CHEMICAL ENGINEERING

September 2011

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Access Intelligence

MAKING WAVES

FIGURE 1. Adopting modern chemistries and technologies for monitoring, analysis and control can go a long way toward easing the water treatment burden that is so very challenging for chemical processors

Modern chemistries and equipment are helping chemical processors get a handle on water treatment challenges

For years it has been the common practice to treat process water with various chemistries to prevent scale, corrosion and microbiologicals. However, as regulatory issues tighten, water scarcity becomes a growing concern and the cost of treatment chemicals increases, chemical processors are finding that stringent treatment chemicals are not the only answer. Instead, they're relying upon a multi-prong effort of chemistry, analysis and monitoring to reduce their process-water treatment costs, while keeping in compliance.

"Chemical processors have multiple challenges and priorities when it comes to water treatment," says Kevin Milici, global marketing manager with GE Power and Water (Trevose, Pa.). He says first and foremost is safety and compliance. "If that isn't under control, nothing else is important."

But moving beyond that basic pillar is the issue of avoiding failure in the form of an unscheduled stop in production. "If a unit comes down because of inadequate water treatment practices or controls, that's a bad day for everyone," says Milici. Assuming this is not a problem, the next level is to avoid impaired unit production where the process is running, but in a sub-optimal state — meaning production throughput or yield is less than desired or the cost of producing is extremely high. "Once we make sure impairment of the operation is not an issue, we move onto optimization, which means helping the processor lower the total cost of water operations over time."

Water treatment optimization includes proper chemical dosage and minimization of fresh water consumption, trends that are pushing reduced chemical treatments and water recycling to the forefront (Figure 1).

The idea is to optimize the consumption of chemicals so the proper dosage is being applied, depending upon the actual conditions of the water being treated at that time. "There was a time when people applied chemistry to a system based on the worst case scenario, even if that situation existed only 5 to 10% of the time," explains Milici. However, water quality and discharge regulations have changed and economics have changed to the point where this is not feasible. As a result, processors are now faced with two major challenges. The first is managing the delivery of chemistry so it meets the needs and conditions in realtime by efficiently applying chemicals without sacrificing the operation and safety of the system. The second is reducing the amount of fresh water being used through water reuse or recycling, which also creates chemistry challenges. "Chemical processors — like other industrial water users — are being pushed to conserve consumption of fresh water and, at the same time, to reduce waste streams through water reuse or improving wastewater discharge levels," says Daryl Weatherup, global product manager with Siemens Industries (Phoenix, Ariz.). "This can generally mean using less water throughout the plant, which often requires the combined approach of using higher quality water inside the processing plant and improving the wastewater or water reuse treatment on the back end of the plant."

Meeting the challenges

One of the first steps in optimizing water treatment is through the use of new, improved and environmentally responsible chemicals. "It is the job of water treatment chemistry to enhance an already existing physical process," says Tim Laube, general manager with Kroff (Pittsburgh, Pa.). "It is very possible for water treatment chemicals to enhance and make a process more efficient both in reducing waste and time."

For example, his company has developed polymers that allow for the removal of zinc phosphate in an efficient way. "We can actually reduce how much chemical is fed by as much as 90% in some cases, which has multiple impacts," he says. "First, less chemical is going into the system, which means less chemical has to be removed from the tail end, saving both the cost of the chemicals and the cost of treating the waste stream. Second, the polymers are not toxic, flammable or dangerous, which makes them green, as well as cost and time efficient."

Similarly, Ashland Hercules Water Technologies (Wilmington, Del.) offers Enviroplus advanced cooling-water treatments that both protect plant assets and meet regulatory requirements through the use of environmentally responsible chemistries.

The family includes a series of multifunctional products formulated with novel blends of organic chemistries, which contain significantly lower levels of phosphorus than conventional

products. Enviroplus products have a minimal impact on the environment due to the favorable toxicity profiles and inherent biodegradability, yet reduce corrosion and scaling in industrial, alkaline cooling-water systems.

A combination of corrosion inhibitors form a film on metal surfaces, providing corrosion protection without pH control. In addition, a combination of polymeric dispersants and oxidant-resistant organic phophonates provides control of calcium scales.

"This product has the potential to waste less water from the cooling system and minimize total water usage in the cooling system than if using traditional corrosion inhibitors and anti-scalants," says Nozi Hamidi, director of global marketing with Ashland.

Another smart, new chemistry system includes, GE Power and Water's GenGard technology for open recirculating cooling systems. The GenGard programs can be applied across the entire pH spectrum from neutral to alkaline and incorporate advanced

PROMISING CANDIDATES ON THE REDUCED- AND CHEMICAL-FREE TREATMENT HORIZON

Emerging market drivers, such as tighter water quality regulations, water conservation and high chemical costs have opened the door for new chemical treatments and non-chemical treatment alternatives that have the potential to give the standard, commodity water-treatment chemicals a healthy dose of competition. Recently, Lux Research (Boston, Mass.) released a report titled "Water Chemicals and Competitors: The Long, Long March of the 'Chemical Free Revolution,'" ranking some of these new and innovative solutions in key treatment markets, including drinking water, wastewater, cooling and boiler water, desalination, mining, industrial and oil-and-gas.

"Opportunities await the new wave of reduced and non-chemical water treatments, but those opportunities are distributed unevenly across application markets," says Brent Giles, a senior analyst with the firm and the report's lead author. "New approaches for treating municipal water, for example, won't budge conventional chemical-based methods. But in the oil-and-gas industry, non-chemical treatments could move very fast because their relatively small footprint enables produced water to be treated at the drill site and reused."

Giles admits that non-chemical treatments almost never completely eliminate chemicals, but technologies like electrocoagulation have the potential to reduce the amount of chemical used, bringing the water much closer to water reuse with less effort. He adds that monitoring plays a big role in chemical reduction because it helps you keep the process in the sweet spot, which reduces the amount of chemicals you are buying and using on the front end and the amount of treatment water you will need on the back end.

Some of the most promising technologies in these areas, according to Giles, include the following:

Water Tectonics, Inc.'s (Everett, Wash.) Wavelonics electrocoagulation technology. The treatment system is an automated, non-chemical water treatment system operating between 100 and 1,000 gal/min for the purpose of removing heavy metals, turbidity, bacteria, phosphorus, chemical oxygen demand and biochemical oxygen demand, sulfides and PCBs.

While it is currently being used in the oil-

and-gas industry, Giles believes electrocoagulation has potential for use in other industries because it effortlessly gets rid of particles in the water. "Heavy particles in water are easily coagulated with this process," he says. "But it may be necessary to treat with chemicals, as well, for very fine particles."

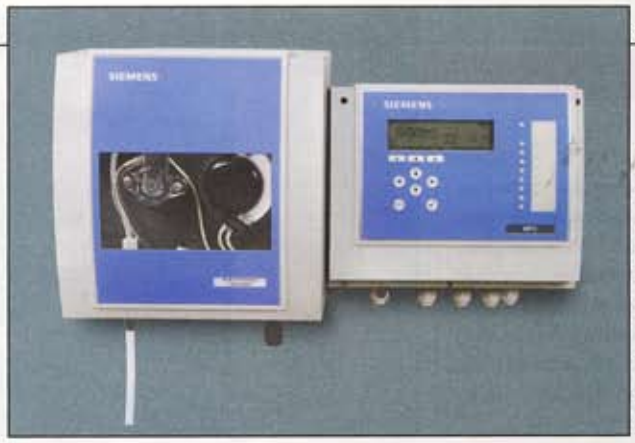
Giles was also a fan of Neosens S.A.'s (Labège, France) monitoring system for preventing fouling in boiler and cooling water. The company's FS-1000 Series for continuous fouling monitoring in cooling systems and critical water processes plugs directly into equipment for realtime monitoring that ensures water treatment efficiency, triggers alerts in case biofilm and or scales abnormally increase, and to optimize and reduce chemical discharges.

The sensor has the ability to continuously monitor the thickness of fouling within the water process, enabling the optimization of treatments and confirmation of treatment effectiveness.

And for those in pharmaceutical manufacturing or any industry with super critical water (SCW) applications, Giles sees a lot of promise in SCFI Group Ltd.'s (Cork, Ireland) AquaCritox SCW oxidation solution. In super critical conditions, the properties of water are changed and the solubility of gases and organic compounds are increased to almost 100%, while inorganic compounds become largely invisible. Oxygen is completely miscible in all proportions with SCW. When a stream containing organic material is placed under super critical condition and oxygen is introduced, a rapid and complete oxidation reaction takes place. This oxidation reaction is exothermic, so the reaction can be auto thermal at very low levels of organic matter. Unlike incineration, the only gaseous emissions from this process are CO_2 and N_2. Phophorous and coagulant can be recovered from the inert residue.

In pharmaceutical applications, the technology does not produce a hazardous concentrate that would normally require disposal. While biological treatment processes produce a waste sludge that requires disposal, the AuqaCritox process produces an effluent liquid stream with low chemical-oxygen-demand (COD) values. Any inert material within the waste stream will exit the process as inert residue.

"This self-perpetuating wastewater treatment eliminates complex organics through complete oxidation while allowing for the retrieval of metals and phosphates," says Giles. ❐



Siemens

FIGURE 2. The Siemens Micro/2000 measurement module measures free and total chlorine residual, chlorine dioxide, ozone or potassium permanganate residuals in potable water, primary or secondary treated wastewater or cooling water

deposit and corrosion additives. The technology includes a new stress tolerant polymer (STP), alkaline enhanced chemistry (AEC) and halogen resistant azole (HRA) in combination with phosphate-based steel corrosion inhibitors. The treatments are stable and retain effectiveness in the presence of chlorine and other halogens,

allowing Legionella compliance when chlorine and bromine residuals are continuously applied at levels for general microbiological control and during periodic system disinfections. Unlike conventional treatments, GenGard allows users to effectively respond to microbial upsets without a loss of deposition or corrosion control.

Fluid Metering, Inc.

FIGURE 3. Accurately metering liquid sodium hypochlorite presents challenges, but the Chloritrol system's valveless duplex-pump design allows sodium hypochlorite directly into the water main, while a second pump removes out-gas bubbles. Dosage equipment such as this can help processors optimize water treatment programs

Dosage, monitoring & analysis

While smarter and more environmentally friendly chemicals are a step in the right direction, the sustainable trend is also moving processors toward reducing the amount of chemicals added during the treatment process, notes Weatherup. "Proper dosing, monitoring and control is the best way to approach this desired reduction of chemical waste," he explains.

Manoj Sharma, vice president, products and services division with Aquatech (Canonsburg, Pa.) agrees. "An effective water-treatment chemical program is a key contributor in optimizing water consumption and improving overall system efficiency," he says. "But the program is even more effective if it is combined with innovative water treatment systems that include hardware. The optimization of integrated chemical and efficient treatment equipment is commonly defined as total water management."

The reason this approach is so effective, according to Stephan Andree, global product manager of analysis and control equipment with Siemens, is because it helps reduce the amount of chemical usage. "Automation of chemical fed processes through the addition of a high quality dosing pump, analyzer and control equipment can reduce chemical use by 30%, versus leaving it without proper control and feed equipment," he says. "Automated feed equipment cuts over and under dosage of chemical, which helps save the cost of chemical, as well as reduces unnecessary chemical usage, making treatment and or reuse more efficient."

A prime example of this type of equipment is Siemen's Micro/2000 Measurement Module Analyzer (Figure 2), which provides a user-friendly display and touch pad with historic data trending. The unit can be con-

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figured for different operating ranges, alarm set points and display information for continuous measurement of oxidant residuals. The measurement module measures free and total chlorine residual, chlorine dioxide, ozone or potassium permanganate residuals in potable water, primary or secondary treated wastewater or cooling water. It is able to measure low oxidant residuals down to 1 ppb.

And, Ashland's OnGuard 2-plus analyzer monitors critical cooling-water and heat-exchanger performance indicators and parameters, including corrosion, fouling, pH, conductivity, temperature, oxidation reduction potential and water flow, and provides realtime measuring and process control.

The analyzer is able, instantly and remotely, to compare existing conditions to defined targets and then adjust automatically to close the gap, provide immediate response to system upsets and provide accurate reports.

GE's offering in the monitoring and analysis arena includes TrueSense, a technology platform that assists users with optimization through monitoring of chemical usage, water use and consumption, operational productivity and human productivity. The online version was designed to provide a direct measurement of functional chemistries that drive success for all dimensions of cooling water management. The platform takes measurement and control technology for multiple analytes using a single detection platform that offers simplicity and stability. The solution can be designed to meet specific goals of a particular water-treatment plan and budget.

Experts agree that adopting these or similar modern chemistries and technologies for treatment, as well as monitoring, analysis and control, can go a long way toward easing the water treatment burden that is so very challenging for an industry where the main concern is producing high quality products and minimizing downtime. "Embracing newer technologies really can reduce the challenges, as well as cost issues, for chemical processors for whom water treatment, reuse and recycling is not a core practice," says Hamdini. ■

Joy LePree