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De.mem helps establish new initiative that aims to promote research and collaboration in the membrane industry

Water and wastewater treatment company De.mem is participating in an initiative by the Singapore government that aims to promote the research, collaboration and commercialisation of innovative membrane products and technologies. It also stands to greatly benefit the company.

The Singapore government's National Research Foundation (NRF) recently announced a new strategic initiative called the Singapore National Membrane Consortium (SG-MEM). To achieve its objectives the SG-MEM will connect expertise in Singaporean research institutes with companies that can use cutting-edge research in membrane technology to meet industry needs.

Under the SG-MEM, research centres, such as the Singapore Membrane Technology Centre at Nanyang Technological University (NTU) and Membrane Science and Technology Consortium (MSTC) at the National University of Singapore (NUS), will be connected to small and medium enterprises (SMEs) such as De.mem.

De.mem says that it is ideally placed to benefit from the SG-MEM as it is one of the 15 founding members. Amongst those, De.mem is one of very few companies that has the capability to manufacture membranes in-house.

It also has a successful track record in technology transfer for low-pressure hollow-fibre nanofiltration (NF) membrane technology, which the company exclusively licensed from NTU in 2016 (see the feature article entitled 'Energy-saving filter for wastewater treatment combines UF and RO', *Membrane Technology* December 2016, page 7).

Compared with other, conventional, water treatment technologies this membrane reduces operating costs and capital expenditure, says the firm.

De.mem completed the set-up of a new factory for the production of this membrane, as well as other types of hollow fiber membranes, in July 2017 (see *Membrane Technology* September 2017, page 5).

The company intends to expand its proprietary technology portfolio around further innovative membrane technologies in the coming months.

Andreas Kroell, CEO, De.mem, commented: 'The new SG-MEM initiative provides an excellent platform for us to further benefit from the outstanding capabilities of the Singapore research institutions, such as the SMTC/NTU, which we have partnered with in the past.'

'The platform will help us to further expand our product portfolio and accelerate product development and commercialisation efforts. Based on our existing manufacturing facility for membranes and our position in the market with strong customer relationships and growing revenues, these research institutions also stand to benefit from their partnership with De.mem.'

Kroell concluded: 'I believe De.mem can provide an excellent opportunity for researchers to commercialise their inventions.'

George Loh, NRF Director (Programmes), added: 'Singapore has built up a strong reputation as a leader in membrane technologies for water treatment. However, larger water companies are more likely to benefit from advancements in membrane technology due to heavy outlay in research and innovation activities.'

'The new membrane consortium will provide smaller companies, such as our SMEs, with access to membrane technologies for diverse application beyond water – to include the food and beverages, fragrance and med-tech sectors. This will help our SMEs build stronger capabilities to adopt the latest innovation for new growth opportunities.'

For more information, visit: http://dememebranes.com, www.ntu.edu.sg/SMTC, www.eng.nus.edu.sg/mstc/index.html & www.nrf.gov.sg

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Containerised desalination system is powered by renewable energy

Germany's Membran-Filtrations-Technik GmbH (MFT), an Aquarion Group company, has introduced a containerised desalination system, which is powered by renewable energy, for producing drinking water from either sea water or brackish water.

The MFT RO 100 desalination system is powered by only wind and solar energy, which is stored in lithium-ion batteries. Capable of producing up to 120 litres of drinking water per hour, the system is ideal for low-power decentralised applications in remote locations where the energy supply is scarce. The energy sources are a 7.5-KWp (kilowatts peak) photovoltaic (PV) system and 350-W wind turbine.

The unit incorporates a remote-control system, which enables MFT to monitor its performance in real time from its headquarters in Cologne. This system records the weather conditions, how much electricity is being provided by wind and solar sources, how much water is being produced, and at what quality. If the quality of the drinking water falls below a certain limit the system switches off automatically.

Each system is pretested and preconfigured and is delivered as a "plug and play" unit for simple installation.

The first plant was shipped to a school in La Guajira, Colombia. This was a first step to operate a large number of decentralised stand-alone and CO_2-free drinking water systems via a centralised cloud-based platform, powered exclusively by renewable energy.

The MFT RO 100 can mix and match different raw-water qualities (sweet/salt water) and different water output quantities, says MFT. Power production and power use can be freely adjusted for different purposes.

Typical applications for these small desalination systems include the production of potable water in individual homes, restaurants, small businesses, tourist resorts, remote camp sites, labour camps, smaller villages or communities with sea water or brackish raw water as the feedwater source.

'With this developed drinking water system fully based on renewable energy and cloud-based remote control, we can produce drinking water at the lowest prices,' commented Karl Michael Millauer, CEO, Aquarion Group.

For further information, visit:
http://www.aquarion-group.com/mft-gmbh.html

Handbook discusses salinity gradient processes in desalination

A handbook that reviews current developments in salinity gradient processes in desalination – one of the most promising technologies to improve energy efficiency in desalination – has been produced by two chemical engineering academics at the UK's Swansea University.

Entitled 'Membrane-Based Salinity Gradient Processes for Desalination', it will be published by Elsevier in July 2018.

Professor Nidal Hilal, Director of the Centre for Water Advanced Technologies and Environmental Research (CWATER) at Swansea University and Editor-in-Chief of the international journal *Desalination*, and Dr Sarper Sarp, Lecturer in Chemical Engineering, both from the College of Engineering, Swansea University are the co-editors of the handbook.

The impending crisis posed by water stress and poor sanitation represents one of the greatest human challenges for the 21st century, and membrane technology has emerged as a serious contender to confront the crisis on a global scale.

The book topics span various types of salinity gradient processes for desalination, such as forward osmosis and pressure retarded osmosis, including novel membranes, process developments and case studies. It also highlights full-scale application approaches.

A large part of the publication is dedicated to membrane types, developments and optimisation, including thin-film composite and hollow-fibre membranes.

For further information, visit:
www.swansea.ac.uk/cwater &
https://www.elsevier.com/books/membrane-based-salinity-gradient-processes-for-desalination/sarp/978-0-444-63961-5

Xylem's results reveal strong fourth-quarter and full-year performance

Xylem Inc's latest set of financial results reveals that the firm performed well in 2017.

The global water technology company reported fourth-quarter 2017 net income of $71 million. Excluding the impact of restruc-

turing, realignment, acquisition-related charges and other special items, it delivered adjusted net income of $137 million in the quarter – a 15% increase over the prior year period.

It says fourth-quarter revenue was $1.3 billion – up 17%, including the full quarter contribution from the Sensus business versus the prior year period which included only two months of Sensus' results.

Revenue for the quarter increased 7% percent on a pro forma organic basis, driven by a strong performance in the public utility end-market in nearly every geography and continued growth in industrial, commercial and residential end markets.

For the full year 2017 Xylem generated $4.7 billion in revenue – up 25% on a reported basis and 4% on a pro forma organic basis.

Full-year reported net income was $331 million, with an operating margin of 11.8%. Adjusted net income, which excludes the impact of restructuring, realignment, acquisition-related charges and other special items, was $433 million, an 18% increase compared with the previous year.

'Our teams delivered a strong performance throughout 2017 and I am very pleased with our full-year results,' said Patrick Decker, President and CEO, Xylem.

'Our relentless focus on the customer, and continuing to enhance our execution in the field, translated into improved results in revenue, orders and backlog growth, with the momentum we built in the second half of the year carrying into 2018.'

Xylem also confirmed the completion of its previously announced acquisition (see *Membrane Technology* January 2018, page 1) of Pure Technologies, a company that specialises in smart infrastructure assessment and management.

For further information, visit: www.xylem.com

H_2O Innovation wins five-year O&M contract in western Canada

H_2O Innovation Inc has recently won an operation and maintenance (O&M) contract in the province of Alberta, Canada, totalling C$4.5 million over a period of five years.

The company, which designs and supplies custom-built and integrated water treatment systems based on membrane filtration technology, for municipal, energy and natural resources end-users, says that the services it is performing relate to daily operation, monitoring and maintenance of water and wastewater systems located within the Kananaskis region of the province.

The contract consists of the operation and maintenance of 11 potable water-treatment systems and two wastewater treatment systems with 28 sewage lift stations. One of the plants being operated under this contract is a membrane filtration system that was supplied by the corporation in 2007.

'Over the years H_2O Innovation has installed hundreds of membrane filtration systems in Canada, all of which would be great opportunities to expand our O&M platform in the country. This project in the Kananaskis region should pave the way for future operation and maintenance contracts, said Greg Bishop, Corporate Client Service Manager, Utility Partners, H_2O Innovation's O&M business line.

For further information, visit:
www.h2oinnovation.com & www.utilitypartnersllc.com

LIFT launches Intelligent Water Challenge

The Leaders Innovation Forum for Technology (LIFT) – a joint effort of the Water Research Foundation (WRF) and the Water Environment Federation (WEF) – launched its inaugural Intelligent Water Challenge in February.

WRF is hosting the event to demonstrate the value of intelligent water systems to utilities and thereby foster the adoption of smart water technologies.

The challenge will be supported by American Water Works Association (AWWA), Smart Water Networks Forum and the International Society of Automation's Water and Wastewater Division, and other organisations.

According to WRF, the aim of the challenge is to give students, professionals and technology aficionados the opportunity to showcase their talents and innovation, with a focus on leveraging data using the best available tools to help utilities better understand the dynamics of complex systems for making better decisions.

The challenge, which runs from March to August 2018, will provide general problem statements and example data sets for participants, along with a series of informational webinars to introduce them to the data sets and underlying systems. Possible problem categories are collection systems, wastewater treatment systems, drinking-water treatment systems, and source water or watershed and distribution networks.

Teams with exceptional and innovative technologies and systems will be invited to present their results, in person, at WEFTEC 2018 (29 September to 3 October) in New Orleans,

In Brief

Video highlights use of CapDI technology in horticulture

Voltea has released a video entitled 'CapDI for Horticulture'. According to the company – which delivers electrochemical water-conditioning equipment to institutional, commercial and industrial customers – this video provides details of its Membrane Capacitive Deionization (CapDI©) installation at a horticulture facility in Queretaro, Mexico. This customer's water supply has high salinity, which means that it is not able to grow tomato seedlings. It installed a CapDI system to solve this problem – increasing profitability by enabling it to begin growing seedlings in-house, rather than buying them from a third party.

More information: http://voltea.com

Seafox orders RO water treatment systems for self-elevating jack-up platform

Global offshore jack-up company Seafox, which operates in the oil and gas sector, has placed an order with Hatenboer-Water for two reverse osmosis (RO) systems. The standard RO water makers will desalinate sea-water into potable water on the Seafox 7 platform, which is used for accommodation, construction, maintenance and well services. The robust standard RO system, named Oceanus, can produce up to 30 m^3 (7925 gallons) of fresh drinking water per day.

De Nora Water Technologies bolsters sales team in Americas

De Nora Water Technologies, which develops sustainable water disinfection and filtration technologies, reports that it has expanded its sales force in the Americas with the addition of seven new positions over the past year. The strengthened team drives water filtration and disinfection technology sales for drinking water, industrial wastewater treatment, municipal water treatment, and ballast water and marine wastewater treatment in Canada, USA, Mexico and South America. The firm says that the new members of the team bring additional experience and a deep understanding of De Nora's key target markets, including power, pulp and paper, steel, food and beverage, and petrochemicals.

Pentair reports fourth-quarter and full-year results for 2017

Pentair Plc has announced fourth-quarter 2017 sales of $1.3 billion. Sales were up 6% compared with the figure posted for the equivalent period a year earlier. Excluding currency translation and acquisitions, core sales grew 3% for fourth quarter. Full year 2017 sales totalled $4.9 billion.

USA, for final judging. The winning teams in each category will receive cash and other prizes.

For further information, visit: www.werf.org/lift

Award acknowledges Fluence's excellence in innovation and growth

Fluence Corp Ltd has been awarded the 2018 Global Decentralized Water & Wastewater Treatment Company of the Year Award by consulting and research company Frost & Sullivan as part of its Best Practices Awards.

Fluence's easy-to-use, sustainable, smart and cost-effective technology and systems, as well as a remarkable year of growth, innovation and leadership, are the key factors behind the company winning this award, says Frost & Sullivan.

The US-based provider of water and wastewater treatment systems achieved significant growth in key markets in 2017, including Latin America's food and beverage industry and China's rural wastewater treatment market (also see *Membrane Technology* January 2018, page 6).

The research report issued by the consulting and research company to confer the award, noted: 'As a new company, Fluence's greatest quality is its diversification. It has several locations and products, and it serves a range of industries, from oil and gas and power to food and beverage.'

Henry Charrabé, Managing Director and CEO, Fluence, commented: 'It is an honour to be acknowledged for our early efforts in achieving what we set out to do and it is only the beginning.'

'This award is testimony to the hard-working members of the Fluence team around the world and we will continue to build on these strengths to provide our partners and customers the best value, most innovative and reliable solutions in the decentralised market.'

For further information, visit: www.fluencecorp.com & ww2.frost.com

SPX Flow contracted to establish dairy ingredients plant in Spain

US-based SPX Flow Inc, which engineers, designs, manufactures, and markets products used to process, blend, filter, dry, meter and transport fluids, is currently involved in a project that will see it establishing a dairy ingredients plant in Galicia, Spain.

According to the company, the contract, worth $60 million, calls for it to design and provide a completely integrated system that maximises return on skimmed milk by manufacturing high-value dry dairy components. It is anticipated that the plant will begin operating in early 2020.

The greenfield project will have the capacity to process milk using membrane systems for milk fractionation and drying technology to produce milk protein powders for infant formula, sports and clinical nutritional products.

The completed facility will feature an array of the firm's fluid-handling components and process technologies, including valves, pumps, heat exchangers, homogenisers, separators and mixers.

'We continue to leverage our global dairy processing expertise to expand our presence and install base in Europe,' said Dwight Gibson, President, SPX Flow Food and Beverage.

'We look forward to working closely with the customer to establish a state-of-the-art milk powder plant, to help it grow its global export business.'

For further information, visit: www.spxflow.com

De.mem sees a positive year ahead following a strong 2017

Singaporean–Australian decentralised water and wastewater treatment company De.mem Ltd ended 2017 in a strong position by winning additional contracts in Australia and is anticipating another successful year in 2018.

The contracts, worth approximately $A800 000, were awarded to the company's wholly owned subsidiary Akwa-Worx Pty Ltd, based in Caboolture, Queensland. De.mem officially expanded into Australia after acquiring Akwa-Worx in September 2017.

'We have been very pleased to see the momentum in our projects business,' commented Andreas Kroell, CEO, De.mem.

Amongst the customers for the most recent contracts awarded to De.mem is Ausco Modular Pty Ltd, one of Australia's largest construction companies using modular technology. The scope of work for this project includes the delivery of equipment, primarily storage tanks that are containerised and mobile systems for potable water or sewage.

Kroell believes that this momentum will carry over into 2018.

'He said: 'The outlook for 2018 is good. Along with these consistent wins we are continuing to develop the technology side of our business, which includes our innovative nano-filter membranes.'

De.mem says that it is hoping that the contracts it has recently won in Australia's mining and construction industries will help it to pursue similar opportunities that it is exploring in China.

Kroell continued: 'We signed an agreement with Virtual Curtain China Ltd (VCCL) in November. It enables De.mem to jointly pursue imminent market opportunities in the Chinese nuclear, mining and minerals, and coal-to-chemical sectors. Our recent work in Queensland and technology portfolio is complementary to opportunities in China.'

With an estimated market size of A$20 billion, China is the world's largest producer of wastewater, generating approximately 68 billion tonnes a year. In 2015, the Chinese government implemented the "Water Ten Plan" – a series of measures that focus on controlling pollution, promoting water treatment science and technology, enforcing laws and regulations, and improving overall water quality.

'De.mem is currently exploring ways of commercialising its nano-filter membrane for use in China,' said Kroell.

'We see plenty of opportunities for our company at the moment, but China is something we will continue to work on this year. There is clearly a huge potential market there for us.'

Since June 2016 De.mem has held an exclusive worldwide licence from Nanyang Technological University (NTU) for the use of its breakthrough nano-filter membrane technology. The low-pressure hollow-fibre nanofiltration membrane can reduce energy consumption by up to 80%, compared with conventional water treatment processes, making it more efficient and cost-effective, says the firm. It also set up a new factory specifically for the production of the nano-filter membrane and membrane modules in July 2017. Both NTU and the factory are located in Singapore.

In October, the company started the first pilot-scale water treatment plants, in which the new membrane is used, in Singapore and Vietnam.

'We were pleased to set up membrane production so soon after listing on the Australian Securities Exchange (ASX),' said Kroell. 'Along with our expansion into Australia, it was one of our major milestones for 2017. It was an excellent year for the company and we are looking forward to what 2018 will bring.'

For further information, visit: http://demembranes.com & http://akwaworx.com

IDA becomes a FAO WASAG partner

The International Desalination Association (IDA) has become a partner of the Food and Agriculture Organization of the United Nations (FAO) and its WASAG – The Global Framework on Water Scarcity in Agriculture – initiative.

'For many years IDA has been an NGO of the United Nations. Our partnership with FAO deepens our relationship and extends our reach into programmes that can ultimately make a great difference in the future of the world. It also is another step forward in establishing relationships with leading organisations around the world that, like IDA, are concerned with solving water scarcity problems,' said Shannon McCarthy, IDA Secretary General.

FAO is a specialised agency of the United Nations that leads international efforts to defeat hunger. The WASAG Framework – launched by FAO and partners at the climate meeting in Marrakech in late 2016 – is designed to bring together key players across the globe and across sectors to tackle the collective challenge of using water better in agriculture to ensure food security for all.

It is an initiative for partners from all fields and backgrounds to collaborate in supporting countries and stakeholders in their commitments and plans related to the 2030 Sustainable Development Agenda, the Paris Climate Agreement (including implementing nationally determined contributions) and other plans and programmes related to agriculture and water.

Agriculture is the world's largest user of water. According to FAO, water use expanded at over double the rate of population growth in the 20th century. By 2050, the world's population is predicted to grow further by 2 billion to 9.3 billion. Combined with changing diets, says FAO, this means that the world will need to produce almost 50% more food to meet demand. This will place greater stress on available water resources, which are expected to be further impacted by climate change.

IDA sees desalination and water reuse as key tools to address this problem.

'Desalination provides the only sustainable new source of fresh water for the world's growing population. It is now practiced in 150 countries, and we estimate that more than 300 million people around the world rely on desalinated water for some or all their daily needs. With water reuse programmes, precious water resources can be recycled for drinking water, agriculture or industrial purposes, thus augmenting water supplies from other sources and conserving water resources,' said McCarthy.

With over 194 member states now part of the United Nations, FAO works in more than 130 countries worldwide. Including IDA's participation, FAO has established partnerships with 48 organisations worldwide.

For further information, visit: www.idadesal.org & www.fao.org/land-water/overview/wasag/en

CustoMem secures €1.4 million EU grant to accelerate commercialisation

CustoMem has received a grant from the European Union's Horizon 2020 programme of €1.4 million (£1.24 million) that will accelerate its pilot phase and enable the UK company to bring to market its next generation granular media.

CustoMem, which was founded in 2015 by Imperial College London graduates Henrik Hagemann and Gabi Santosa, has combined its expertise in biomaterials and synthetic biology to create CGM (CustoMem Granular Media). This novel bio-adsorbent can selectively capture micropollutants, like Perfluorinated Compounds (PFCs) from wastewater in standard steel tank processing equipment that provides significant cost savings to customers, compared with traditional adsorbent materials like anion-exchange media and granular activated carbon.

The award to CustoMem is funded through the Horizon 2020 SME Instrument, part of the European Innovation Council, supporting innovators and entrepreneurs. Horizon 2020 offers funding and additional support for breakthrough ideas with the potential to create new markets or revolutionise existing ones.

'This is a game-changing grant for us,' said CustoMem CEO Henrik Hagemann.

'Our products' superior performance and cost-effectiveness have been validated in our laboratory and initial trials with clients. This grant enables us to scale up to industrial pilot trials of greater than 100 m^3/day flow rates.'

CGM is being targeted for use at commercial airports and petrochemical plants. CustoMem says that it is particularly relevant to navy and air force bases where Aqueous Film Forming Foams (AFFFs) for firefighting are indispensable for safety reasons.

'We are already undertaking initial testing with a number of companies and organisations, including two commercial European airports,' said Hagemann.

'Following this EC grant we are now ready to upscale and are actively welcoming partners to trial our solution on-site.'

CustoMem is based at the Imperial College Innovation Hub in London. As part of its plans for accelerated commercialisation, the company receives mentorship from a number of specialists in its field, including Dr Rita Glenne, former chief technology officer, Reactive Metal Particles AS; Dr Steve Gluck, former technology Fellow at Dow Water and Process Solutions and current scientific advisor to a number of water and wastewater companies; Dr Steve Colley, former director of Johnson Matthey Water Technologies; and Dr Tali Harif, Innovation portfolio manager at Severn Trent Water and previously head of the water treatment business unit at water and environmental consultants WRC.

For further information, visit: www.customem.com & http://ec.europa.eu/programmes/horizon2020/en/h2020-section/sme-instrument

Manual aids design of water resource recovery facilities

The latest edition of 'Design of Water Resource Recovery Facilities', manual of practice No. 8 (MOP 8) is now available from the Water Environment Federation (WEF).

As the water sector's premier manual of practice for water resource recovery facility design, the sixth edition features a convenient single-volume format that makes it easier than ever to reference the latest guidance on procedures to effectively design or upgrade a recovery facility, says WEF.

Published by WEFPress, a joint publishing venture between WEF and McGraw Hill, this latest edition features contributions from more than 175 wastewater engineering experts and presents the state-of-the-art resource in facility planning, configuration and design.

This enhanced resource reflects the transition from wastewater treatment to water resource recovery and the importance of environmental issues and energy generation. New and expanded topics include the use and application of modelling wastewater treatment processes, advances in biological treatment, and advances in biosolids handling, including effective thermal hydrolysis.

For further information, visit: www.wef.org/MOP8

Osmoflo's technology helps mitigate water shortage in Cape Town

Edited by Simon Atkinson

Containerised water treatment plants from global desalination company Osmoflo are helping to mitigate the shortage of potable water in Cape Town, South Africa, as this brief article reveals.

South Africa's Quality Filtration Systems (QFS) and Australia-headquartered Osmoflo, which designs, constructs and operates water treatment plants, have secured a contract to provide an emergency desalination plant for the Victoria & Alfred (V&A) Waterfront in Cape Town. Serving the waterfront project, the plant will address the increasing water demands of the city and the immediate surrounding region.

The V&A Waterfront is located in the heart of Cape Town and is divided into various districts that attract more than 23 million visitors each year. Situated in South Africa's oldest working harbour, the area has been developed for mixed-use – with both residential and commercial real estate. The water treatment project was instigated by the city of Cape Town with the requirement to mitigate the shortage of potable water caused by one of the region's worst droughts on record.

SWRO and multimedia filtration

The project involves the supply, installation and commissioning of a containerised sea-water reverse osmosis (SWRO) and multimedia filtration plant, rated at 2 million litres (528 344 gallons) per day.

Loading an emergency desalination plant onto a ship for its journey to Cape Town ***(photograph courtesy of Osmoflo).***

This is being delivered under a rental contract for a minimum duration of 24 months. With a tight completion schedule of eight weeks, the plant is scheduled to be operational by March 2018, with Osmoflo also providing operations and maintenance support.

'The Waterfront project is a prime example of fast deployment of equipment to produce potable water…'

The containerised plants, measuring 2 × 12 m (7 × 40 ft) were shipped from Osmoflo's Dubai hub, and with a 30-day transit time they travelled a distance of approximately 10 000 km (6214 miles) to Cape Town.

The two companies have been following the city's need to augment severely restricted potable water supplies. According to Osmoflo, this engagement by QFS showcases its ability to deliver water treatment systems anywhere in the world to the right local partners.

Dire situation

Emmanuel Gayan, CEO and Managing Director, Osmoflo Group, commented: 'We have been aware of the dire situation facing some municipalities in South Africa and we have the equipment available to provide immediate potable water assistance. We are proud that through this engagement we are able to be one part of the solution for this region.'

Herman Smit, Managing Director, QFS, added: 'As a water treatment company with membrane-based technology, QFS is proud to be part of the solution and to show Cape Town the potential of membrane treatment being used for desalination.'

'The Waterfront project is a prime example of fast deployment of equipment to produce potable water in less than 10 weeks. QFS's collaboration with Osmoflo is a perfect match between technology supply and local implementation.'

For further information, visit: www.osmoflo.com & www.qualityfilters.co.za

(This news focus is based on press material issued by Osmoflo.)

Fast-track water treatment project

Osmoflo recently delivered a containerised water-treatment system for a project in South Australia for APR Energy.

APR Energy, which provides fast-track, mobile, power-generating systems, was awarded a contract by SA Power Networks to deliver 276-MW of back-up power to protect South Australia from power blackouts. The project also provides key environmental advantages for South Australia with emissions-friendly power-generating capacity.

Osmoflo provided two containerised ultra-high purity water plants, rated at 600 m^3 (158 503 gallons) per day. The systems comprise brackish water reverse osmosis desalination and polishing plants, which are being used to produce high-quality water required in the operation of power generators. Delivery of the water treatment project was required in just five weeks from placement of the order – with completion and installation achieved in early October 2017.

For further information, visit: www.osmoflo.com & www.aprenergy.com

NIROBOX deployment continues to gain momentum worldwide

Edited by Simon Atkinson

Building on recent successes, Fluence Corp Ltd's smart packaged NIROBOX desalination system is now helping a company on an island located off the east coast of Africa to provide a quick and environment-friendly way of addressing water scarcity. In other news, the US-based provider of water and wastewater treatment systems reports that the global reach of this desalination technology continues to expand.

Towards the end of 2017 Fluence announced that it had been awarded a contract worth €1.5 million by France's VINCI Construction Grands Projets to supply three NIROBOX™ smart packaged sea-water desalination units for the island of Mayotte – situated between Madagascar and the coast of Mozambique. This success follows the company's recent award of a NIROBOX desalination plant in South Africa, with a capacity of 10 000 m^3 (about 2 642 000 gallons) per day.

Henry Charrabé, Managing Director and CEO, Fluence, said: 'The global decentralised water purification market value will increase from US$2.7 billion in 2016 to US$4.4 billion in 2021. We have designed our NIROBOX smart packaged solution to capture a large part of this market.'

'Due to its many design advantages that result in significant energy and cost savings for the client and the very short delivery time, VINCI Construction Grands Projets selected the smart packaged NIROBOX SW reverse osmosis desalination solution for this project. This not only aligns with Fluence's ongoing mission to assist its clients in maximising their water resources, but NIROBOX's modular flexibility will enable Mayotte to expand and adapt the plant as its needs change.'

Water restrictions

The island of Mayotte, situated in the Indian Ocean, is an "overseas department" of France. It consists of a main island, Grande-Terre, a smaller island, Petite-Terre and several islets. Treated water from the NIROBOX will serve the entire Petite-Terre island population.

Mayotte was forced to impose water restrictions because of the late arrival of seasonal rains. The island's resources were already under pressure from a rising local population, which saw water consumption jump by 9.7% in 2016. The drought has exacerbated Mayotte's water scarcity, and a way of immediately producing high-quality potable water was needed.

NIROBOX systems

Three NIROBOX sea-water reverse osmosis (SWRO) systems, with a total capacity of 3000 m^3 (792 516 gallons) per day, have been supplied to VINCI, which is building the plant, including the intake and brine discharge line. The facility will be operated locally by the water utility Société Mahoraise des Eaux.

The NIROBOX SW (sea water) desalination system is a modular, pre-assembled, smart, packaged containerised system that is ideal for rapid deployment, and requires only a small land footprint area with minimal infrastructure. According to Fluence, the system delivers the market's lowest energy consumption and chemical usage through the use of a patent-pending process design that minimises its impact on the environment.

It comes ready for integration with other systems and equipment, which makes it easy to deploy, install and commission. Its modular design allows for staged expansion to support capacity upgrades and contributes to its fast-to-deploy set-up – the shortest in the desalination industry, claims the firm.

Global reach

Fluence reports that it is continuing to expand globally – entering the Philippines, and growing further in Argentina with agreements to provide its NIROBOX system. It says that the decentralised treatment system continues to provide fast, effective options for the production of potable water around the world.

Commenting on the continued expansion of NIROBOX technology, Charrabé said: 'Our entry into the Philippines, with commissioning undertaken one week after order receipt, and further growth in Argentina, clearly show the increasing global reach of the NIROBOX family of water treatment solutions, as well as the versatility of treatment options available from Fluence.'

In the Philippines, Fluence has supplied a NIROBOX SW unit for use in a new resort facility, to produce 1000 m^3 (264 172 gallons) of desalinated, potable water a day for consumption. The unit was installed and operating within one week of the firm receiving the order. This provided the resort with an immediate, independent and reliable source of drinking water. In addition, the highly compact SWRO pre-packaged system, included energy recovery features, saving the resort physical space and reducing its energy consumption.

In Argentina, the company will provide its first two NIROBOX BW (brackish water) units in South America to the Municipality of Berazategui, in Buenos Aires.

These units will be installed in the industrial zone surrounding the city and will each produce 1500 m^3 (396 258 gallons) of potable drinking water a day – to be supplied to two areas where residents currently only have access to highly polluted well water. The custom-designed units, which include RO and ultraviolet filtration technology, are expected to be built, delivered and commissioned in under five months.

For further information, visit:
www.fluencecorp.com/nirobox

(This news focus is based on press material issued by Fluence Corp Ltd.)

inge showcases major projects worldwide that rely on its ultrafiltration technology

Edited by Simon Atkinson

Here, inge GmbH, the German ultrafiltration technology company that is part of BASF SE, provides multiple examples of large-scale projects around the world that rely on its membrane technology. The summaries of the reference projects that are presented in this article are just a selection of the company's recent achievements.

There is growing awareness of the importance of drinking water treatment and eco-friendly methods of wastewater reuse and recycling – not just in arid regions, but worldwide. Against this backdrop, ultrafiltration (UF) has taken on an increasingly important role over the past 15–20 years in a broad range of water treatment applications.

As treatment plants increase in size so too do the challenges involved in building and running them. As a result, the quality and reliability of their components have become key factors, and comprehensive technical support from component suppliers has become crucial to the success of plant engineering projects. inge® has achieved huge success in recent years by identifying and fulfilling those needs.

inge GmbH supplied 10 ultrafiltration lines as a pretreatment stage for reverse osmosis for this sea-water desalination plant located in the Nungua Township near the Ghanaian capital Accra *(photograph courtesy of inge GmbH).*

Accra, Ghana

Huge quantities of drinking water are required for the metropolitan area of the Ghanaian capital Accra. To meet these needs, a cutting-edge sea-water desalination plant was officially opened about two years ago in Nungua Township, some 12 km (7.5 miles) from the city.

The plant uses reverse osmosis (RO) to produce 60 000 m^3 (15.8 million gallons) of drinking water a day for around 500 000 people.

Following a rigorous selection process, the plant contractor chose inge to equip the plant with 10 UF lines as a pretreatment stage for RO. In addition to specifying UF technology, consulting expertise and engineering services at the planning stage, the client also expressly requested an expanded package of services for this project.

inge says that in response it offered not only its high-performance UF racks with patented Multibore® membrane fibres, but also the central header pipes, valve units, local instrumentation and assembly of the UF lines. This full package bid proved to be enough to secure the contract.

Despite the fact that the quality of the feed-water turned out to be significantly lower than the figures stated in the tender, the UF system has been successfully supplying 135 000 m^3 (35.7 million gallons) of pre-filtered water a day to the RO stage ever since, helping to turn sea water into clean drinking water for the local population.

Putatan, Philippines

The private water company Maynilad operates in the western part of the Manila metropolitan area in the Philippines – supplying drinking water to over 9 million people. It runs a total of three water treatment plants, one of which – situated in the Putatan barangay in the city of Muntinlupa – uses inge UF technology.

The water is drawn from the Laguna Lake, which lies to the south-east of Manila and borders Muntinlupa. The lake water undergoes a rigorous filtration process before being used to supply 490 000 people with a total of 150 million litres (39.6 million gallons) of clean drinking water a day, 50 million litres (13 million gallons) a day of which is filtered by inge UF technology.

However, purifying the water poses some significant challenges, says the company. In addition to seasonal variations in water quality, the lake also becomes soiled by industries that include a nearby slaughterhouse and extensive fish farming, next to where the water is extracted.

Despite the quality of the lake water, which is often extremely poor, the UF modules have been running without a hitch for the past two years, delivering consistently clean water that meets the required quality standards.

According to inge, it was not just the high yields and consistent quality of the purified water that prompted the operator to choose this system. Both the plant constructor and the end customer were reassured by the firm's experience and expertise in treating surface water and by the flexible operation of its innovative T-Rack® 3.0 concept. They were also impressed by the comprehensive technical support inge provided throughout the installation and commissioning stages.

The whole package was rounded off with extensive training for treatment plant employees by the German company's team. This ultimately led to highly satisfied customers and an important reference project for South East Asia.

The follow-on project, which is scheduled to be completed in 2018, also uses inge modules.

Jamnagar, India

inge also played a vital role in a major project in the Indian city of Jamnagar, which involved the largest sea-water desalination plant that the company had ever equipped with its membrane technology.

inge GmbH played a vital role in a major project in the Indian city of Jamnagar. It supplied the ultrafiltration modules used in the pretreatment stage for reverse osmosis in the sea-water desalination process used at a refinery complex. Over 4000 T-Rack® 30 modules went online in April 2017 ***(photograph courtesy of inge GmbH).***

Built by the contractor IDE Technologies, the plant supplies process water to one of the world's largest refinery complexes, which is based in Jamnagar, in the Indian state of Gujarat.

inge supplied the UF modules used in the pretreatment stage for RO in the sea-water desalination process. Over 4000 T-Rack 3.0 modules went online in April 2017. Since then, they have been supplying 456 million litres (120 million gallons) of pre-cleaned water a day to the RO units.

The UF pretreatment stage significantly improves the quality of the sea water that is treated using conventional pre-cleaning methods, and the UF modules play a major role in protecting the highly sensitive RO membranes.

inge initially installed a pilot system on-site to prove that its modules could comfortably fulfil the customer's demanding standards for the UF system. Even during the monsoon season – when the water was particularly challenging – the UF modules still met the targets for process stability, filtrate quality and yield.

Furthermore, the T-Rack 3.0 concept satisfied all the customer's requirements regarding a compact and space-saving design. During the execution of the project inge provided technical support for the entire UF system in collaboration with the plant contractor.

Jazan, Saudi Arabia

Another key project undertaken by Inge involved a plant in the port city of Jazan in the Kingdom of Saudi Arabia, situated on the coast of the Red Sea.

The UF membrane expert was selected by the petroleum company Saudi Aramco to provide UF modules as a pretreatment stage for a sea-water desalination plant. The firm's modules are designed to deliver 105 000 m^3 (27.8 million gallons) of filtered water a day to the RO stage.

Saudi Aramco insisted on a top-quality UF system and laid down a series of rigorous requirements for the technical equipment and documentation, says inge. All the suppliers involved in the project were subject to the most demanding standards. This policy included the UF lines, which had to comply with strict earthquake-resistant design specifications.

The plant contractor was familiar with, and enthusiastic about, inge products and technical support based on its experience with previous projects in Saudi Arabia. Together, the contractor and the inge team managed to fulfil all the customer's stipulations and win the contract.

A further sea-water desalination plant has already been commissioned in Jazan. Once again it deploys inge UF technology as a pretreatment stage for RO. The new plant will be used to convert sea water into drinking water for Jazan Economic City – a recently established city located 60 km (37 miles) north-east of Jazan. This planned city, which will eventually be home to 500 000 people, will be based around the manufacturing industry and the energy sector.

The UF system will have an output of 168 million litres (44.4 million gallons) per day. The drinking water treatment plant is expected to be up and running by the end of 2018.

TUAS III – Singapore

A project that offers another striking example of the application of inge's technology in South East Asia is the TUAS III sea-water desalination plant in Singapore.

The island city-state has no fresh water reserves of its own and is therefore entirely reliant on alternative sources of drinking water. As well as rainwater collection, these sources include cleaned and recycled water, imported water and sea-water desalination.

This latter option already makes up one quarter of Singapore's water supplies and is steadily gaining in importance. Since 2005 the country has had the technology in place to secure enough water for its more than 5.5 million citizens, and by 2060 it hopes to cover 30% of its water requirements using sea-water desalination, says inge.

The company supplied a UF system to pretreat 289 000 m^3 (76.6 million gallons) of pre-filtered water a day for the subsequent RO stage.

This is the first sea-water desalination plant in Singapore to be run directly by the Public Utilities Board (PUB), the national water agency. As well as supplying the UF technology, inge also provides extensive technical support to ensure that all of the customer's requirements are met.

For further information, visit: www.inge.basf.com, www.mayniladwater.com.ph, www.ide-tech.com, www.saudiaramco.com & www.pub.gov.sg

(This news focus is based on press material issued by inge GmbH.)

PATENTS

Water treatment membrane composed of a porous carbon structure

Applicant: **Korea Research Institute of Chemical Technology, Korea**

This invention relates to a water treatment membrane that is composed of a porous carbon structure prepared from an intrinsic porous polymer, and to a method for preparing it. According to the inventors, the membrane described has a porous structure with a high surface area. This is achieved by carbonising a porous polymer film prepared from the intrinsic porous polymer. It also exhibits excellent water permeability and salt rejection, enabling it to be used in a range of applications, including reverse osmosis and nanofiltration, which are parts of a water treatment process.

Patent number: WO/2017/082529

Inventors: K. Lee, B.G. Kim, Y.J. Yoo, Y.S. Kim, J.C. Won and D.-G. Kim

Publication date: 18 May 2017

Polymeric features on the surface of porous membranes

Applicant: **Entegris Inc, USA**

This patent provides details of porous membranes for liquid filtration. In particular, it discusses polymeric features on the surface of the porous membranes, or films of porous membranes, that aim to enhance functionality. One aspect of this disclosure covers a porous membrane that includes the following: at least one polymeric feature on its surface. This feature is "bonded" to the membrane using what is described as a nanoscale injecting-moulding device. Another aspect of this disclosure deals with a porous membrane that has a structure comprising first and second film layers, and at least one polymeric feature which resides between these layers. This feature is bonded to at least the first film layer. Another approach involves making at least one polymeric feature on a porous membrane. In this case, material

from a nanoscale injecting-moulding device is dispensed onto the surface of the membrane. The method further includes bonding this to a material used for the porous membrane via a molecular inter-reaction. One embodiment involves using a pack composed of a pleated porous membrane. The pleats comprise alternating "peaks" and "valleys", with opposing membrane walls interconnecting them. The porous membrane has first and second surfaces, and comprises one or more polymeric features bonded to a portion of at least the first surface of at least one of the opposing membrane walls. The polymeric features separate the opposing walls of the pleat.
Patent number: WO/2017/087461
Inventor: J.P. Puglia
Publication date: 26 May 2017

NF composite membranes including a self-assembled supramolecular separation layer

Applicant: **BASF Se, Germany**
This invention concerns nanofiltration (NF) composite membranes that comprise at least one polymeric porous substrate layer and at least one porous self-assembled supramolecular membrane layer. Also discussed by the associated patent is a method for preparing these membranes, and using them to separate, filter and purify heavy metal cations, inorganic anions and organic small molecules. Filter cartridges and filtration devices based on the composite membranes are also described by the patent.
Patent number: WO/2017/085054
Inventors: W. Wohlleben, K. Seidel, K. Werle and N. Widjojo
Publication date: 26 May 2017

Exposed segmented nanostructure arrays

Applicant: **University of Houston System, USA**
A template-assisted electrochemical synthesis (TAES) technique that is used to produce an exposed segmented nanostructure array (ESNA) forms the subject of this patent. The ESNA provides a conductive substrate, insulating layer and an array of segmented nanostructures. The insulating layer separates the conductive substrate from the exposed portions of the segmented nanostructures, but another portion of the nanostructures may be embedded in the insulating layer. This embedded portion may be in contact with the conductive substrate. The ESNA is produced by electrochemical deposition processes using a multi-layered membrane with a conductive substrate as a template. The multi-layered membrane has layers with pores corresponding to the dimensions of the desired segments of the segmented nanostructure. When a specific shape is desired on the tip of the nanostructure, deposition continues for a predetermined time after the pore is filled. After deposition of the material in the pores of the multi-layered membrane, one or more layers (of the multi-layered membranes) are dissolved to expose a portion of the segmented nanostructures, whilst another portion of the segmented nanostructures remains embedded in the undissolved part of the multi-layer membrane. When capped or core-shell ESNAs are desired, the deposition is separated into multiple steps to achieve the required segmented nanostructure.
Patent number: WO/2017/087770
Inventors: L. Sun and C.M. Ortega
Publication date: 26 May 2017

Permeable membrane based on a polymer and laminate

Applicant: **DIC Corp, Japan**
This invention addresses the problem of creating a gas-selective permeable membrane, which has gas permeability and gas selectivity that enables the separation of a target gas and other gases, is hardly affected by temperature and has excellent handling properties, such as high strength. The associated patent describes a gas-selective permeable membrane that contains a polymer in which molecules are aligned optically in one or more axes by using at least one polymerisable compound; and a laminated structure in which the permeable membrane is laminated on a gas permeable substrate.
Patent number: WO/2017/086203
Inventors: Y. Kuwana, K. Endo, I. Nishiyama, S. Matsuzaki and Y. Kadomoto
Publication date: 26 May 2017

Ultra-thin pinhole-free flexible metal–organic films

Applicant: **Massachusetts Institute of Technology, USA**
This patent describes facile, one-step initiated plasma-enhanced chemical vapour deposition methods that are used for synthesising hyperthin (for example, less than 100 nm) and flexible metal–organic covalent network (MOCN) layers. As an example, the MOCN may be made from zinc tetraphenylporphyrin (ZnTPP) building units. When deposited on a membrane support, the MOCN layers demonstrate gas separation capabilities that exceed the upper bounds for multiple gas pairs, whilst reducing flux compared with the support alone.
Patent number: WO/2017/087782
Inventors: K.K. Gleason, M. Wang, N.D. Boscher and P. Choquet
Publication date: 26 May 2017

Reinforcing a hollow-fibre membrane for water treatment

Applicants: **I.S. Kim**, and **Alpha Co Ltd – Korea**
This invention relates to a heat-treatment device that is applied to the inner surface of a braid for reinforcing a hollow-fibre membrane that is used for water treatment. According to the inventors, this device is configured to densify the texture of the inner surface of the braid – increasing its inner diameter. It is also configured to improve the roundness of the inner and outer diameters, and increase the pressure-resistant strength, thereby enhancing the physical characteristics of the hollow-fibre membrane. In addition, it is configured to improve filtration reliability and water permeability, and extend service life and reduce costs.
Patent number: WO/2017/090788
Inventor: I.S. Kim
Publication date: 1 June 2017

Support for membrane-based filtration device

Applicant: **Merck Patent GmbH, Germany**
This patent provides details of a membrane support that is usable, for example, in a filtration device. A surface is provided on the upstream side of the membrane support. It is adapted to support a flat filtration membrane. A drainage structure is arranged below the support surface to collect fluid that has passed through the filtration membrane, and guide it to the downstream side. The support surface contains a plurality of recesses. These are distributed over the surface and are formed to absorb the expansion of the filtration membrane. The support avoids "fold formation" of the membrane caused by expansion, following hydration.
Patent number: WO/2017/088951
Inventors: S. Olivier and D. Metz
Publication date: 1 June 2017

Tubular filter membrane element and method for producing it

Applicant: **Krallmann Kunstostoffverarbeitung GmbH, Germany**
In order to produce a tubular filter membrane element for microfiltration applications, a plastic section of a small membrane tube is sealed at one axial end and is fitted with

a plastic adapter piece at the opposite end, reveals this patent. The adapter piece is injection-moulded onto the section of the small membrane tube, but is preferably welded to it. The section of the small membrane tube is sealed at one axial end by bringing the end into contact with a "hot stamp".
Patent number: WO/2017/088975
Inventors: K. Aufderheide, W. van Druten and A. Oppers
Publication date: 1 June 2017

Method for preparing an alkaline anion exchange membrane

Applicant: **Hangzhou Dianzi University, China**
Disclosed is a preparation method for an alkaline anion exchange membrane together with details of its use in a fuel cell. The method described includes using polyvinyl alcohol as a base body to provide the mechanical strength of the membrane, and a commercialised alkaline resin as an anion exchange resin of a chemically active group. These two components are mixed to initiate a cross-linking reaction. An inorganic salt of a transition metal and doping transition metal ions are added during the formation of the alkaline anion exchange membrane. Fuel permeating from the cell anode can be quickly catalytically reacted in the ion exchange membrane by using the catalytic characteristic of the transition metal ions, so that the ion conductivity of the membrane is improved, and the electrical resistivity of the fuel cell is effectively reduced. A fuel cell that is based on the anion exchange membrane detailed by this patent exhibits excellent electricity generating performance, claim the inventors.
Patent number: WO/2017/088732
Inventors: H. Qin, C. Zhu, Y. Hu, K. Chen, J. Liu, Z. Kong, H. Wang and Y. He and Z. Ji
Publication date: 1 June 2017

Membrane bioreactor

Applicant: **Kemira Oyj, Finalnd**
According to the abstract of this patent, this invention aims to improve phosphorus precipitation and membrane flux in a membrane bioreactor (MBR). It relates to a composition for the treatment of wastewater using a MBR, comprising a mixture of inorganic coagulants and organic water soluble polymers. The coagulants are selected from compounds containing iron and/or aluminium, whilst the organic water soluble polymers are selected from the group consisting of anionic, cationic, nonionic polymers, polysaccharides and polyphenolic compounds, and various combinations of these.
Patent number: WO/2017/089330
Inventors: M. Hesampour, F. Azarnoush and S. Halttunen
Publication date: 1 June 2017

Nanofibre FO membrane with a tubular shape

Applicant: **Istanbul Teknik Universitesi Rektorlugu, Turkey**
This invention provides a way of obtaining a nanofibre membrane by coating a hollow, braided rope with a nanofibre layer. It also discusses the use of the tubular nanofibre membrane as a support layer membrane, and the fabrication of a forward osmosis (FO) membrane by coating its surface with a thin composite film. The resulting tubular, nanofibre FO membrane can be used in water and wastewater treatment, and desalination processes. The inventors say that it has a high water flux and a low reverse salt flux, as well as a low tendency to fouling.
Patent number: WO/2017/091178
Inventors: I. Koyuncu, S. Guclu, M. Eyvaz, T. Aslan, A. Yuksekdag, E. Yuksel and S. Arslan
Publication date: 1 June 2017

Zwitterionic sulfone polymer blend for hollow-fibre membranes

Applicant: **General Electric Co, USA**
Porous hollow-fibre polymeric membranes are employed in many applications, such as haemodialysis, ultrafiltration, nanofiltration, reverse osmosis, gas separation, microfiltration and pervaporation. For many of these applications, membranes with optimal selectivity and chemical, thermal and mechanical stability are desirable. In many applications (for example, bio-separation or water filtration) it also may be desirable to have membranes with one or more of the following: improved hydrophilic properties, biocompatibility, or low fouling. This patent discusses polymer blends that alleviate certain limitations of previously known methods for the manufacture of hollow-fibre membranes. It says that these blends increase processability of functionalised polymers and also reduce the need for post-casting functionalisation of membranes. The hollow-fibre membranes comprise a blend of a sulfone polymer with zwitterionic functionality and a second sulfone polymer. The blends aim to improve the polymer network structure and enhance mechanical performance. In addition to improving processability – making it easier to manufacture the hollow-fibre membranes – they provide the desired hydrophilic and/or biocompatibility properties. Thus, by blending a low amount of sulfone polymers with zwitterionic sulfone polymers, the processability of zwitterionic sulfone polymers into membranes is improved. Furthermore, the mechanical properties of membranes are significantly improved whilst maintaining membrane morphology and low binding characteristics. Advantageously, the resulting membranes alleviate problems associated with leaching of water soluble polymers, such as PVP, from the matrix, thereby reducing product variability.
Patent number: WO/2017/096140
Inventors: H. Zhou, M.J. Misner, W. Yuan, J.-A. M. Burdick, P.J. McGuirk, J.E. Howson and R.D. Burchesky
Publication date: 8 June 2017

Photo-bioreactor device and a method of using it

Applicant: **Arborea Ltd, UK**
A photo-bioreactor device has been developed that can be used to generate biomass and assist in environmental remediation. It is capable of removing gases, such as carbon dioxide and nitrogen oxides, from the environment, and it also can generate oxygen. The device includes a first and second membrane layer. These are arranged such that at least a portion of the first membrane layer is directly bonded to at least a portion of the second membrane layer in order to form a defined boundary around non-bonded portions of the first and second membrane layers. This structure defines a photo-bioreactor unit that is capable of containing a fluid. At least one of the layers is translucent, and at least a part of the first and second membrane layers is permeable to gases. According to the patent, the permeability coefficient of oxygen through the first and/or second membrane layer is not less than about 100 Barrer (typically not less than about 300 Barrer, but ideally not less than about 500 Barrer). The photo-bioreactor device also includes an inlet and outlet port to enable fluid to circulate through the unit.
Patent number: WO/2017/093744
Inventors: J.P. Melchiorri and T. Dell
Publication date: 8 June 2017

Membrane-based system for the purification of natural gas

Applicant: **Air Liquide Advanced Technologies US Llc, USA**
Natural gas may be purified by removing C_{3+} hydrocarbons and CO_2 using one or more separation units, respectively, to yield conditioned gas that is lower in C_{3+} hydrocarbons

and CO_2 (compared with the unconditioned natural gas). Notably, the feed gas need not be subjected to Joule–Thomson expansion and molecular sieve dehydration performed by conventional processes. Rather, any water-rich reject stream from the separation unit, or units, is dried downstream with a smaller compressor and molecular sieve or gas separation membrane dehydration system before it may be reinjected deep underground or deep under the sea bed. The method for purification of natural gas – including methane, CO_2, water and C_{3+} hydrocarbons – that forms the subject of this patent involves conveying a feed gas, which consists of natural gas, to at least one separation unit. Dry, conditioned natural gas is withdrawn from at least one separation unit, enriched in methane, compared with the feed gas and deficient in C_{3+} hydrocarbons, CO_2 and water, again compared with the feed gas. One or more gaseous reject streams are withdrawn from at least one separation unit, wherein a totality of these reject streams is enriched or deficient in C_{3+} hydrocarbons, water and CO_2, compared with the feed gas and deficient in methane, again compared with the feed gas. One of the gaseous reject streams is compressed so that the water it contains condenses and a biphasic stream (having liquid and gaseous phases) is produced. The gaseous phase is fed to a dehydration apparatus in order to remove at least some of the water it contains and to produce a stream of the dried gaseous phase.
Patent number: WO/2017/096149
Inventors: Y. Ding and S.K. Karode
Publication date: 8 June 2017

Multi-stage forward osmosis process

Applicant: **Korea Institute of Machinery & Materials, Korea**
A desalination apparatus and method based on multi-stage forward osmosis (FO) process has been developed. The desalination apparatus described in one embodiment of this invention comprises first and second FO units. The first unit consists of a first FO membrane; a first feed channel, which is in contact with one side of the FO membrane and through which wastewater is introduced; and a first draw channel, which is in contact with the opposite side of the first FO membrane and into which a first draw solution flows. The second FO unit is composed of a second FO membrane; a second feed channel, which is in contact with one side of the second FO membrane and into which the diluted first draw solution, discharged from the first draw channel, flows; and a second draw channel which is in contact with the opposite side of the second FO membrane and into which the second draw solution flows.
Patent number: WO/2017/095137
Inventors: S.Y. Lee, Y.C. Kim, S.J. Park and H.-S. Kim
Publication date: 8 June 2017

Thin-film composite hollow-fibre membrane

Applicant: **National University of Singapore, Singapore**
Details of a thin-film composite hollow-fibre membrane are given by this patent. It comprises a porous hollow-fibre support layer formed from a suitable polymer, and a selective layer on an outer circumferential surface of the hollow-fibre support layer. This selective layer is formed from a cross-linked polyamide. The thin-film composite hollow-fibre membrane has a salt permeability of 0.028–0.042 $lm^{-2}h^{-1}$ and a collapse pressure of at least 20 bar.
Patent number: WO/2017/099671
Inventors: Z.L. Cheng, X. Li and T.-S. Chung
Publication date: 15 June 2017

Membrane-based system for generating high-purity nitrogen

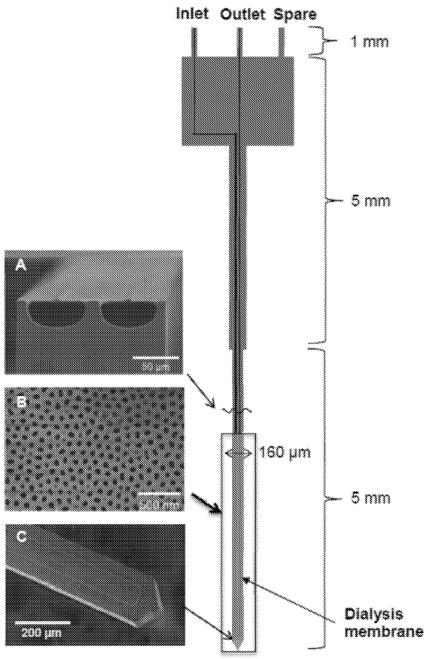
Applicant: **Generon IGS Inc, USA**
In this invention a non-cryogenic system for producing high-purity nitrogen is connected to a coiled-tubing unit. The nitrogen is produced by passing compressed ambient air through two polymeric membrane modules, connected in series. The output of the second module is a stream of high-purity nitrogen, which is conveyed into a coiled tube. The nitrogen can be used to create an inert environment in the interior of the tube, or the coiled tube can be inserted into an oil well, in order to deliver the nitrogen. The use of nitrogen in the coiled tube helps to prevent corrosion.
Patent number: WO/2017/100233
Inventors: J. Font, K. Doucet, M. Straub and J.A. Jensvold
Publication date: 15 June 2017

Method for producing a gas separation membrane with a protective layer

Applicant: **Fujifilm Corp, Japan**
This patent describes a method for producing a gas separation membrane with a protective layer. The inventors say that it has a protective layer and good gas permeability before a rubbing resistance test and good gas permeability after a rubbing resistance test. The method for producing the membrane involves a series of steps. The membrane, which satisfies a specific condition and has a resin layer that contains a compound, which has a siloxane bond, is formed by subjecting a resin layer precursor (with a siloxane bond) to surface-oxidation treatment. In a subsequent step, a protective layer is provided on the resin layer before wind-up.
Patent number: WO/2017/098887
Inventors: Y. Mochizuki, S. Yoneyama and M. Sawada
Publication date: 15 June 2017

Fabrication of a micro-dialysis probe based on a nanoporous membrane

Applicant: **The Regents of the University of Michigan, USA**
Micro-dialysis sampling is an essential tool for *in vivo* neurochemical monitoring. Conventional dialysis probes are over 220 µm in diameter and have limited flexibility in design because they are made by assembling preformed membranes. The probe size constrains spatial resolution and governs the amount of tissue damaged caused by probe insertion. To overcome these limitations the inventors cited in this patent say that they have developed a method to micro-fabricate probes in silicon that are 45 µm thick and 180 µm wide. These probes contain a buried, U-shaped channel that is 30 µm deep and 60 µm wide and terminates in ports for external connection. A 4-mm length of the probe is covered with a 5 µm thick nanoporous membrane. The membrane was micro-fabricated by deep-reactive ion etching through a porous aluminium oxide layer. The probe has a cross-sectional area which is 79% less than that of the smallest conventional micro-dialysis probe. The probes yield 2–7% relative recovery at 100 nL/min perfusion rate for a variety of small molecules. The probe was successfully tested *in vivo* by sampling from the striatum of live rats. Fractions were collected at 20 min intervals (2 µl) before and after an injection of 5 mg/kg, IP amphetamine. Analysis of fractions by liquid chromatography mass spectrometry revealed reliable detection of 13 neurochemicals, including dopamine and acetylcholine, at basal conditions. Amphetamine evoked a 43-fold rise in dopamine, a result nearly identical to using a conventional dialysis probe in the same animal. The micro-fabricated probes have the potential for sampling with higher spatial resolution and less tissue disruption than conventional probes, say the



The basic layout of a sample micro-fabricated micro-dialysis probe. Various embodiments discussed in patent WO/2017/100028 provide details of a micro-dialysis probe made from a unitary block of material and comprising, from a proximal end to a distal end, a body, a support shank, a shank and tip.

inventors. It also may be possible to add functionality to the probes by integrating other components, such as electrodes, optics and additional channels.
Patent number: WO/2017/100028
Inventors: R.T. Kennedy, H.J. Yoon, T. Ngernsutivorakul and W.H. Lee
Publication date: 15 June 2017

Fluoride recovery

Applicant: **Airrane Co Ltd, Korea**
This invention concerns a method for recovering a fluoride gas in, for example, a semiconductor processes. It involves compressing a gas mixture (containing a fluoride gas) to enable it to be supplied to the first-stage gas-separation component that includes a hollow-fibre membrane module, where it is then separated into a first concentrated gas and a first permeable gas. The first concentrated gas is supplied to a second-stage gas-separation component, which also consists of a hollow-fibre membrane module, in order to separate it into a second concentrated gas and a second permeable gas. According to the associated patent, the multistage gas separation process (of two or more stages) includes a hollow-fibre membrane module with a high selectivity for nitrogen. Fluoride gas can be efficiently recovered from the gas mixture that includes nitrogen.
Patent number: WO/2017/099278
Inventors: S.Y. Ha, H.C. Koh, J.H. Lim, M. Jo, J.-C. Moon and S.-J. Jeong
Publication date: 15 June 2017

Treating fracturing flow-back from an oil–gas field using a ceramic membrane

Applicant: **Jiangsu Jiuwu Hitech Co Ltd, China**
A method and apparatus for treating fracturing flow-back from an oil–gas field, using a ceramic membrane, are described by this patent. The method involves first performing gel-breaking and flocculation treatment on gel-containing fracturing flow-back and then reducing the viscosity of the fracturing flow-back by means of ozone treatment. The final stage uses fine filtration based on ceramic membrane technology. According to the inventors, this method can improve the flux of a ceramic membrane and operational stability. It also can shorten the treatment time, simplify processing procedures and reduce the cost of treating fracturing flow-back. The apparatus comprises a flocculation and sedimentation tank that is connected to a viscosity-reducing reaction kettle. An ozone feeding port is provided on the viscosity-reducing reaction kettle, and the latter is connected to an inlet at an intercepting side of the ceramic membrane.
Patent number: WO/2017/096569
Inventors: C. Zhang, S. Zhang, F. Liu, W. Deng, W. Peng, H. Zhang and K. Fan
Publication date: 15 June 2017

Separation membrane for processing a gas mixture containing an acidic gas component

Applicant: **Toyo Tire & Rubber Co Ltd, Japan**
A separation membrane for processing a gas mixture containing an acidic gas component forms the subject of this patent. It is provided with a uniform and dense separation layer that is free from defects. The separation membrane described has an inorganic porous supporting body; and an intermediate layer that is formed on the surface of the supporting body and contains a polysiloxane network structure or a hydrocarbon group-containing polysiloxane network structure. The separation layer is formed on the intermediate layer and contains a polyethylene glycol and a hydrocarbon group-containing polysiloxane network structure. The weight per unit area of the intermediate layer is 0.1–4.0 mg/cm^2, whilst the weight per unit area of the separation layer is 0.1–3.0 mg/cm^2.
Patent number: WO/2017/098916
Inventors: T. Kurahashi and K. Kuraoka
Publication date: 15 June 2017

Selectively permeable graphene oxide membrane

Applicant: **Nitto Denko Corp, Japan**
This invention pertains to a membrane based on grapheme, which has selective resistance to solutes or gas, whilst providing water permeability. According to the associated patent, the selectively permeable membrane comprises graphene oxide (GO) or reduced GO. The GO membrane composition may be prepared by using a water soluble cross-linker, which may be compatible with the polyamide coating of a reverse osmosis membrane. Methods of efficiently and economically making these GO membrane compositions are also described. Water can be used as a solvent in preparing the GO membrane compositions, which makes the preparation process more environment-friendly and cost-effective, claim the inventors.
Patent number: WO/2017/106540
Inventors: S. Zheng, I. Kitahara, M. Kobuke, P. Wang, C.R. Bartels, Y. Yamashiro, M. Hirose, S. Noumi and W. Lin
Publication date: 22 June 2017

Biomolecular measurement

Applicant: **Hitachi High-technologies Corp, Japan**
The biomolecular measurement apparatus that is described by this patent comprises first and second liquid baths which are filled with an electrolyte solution, and a nanopore device that supports a thin membrane (containing nanopores). This is located between the first and second liquid baths so as to connect them (through the nanopores). Also discussed is an "immobilisation member", disposed in the first liquid bath, has a size larger than that of the thin membrane, and on which biomolecules are immobilised. At least the nanopore device or the immobilisation member has a grooved structure.
Patent number: WO/2017/104398
Inventors: R. Akahori, K. Takeda and I. Yanagi
Publication date: 22 June 2017

These patent summaries are based on materials from the World Intellectual Property Organization's Patentscope database https://patentscope.wipo.int.

EVENTS CALENDAR

13–16 May 2018
MELPRO 2018 (International conference focused on membrane and electromembrane processes)
Prague, Czech Republic
Contact: CZEMP, Česká membránová platforma z.s., Mánesova 1580, 470 01 Česká Lípa, Czech Republic
Tel: +420 724 865 177
Email: conference@czemp.cz
www.czemp.cz & www.melpro.cz

27–31 May 2018
The 15th IWA Leading Edge Conference on Water and Wastewater Technologies – Technological Innovations for Improving Water Security
Nanjing, China
Contact: International Water Association, Alliance House, 12 Caxton Street, London SW1H 0QS, UK
Tel: +44 207 654 5500, Fax: +44 207 654 5555
http://iwa-let.org

9–13 June 2018
NAMS 2018 – 27th Annual Meeting
Lexington, Kentucky, USA
Contact: North American Membrane Society, University of Arkansas, Ralph E. Martin Department of Chemical Engineering, 3202 Bell Engineering Center, Fayetteville, AR 72701-1201, USA
Tel: +1 479 575 3419, Fax: +1 479 575 7926
Email: Isabel.Escobar@uky.edu
www.membranes.org/2018/index.html

10–13 June 2018
8th International Colloids Conference
Shanghai, China
Contact: Elsevier Ltd, The Boulevard, Langford Lane, Kidlington, Oxford OX5 1GB, UK
Tel: +44 1865 843000
Email: conferenceinfo@elsevier.com
www.elsevier.com/events/conferences/international-colloids-conference

17–20 June 2018
1st International Conference on Water Security
Toronto, Canada
Contact: Elsevier Ltd, The Boulevard, Langford Lane, Kidlington, Oxford OX5 1GB, UK
Tel: +44 1865 843000
Email: conferenceinfo@elsevier.com
www.elsevier.com/events/conferences/water-security-conference

8–12 July 2018
Singapore International Water Week
Singapore
Contact: Singapore International Water Week Pte Ltd, 40 Scotts Road 22–02, Environment Building, Singapore 228231
Tel: +65 6595 6303
Email: info@siww.com.sg
www.siww.com.sg

9–13 July 2018
Euromembrane 2018
València, Spain
Contact: Technical Secretariat , Universitat Politècnica de València, Centro de Formación Permanente, Edificio Nexus (6G), Camino de Vera s/n, València, 46022, Spain
Tel: +34 963 877 751
Email: congresos@cfp.upv.es
http://euromembrane2018.org

29 July to 2 August 2018
African Membrane Society 2nd International Congress (AMSIC-2 2018)
Johannesburg, South Africa
Contact: Nanotechnology and Water Sustainability (NanoWS), UNISA Science Campus, Corner of Christian de Wet and Pioneer Avenues, Florida, Gauteng, 1709, South Africa
Tel: +27 11 670 9716
Email: nanows@unisa.ac.za
www.sam-ptf.com/index.html

29 September to 3 October 2018
WEFTEC 2018 – 91st Annual Technical Exhibition & Conference
New Orleans, Louisiana, USA
Contact: Water Environment Federation (WEF), 601 Wythe Street, Alexandria, VA 22314, USA
Tel: +1 571 830 1545,
Fax: +1 703 684 2492
www.weftec.org

22–26 October 2018
Ontario Water Innovation Week
Toronto, Canada
Contact: Water Technology Acceleration Project (WaterTAP), 20 Adelaide Street East, 13th Floor, Toronto M5C 2T6, Ontario, Canada
Tel: +1 416 593 0303
www.watertapontario.com

14–15 November 2018
Aachener Membran Kolloquium
Aachen, Germany
Contact: Aachener Verfahrenstechnik – Chemical Process Engineering, RWTH Aachen University, Forckenbecktstr. 51, D-52074 Aachen, Germany
Tel: +49 241 80 29942,
Fax: +49 241 80 92252
Email: amk@avt.rwth-aachen.de
www.amk.rwth-aachen.de

Innovation Fund Denmark grant supports use of Aquaporin Inside technology for treatment of hospital wastewater

Aquaporin A/s, a water technology company based in Copenhagen, Denmark, with operations in Singapore and China, reports that Innovation Fund Denmark (IFD) has recognised its Inside™ technology by granting funds dedicated to improving the treatment of wastewater produced by hospitals.

According to the company, the new method – using the effective and selective Aquaporin Inside membrane – will potentially enable hospitals to treat and cure patients without burdening finances and the environment.

Remnants of pharmaceuticals and hormone disrupting substances are a growing problem in water resources and the environment. Traces of pharmaceuticals are increasing, especially in areas where drinking water supplies are affected by wastewater.

The project commenced in February 2018 and is set to conclude by the end of August 2018.

Michael Holm Møller, Business Development Executive, Aquaporin, explained: 'For a membrane to retain compounds as small as medicine in wastewater is extremely complex, but nonetheless of very high importance in a modern society. The Aquaporin Inside technology can be the solution to international concern of pharmaceuticals in our water supply and environment.'

The grant from IFD is part of the initiative InnoBooster, which supports innovative business for growth and social commitment. For the project Aquaporin has partnered with DHI, which specialises in water environments.

Ulf Nielsen, Chief Planner, DHI, commented: 'We are excited about cooperating with Aquaporin to further develop and adjust this cutting-edge technology.'

'Pharmaceuticals are known as particularly persistent substances which are toxic in very low concentrations. This innovative technology opens new possibilities for reuse of polluted wastewater after efficient treatment.'

For more information, visit: https://aquaporin.dk, https://innovationsfonden.dk, www.dhigroup.com & https://innovationsfonden.dk