WATER QUALITY
& HEALTH COUNCIL
PERSPECTIVES

Community Drinking Water Treatment Using Calcium Hypochlorite

By Steve Hubbs, PE
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Calcium hypochlorite systems in Honduras (left) and New York (right)
Photo credit: Steve Hubbs (left) and Elio Limonchi, Lonza (right)

Conventional water treatment transforms raw water into finished drinking water that is biologically and chemically safe. We recently celebrated the 110th anniversary of U.S. drinking water chlorination, a disinfection technology that debuted in Jersey City in 1908 using a dry compound called "chloride of lime." Today we more properly call it calcium hypochlorite.

Most U.S. drinking water systems use chlorine-based disinfectants, most commonly liquid chlorine bleach (sodium hypochlorite solutions) or chlorine gas (stored in pressurized tanks).[1] However, a growing number of small-to-medium U.S. systems (such as the City of West Springfield, Massachusetts), as well as rural-to-urban communities in developing countries, apply solid calcium hypochlorite for drinking water disinfection to help protect drinking water supplies.[2]

Drinking Water Treatment: Chlorination Basics

All systems customize their drinking water treatment, storage, and distribution to both fulfill the needs of their community and to address the unique characteristics of their raw water supply. Without adequate and reliable disinfection, consumers are at risk of contracting and spreading waterborne diseases caused by viruses, bacteria, and other microorganisms. Other drinking water treatment objectives include producing water that looks and tastes good and does not corrode pipes and household plumbing.

Regardless of the type of chlorine applied, primary disinfection is accomplished by *free chlorine*, which can readily penetrate the cell walls, slime coatings, and even resistant shells of most microorganisms that might be present. Once inside the microbial cell wall, free chlorine wreaks havoc on bacteria, disrupting metabolic processes and causing rapid cell death. And unlike ozone or ultraviolet light, chlorine can provide lasting, *residual (secondary) disinfection* to help ensure safe storage and distribution of treated water to our homes, schools, and businesses.

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[1] According to the recent yet anecdotal results (i.e., 1.4% response rate) of the American Water Works Association's 2017 Water Utility Disinfection Survey, 6% of respondents used "solid" (calcium) hypochlorite.
[2] Calcium hypochlorite is also used to provide temporary or emergency drinking water disinfection.

Spotlight on Calcium Hypochlorite

Manufacturers continue to improve the design and scalability of calcium hypochlorite drinking water treatment systems, including customizable chemical feed units. Although still best known for swimming pool disinfection, calcium hypochlorite feeder systems are also used around the world in drinking water and wastewater systems, cooling towers, building water systems, and throughout the food and beverage industries.

Calcium hypochlorite briquettes
Source: Elio Limonchi, Lonza Water Treatment

Calcium hypochlorite is typically sold in powder and various-sized pellets, tablets, and briquettes. Granular calcium hypochlorite can be “broadcast” directly into water (typical pool application), or mixed with water and fed as a solution. Briquettes are commonly used in feeders that pass a side-stream of the process water over the dry chlorine, and in systems that dissolve packet materials from the bottom using spray feeders.

A common downside of calcium hypochlorite use is the formation of precipitates (solid particles) of calcium deposits in systems that include pumping from a chlorine solution tank. Such deposits must be removed, which typically involves periodic tank cleaning. Deposits in the chemical feed lines and pumps can be reduced by routine flushing/cleaning with vinegar (a commonly available acid that can dissolve calcium deposits). The use of solid briquette feeders reduces problems with precipitate formation, and can be used in systems with chemical feed pumps or gravity systems without pumping (a particular advantage in spring-fed systems in rural areas that have no electricity).

Why Calcium Hypochlorite?

As noted previously, U.S. and international communities that use calcium hypochlorite for drinking water treatment and disinfection typically serve small (often very small) populations. The primary advantages are related to storage and feeding compared to chlorine gas or liquid bleach. Specifically, dry calcium hypochlorite can help eliminate some of the potential risks of using chlorine gas or liquid chlorine bleach, which can lead to decreased operation and maintenance costs. Initial capital costs for calcium hypochlorite systems can also be relatively inexpensive (a major reason for its popularity in developing countries). Additional considerations include reduced transport, training, and safety equipment (no need for scrubber systems or self-contained breathing apparatus). A further consideration is the almost 2-year shelf life of calcium hypochlorite, which is typically stored in 50-lb buckets that are more easily stored than chlorine gas cylinders or drums of bleach.

From automated systems in small U.S. cities to village wellheads in Honduras, calcium hypochlorite can be a cost-effective, preferred option for community drinking water chlorination.

Steve Hubbs retired from water treatment operations at the Louisville Water Company in 2004. He remains an active volunteer in the drinking water community today. He has installed several calcium hypochlorite systems in Central America.