Water Chlorination Technology

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A look at chemical feeder technology that uses small briquettes of solid calcium hypochlorite to provide a chlorine solution.

Water system operators know the challenges of keeping municipal drinking water consistently and safely chlorinated. Increased safety concerns regarding common disinfectants and mandated chlorine residual targets make maintaining large or small water systems difficult.

Common Disinfectants

Due to safety concerns surrounding chlorine gas, some municipalities have looked for alternative methods of chlorination. Chlorine gas is a dangerous gas that is lethal at concentrations as low as 0.1 percent air by volume; the risk of a gas leak is a serious concern to the community.

To combat this issue, many operators have switched to liquid bleach as a means of disinfection. Bleach is effective; however, it decomposes quickly (less than 30 days) and becomes less chemically effective as it ages. Bleach is corrosive and can cause off-gassing or "air lock" issues in dosing pumps. It must be stored with great care in secondary containment.

Solid calcium hypochlorite has been around for awhile but was never convenient to use because it required operators to prepare solutions prior to use. New feeder systems with advanced spray technology now make calcium hypochlorite a reliable, safe choice for water chlorination. Small briquettes of solid calcium hypochlorite provide a chlorine solution for use in many applications including the treatment of surface and groundwater for municipal drinking water use and the treatment of wastewater effluent.

Apex Service Technician Clayton Butt and Water Operator Tom Shrewsbury of Hebron, Ill.

System Benefits

In numerous drinking water applications, such as wellheads, small-to medium-sized surface water treatment plants and booster stations, calcium hypochlorite briquettes and chlorinator systems can provide numerous benefits. The same is true for many wastewater applications, including small- to medium-sized treatment plants (up to 6 mgd) and water reclamation facilities. Some of the benefits and advantages include:

- *Longer chemical shelf life.* Calcium hypochlorite briquettes have up to a two-year shelf life.
- *Onsite generation.* By making a fresh, dilute hypochlorite solution only as needed, a facility eliminates either bulk solution or large cylinder storage, thereby simplifying storage and handling while alleviating numerous safety and liability concerns.
- *No off-gassing.* Calcium hypochlorite solutions from this system are stable. Chemical metering pumps do not become air-bound.
- *Corrosion control.* Calcium hypochlorite solutions are less corrosive than bleach. Because bulk liquid disinfection chemical storage is eliminated, associated corrosive fumes are eliminated.
- *Operator safety.* The dry chemical is easier to handle and, based on the lower solution strength, calcium hypochlorite reduces potential hazards for plant personnel.
- *Less restrictive.* Calcium hypochlorite briquettes need to be stored as Class 1 oxidizers but do not require expensive secondary containment. They are not bound by restrictive chemical tank and transfer station requirements.
- *Small footprint.* The footprint of a calcium hypochlorite feed system is only 14.5 sq ft, and no bulk liquid storage or containment is required.
- *Reduced vulnerability.* Potential plant vulnerability is reduced with the calcium hypochlorite system. There are no storage tanks or pressurized vessels. The system can easily be located indoors and out of sight.

New Feeder Systems

Recent advances in feeder technology prepare and automatically deliver a consistently accurate dose of liquid chlorine available for disinfection applications. A new feeding system can supply up to 250 pounds of AVDL/day. Typical installation of a modular unit requires only water and electrical hookups. In the patented spray technology, supply water injected into the unit sprays upward into a well packed bed of calcium hypochlorite briquettes. Unlike an erosion feeder, this technology allows contact with the entire bottom of the bed evenly, allowing a more consistent dosage that is collected in a lower reservoir and continuously mixed.

The briquettes are small, smooth and "pillow shaped" for optimum packing. These briquettes are certified to NSF/ANSI Standard 60 and contain an anti-scale additive to reduce maintenance. Because the briquettes are a dry form of chlorine, they have a two-year shelf life, compared to commercial sodium hypochlorite liquid (bleach), which typically degrades significantly in less than 30 days. A dry solid is less hazardous, easier to handle and occupies much less space than liquid bleach. The dry chemical is shipped and can be stored in 50-lb bucket containers.

When used for drinking water applications, the system provides the precision dosing required in pressurized water distribution systems. The system uses a standard dosing pump and injector to deliver the solutions directly into pressurized water pipes. The reservoir is filled with approximately 1.7 percent available

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chlorine solution, and an electronically controlled spray manifold maintains volume. The hypochlorite solution is injected into the application with a highly accurate positive displacement chemical metering pump specified for the application. The pump may be mounted directly on the base of the chlorinator.

"The load cells equipped on the feeder give an accurate direct reading of the amount of available chlorine delivered, proving to be an efficient solution to ensuring consistently accurate chlorination in drinking water while eliminating many long-standing concerns associated with Cl2 and NaOCl use," said Zach Adams, chemical engineer for Arch Chemical.

Although commercial bleach is priced lower than calcium hypochlorite, the comparison must be made in terms of the cost of available chlorine. The capital cost for a calcium hypochlorite system is usually less than half of the complete NaOCl system. Factor in losses due to NaOCl degradation, manpower to re-prime pumps due to off-gassing, safety and regulatory compliance, and the higher unit cost of the dry chemical is mitigated.

When water operator Tom Shrewsbury of Hebron, Ill., was having troubles with a C12 chlorination system at one of its wells, he piloted a briquette chlorinator for the Illinois EPA in 2008. "The system is much safer, requires little upkeep and is working consistently," says Shrewsbury. "We are very happy to have found this method of disinfection."

The Illinois EPA approved the use of this new technology in January 2009.

As more municipalities convert to this technology for disinfecting water, water providers can reduce safety concerns, eliminate chlorine taste and odor complaints and ensure accurate and dependable chlorine use.

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