

Evaluating Your Chlorination System

Tablet Chlorination Proves a Viable Alternative

Water chlorination has been one of the greatest innovations of the last century. The technology not only has made our drinking water safe, it has provided effective water purification for a multitude of other industries.

Yet, while chlorination is a hero in many ways, as with any chemical, there are considerations to be made regarding its application. This article will focus on three popular forms of chlorine: gas, sodium hypochlorite and dry calcium hypochlorite tablets. Each has advantages and disadvantages relative to cost, convenience, effectiveness, storage and regulatory issues. A look at the pros and cons of each can answer many questions about what's right for your application.

Chlorine Gas

The good news about chlorine gas is that it is relatively inexpensive and doesn't produce byproducts such as chlorite or chlorate ions. For companies, small municipalities and small systems concerned about budgets, chlorine gas is very attractive. Yet, that's where most of its "pros" end. Two disadvantages of chlorine gas are toxicity and corrosiveness.

A more serious disadvantage of gaseous chlorine is the total cost of handling and operating safety. Federal regulations limit the amount of gas that can be stored at a single location without extensive provisions to contain potential leaks. On-site storage of large quantities of gas must be enclosed in and protected by systems called "scrubbers," which have the ability to contain and neutralize gas in the event of a leak. Scrubbers are costly to purchase and install and require regular maintenance. In addition, operators must have an emergency response plan in place. Such plans usually are authored by an engineering firm following a careful study of the operator's overall operation. Costs can mount quickly.

Other maintenance costs include frequent overhauls of regulators and the requirement to wear protective breathing gear when handling containers or providing maintenance on the systems even with the smallest installations.

Finally, a little-known cost associated with using chlorine gas is the record-keeping and reporting required. Such regulations have been imposed by the

Occupational Safety and Health Administration (OSHA) and add to the labor costs of using chlorine gas. In short, the overall related costs of using chlorine gas can far outweigh the cost of the gas itself.

Sodium Hypochlorite (Bleach)

A second type of chlorine commonly used today is liquid sodium hypochlorite or bleach. At first glance, bleach seems like the perfect alternative to gas since it's relatively cheap, easy to apply and not nearly as lethal as gas. After all, it's just household bleach, right? Most everybody has that at home under their kitchen sink.

Liquid sodium hypochlorite also has several disadvantages. First and foremost, the product breaks down over time, losing efficacy and forming byproducts, which can add additional problems to solve. When you consider that residual injection rates are sometimes less than 1 part per million (ppm), continuous loss of chemical strength can be a real challenge in maintaining consistent residuals. It's like shooting at a moving target with bullets that are less than fully charged

with gun powder. Constant corrections must be made to the injection rate in order to compensate for the steadily decreasing strength of the disinfectant. The breakdown of sodium hypochlorite depends on storage temperature and the presence of impurities in the concentrated product. A decomposition byproduct of sodium hypochlorite is sodium chlorate. For every 1 percent of hypochlorite lost, 0.8 percent sodium chlorate is formed. Thus, if an 8 percent active hypochlorite product is used to provide six ppm of available chlorine in water, it also will deliver 1.5 ppm sodium chlorate.

Metering pumps and other injection components are vulnerable to corrosion. Since bleach is considered a hazardous chemical, containment at the treatment site is a consideration. Metering pumps typically are placed on top of containers, which requires lifting chemical to the pump. As bleach off-gasses, pumps often lose their prime causing the system to either fail entirely or pump inconsistently. Like chlorine gas, personnel working with this form of chlorine should receive safety training and wear proper protective clothing during handling. Employees



*New look, new location...
same commitment to quality
and service. Trust the leader.*

Pacific Ozone Technology
6160 Egret Court, Benicia, Ca 94510
707-747-9600 Ph / 707-747-9209 Fx
Sales@Pacifcozone.Com

About the Author

Carl Hammonds is founder and president for the Houston-based Hammonds Companies, Inc., a manufacturer of tablet water chlorination systems. Hammonds introduced the concept of factory engineered tablet chlorination systems to the industry during the mid-1990's as a sole source manufacturer for PPG Industries, Inc. In October 2000, Hammonds unveiled its own next-generation advanced technology tablet chlorination system.

Consider This

Selecting the right disinfection equipment for the job can be difficult. When selecting among chlorine gas, sodium hypochlorite or chlorine tablets, consider these points carefully.

- **Personnel safety.** You have to put the safety of humans ahead of all other factors—it's the law. Like everything else, safety comes at a cost. Special storage and handling, liability insurance, personnel training and government imposed record-keeping must be taken into account when figuring the total cost.
- **Performance.** Whichever form of the chemical and equipment you finally choose, be sure it has a proven track record of performance. Technology that must be constantly tweaked and adjusted or carries with it "variables" will soon get old. Simply stated, it has to work.
- **The chemical.** Don't fail to consider all of the costs of dealing with any form of chlorine. A bargain on the front end may have liabilities that tilt the scales when factoring in all the incidentals. Environmental impact, federally mandated safety equipment and operating and handling characteristics such as effects on equipment maintenance must be considered. A massive containment project or scrubber system may offset the savings in chemical costs over a project's life.
- **Match people and technology.** Be sure to match a technology with your operating and maintenance team's capabilities. Even the most basic maintenance task can be unacceptable if you don't have a properly trained and willing staff. On the other end of the technology scale, choosing the latest high tech marvel can prove a disaster if the level of expertise in your organization doesn't match the manufacturer's expectations. Even the best technology won't have a chance for success if your operating personnel won't buy into the program. Equipment that intimidates your personnel will be doomed to failure.

working with the solution also take on the risk of physical injury in just handling the heavy drum containers. Companies using bleach also must pay careful attention to ambient temperatures and proximity to equipment susceptible to corrosion when storing the chemical. In addition, bleach never should be stored near acid products, since the reaction between acid and sodium hypochlorite will produce a potentially fatal chlorine gas.

Another consideration associated with the use of bleach is its overall efficiency. Companies and small municipalities that use this form of chlorine often report an uneven distribution of the solution throughout the water supply. It appears that liquid chlorine provides "pockets" of the substance near the distribution source and only trace amounts in outlying areas.

Financially, bleach remains the lowest cost alternative to gaseous chlorine relative to pure chemical cost. Similar to gas, the total cost of disinfection includes many subtle factors beyond that of the basic chemical.

Dry Chlorine Tablets

A third type of chlorine becoming increasingly popular today is calcium hypochlorite in dry tablet form. Calcium

hypochlorite, particularly in tablet form, is an effective alternative to gaseous chlorine and even liquid sodium hypochlorite. It contains about 65 percent available chlorine, is safer to handle and easily can be loaded into feed equipment.

Perhaps the greatest advantage of solid calcium hypochlorite disinfection is the overall safety factor. Although solid tablets emit an odor similar to that of swimming pool chemicals, other than a simple dust mask and gloves, there is no special breathing protection or personal safety gear required for general handling. Buckets can be stored in most dry facilities but must be kept from coming into contact with organics such as acids or oils since calcium hypochlorite is classified as an oxidizer. When stored properly, calcium hypochlorite tablets are relatively stable over long periods of time, losing only 5 percent of their strength in the first year.

Most manufactures offer calcium hypochlorite tablets with a sequestering agent blended into the tablets, which for the most part, keeps calcium in the chemical from plating out on system components. Occasional cleaning of sediment from solution tanks is considered easy and requires very little on-site labor. It is important to choose a system

that accurately meters the solution evenly and consistently into the water stream. Calcium hypochlorite systems previously had a bad wrap due to some bad publicity regarding some people who attempted to use little more than swimming pool systems as a means to dissolve and distribute the chemical. The problem with using such a system is that high volume centrifugal pumps cannot provide fractional ppm consistency required for potable treatment. A well-designed calcium hypochlorite system should have the option of manual or automatic controls making it possible to receive pacing instructions from either a chlorine analyzer or flow meter. For any calcium hypochlorite system to function properly, it must provide even and consistent dissolution of the solid tablets. From that point on, the system functions much like a bleach system, only with far more stability.

The downside of calcium hypochlorite is chemical cost. Depending on quantities

purchased, the cost is in the range of 50 percent greater than that of bleach. However, new developments may evolve that accept granulated calcium hypochlorite. These new systems will have all the benefits of tablets but compete heads up with bleach in cost.

A good case can be made for all three forms of chlorine. However, it is important when choosing any long-term methodology to make more than a superficial appraisal of the concept.

A difficult economy and an increased focus on efficiency makes choosing disinfection equipment a difficult task. It involves far more than simple cost of the chemical or equipment alone. A system that works for you will be one that considers your organization's ability not only to purchase and install, but to operate and maintain a program throughout its projected life. Fail to consider that, and you will fail, indeed.

WQP

For more information on this subject, write in 1016 on the reader service card.



LearnMore!

For more information related to this article, go to www.wqpmag.com/lm.cfm/wq090306