DE NORA
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How To Improve Water Treatment With Innovative Technology

Water professionals are constantly looking for ways to produce the highest quality water while staying within limited budgets. In addition, regulations are constantly changing, becoming increasingly stringent. New technologies are essential to meeting customer demands for quality and cost.

De Nora is a global leader of sustainable technologies for water treatment solutions. Their international R&D team of scientists, engineers, and chemists are at work finding breakthrough technologies in water treatment. Water Online spoke with De Nora's Filippo Ronzani, Ph.D., to find out more about innovations in the water sector.

What fundamental problem with chlorine disinfection resulted in the invention of a breakthrough product?

De Nora was founded in 1923 to pursue the commercial exploitation of inventor Oronzio De Nora's first patent, an electrochemical cell to produce sodium hypochlorite. In the 1960s, De Nora developed DSA® anodes, metallic anodes coated with a catalytic layer made with noble metal oxides, that solved two critical problems with the production of chlorine. First, the new DSA® anode reduced the cost of energy consumption to nearly half. Second, since the groundbreaking new anodes were no longer consumed in operation like the traditional graphite version it replaced, the lifecycle of the electrolytic cell was dramatically extended.

The process optimization and the cost reduction deriving from the DSA® anode revolution also enabled the move to producing chlorine on site: New On-site generation systems could be located directly at the water treatment plant, delivering the safety benefits of not storing and transporting corrosive chlorine and bleach.

How does on-site, on-demand chlorine generation work?

The operation of an electrochlorination system is straightforward: Influent water is passed through a water softener to reduce hardness, thereby reducing the scaling of electrodes and lengthening the intervals between cleanings. Using softened water, salt is dissolved in a tank to form a concentrated brine solution. The brine solution is passed through an electrolytic cell that, using DC current from a rectifier, electrolyzes the diluted brine into a 0.8% solution of sodium hypochlorite. The 0.8% hypochlorite solution flows into a storage tank. Hydrogen, the only byproduct of the process, is safely vented to the atmosphere.

Since 1995, the ClorTec® on-site sodium hypochlorite generator has been employing the pioneering De Nora DSA® anode technology, tailored to increase efficiency with a patented coating formulation to generate hypochlorite safely and effectively. In 2016, De Nora launched the new ClorTec® DN generator,

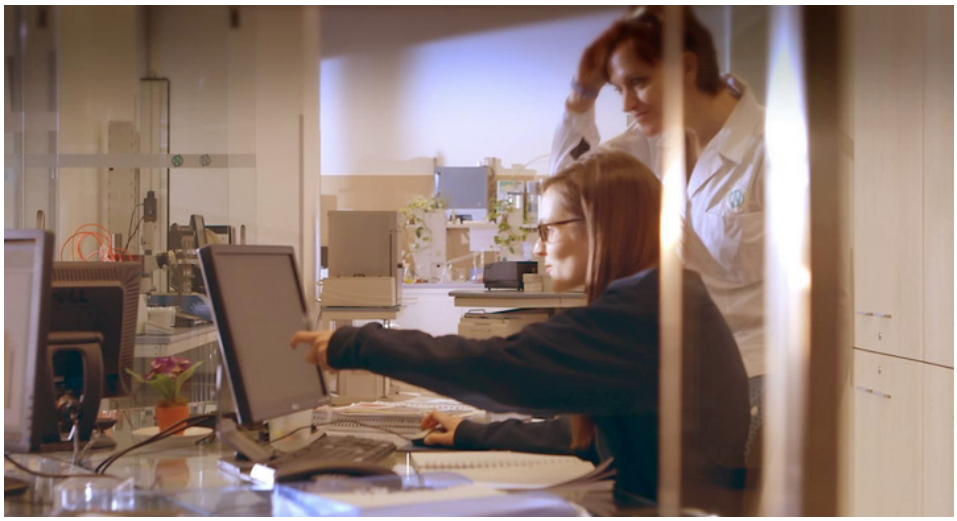
which incorporated a unique design to more rapidly and effectively remove hydrogen from each cell. Along with other benefits, the new design creates a more stable solution concentration and chlorine production.

What additional treatment processes have been acquired to complement De Nora's electrochemical water treatment technologies?

In 2015, De Nora acquired best-in-class water treatment technologies that complement their electrode technologies, including ozone generation systems, ballast water treatment systems, filtration, gas feed disinfection, and instrumentation and controls. These are well-known brands in the industry: BALPURE®, Capital Controls®, ClorTec®, De Nora Ozone, De Nora TETRA™, EST™, OMNIPURE™, SANILEC®, SEACLOR®, SORB 33®, and UAT™.

How do innovators find new technologies?

Our cutting edge R&D team is at the forefront of De Nora's growth plans, identifying business opportunities through our fundamental internal expertise, as well as finding and leveraging external solutions and ideas. De Nora's open innovation approach and long-term vision includes looking for solutions presented from outside of the business, not only internal advancements. Sources of innovation that support De Nora's current business lines and create new businesses can hide everywhere. Our goal is to discover these new sources of innovation in the form of scientific production and licensing opportunities in academia, through specific expertise, and with innovative startup companies. De Nora's innovation success is founded on incremental and radical innovation moving forward together, drawing inspiration and implementation paths from a global network still to be discovered. This new way of innovating requires a focus within what we call "strategic arenas" — to optimize efficiency — and, at the same time, a wider view to identify new strategic arenas.



What are the major challenges to finding and developing new water treatment technologies?

The main challenges are competition, cost, and the complexity of water treatment. While De Nora Water Technologies is a worldwide leader, there are many players and technologies in this large sector. We aim to be solution providers, not simply a supplier of equipment and systems. Water pollution is a very complex problem to solve. The technology for one contaminant might not be ideal for another, and there isn't one simple turnkey process that solves the many problems of water treatment.

For example, desalination treats salt water, separating the reusable water but leaving a heavy concentrated brine. What can we do with the brine that is also cost-effective? This is the challenge. Or take the oxidation of organics. While many different technologies are available to treat and oxidize, they can create even more toxic byproducts. That's another challenge.

Of course, challenges lead to opportunities, and we're working with our internal team and our external partners to discover solutions that address these challenges.

What other types of R&D efforts are ongoing that have applications in electrochemical water treatment?

Internal R&D efforts have led to multiple recent product innovations for OMNIPURE™ Series 64 ballast water treatment, MicroChem3® analyzer/controller, and the Capital Controls® gas feed disinfection systems. We conduct ongoing research to reduce costs and improve operational efficiencies for all of our existing product lines. One example I can share is that our team is looking at manufacturing technology to mass manufacture a newly developed miniaturized electrochemical cell able to produce from tap water radicals, like ozone and hydroxyl radicals, for on-site water disinfection and treatment.

What external innovations are being reviewed for breakthrough technologies by De Nora's R&D team?

Looking outward, many technologies treat polluted water to remove contaminants without actually destroying them. Nitrate, for example, is a simple toxic compound but a big problem, especially in the US. While technologies are available to separate the nitrates, they still require further steps for disposal and final removal, which can be complicated and expensive. Our team is analyzing how to destroy and completely eliminate the compound in fewer steps, instead of creating the new issue of final removal. One ongoing project with an external partner in Europe is developing new materials to adsorb heavy metals and organic micropollutants. It's still in the early stage, but this research is showing very encouraging results. ■