Sustainable and Reliable water innovations

PWNT provides innovative water treatment technologies for clients who require high quality drinking water output with low long- term operating costs.

PWNT, meaning ”Pure Water & Nature Technologies” was created from the Dutch water utility PWN’s vision of sharing with the world more than 100 years of experience and innovations in water treatment. Through extensive R&D programmes, we have developed efficient and sustainable solutions in water treatment based on suspended ion exchange (SIX®), In-Line Coagulation (ILCA®), ceramic membrane applications (CeraMac®) and advanced oxidation, applications that can be used for a wide variety of water sources.

All our solutions offer lower life-cycle costs, greater efficiency and much lower environmental impact. We work closely with our clients to create optimal results and strongly believe in partnering with highly recognised universities and globally respected companies.

www.pwnt.com

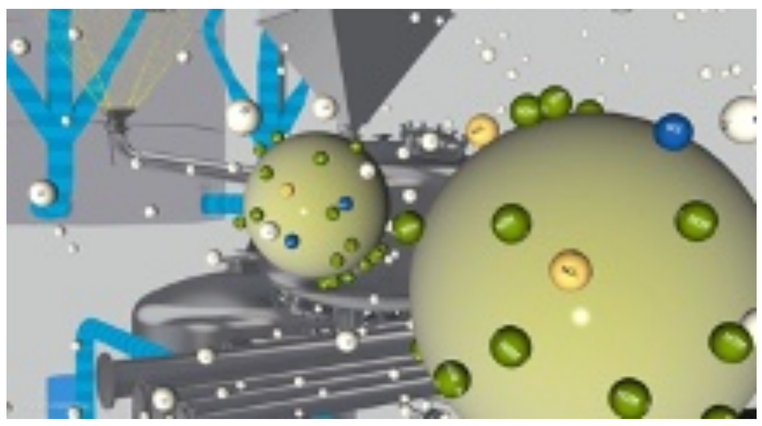
SIX®

Suspended Ion Exchange for organics removal

SIX® is a suspended ion exchange process, developed by PWNT as an alternative to coagulation for organics removal. It is suitable for treating surface waters to remove dissolved organics. The system uses an efficient resin contacting, separation and regeneration system, with brine used up to five times which helps reduce waste streams.

The advantages of SIX® are:

- Efficient removal of organics (60-90%)
- High UV transmission achieved (>90%)
- No iron or aluminium based sludge
- Compatibility with a variety of commercially-available resins to achieve a wide range of required water quality targets, allowing flexibility to meet different conditions
- Very minimal chemical requirement - the only major chemical requirement is salt (sodium chloride) for regeneration
- Resin is recycled with low resin attrition and loss, thus low additional resin is needed over time
- Short resin contact times, implying no risk of resin blinding and biofouling
- Full-scale resin service life > five years
- Other anions, such as sulfate and nitrate, are also removed
- Possible regeneration with sodium bicarbonate



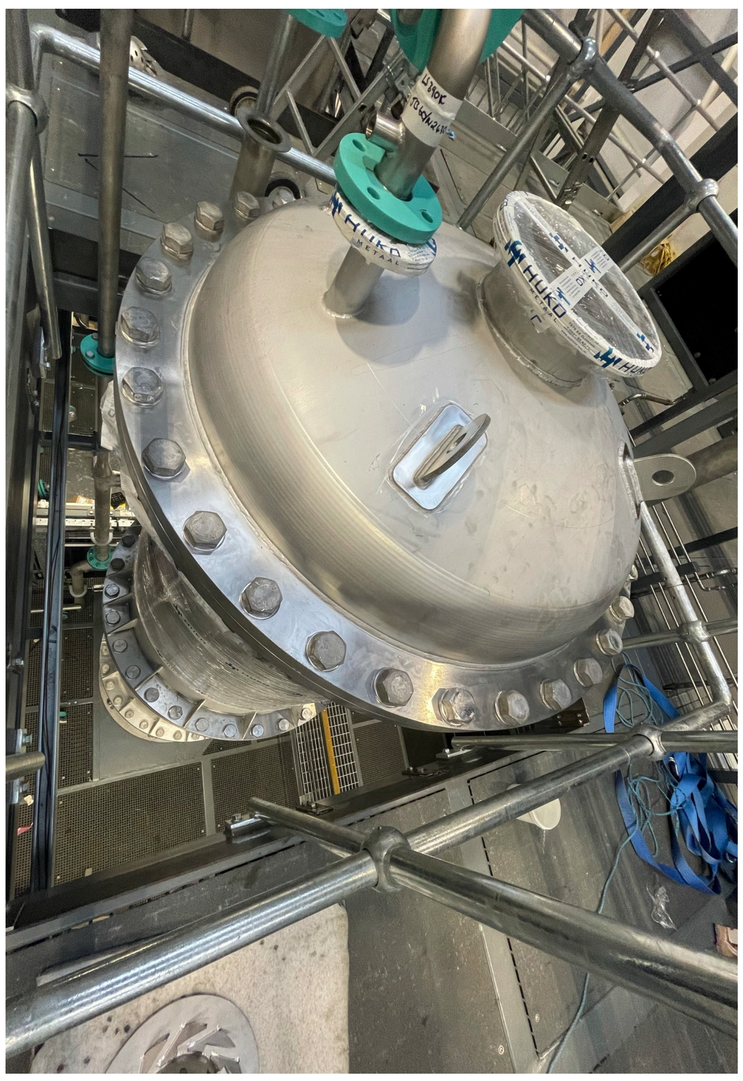
ILCA®

In-Line Coagulation and Adsorption

PWNT’s In-Line Coagulation and Adsorption (ILCA®) process was developed to minimise coagulation/flocculation footprint and to simplify pre-treatment upstream of CeraMac®. For most surface waters, coagulated feed water lowers the ceramic membrane fouling rate, but strong, large, setting flocs are not required for filtration with ceramic microfiltration. ILCA® was developed to provide only the necessary mixing at a short contact time for the CeraMac® system.

The advantages of ILCA® are :

- Any commercially available coagulant can be used.
- Normal pH control is also utilised to maximise DOC removal and minimise residual metal (e.g. Al^{3+}) concentrations.
- With no moving parts or powered equipment, the operating cost and maintenance are minimal
- It can operate as gravity or pressure driven to fit into the necessary hydraulic profile
- It has a smaller footprint and operating cost, compared to conventional clarifiers



CeraMac®

Cost-effective ceramic membrane design

CeraMac® is an innovative and cost-effective ceramic membrane filtration process designed by PWNT. This design allows the economically feasible use of ceramic membranes on surface water for large-scale applications, as well as in reuse and desalination pre-treatment applications.

The advantages of ceramic membranes include:

- No fibre breakage
- Indefinite life span (Proven to be > 20 years in continuous usage)
- Use of ozone upstream of the membrane for cleaning
- Possibility of using strong chemicals to clean the membrane and prevent fouling
- Use of high backwash rates to restore permeability
- Narrow pore size distribution
- Sustainable materials, with no plastics
- Potential for high throughput with small footprint relative to other technologies

CeraMac® offers a compact proprietary system with multiple membranes mounted in a single vessel. This reduces the cost of the ceramic membrane system to a level which makes the system cost competitive.

CeraMac® offers the following benefits:

- Very small footprint
- Low energy consumption
- High reliability
- Low maintenance
- Powerful backwash, at a pressure of 5 bar
- High productivity > 95%.

pwnt Global Success Stories

SIX® and CeraMac®
Andijk III, PWN, The Netherlands

The Andijk III plant in the Netherlands includes PWNT's SIX® (suspended ion exchange) and CeraMac® (ceramic membrane filtration process). It produces water of a better quality with lower environmental impact and decreased energy consumption. Andijk III has a design capacity of 120 MLD (32 MGD). SIX® removes dissolved organic substances, as well as other anions, like nitrate and sulphate if present. Resin is in contact with the water for about 30 minutes before being regenerated. SIX®-treated water then passes through the ceramic membranes, which serve as the main filtration barrier. All particles larger than 1/10,000th of a millimeter are removed. The treated water may still contain a quantity of hazardous substances, such as pesticides, viruses or drug residues. Advanced oxidation is used after the CeraMac® process, which uses a combination of UV and hydrogen peroxide to render these substances harmless. The clarity of water is increased thanks to SIX® and CeraMac®, and considerably less energy is required for UV treatment. Finally, an active carbon filter removes the remaining substances from the water, making it fit for consumption.

SIX®, ILCA®, and CeraMac®
Mayflower WTW, South West Water, United Kingdom

After a successful pilot, SWW installed SIX®, in-line coagulation and adsorption (ILCA®), and CeraMac® microfiltration in their new 90 MLD (23.8 MGD) Mayflower water treatment works (WTW). With three source waters, the main challenges included varied and sometimes high levels of dissolved organics, along with the potential for high disinfection byproducts in the distribution system. This plant has been in service since 2020. The plant includes two trains of SIX® and ILCA®, and ten CeraMac® vessels, each with 90 membranes, all of which were installed in a compact layout.

CeraMac® C-90 installation
Andijk III, PWN, The Netherlands

CeraMac® C-90 installation
Choa Chu Kang Waterworks, PUB, Singapore

CeraMac® C-90 installation
Mayflower WTW, South West Water, United Kingdom

CeraMac® C-37 installation
Sonnenberg WTP, ewl energie wasser luzern, Switzerland

CeraMac® with Ozone
Choa Chu Kang WTW, PUB, Singapore

The Choa Chu Kang Waterworks (CCKWW) in Singapore has been operated since June 2018. It is currently the largest ceramic membrane plant for drinking water treatment in the world. This plant was designed after an 18-month demonstration-scale study, where ozone was continuously applied to the membrane. The full-scale facilities include 12 CeraMac® vessels, each with 90 membranes. Ozone is applied to clarified water just upstream of the membranes, and this helps to achieve an extraordinary stable operation at fluxes as high as 360 LMH (212 GFD). This plant has a design capacity of 180 MLD (47.6 MGD).

Sonnenberg WTP, ewl energie wasser luzern, Switzerland

This 30 MLD (8 MGD) facility treats mountain spring water with ozone followed by three CeraMac® vessels, each with 37 membranes. The ozone pretreatment helps to achieve a sustainable high flux. This plant has been in operation since 19 October 2018.

Bonnycraig WTW, Scottish Water, Scotland

The 4.5 MLD Bonnycraig WTW became operational at the end of 2022. This plant uses four C19 ICA®+ CeraMac® trains to treat a reservoir water as a drinking water supply. The whole plant was constructed off-site in transportable treatment units (TTU) with Ross-Shire Engineering (RSE), which made installation on site more efficient and safer.

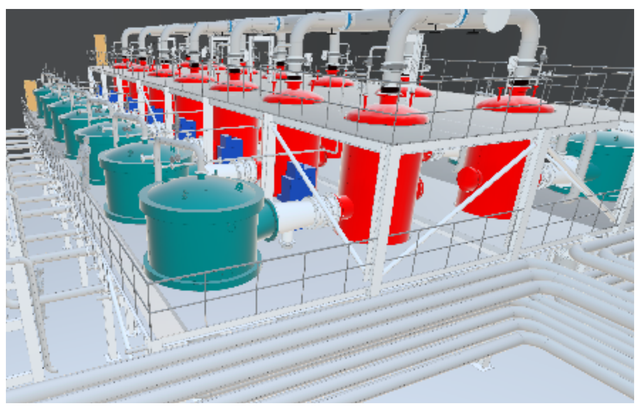
Hampton Loade WTW, South Staffs Water, United Kingdom

The Hampton Loade WTW will have a capacity of 210 MLD and will be operational in the summer of 2024. This plant will have twenty C90 CeraMac® vessels that treat a river supply that is pretreated with solids contact clarifiers. Once completed, this will be the largest ceramic drinking water plant in the world.

Witches Oak WTW, Severn Trent, United Kingdom

This 90 MLD water treatment plant will be operational in the summer of 2024. This plant is designed with ILCA® followed by 14 C90 CeraMac® trains which will treat river water.

CeraMac® C-19 installation
Bonnycraig WTW, Scottish Water, Scotland



Witches Oak 3D Model

Nieuwe Hemweg 2, 1013 BG Amsterdam, The Netherlands | T: +31 314 749 000 | E: info@pwnt.com

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