also reduces hydrogen carbonate, sulfate, nitrate and chloride. It produces soft water for the residents, protects the drinking water network — owing to less corrosion — and saves households costs of approximately €150 per year owing to energy savings and fewer cleaning agents.

Carix is both energy efficient and beneficial to local residents but it has an even bigger environmental plus point which is what warranted government-backed funding from the Climate Action Plan.

The technology regenerates itself by recovering its carbon dioxide (CO₂) exhaust gasses and is able to reuse them as a regeneration agent instead of emitting them directly into the air. This relieves the atmosphere of 630 tons of CO₂ per year — equivalent to the CO₂ emissions of 6.6 million kilometers traveled in a car every year — and directly benefits the local environment and air quality.

Due to the large energy savings, especially when compared to traditional reverse osmosis technologies often found on drinking water plants, the German Ministry of Environment has sponsored the technology used at the waterworks in Moos countrywide.



There are currently 21 Carix systems in operation across Europe, where environmental and sustainable benefits are highly sought. Compared to membrane processes such as reverse osmosis, as a basis, ion exchange produces around 60 percent less wastewater and uses 50 percent less energy. •



Uwe Sauer, Business Development and Sales Manager Municipal Applications, Veolia Water Technologies:

“The basic principle of the Carix process has not changed since it was invented by Veolia. It’s an ion exchanger that can be regenerated with carbon dioxide to soften drinking water. However, the latest generation of the system is no longer proportional to older systems in terms of yield and energy consumption. With this latest technology, the Moos waterworks sets standards in terms of ecology, economy and drinking water quality.

In a nutshell, with a softening from 20 to 25 degrees of hardness (°dH) reduced down to 8 to 10 °dH; the amount of wastewater produced is four to eight percent less; and energy consumption has been halved to between 0.25 and 0.15 kilowatt-hour per cubic meter, the technology results in savings and optimizations across the board.

In addition to the higher loading capacity of the ion exchange resins, the main reason for these savings is the modification of the CO₂ recovery during regeneration. The vacuum range of the degassing — for the CO₂ recovery — can now be set variably between 200 and 1,000 millibars. The gas extraction units are also equipped with highly energy-efficient synchronous reluctance

motors and frequency converters, and a new control concept ensures energy-saving and needs-based gas production.”



Carix™

The only ion exchange process for drinking water softening without harmful regeneration chemicals. The exchanger resins are regenerated by the produced carbon dioxide while simultaneously reducing sulfate, nitrate and chloride.

Years of experience

More than 35 years

Worldwide references

21

Applications

Drinking water

Hard water

Economic softening

Markets

Municipal

Food and beverage (mineral water and breweries)

Size/footprint

200 to 2,000 square meters

Daily capacity

300 to 30,000 cubic meters per day

Benefits

Low OPEX

Cations and anions removal without corrosive effects on the water quality

Up to 50% saving in detergent and cleaning agent usage.

Environmental benefits

60% less wastewater consumption*

50% less energy consumption*

Overall lowered carbon footprint

**compared to membrane desalination*

Doubling in size and still on the rise

The City of Durham, North Carolina, is so popular it is on track to double in size in the next 25 years. Learn how the city has planned for this in terms of its wastewater treatment while continuing to meet stringent environmental regulations.



Wastewater treatment systems have always played a vital role in our society. Yet the current market is booming. According to a new market research report published by Meticulous Research, the water and wastewater treatment technologies market is expected to grow at a compound annual growth rate (CAGR) of five percent between 2020 and 2029, reaching \$24.63 billion by 2029.

The research report, which focuses on membrane separation and filtration, sludge management, activated sludge and clarification technology usage in the United States (US), identifies five key factors prompting this growth: the growing focus on water pollution abatement; strong technological networks; the increasing need for water reclamation and reuse; rising water pollution; and the growing number of new manufacturing plants in the country.

Furthermore, tightening new governmental regulations on the safe and appropriate use of wastewater and its discharge plus a

growing demand for energy-efficient and advanced water treatment technologies, are all contributing to a hub of innovation and research and therefore overall improvements in wastewater treatment.

Already ahead of this curve is the City of Durham, located in the Research Triangle Region of North Carolina, which completed a comprehensive wastewater master planning effort in 2011.

Durham is among the fastest growing and cited as one of the most exciting cities in the US to live in. The city was traditionally known for its tobacco production but it has transformed itself into an up-and-coming city boosting lots of jobs as it houses one of the most prominent high-tech research and development centers in the country not to mention, Durham is the location of Duke University and Duke University Medical Center.

With a 2020 population of 292,301, it is the fourth largest city in North Carolina and its population has increased by 28 percent since the most recent census. And officials expect Durham's population to double in the next 25 years.

Owing to this, the City of Durham recognized the importance of its municipal wastewater treatment plants (WWTPs) and knew it needed to identify cost-effective methods to manage its total nitrogen (TN) levels to meet increasing environmental regulations.

The city is responsible for the operation of two WWTPs — the North Durham Water Reclamation Facility (NDWRF) and the South Durham Water Reclamation Facility (SDWRF), both permitted to treat 20 million

Durham evaluated different treatment techniques to meet strict total nitrogen limits

gallons per day (MGD) — so it completed a comprehensive wastewater master plan that evaluated different treatment techniques for meeting strict TN limits.

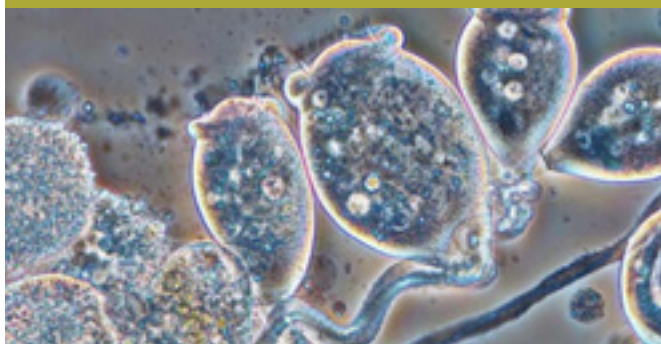
The SDWRF plant needed to meet a TN limit of three milligrams per liter at its design flow to comply with the total maximum daily load (TMDL) in the Jordan Lake Watershed, which serves as a source of drinking water in the region.

Durham selected Anita™ Mox which is specially developed to treat centrate, filtrate and pressate streams, highly loaded in ammonia that require total nitrogen removal. The process is performed in two steps: aerobic nitrification and anoxic ammonia oxidation performed by anammox bacteria.

The two steps take place in a one-stage biofilm process in different layers of the biofilm: nitrification (aerobic) in the outer layer of the biofilm and deammonification (anoxic) in the inner layer. In the case of South Durham, the process was calculated to be three times lower in cost per pound of nitrogen removed when capital and operating costs were considered — it was estimated to cost \$0.93 per pound of nitrogen removed (\$/lb N), while the most cost-effective mainstream biological nutrient removal (BNR) solution was estimated at \$2.66/lb N.

At the SDWRF, the system was started up in 12 weeks. Now operating full-scale, the system is achieving greater than 80 percent ammonia removal and 70 percent total inorganic nitrogen (TIN) removal, both exceeding guaranteed values.

If the research from Meticulous is anything to go by, more and more municipalities, including the NDWRF, will be following in the footsteps of South Durham to better manage changes, not only in the treatment and reuse requirements of WWTPs but also in meeting government regulations and supporting economic growth. ●



Anita™ Mox

Anita Mox is an energy-efficient process to treat highly concentrated ammonia-loaded effluents. It reduces operating costs and can contribute to reaching an energy self-sufficient plant status while meeting regulatory requirements on nitrogen concentrations in treated wastewater.

Years of experience

15

Worldwide references

More than 35 years

Application

Wastewater

Markets

Municipal sidestream

Municipal mainstream

Microelectronics

General industry

Benefits

90% ammonia removal with less oxygen

75-85% total nitrogen removal with no external carbon

Greater stability for the mainstream

Reduced load/increased capacity of the plant

Self-regulated and remotely optimized with Hubgrade digital solutions

Environmental benefits

Energy saving solution

Reduction of chemicals

Low nitrogen dioxide emissions

The future of municipal water

Throughout history, technology has played a pivotal role in human development but what does it hold for the future of water?

How we utilize technology will be the rise or fall of our species

From gunpowder to the compass, every human empire has risen or fallen with the help of technology. In less than a lifetime, technology has advanced so rapidly that it has changed the way society behaves and operates, on a global scale.

From the creation of the internet in 1974 to the everyday smartphone, which is more powerful than the computer that sent Apollo 11 to the moon, in approximately 50 years our technological advancements are clear. However, looking to the future, the next triumph of technology will not be the rise or fall of an empire, it will be the rise or fall of our species.

We are at a tipping point in our fight against climate change and resource depletion — a vital one being water. Many of the water sources that sustain our way of life are already under severe stress; however, the demand for safe, clean water continues to rise.

It's projected to increase 55 percent by 2050 — this includes a 400 percent rise in demand to maintain manufacturing processes — as the global population is predicted to soar to 9.7 billion. This is two billion more people than today. According to research from the Massachusetts Institute of Technology, this means 52 percent of the world's projected population will live in water-stressed regions and over five billion people will suffer from water shortages due to climate change, increased demand and polluted supplies.

Without action, this paints a grim picture. But, with the help of technology, we are now able to move at a pace and at a scale that has never been possible throughout our history. And artificial intelligence (AI) is at the heart of this.

Today, AI is ubiquitous — it controls the adverts we see on social media, powers our Alexa and helps to detect fraud. In addition, AI is already proving itself to be critical in three fundamental ways to support sustainability with many possibilities for growth.

Firstly, **AI is starting to have the power to analyze and comprehend the ecological complexities of local, national and global water cycles.** *“The combination of AI, particularly with machine learning and water process expertise already helps predict the process and mechanical behavior of water technologies and equipment,”* explains Christian Pitavy, Chief Digital Officer at Veolia Water Technologies.

“We have already started using both live and forecast weather data to predict the impact on the local water infrastructure and therefore the surrounding environment. This may soon become the norm as we use algorithms for storage and optimal network flow. This is likely to become vital as extreme weather events trigger downpours since this foresight will help prevent the risk of untreated effluent overflows.”



Christian Pitavy, Chief Digital Officer at Veolia Water Technologies.

Looking to the future of how AI can help deal with ecological complexities, Pitavy predicts, “large utilities will be connected to smart, local grids that are powered by circular loops of resources — solar, wind, water reuse, anaerobic digestion, etc. These local grids will be so local and analytics will be so advanced that there is likely to be a digital twin of every household. If this becomes reality, we will be able to use AI to meet all individual utility needs without fossil fuels or devastating natural resources. As well as looking at the weather and managing our needs, we’ll also be able to monitor what our environment needs as well, depending on the local landscape and biodiversity. It will be possible to tell when forests and bushlands require watering to prevent forest fires, and we will be able to adapt effluent reuse to prevent flooding or even help us protect our oceans.”

The second big arena where AI will play a key role in boosting sustainability is consumer education and behavioral change. Already AI is used by consumers to improve their health and conveniently manage small household items with smart home devices. In the same sense, AI will help consumers adopt more sustainable behaviors and make better choices when it comes to their water usage.

“In the years to come we will see the development of apps for users suggesting, through the use of AI models, when to use the dishwasher or washing machine to be more sustainable — this insight would be gathered by and linked to smart, local grids,” explains Louis W. Ø. Larsen, Digital Business Developer for Hubgrade.

“In the face of climate change, these seemingly ‘small’ everyday necessities will need to be better controlled to lessen the impact on the environment and to make sure resources are shared. As populations grow, water supplies will become more variable as demand increases and this is where AI systems will coordinate this

varying supply to the demand to satisfy the system in the best possible way.”

Larsen adds, “I imagine that flexibility to water access could in part be solved with smaller loops or grids, like the power industry, meaning air moisture capture and neighbor scale treatment systems. Where local communities can share the available resource via apps, for example, trends in usage could then be analyzed and interpreted by AI models to predict when the water would be available and where and how it is to be used instead of discarded directly. One man’s trash is another man’s treasure sort of approach.”

Finally, **AI will optimize how vital resources, including water, are reduced, used and reused as part of the ecological transformation.**

“The foundation of this technology is already in place,” explains Chloe Dupont, Head of Digital Transformation at Veolia Group. In addition to better managing water throughout production processes, today AI also helps identify water leakage meaning we can go one step further in reducing the amount of water wasted. And when it comes to equipment, algorithms help predict when to change filter membranes which significantly contributes to an uninterrupted clean and safe water supply in manufacturing processes,” explains Dupont. “All of these things help better protect our water cycle and help us work more in harmony with the local ecology.”

“I dream that AI becomes part of the day-to-day life of water operators with live data, predictions, and suggestions of actions all together supporting quicker and more informed decisions to protect water resources. I believe solutions are still to be invented in the face of increasing water challenges and collaboration between municipalities and industry, water experts, data scientists, start-ups and beyond will become even more fundamental to imagine innovative and digital solutions for ecological transformation.”



Louis W. Ø. Larsen,
Digital Business
Developer for Hubgrade.



Chloe Dupont, Head of
Digital Transformation
at Veolia Group.

Utilities will be connected to smart, local grids powered by circular loops



So, there we have it. The future of water has already started thanks to the power of AI matched with human expertise. And it will prove to be our period's equivalent to Newton's apple, Fleming's penicillin and Bell's telephone. Our experts predict the true rise of humankind will come from our ability to understand and action what we learn from super-advanced AI so let's embrace AI for both pace and progress to protect our global empire.

their entire sewer network owing to frequent heavy rainfalls.

It started at their Agtrup wastewater treatment plant (WWTP), in 2007, which began using Hubgrade Performance to maximize its existing facilities — this resulted in a 25 percent decrease in total nitrogen (Total-N) and a reduction of the chemical precipitant by 45 percent. Then, In 2011, as part of a large WWTP extension, they



BlueKolding: the municipality using real-time data to increase sewage system resilience in the face of climate change

For more than 14 years, BlueKolding A/S — the company responsible for the municipality of Kolding in Jutland, Denmark — has prioritized and applied technology to ensure they can maintain steady plant loads and avoid combined sewer overflows (CSO) across

digitally integrated their entire sewerage system as well as three satellite wastewater treatment plants in Vamdrup (2012) and Christiansfeld and Lunderskov (2013). In 2017, all of this was moved to the cloud. But BlueKolding didn't stop there.

Their latest innovation projects include: **SMARTGrid** system, which is designed to withhold wastewater for up to 24 hours

so that treatment takes place when the electricity tariff is low; and **BlueGrid**, which uses the sewer system data as well as weather forecasts and rain radar data to sell balancing services to the electrical grid with a short response time via up or down adjustments of the energy consumption and production.

“We work continuously to energy-streamline our processes. Setting up an advanced SMARTGrid system with close interaction between the treatment of wastewater and electricity market tariffs is a huge step forward for us,” explains Per Holm, CEO of Bluekolding. *“[And] BlueGrid serves as a good example of BlueKolding’s commitment to due diligence in relation to the challenges posed by heavier and increasing amounts of rain. It also constitutes an important part of our strategic ambition to be a front-runner in the digitalization of our company and an inspiration to our industry by making the most of the data we have available. In order to do so, we have grown accustomed to moving further and faster than rules and regulations require us to.”* •



Per Holm,
CEO of Bluekolding

Hubgrade

PERFORMANCE

Hubgrade digital solutions — Performance Plant module

The Plant module of Hubgrade Performance is an online digital twin of the wastewater treatment plant and sewer network. It uses real-time data and advanced algorithms to provide continuously optimized setpoints to the PLC control delivering insight to operators, process engineers and management teams.

Years of experience

More than 25 years

Application

Wastewater

Markets

Municipal

Pulp and paper

Food and beverage

Mining

Oil and gas

Pharmaceutical

Benefits

Reduce operating costs (energy and chemicals)

Increase hydraulic and biological capacity

Compliance and stable operation

Environmental benefits

Carbon footprint savings

Energy savings

Chemical savings

Compliance with environmental regulation



Holiday hot spots tackle water scarcity with wastewater reuse

In addition to heatwaves and volatile storms, water scarcity is a growing concern for the tourism industry as it restricts the provision of water-intensive amenities such as pools and limits supplies needed to support activities. From Morocco to Saudi Arabia, discover how cultural holiday destinations are taking action to limit their environmental impact.

Tourism will continue to be particularly vulnerable and so it is important the sector focuses on reducing its carbon and resource intake to protect itself

Tourism is a prime example of a volatile industry. It falls victim to political, social and economic shifts and it is also facing severe environmental impacts. In turn, tourism also significantly contributes to the climate crisis.

Approximately eight percent of all global emissions stem from tourism, which, in turn, has a direct impact on the environment and climate. So what is the travel and tourism industry doing, not only to mitigate the consequences of climate change but also to reduce its impact?

Morocco is one of the leading destinations for international tourists traveling to Africa. And it is growing. In 1995, 2.75 million tourists visited Morocco adding \$1.74 billion to the economy and accounting for 3.8 percent of the gross national product (GNP). Pre-pandemic, in 2019, this had grown to 13.11 million tourists adding \$9.95 billion (8.3 percent of GNP). Considering this trend, the Moroccan economy has a lot to gain and a lot to lose when it comes to environmental risk, especially as the country is expected to face a major water shortfall prompted by both water demand increases and infrequent precipitation induced by climate change.

To help reduce its water consumption and therefore environmental impact, a tourist complex in Imi Ouaddar, a village in the Agadir region of Morocco, has invested in a complete wastewater treatment system to aid water reuse. Ecodisk™ is a wastewater treatment technology, developed by Veolia Water Technologies subsidiary PMT, that guarantees an organic treatment of domestic wastewater underpinned by a patented rotating biological contactor (RBC) technology.

Commissioned in 2018, the system now safely treats the wastewater of approximately 5,350 population equivalent (PE) without adding any chemicals. It also facilitates reuse and provides irrigation water for green lands within the hotel's grounds, helping to reduce the potable water drawn from the natural environment and so limiting the pressure on local water resources.

Likewise, in Saudi Arabia, a town located on the north-western outskirts of the Saudi capital, Riyadh, has begun work to renew the historic city and turn it into a cultural epicenter to encourage tourism.

This historic town will be transformed via a \$20 billion, government-backed, development project into a global tourism destination rooted in historical culture and heritage. The project, set in a peri-urban commune, needs separate construction sites throughout the region and therefore also requires unitary wastewater treatment plants for the local workers; and so, Ecodisk will ensure a minimum daily capacity of 20 cubic meters per day.

After biological treatment, the clarified water enters a tertiary filtration step before disinfection. The treated water is then fully compliant with local water regulations and so it will be directly reused as irrigation water for the habitational green lands.

The technology, with its compactness, low electrical consumption and simple operation helps reduce the environmental impact of this soon-to-be holiday hot spot. Once again, this means that our customer is minimizing the environmental footprint of its operations.

Furthermore, this complete domestic wastewater treatment solution is 100 percent organic and economical in terms of its energy consumption and therefore in line with Saudi Arabia’s latest climate plan. The country is focused on reducing, avoiding and removing 278 million tons of greenhouse gas emissions (GHG) annually by 2030 — more than twice its previous target.

Wherever the holiday destination is, the impact of climate change on tourism is likely to manifest itself according to local conditions. Many of these impacts will develop indirectly through increased stresses placed on environmental systems. But, either way, tourism will continue to be particularly vulnerable and so it’s important the sector focuses on reducing its carbon and resource intake to protect itself. ●



Ecodisk™

Ecodisk is a wastewater treatment system based on rotating biological contactor (RBC) technology. It is specifically designed to meet the needs of small to medium-sized communities such as hotels, construction areas, camping sites, military bases as well as remote facilities.

Years of experience

7

Patent date

2008

Worldwide references

20

Applications

Municipal wastewater treatment

Reuse

Markets

Municipal

Travel and tourism

Military

Commercial

Healthcare

Size/footprint

6 to 30 square meters

Daily capacity

100 to 10,000 population equivalent (PE)

Benefits

Extremely low OPEX

Small footprint

Fast and easy implementation

Environmental benefits

Low electrical consumption

Reduced carbon impact

Compact module footprint

No nuisance - noise and odor

Introducing an ultra-compact biological treatment with concentrated technology

Specifically designed to meet the needs of small to medium-sized hotels, construction sites and municipal communities in remote areas, Ecosim™ provides biological treatment for domestic wastewater, within a range of 50 to 2,000 population equivalent (PE).

Easily integrated into an existing wastewater treatment system, Ecosim is PMT's — a subsidiary of Veolia Water Technologies — newest wastewater treatment system featuring a patented hybrid technology between a rotating biological contactor (RBC) and Moving Bed Biofilm Reactor (MBBR).

Compared to its older cousin, Ecodisk™, Ecosim is up to 300 percent more compact while offering the same plug-and-play biological treatment capabilities. Now, Munir Ali Turan, Process and Sales Engineer from PMT tells us what we need to know about this new technology on the block.

extensive sewage lines as well as simplifying maintenance and operations.

Another important aspect is energy autonomy for two key reasons. Firstly, to reduce the carbon footprint of the operations but also to improve resilience in areas where electrical grids face instabilities. Fully solar-powered and hybrid solutions are gaining a lot of attention.

The third focus is reuse. Today many of our customers require reuse as a standard on their treated wastewater. This helps bridge the gap between supply and demand, especially in the Middle-East and Africa region where there is already a potable water shortage."

What are the new trends in domestic wastewater treatment?

"There are three important movements in the domestic wastewater market. The first is localization whereby multiple small to medium-sized decentralized wastewater treatment plants (WWTP) are installed, instead of one or two large ones. This facilitates an on-source treatment approach while avoiding the relative costs and risks associated with

What are the big challenges customers are facing and how are they tackling these obstacles?

"Staffing and resilience are certainly the biggest obstacles we help our customers workaround. Many of our customers are not able to have trained engineers on-site around the clock due to the fact operations are relatively small and often remote. To counteract this, the technology being counted on needs to be robust and reliable, and also require maintenance during the operation phase. Then, in terms of resilience, as mentioned earlier, many of our customers are completely off-grid or can encounter large





interruptions in their electricity feed so their solutions need to be completely — or at least semi — autonomous.”

Ecosim combines Ecodisk and AnoxKaldnes® MBBR technologies, so what are the defining principles?

“Ecodisk is an attached growth process where the development of the biology takes place on the disc surface. The key advantage is that Ecodisk has only a single gear-motor in order to maintain the mechanical aeration of the system resulting in extremely low OPEX, compared to the competing blower-based technologies.

AnoxKaldnes® MBBR is a moving bed biofilm reactor technology that is also an attached growth treatment process but the development of the biology takes place on the dedicated media surface. Due to its design and unique 3D structure, the projected surface area for bacterial activity is much larger than competing technologies. This provides a highly compact solution which ensures an important advantage in the wastewater treatment market.

Now for Ecosim. This newly developed combination includes both advantages: it has a drum filled with the 3D MBBR media, which

provides a high projected surface within a low footprint; and it only has one gear-motor, which provides adequate aeration for biological activity with low OPEX.”

What are the main benefits Ecosim ensures to customers?

“Ecosim provides a high surface area for bacterial development within a small footprint and there are several benefits thanks to this: firstly, the compactness. Compactness means faster manufacturing time as well as easier and cheaper transportation. In addition, it can be implemented rapidly on-site. Secondly, it has lower power requirements and therefore reduced electrical consumption meaning it requires less OPEX; and still, the one gear-motor provides the adequate oxygen transfer to the biofilm.”

How should customers choose between Ecosim and Ecodisk?

“Both technologies come from the same process family and both can be customized to meet specific requirements by our technical department so it really depends on each customer’s needs. The key thing to remember is that Ecosim is more compact with a higher projected surface area but within a restricted footprint. Whereas, Ecodisk has a smaller surface area for the same footprint and it

Many of our customers require reuse as standard on their to helpbridge the gap between supply and demand, especially in regions where there are potable water shortages



can feature up to five biological tanks within the same module, which means that it can provide a higher retention time than Ecosim.”

Continual improvements in wastewater treatments are necessary as discharge requirements become stricter. What part does Ecosim play?

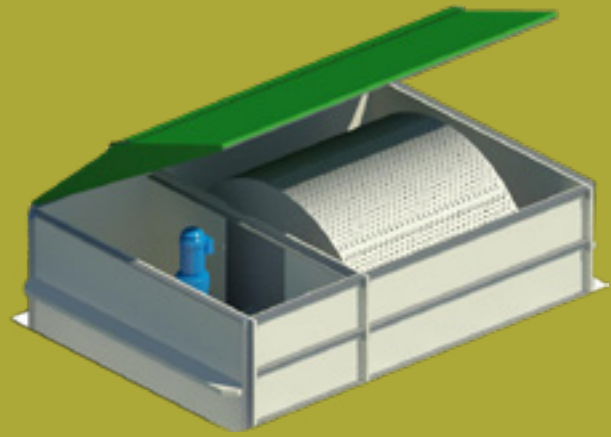
“As discharge standards become stricter and as the global population increases, existing WWTPs will start to suffer from the excess charge coming to the plant. Thanks to its modular, plug-and-play approach, Ecosim can propose a rapid upgrade of existing infrastructure by reinforcing the existing treatment process, either as a tertiary step or by proposing an additional parallel line to take on extra flow.

For example, let’s look at a lagoon treatment or extended aeration which is functioning for carbon and ammonium (NH₄) removal. Owing to population increases, the excess carbon loading starts to reduce NH₄ removal performance. In this case, Ecosim can be introduced downstream to provide an extra surface area for nitrifiers and hence take the excess load on the existing lagoon.”

In terms of increasing environmental restrictions, what are your predictions and how can wastewater managers prepare?

“For sure we will face an increased obligation to reuse water owing to the mounting water stress and the impacts of climate change on a global scale. It’s a matter of when not if. Another reason for the increase in reuse is the need to limit unused discharge. By reusing treated wastewater, clients not only create extra value by using the resource for other needs but they become more self-sufficient, efficient and sustainable.” •

Ecosim can propose a rapid upgrade of existing infrastructure by reinforcing the existing treatment process



Ecosim™

Ecosim brings a new approach in the wastewater treatment market. It is a combination of a rotating biological contactor (RBC) and a moving bed biofilm reactor (MBBR), designed for decentralized treatment powered by solar energy.

Years of experience

New product

Patent date

2021

Applications

Wastewater
Reuse

Markets

Municipal
Travel and tourism
Military
Commercial
Healthcare

Size/footprint

6 to 10 square meters

Daily capacity

50 to 2,000 population equivalent (PE)

Benefits

Four times more compact than Ecodisk™
Limited transportation challenges
Reduced lead times
Fast and easy implementation
Low OPEX

Environmental benefits

Low carbon footprint
Solar energy option



Hybas™

WATER TECHNOLOGIES

Hybas™ is an Integrated Fixed Film Activated Sludge (IFAS) solution that is compact and requires little process volume to achieve a reduction of organic material and nitrogen. It can often be used to upgrade existing industrial and municipal activated sludge plants without the need for extra volume.

Benefits

- Upgrade of existing activated sludge plants with no minimum or maximum daily capacity
- Improved ammonia removal
- Increased capacity
- Greenfield applications

Environmental benefits

- Latent enhancement of micropollutant removal
- Improved biogas production over conventional systems
- Reduced air consumption over conventional systems
- Smaller construction footprint or no new CO₂ footprint

More than
20 years of
experience

More than
100 worldwide
references



The world’s largest disc filter installation reduces dependency on the Nile

What does the world’s longest moustache, oldest person ever to have lived and Veolia Water Technologies’ Hydrotech™ Discfilter have in common? They are all Guinness World Record holders.

Guinness World Records recognizes disc filter installation in Egypt as the largest in the world.

Guinness World Records, the global authority on record-breaking achievements since 1955, has recognized Hydrotech’s disc filter installation in Egypt as the largest in the world.

The Bahr El-Baqar wastewater treatment plant opened in September 2021 to tackle one of the biggest challenges facing the country: water scarcity. Without the Bahr El-Baqar plant, Egypt’s rapidly growing population and expanding economy would struggle to secure enough water to sustain itself since it was relying on one source: the River Nile.

Traditionally, the Nile was seen as the passageway between life and death; however, in recent years, it has taken on a new role as the backbone of Egypt’s industrial and agricultural sector as well

as the primary source of drinking water resulting in severe water scarcity.

“Any alteration to Nile flows could make a huge difference. Every two percent drop of water affects one million people,” states Randa Aboul Hosn of the United Nations Development Programme.

To help reduce dependency on the Nile, and ensure water resources are sustainably managed, the Bahr El-Baqar plant treats 5,000,000 cubic meters of wastewater per day — equivalent to the water of one hundred and forty million showers.

Veolia’s team supplied the plant with the record-breaking, 120 disc filters to recover and recycle the wastewater by removing organic

compounds, bacteria and other harmful elements so it can be used for irrigation in the Sinai governorate.

“Scarce availability of clean water is a global problem. Disc filters make wastewater reuse for irrigation possible. This is important in ensuring that all people can have access to clean drinking water in the future while at the same time fighting global hunger,” adds Peter Wiktorsson, Project Manager at Veolia Water Technologies.

The Bahr El-Baqar plant disc filter installation is by far the biggest in the world, both in the number of filters supplied and total filtration area. This helps reduce the environmental impact of the plant and reduce water intake from the Nile overall.

In June 2021, the plant started to treat water for reuse in agriculture to assure the possibility to grow crops in a normally dry area. The Hydrotech Discfilters are installed to capture suspended solids and therefore help secure the required water quality.

Alongside the world’s tallest dog and fastest women’s marathon runner, this flagship disc filter reference is firmly placed in the Guinness World Records’ database. ●



Hydrotech™ Performance Filter

The latest Hydrotech Discfilter — the Performance Series — is a patented solution for faster particle extraction. It has more than twice as much filtration area per filter unit as previous disc filter models making it a very space-efficient solution.

Years of experience

3

Patent date

2021

Applications

Wastewater

Industrial wastewater treatment

Drinking water

Stormwater management

Reuse

Water pre-treatment

Markets

Municipal

Industrial

Size/footprint

40 to 271 square meters

Daily capacity

43,200 cubic meters per day

Benefits

More than twice as much filtration area per filter unit

Enhanced extraction of solid particles

Increased filtration capacity

Environmental benefits

Energy-efficient

Small footprint





Pharmaceutical

Veolia Water Technologies advises and assists the pharmaceutical industry on compliant purified water, water for injection, clean steam and wastewater systems. Our expertise helps to reduce your production costs through better water management and optimization, while ensuring high-quality water and controlling the environmental impact of your activities.

Recycling polluted industrial wastewater

Cristina Del Piccolo, Veolia Water Technologies' Process and Research and Development Manager, discusses the current industrial wastewater management sector and how we must tackle new-age pollution with innovation.

Based in Italy, Del Piccolo has been with the company since 2002 and is responsible for the technical department within one of the company's technology-focused business units. Her work is underpinned by Evalued™ evaporation technologies that recycle polluted industrial wastewater, helping global customers across healthcare, pharmaceutical and automotive markets reap environmental, economic and financial benefits. Here she shares with us her thoughts.

What is the current state of industrial wastewater recycling?

"In terms of regulation, if we're talking about developed countries, we are all more or less on the same page. However, of course, some countries are doing better than others and some countries need to do more.

Many of the businesses we see leading the way are those in countries with access to fewer resources overall, so they need to recover more water to ensure their business continuity. The good news is, there are a lot of industries that pay attention, not just to respect

the regulations — which is essential — but who go further to proactively protect the environment.

In terms of what these regulations and companies are focused on, today there is a sufficient focus on all known major pollutants and contributions; however, this is evolving. In the last few decades, we have developed so much in terms of new drugs and industrial chemicals so research is ongoing into new pollutants. As a result, our knowledge is constantly growing, such as awareness of endocrine disruptors which are gaining an increasing amount of attention with the authorities, and so regulations are constantly in review as the 'current state' is better understood."

How much of a focus is water reuse in the industrial sector?

"There is a very large focus on reuse but also in finding other ways to think about wastewater as a resource. One way for sure is evaporation and crystallization technologies which recover until the very last drop. Evaporation is starting to be considered not only as the ultimate treatment step to achieve zero liquid discharge plants but it can also be applied inside the production line. In doing so, wastewater streams can be reused inside the production process itself. Evaporation can transform wastewater into a new stream for which alternative options are possible right up until recovery as a new resource. The success of this is dependent on the company, their industry,



their utilities and the water quality grade needed. However, what is now widely understood is that there is a resource and so, together, we think about a way to use this. Reuse requires creativity but we are getting there.”



What are the main benefits these “new” resources bring to the industrial sector?

“There are many. Following evaporation and crystallization — where everything is recovered — you’re left with a final residue which is the lowest volume you can achieve. This means all potential resources have been captured but the benefits don’t stop there. In terms of waste management, the residue occupies less space and so results in lower transportation and disposal costs. Not forgetting a vastly reduced carbon footprint.”

What is the biggest challenge facing the industrial wastewater sector?

“Pollutants that are not easily treated by conventional technologies. Many conventional technologies, such as those developed to treat traditional markets like the food and beverage industry and their biodegradable compounds, were developed years ago. Pollution then was different from what we have now owing to the new chemicals and drugs that industries use in manufacturing or new metals, which come from new industrial processes and new products. Furthermore, our general understanding of all these contaminants is much better and we pay attention to a much longer list that requires different treatment approaches. This is where innovation is key so we can keep up with requirements, not only in terms of pollutant change but increased regulations.”

How is industry addressing these new-age pollutants?

“The treatment of pollution at the source is an important topic. The idea is to tackle pollution where the concentrations are much higher and flows are reduced, straight out of the factory, as opposed to in the municipal wastewater system once they’ve dispersed. Yes, this treatment is done in the municipal system but technically speaking, we can face the two situations in completely different ways with two different process lines best suited to the level of parts per million (ppm) of a compound in the wastewater stream. This will give us a much better treatment rate. It makes a lot of sense to try to segregate them. What is clear is that evaporation is a very refined technology, especially for active pharmaceutical ingredients (APIs) — the very big and complex molecules — as a separation technology.”

What about the pharmaceutical industry, how is it addressing these new pollutants?

“It’s no secret that discharge from pharma sites, where the drug manufacturing takes place, can cause pollution risks in distant locations from the final user. And this is why treating pollution at the source is so important. Our customers answer this, once again, with evaporation, which is an effective solution for all wastewater coming from



pharma production that contains particularly challenging (APIs) which are very complex molecules and/or antibiotics.

APIs are not easily managed by traditional treatments such as biological plants; however, an evaporator can be installed within an existing wastewater treatment line, where the most challenging streams could be segregated, or within the wastewater treatment line, where difficult components can create problems for traditional treatment plants. Either way, what makes sense is to separate this stream so the traditional plants can keep treating the rest of the water which is easier to manage. This, in my opinion, is the main driver for the pharmaceutical industry since APIs are a relatively new obstacle. The pharmaceutical industry must continue to make existing plants adequate as limits are imposed on these particular substances — limits that until now weren't foreseen or controlled.”

What does the future of industrial wastewater recycling and reuse look like to you?

“We will continue to push towards reduction of the water until it is a constant requirement. This will be underpinned by the technologies we now have, and we must continue to invest in order to make it easier to recover water with higher efficiency and reduced OPEX. Until very recently, if customers wanted to recover all their water, the process line that they needed to put in place was normally complex and costly — both in terms of CAPEX and OPEX. But technology is bridging this gap and making it much more accessible to small to medium companies, not just industrial giants.” •



Evaled™

Industrial wastewater treatment evaporators

Years of experience

Over 40 years

Patent date

EVALED PC series - pending patent Italy 2019

EVALED AC R series - under filing patent March/April 2022

Worldwide references

Over 3,300

Applications

Industrial wastewater treatment

Reuse

Markets

Pharmaceutical

Cosmetics

Automotive

Landfill

Photovoltaic and microelectronics

Food and beverage

Chemical

Mining and primary metals

Power

Size/footprint

From 0.60 to 22 square meters

Daily capacity

From 0.1 to 120 tons per day of distillate produced

Benefits

Wastewater disposal volume and cost reduction

Low energy consumption

Remote control and monitoring

Environmental benefits

Water reuse

Zero liquid discharge (ZLD)

Low CO₂ footprint



Micropollutants, the hidden toxic residues requiring treatment

Currently, the most common practice for removing micropollutants from water is activated carbon adsorption. However, this removes up to only 30 percent of micropollutants. Now there's a post-treatment biological removal solution that can safely remove 50 to 80 percent of difficult-to-degrade pharmaceuticals from wastewater.

Every time we use water it goes back into the environment less purified than it was and often contaminated with micropollutants.

Defined as man-made biological or chemical contaminants, micropollutants make their way into ground and surface waters at trace level quantities — equal to or below the microgram per liter. These can include everything from pesticides, pharmaceuticals and industrial chemicals that are continuously released into our wastewater systems from our homes, workplaces and industries.

Treating micropollutants is highly complex and conventional technologies cannot completely isolate them. In fact, during wastewater treatment at both municipal and industrial sewage plants, some micropollutants end up in aquatic environments because they haven't been eliminated. When this happens and micropollutants are discharged into the environment, they can cause acute and chronic toxic effects even at very low

concentrations. Even so, these residues are poorly assessed and regulated on a global scale, in part, due to their complex chemical formula and the previously mentioned limitations of conventional wastewater treatment plants (WWTPs).

Action to prevent the release of micropollutants is needed both up and downstream and innovation can — and will — help improve the capabilities of conventional WWTPs.

One such innovation is eXeno™, an effective, economic and environmentally friendly solution. It is based on AnoxKaldnes® MBBR (moving bed biofilm reactor) technology and relies on microorganisms growing as biofilm on plastic carriers.

By using multiple reactors in series, the MBBR technology can select specific microorganisms specialized in removing difficult biodegradable compounds like pharmaceuticals. This multiple reactor concept is broadly applied by

AnoxKaldnes as a way to remove multiple and complex compounds from wastewater such as is found in the pharma industry.

One **industrial example** is JSC Grindeks (branded as Grindex), an internationally operating Latvian pharmaceutical company, headquartered in Riga. They required a five-stage eXeno MBBR process for the degradation of difficult-to-degrade organic compounds from their drug production. The focus was on the removal of phenols and high concentrations of organically bound nitrogen compounds with a capacity of 500 cubic meters per day.

A **municipal example** is Warburg WWTP (Stadtwerke Warburg GmbH Warburg), which is situated in North Rhine-Westphalia, central Germany on the river Diemel. It receives municipal and industrial wastewater and so, to reduce the discharge of micropollutants, Warburg upgraded its WWTP treatment process with a new and advanced treatment technology, consisting of ozonation. However, ozonation only partially oxidizes micropollutants and, as a result, transformation products (TPs) with unknown properties can be formed. In order to minimize the risk of releasing unknown and potentially toxic TPs into surface water, we installed eXeno post-ozonation. The implementation of eXeno resulted in the elimination of 95 percent of the TPs created through ozonation.

Additionally, following the success of this advanced treatment at Warburg, a second German plant was built in Rheda-Wiedenbrück with the same process scheme.

It is clear that there is an increasing concern regarding the impact of micropollutants in our wastewater and a growing call to action for those responsible to ensure wastewater discharge standards are maintained. As global understanding evolves it is vital new innovations are used to tackle new pollutants, not only to protect the environment but also to protect human health. ●



eXeno™

eXeno is based on MBBR (moving bed biofilm reactor) and is used for the biological removal of drugs and other complex compound residuals in wastewater.

Years of experience

More than 30 years

Worldwide references

More than 30

Applications

Wastewater

Tertiary

Markets

Municipal

Industrial

Healthcare

Pharmaceutical

General industry

Benefits

High removal (50-80%) of difficult degradable pharmaceuticals

Biological treatment

Compact

Environmental benefits

Chemical reduction

Biological removal of toxic compounds

Avoids the release of by-products

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Resourcing the world