

MIOX ON-SITE CHEMICAL GENERATOR

DISCRIPTION AND SPECIFICATIONS

The electrolytic cell of a MIOX on-site chemical generator uses salt combined with water and electricity to generate disinfectant at the point of use. MIOX offers two different types of on-site chemical generators. MIOX's sodium hypochlorite (HYPO) systems are engineered to provide the absolute lowest cost and most reliable bleach available on the market. Alternatively, MIOX's Mixed Oxidant Solution (MOS) systems are engineered for maximum disinfection efficacy through proprietary cell design, control of power and cell geometry

MIOX offers both mixed-oxidant and hypochlorite generators. The chemicals are generated at less than 1% concentration. Because the on-site generation process uses only salt, water and electricity, water treatment facilities can do away with the hazardous chemicals, such as chlorine gas or bulk bleach, typically associated with water disinfection. With a MIOX generator, dry salt is loaded into a brine tank and combined with water to form a saturated brine solution. This brine is then diluted to a 3% to 5% concentration and fed to the electrolytic cell, which produces either a mixed-oxidant or hypochlorite solution, depending on cell parameters. The disinfectant solution is collected in a storage tank with a low-level float that activates the MIOX generator as the tank is emptied and a high-level float that turns off the system when the tank is full. The disinfectant is injected into the water stream, and the chlorine residual can then be measured using a standard DPD test.

Four Key Benefits

Improved Operator Safety

Chlorine sources traditionally used in water disinfection pose a variety of hazards to the operator. Chlorine gas is probably the most hazardous source of chlorine used by water treatments plants; it is toxic and the use of chlorine gas cylinders also poses a pressure hazard. Industrial strength bleach used for water disinfection is a 12.5 percent-by-weight solution, which is caustic. On-site Generator (OSG) systems use only water and salt and produce non-hazardous oxidant solutions with a chlorine content that typically contains less than 0.8 percent free available chlorine. Treatment plants that use OSG systems typically have to face less oversight from state health agencies, provide less safety training for operators, and have less of an insurance issue compared to those using traditional forms of chlorine.

Information is provided in the short videos which compare MIOX to hazardous chemicals like chlorine dioxide and chlorine gas. Click on the links below:

<https://www.youtube.com/watch?list=PLsgAUXsUB5zIW-YNKrmnL9-8UgHnJe4S&v=1EqVssUgyHI>

<https://www.youtube.com/watch?list=PLsgAUXsUB5zIW-YNKrmnL9-8UgHnJe4S&v=DthoIFD84yA>

Higher Quality Chemicals

Recent research has indicated that hypochlorite storage leads to chlorate (ClO₃⁻), and perchlorate (ClO₄⁻) production from hypochlorite anions. Additionally, factors such as time in storage, temperature at storage, and exposure to sunlight can cause hypochlorite loss through other chemical degradation pathways. These observations indicate that older hypochlorite will contain less and less free available chlorine and more degradation products. Storage issues mount in areas that are required to have 30-day or higher supplies of disinfectant chemicals on hand. MIOX OSG systems, on the other hand, typically produce only a two- to three-day supply of chlorine at a time, thus providing a potent disinfectant. Salt does not decompose, so that long-term requirements can be met by storing enough salt to comply with regulations.

Greener Application

MIOX OSGs mean greener operations compared to traditional chlorination methods. In addition to the reduction in use and potential accidental release of toxic chemicals, transportation of chemicals from factories to the water plant is reduced. For example, it takes one delivery of salt to produce the same amount of chlorine as more than three deliveries of 12.5 percent sodium hypochlorite solution. This, therefore, lessens the carbon footprint of the plant because less fossil fuel is needed to supply the plant with disinfectant.

Cost Savings

OSGs typically produce chlorine at a much lower cost than traditional delivery methods, primarily because there is no need to continuously purchase expensive chlorine chemicals. This is especially the case for systems using calcium hypochlorite. Additional savings come from decreased transportation and safety-related costs, and lower insurance premiums. Although OSG systems usually present a large, up-front capital equipment cost, most water plants realize a return on their investment in OSG equipment within two to three years.

MIOX systems are used in multiple applications through a wide range of products, cost-effectively producing disinfection chemistry from 1 to 906 kg per day FAC (free available chlorine) utilizing a single on-site chemical generator. Multiple on-site generators can be used in series to provide higher free available chlorine capacities based on the application requirements. With this flexibility, MIOX on-site chemical generators can be utilized in many applications including:

- Drinking water treatment for small communities to cities of 10 million people
- Wastewater treatment for municipalities and industrial processes
- Large industrial cooling towers and district cooling buildings
- Oil & Gas water treatment including frac and produced water recycling
- Food and beverage applications including clean-in-place and process water
- Legionella prevention at hotels, casinos, universities, and hospitals

In addition, MIOX's on-site chemical generators are much more compact in design compared to competition. On-Site Generator comes with the electrolytic cell, transformer/rectifier and control system installed in one enclosure with all interconnect piping and wiring already done and system is completely factory tested prior to shipping

from MIOX factory. The design advantages are small footprint, ease of installation and reduction of labour and materials needed on site.

MIOX performs very much like chlorine dioxide (ClO₂) without the costs and complicated operations, and with a stable, long-lived residual. By comparison with ClO₂, the MIOX mixed-oxidant solution is robust to variations in raw water oxidant demand. Maximum contaminant levels (MCLs) are around .8 mg/L for chlorine dioxide, as opposed to the MCL for chlorine, which is around 4.0 mg/L. Thus, if a customer has ClO₂, they will be continually making adjustments based on raw water quality, far more than they would with MIOX, which doesn't have to be adjusted because of the automated system operations, plus the larger window within which the residual at the tap can range. The operator can set a dosage sufficient to meet a residual target and be assured that the target will be met within the broad limits of detectable and 4 mg/L without devoting a lot of time to adjustment of the dose. With MIOX equipment having automated monitors and controllers, hitting the target residual is virtually assured with only routine servicing of the equipment.

MIOX Mixed Oxidant Solution (MOS) was discovered by scientists at Los Alamos National Laboratory in 1982; the first patent for MIOX electrolytic technology was issued in 1988; the first field unit was installed in 1992; the company MIOX Corporation was incorporated in 1994; and the technology was developed for the US Army under a Defense Advanced Research Project Agency (DARPA) grant and commercialized in 2003 under a US Navy Small Business Innovation Research (SBIR) grant. Today MIOX holds 55 total patents on electrolytic expertise with thousands of equipment installations in over 50 countries.

The electrolytic technology used today by MIOX to create Mixed Oxidant Solution (MOS) was developed for the U.S. military in 2003 under a Defense Advanced Research Projects Agency (DARPA) grant from the United States Department of Defense. The Army presented a technical challenge to MIOX: it needed a portable water disinfection system that could be used quickly in any remote location and in any environment. Groundwater contamination was a primary challenge for US troops because traditional water disinfection methods were unable to eliminate *Cryptosporidium* and other diseases from drinking water quickly in remote locations. Utilizing bulk sodium hypochlorite or hypo tablets could reduce *Cryptosporidium* by 3 log reduction in 24 hours, which was not efficient enough to promote troops' mobility in unfamiliar territories with unreliable water sources. Years of subsequent research and development show MIOX technology offers a very safe and extremely effective water disinfectant capable of eliminating dangerous microorganisms including bacteria, viruses and protozoan cysts.

MIOX invests deeply in intellectual property and regularly partners with new industries to develop solutions that meet very unique disinfection needs. Today MIOX holds 55 total patents on electrolytic expertise with thousands of equipment installations in over 50 countries. On-Site Generators come with the electrolytic cell, transformer/rectifier and control system installed in one enclosure with all interconnect piping and wiring already done and system is completely factory tested prior to shipping from MIOX factory.

Links to case studies for Bogota and Kolom drinking water treatment plants:

<http://www.miox.com/news-press/press-releases/oniko-installs-miox-on-site-disinfection-system-in-the-ukrainian-city-of-ko>

<http://www.miox.com/news-press/press-releases/miox-ships-large-scale-disinfection-equipment-to-bogota-colombia>