Dutch ceramic membrane technology could encourage wastewater recycling in Australia.

NEW TREATMENT TRIALLED IN MELBOURNE

Jonathan Clement

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by Jonathan Clement

The enduring lesson from Australia’s decade-long drought, which prompted the hurried spending of billions of dollars on desalination plants and recycling projects, is that next time we need to be ready with cost-effective supply systems that are resilient enough to deliver sufficient water during prolonged dry periods.

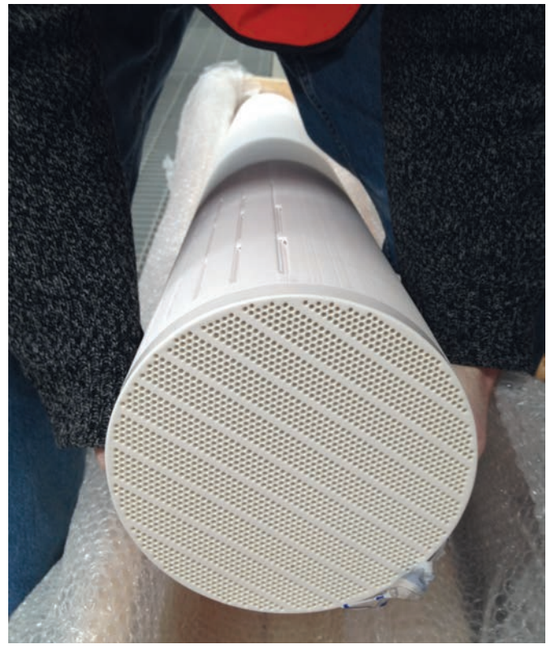
As a regular visitor to Australia and having contributed to the design of the advanced water treatment plant at Bundamba in southeast Queensland, I am impressed by the extent to which water utilities are doing their best, under today’s economically constrained conditions, to prepare Australia’s major cities for the inevitable next dry period.

Water recycling is a vital solution for water-scarce countries such as Australia. In times of drought it is one of the few available water resources.

There are major challenges in converting wastewater to potable water, the first being public perception, an obstacle Australia has yet to tackle convincingly. Further, there is a significant technological challenge in removing high levels of contaminants, which one hopes will go some way towards convincing the Australian public of the safety of recycled water.

To deal with both challenges a high-level treatment system is required. The treatment that has been generally accepted to date is a combination of multiple technologies. This, in most cases has, included three steps: membrane microfiltration and reverse osmosis followed by advanced oxidation. This multiple-barrier approach is rather costly when treatment of most surface water can be achieved with membrane filtration alone.

CeraMac vessel with ceramic elements and a backwash tank.



CeraMac vessel elements installed at Melbourne’s Eastern Treatment Plant.

An international team of experts, led by Victoria University and funded jointly by the Australian Water Recycling Centre of Excellence and PWN Technologies (PWNT), is currently undertaking research to determine if water recycling can be more affordable and sustainable. This novel approach, which is being trialled for the first time in Australia at Melbourne’s Eastern Treatment Plant (ETP), could be a major breakthrough as it combines the treatment into a single step. It uses a resilient and robust ceramic membrane system, developed in the Netherlands by PWNT, the research and development arm of a public water utility.

PWN is a Dutch water supply company. Owned by the province of North Holland, it is a social enterprise operating on a non-profit basis. Since it opened its first pilot plant in 1966, PWN has developed innovative treatment technologies in order to guarantee top quality drinking water where existing treatment proved to be insufficient.

PWN Technologies was founded to make these innovations available to other water companies. What makes this company different is that its revenues are invested in new research and development programs. The key to its success has been the innovative adaptation of existing technologies to produce the best possible water quality with almost no waste (zero liquid discharge) at the lowest possible energy demand.

Ceramic membranes, which are well known to be very sustainable because they can last for over 20 years and are not susceptible to fibre breakage, have until now been considered too expensive for the municipal drinking water market. PWNT’s breakthrough has been to create a new ceramic membrane system that reduces the footprint and material by more than 90% and improves overall efficiency. The key design feature of the CeraMac is that, rather than having ceramic membrane modules in individual stainless steel casings, up to 192 ceramic elements can now be housed in a single stainless steel vessel. This greatly reduces the costs of the ceramic membrane system to a level which makes the system cost competitive with polymeric membranes.

Ozone, an oxidant that destroys micro-contaminants, can be applied directly on the membrane. The ozone has a catalytic reaction on the membrane, which keeps the membrane clean. The end result is that the system can work at a very high rate (flux) with very little water loss.

An important aspect of PWNT’s achievement has been the successful integration CeraMac with suspended ion exchange

CeraMac-19 vessel (right) and backwash tank (left) being installed into an existing sand filter bed at Choa Chu Kang Waterworks, Singapore.

An illustration of Ceramac vessels and backwash tanks.

(SIX), a process to remove organics that can foul membranes and allows higher efficiency than is possible with coagulation. The company has successfully developed a suspended resin system capable of using various types of recyclable resins, not dependent on magnetic resin, to remove a high percentage of organics and serve as a robust pre-treatment system for membranes and UV treatment.

This unusual combination of effects – micro-contaminant destruction with simultaneous enhanced membrane operation – could be the key to more economical water reuse for Australia. Results from the ETP trial in Melbourne are expected in July. Preliminary trial results show that the membrane operation is efficient despite high organic levels.

In Holland, the estimated cost savings compared with conventional polymeric membranes is in the order of 30%.

In Singapore, an 18 month trial of a fully operational demonstration plant treating surface water has produced not just superior treatment outcomes but also savings of up to 40% on comparable polymeric systems. ■

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