

Advanced solutions for the water treatment industry



SMC has global teams of specialists who can help water treatment companies to find the right management and control solutions for any application.

Water scarcity is making the reuse of wastewater much more common by industry sectors, including chemical, pharmaceutical, oil and gas, food, pulp and paper, metal, mining and power generation. With different requirements, each industry is developing different processes and technologies for treating the particular wastewater they produce.

The operation and control aspect of water treatment is generally considered to be key for the individual treatment stages, which can include operations such as separation, floatation, settling, filtration, neutralisation, absorption, ion exchange, chlorination, and many more.

From its roots in the pneumatics market back in 1959, SMC has evolved, together with customers, to being a comprehensive automation and control solutions provider, making the company an ideal partner for helping water and wastewater facilities to digitise and automate their plants. Two recent flagship successes that demonstrate SMC's capability and cooperative development approach include:

- SMC's involvement with Viewpoint on the development of ToxMate: a real time bio-based micropollutants detection system for instantly detecting micropollutants.
- For the Paris Olympics, SMC partnered with Nereus of France in the development of a zero-wastewater recycling and reuse system for recycling and reusing the effluents produced in one of the buildings in the athletes' village: aptly named, the Cycle Building.

ToxMate bio-detection of micropollutants

ViewPoint's ToxMate is a technological break-

through for real-time detection and identification of micropollutants in treated water from urban or industrial wastewater and drinking water treatment plants.

This innovation is based on the observation that aquatic invertebrates – gammarids, leeches and radix (freshwater snails) – are highly sensitive to human pollution. ToxMate analyses the behaviour of these three freshwater invertebrates in a continuous flow of water using a vision camera-based system.

In the presence of micropollutants, invertebrates modify their behaviour in different ways: they may swim away, for example, or change their position. Based on years of laboratory research in a variety of environments, Viewpoint has developed a detailed map of these behaviours in response to specific pollutants. This data enables them to identify the presence of many specific micropollutants based on the observed reactions of the bio-organisms.

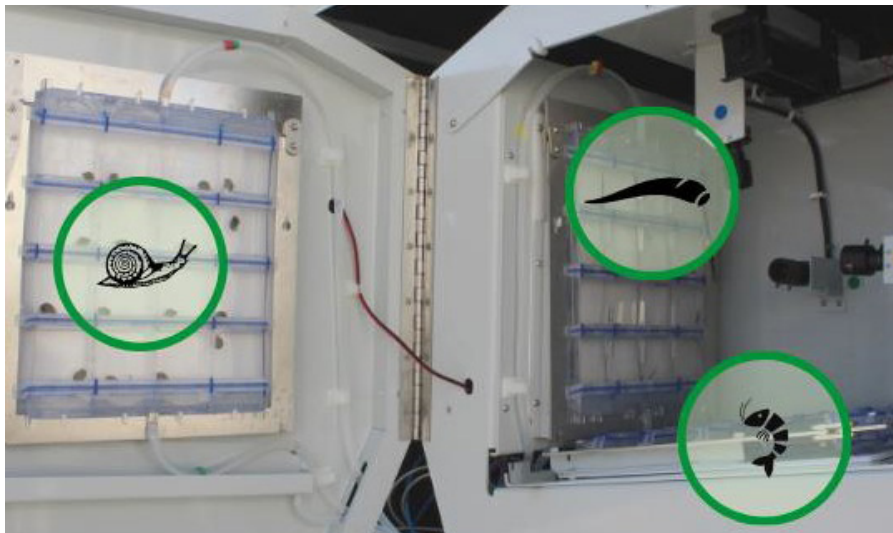
Because living organisms are involved, this measuring system requires precise temperature control, which has been achieved as a result of a close collaboration with SMC. "Our aim was to standardise analysis conditions. All parameters had to be completely identical if we were to correctly interpret the behaviour of the aquatic invertebrates," explains Frédéric Neuzeret of ViewPoint.

The temperature control of the effluent under different sampling conditions was

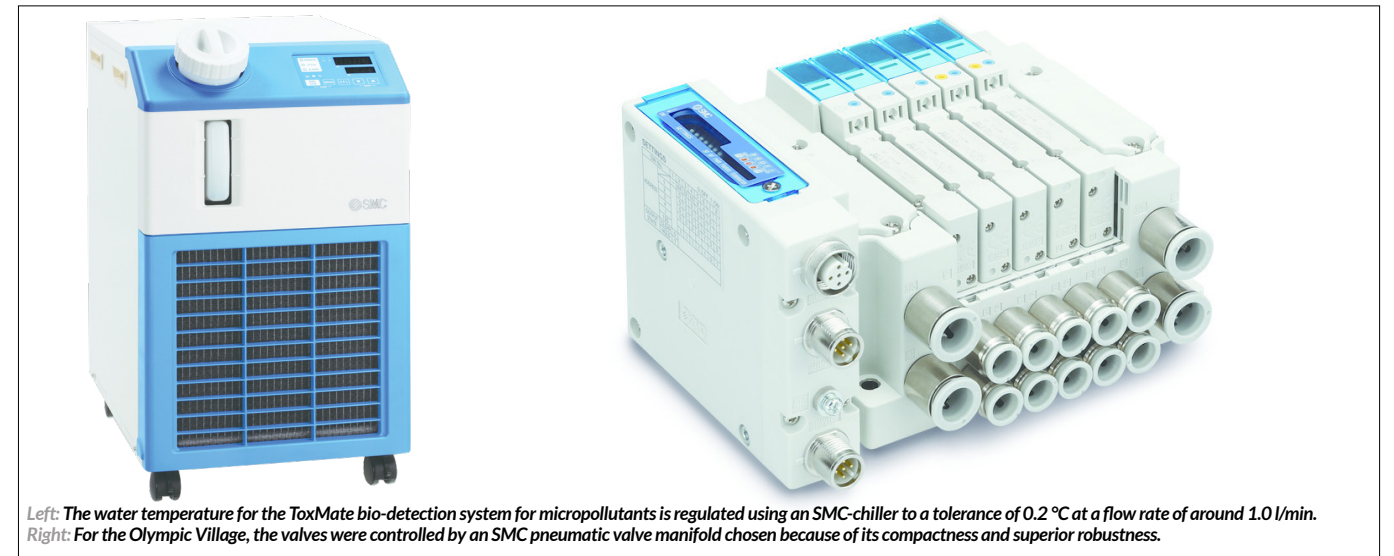
a particular challenge for which the SMC solution was chosen. The water temperature is regulated using a chiller to a tolerance of 0.2 °C at a flow rate of around 1.0 l/min. To ensure such precise regulation, it was not possible to measure the temperature simply in the heat exchanger tubes, so it was decided to place probes and additional sensors in the basin to activate the chiller's power more appropriately and quickly. The water flow causes the temperature in a tank to become stratified, so additional probes were added to enable more accurate temperature measurement for optimum control, with communication via MODBUS on the RS-485 protocol.

Neuzeret adds: "SMC's solution emerged as the best choice, not only for its unrivalled compactness, but also for its exceptional reliability. What really set SMC apart was its technical expertise and support in developing a tailor-made solution. The chiller's robustness proved to be a major asset, guaranteeing consistent, reliable performance. In addition to this extremely important aspect, the collaboration with SMC focused on the design of a sophisticated and precise closed-loop temperature control system.

Integrating ToxMate into existing infrastructures is remarkably easy, and if the targeted micropollutants are known, the process is even simpler. For wastewater treatment plants, the challenge may be greater due to the variability of the substances present in



ViewPoint's ToxMate analysis the behaviour of three freshwater invertebrates in a continuous flow of water using a vision camera-based system.



Left: The water temperature for the ToxMate bio-detection system for micropollutants is regulated using an SMC-chiller to a tolerance of 0.2 °C at a flow rate of around 1.0 l/min. Right: For the Olympic Village, the valves were controlled by an SMC pneumatic valve manifold chosen because of its compactness and superior robustness.

the water, but the results obtained rapidly become reliable, providing operators with invaluable data for real-time water quality monitoring. ToxMate offers a significant step forward in the automation and digitisation of water treatment plants, offering greater regulation of water purity, a crucial requirement of the treatment process.

Water recycling at the Paris Olympics

An environmentally friendly water filtration system, built using SMC system components, was used by NEREUS in a zero-waste water plant to help recycle and reuse effluents from one of the buildings in the athletes' village at the Paris Olympics.

The 26 apartment Cycle Building is a demonstration plant equipped with an innovative system for filtering the wastewater from the showers, kitchens and toilets to allow the water to be reused.

Thanks to the NEOSTEP® solution from NEREUS, this water is purified to the point of being drinkable, and used for flushing toilets, in washing machines, for cleaning and for irrigating green spaces. In addition, the system recovers heat from wastewater, which is used to pre-heat the domestic hot water. The overall goal is to recycle 90% of the wastewater, and to reduce water consumption by 60%, while also limiting energy consumption.

At its starting point, NEOSTEP® uses dynamic filtration technology for very low energy consumption. Unlike traditional frontal filtration, where particles stick to the filter surface, tangential flow filtration allows the fluid under pressure to pass through filter membranes tangential to the flow direction. This limits particle accumulation on the filter itself and avoids filter membrane blockages.

Dynamic filtration is an innovative variant of tangential flow filtration, offering high permeate flow rates while considerably reducing the risk of clogging, thanks to high-shear rotating filter membranes. This method

consumes around 80% less energy, making it an efficient and environmentally friendly filtration solution. By incorporating the latest membrane technology with dynamic tangential flow ultrafiltration, combined with biological treatment, followed by a final reverse osmosis filtration stage, the Nereus has created a compact and modular wastewater treatment solution that can also recover up to 49.7 kWh of heat per year, equivalent to avoiding 9.2 t of CO₂ emissions.

These compact wastewater treatment plants can be installed close to where they will be used, whether in parks and gardens, eco-districts or sustainable buildings, and they are factory-tested and delivered ready for use. Guilhem Molles, technical director of Nereus, says: "We need to use components that are compact and, above all, reliable, because it's crucial for us to avoid on-site repairs, which can be anywhere in the world." Hence the use of SMC's premium products and the reliance on its responsiveness.

In the Olympic Village installation, 12 water circuits are managed and controlled by three SMC angle-seat valves. These valves open and close the pipes to clean them or take them out of service if necessary.

The valves are controlled by an SMC pneumatic valve manifold: "After testing the valve islands from many different companies active on the market, we chose the solution offered by SMC because of its compactness and superior robustness," says Molles, adding: "SMC's water-resistant pneumatic valve manifolds, with their IP 67 certification, are essential for installations that have to be cleaned with water."

The Olympic Village installation in Paris has 12 water circuits that are managed and controlled by three SMC angle-seat valves. With a life of up to 10-million cycles, these air operated valves achieve a high flow rate while minimising pressure losses.

SMC valve manifolds are designed to withstand up to 5 000 000 cycles, and feature IO-Link communication. And for more corrosive environments, such as in coastal or tropical regions, Nereus has worked closely with SMC and used AMG water separators – which remove up to 99% of the water from the air lines – along with FRL air-quality treatment units.

"NEREUS technology has great potential, because of its low energy consumption. Although the price of membranes remains high, the return on investment is estimated at around five years," predicts Molles.

And their costs are steadily going down. Currently, the applications are mainly in industry and the tertiary sector, but with the advantages of the technology, its use is likely to spread into wastewater treatment plants, which are major consumers of energy.

Peter Findlay, managing director of SMC South Africa says: "SMC has global teams of specialists who can help water treatment companies to find the right management and control solutions for any application. Whether plants are using reverse osmosis membranes; micro-, ultra-, or nano-filtration stages; or ozone systems, we have cutting edge products that are specifically designed and developed to help manage and efficiently control each stage of the treatment process," he concludes.

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