From Andijk III to Choa Chu Kang Waterworks: PWNT

Wholly owned by Dutch Utility PWN, PWN Technologies (PWNT) is an advanced water treatment technology provider that develops efficient and sustainable solutions in water treatment based on suspended ion exchange, ceramic membrane applications and advanced oxidation. The company is unique in its formation as compared to other water technology providers in that it benefits from PWN's 96 years of experience and innovations in water treatment. As a utility itself, technologies developed by PWN and commercialised by PWNT are based on observations of challenges faced by utilities around the world and aim at offering lower life cycle costs, higher efficacies and a much lower environmental impact. One of these developments and perhaps what PWNT is best known for is the CeraMac®. PWNT is based in the Netherlands and has its Asia-Pacific headquarters in Singapore.

"We grew out of doing research and development (R&D) and getting new ideas for technologies and processes," says Chief Technology Officer, Gilbert Galjaard. "Now, we commercialise these technologies and processes."

These technologies that Mr Galjaard refers to are the company's Suspended Ion Exchange process (SIX®) and CeraMac®. Both processes have been proven and validated, says Mr Galjaard, and are implemented at perhaps one of the world's most sensational ceramic membrane based plants – Andijk III in the Netherlands.

SIX® is a process designed to remove colour – including Dissolved Organic Carbon (DOC), sulphate, nitrate and phosphate – from water to improve the efficiency of downstream processes as membrane filtration or advanced oxidation and reduces the formation of trihalomethanes (THMs) after a final disinfection with chlorination. According to Mr Galjaard, the SIX® process can remove up to 80 to 90% of DOC, which is an improvement from conventional technologies that can remove just 40 to 60% of that. The philosophy behind the SIX® process is based on an advanced plug flow reactor followed by a specially designed lamella settler. The settled resin is then completely regenerated and reused.

Additionally, compared to other available technologies on the market, SIX® is designed to be more compact and has a lower resin concentration and inventory, lower salt usage, higher effluent quality and better control of the adsorption process. It also allows for the use of different types of resin.

CeraMac®, on the other hand, is a filtration process that combines up to 192 ceramic membrane elements into one vessel so that the application of ceramic membranes becomes a highly economical and compact solution. Based on advanced R&D and large-scale demonstration testing, several problems in the existing filtration processes have been solved, he said. Incorporating CeraMac® translates to a much more compact footprint with lower energy consumption, a more reliable operation with lower maintenance, and higher productivity at a lower cost than existing membrane systems. According to Mr Galjaard, CeraMac® systems may be expected to last for 30 years or longer, with the current longest operational ceramic membrane plant being nearly 20 years old.

Most recently, PWNT has been assigned by Singapore's national water

agency, PUB, to build a 180 MLD CeraMac® water treatment plant at the Choa Chu Kang Waterworks (CCKWW). The PUB will be one of the first utilities besides PWN to employ this, according to Mr Galjaard. The plant is slated to be operational by 2018 and will be one of the world's largest ceramic membrane plants for drinking water treatment.

"What is interesting about our technologies is that we are now trying to use a combination of ozone and ceramic membranes because our ceramic membranes can withstand the ozone – which is like a continuous cleaning agent – and at the same time, the ozone oxidises all sorts of contaminants like viruses, taste and odour compounds," says Mr Galjaard.

"This is something that we will be implementing at the CCKWW."

He adds: "Sometimes DOC can be very high for conventional treatment processes in treating, for instance, secondary effluent of domestic wastewater plants. This leads to a lot of ozone and/or energy for advanced oxidation processes. SIX® can help in this case to reduce the DOC to such an extent that the overall costs become much lower than the total treatment as processes become much more efficient at a smaller climate footprint and at a lower energy consumption."

Technologies from PWNT have been dubbed as revolutionary, and there has been a lot of interest from several countries. While these technologies may not come cheap, Mr Galjaard encourages utilities not to be deterred by the upfront capital expenditure but to think further and look at the cost savings to be made over the long term. He believes that strategies work in long cycles as opposed to tactics that tend to be relatively short-termed, and so utilities looking at strategic long-termed sustainable water treatment solutions will find it interesting to explore what PWNT has to offer.

"The biggest misconception about our technology is that it's expensive," he notes. "It is common for people to think of advanced technologies as expensive, and while that may be true in terms of CAPEX, if you look to the total life-cycle costs and therefore the OPEX, we are able to treat water at a lower price per cubic metre. Hence, if you do a comparison on the total life-cycle, we have technologies that are much cheaper than other existing installations'."

Despite the attention it has received from countries around the world, PWNT is not resting on its laurels. Similar to one of the core beliefs at the company that its new logo unveiled at SIWW 2016 signifies, innovation and R&D remain key to the company's operations and Mr Galjaard tells WWA that the company continues to engage in R&D works with other utilities and universities. Hence, the industry can expect more game-changing technologies from the Dutch innovator.

One example that he highlighted is PWNT's participation as leading project partner in the DOC2C's project. This project is an extensive research programme of four years to investigate the possibility of improved DOC removal from source waters, having received a grant from the Interreg 2 Seas Programme, a European programme that is focused on the 2 Seas Area (the North Sea and the English Channel regions). Other project partners of the DOC2C's consortium are South West Water (UK), De Watergroep (Belgium), Lille University (France) and Delft University of Technology (Netherlands). **WWA**

Interreg
2 Seas Mers Zeeën
DOC2C's
European Regional Development Fund

Catering to regional challenges

Although PWNT started from and is based in the Netherlands, Mr Galjaard understands that there are several different sets of challenges that the company will have to cope with when it expands to Asia – it is a widely known fact that the region comprises of countries that are at different stages of development with different characteristics. Therefore, he identified one thing specifically that the company is able to solve with their technologies – the treatment of secondary effluent.

"The direct reuse of secondary effluent is a challenge for the region too, and it is a better source of water than perhaps seawater desalination or stormwater reuse in terms of stability and impact on the globe," opines Mr Galjaard. He believes that given that stormwater use in packed cities such as Singapore will face difficulties such as contamination, secondary effluent will be easiest to treat, although the challenge to be overcome is to convince people that the technologies available today are good enough to produce premium drinking water.