

# HALOX Products Fact Sheet

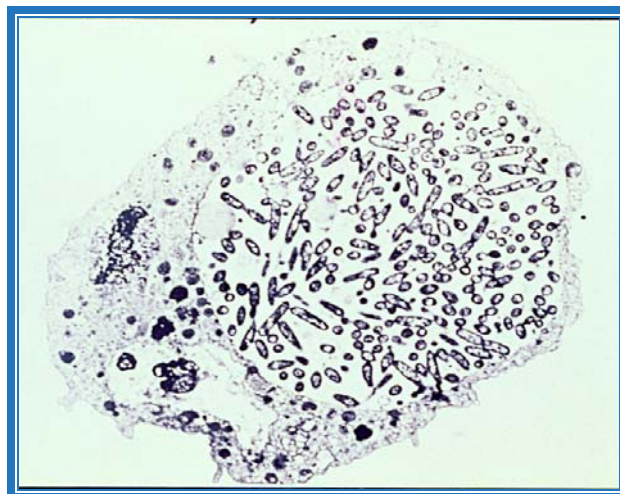
## Biocidal Efficacy Of Chlorine Dioxide (ClO<sub>2</sub>)

### Introduction

Microbial infection is responsible for hundreds of thousands of illnesses and thousands of deaths each year in the United States. Frequent outbreaks of disease have been linked to food handling and processing (Salmonella, Shigella, and E. Coli), drinking water (Giardia, Cryptosporidium) and hotels, cruise ships, hospitals and office buildings (Legionella).

### Significance of Biofilm

A related major problem is biofilm. When certain microbes reach a surface, they attach themselves by producing polysaccharides (similar to a spider web in design and function). This material is sticky and very difficult to remove. Channels are formed in this film, through which water flows. The sticky web catches nutrients and other microbes that pass by, providing food and a quick growth mechanism. Problems associated with biofilm growth include: 1) fouled heat exchange equipment in cooling systems, 2) increased corrosion rates on equipment, and 3) formation of a habitat for pathogenic organisms. Even if all waterborne microorganisms are eliminated, regrowth quickly occurs due to bacterial communities and nutrients in the biofilm.



Legionella

### Chlorine Dioxide

Chlorine dioxide (ClO<sub>2</sub>) is a highly effective, environmentally-friendly biocide. It is a selective oxidant that attacks planktonic and sessile bacteria, disinfects surfaces, and rapidly reduces biofilms. ClO<sub>2</sub> is a stable, dissolved gas that is a strong bactericide and virucide at concentrations as low as 0.1 ppm. With minimal contact time, it is highly effective against pathogenic organisms such as Legionella, amoebal cysts, Giardia cysts, E. Coli, and Cryptosporidium. ClO<sub>2</sub> reduces biofilms so bacterial regrowth is significantly impeded.

ClO<sub>2</sub> does not ionize to form weak acids (as chlorine and bromine do) in aqueous solutions. This allows ClO<sub>2</sub> to be effective over a wide pH range.

### Biocidal Efficacy

ClO<sub>2</sub> is arguably the best biocide approved by the USEPA and FDA. Unlike chlorine, it does not form carcinogenic disinfectant byproducts (THMs and HAAs), and it is more effective at lower dosing levels.

The criteria for disinfection, as defined by the USEPA, are as follows. ClO<sub>2</sub> meets all of these criteria.

1. a 99.9% reduction in Giardia lamblia (3 log reduction)
2. zero lactose fermenting coliform
3. less than 10 cfu/mL non-lactose fermenting coliforms and
4. 99.99% reduction in enteric virus (4 log) concentrations.

### Chlorine Dioxide Approvals

- United States Environmental Protection Agency (USEPA)
- United States Food and Drug Administration (FDA)
- Building Services Research and Information Association of the UK (BSRIA)

### Disinfectant Power of ClO<sub>2</sub>

ClO<sub>2</sub> is shown to be an effective disinfectant at residual concentrations between 0.2 and 0.8 ppm. ClO<sub>2</sub> penetrates the cell wall of the microorganism and disrupts metabolic functions. This is more efficient than other oxidizers that "burn" whatever they come in contact with. This allows lower effective concentrations to be used. ClO<sub>2</sub>, like ozone, is a dissolved gas that penetrates biofilm by molecular diffusion. However,

unlike ozone, ClO<sub>2</sub> is stable and soluble, allowing it to travel to the base of the film where it attacks microorganisms and attacks and loosens the biofilm at its point of attachment. Other oxidizers react mostly on the surface of the biofilm to form an oxidized layer, like charring on wood. This precludes further penetration. No biocide has proved to control biofilm better than ClO<sub>2</sub>.

### **Halox Chlorine Dioxide Generators**

Because U.S. Federal law prohibits the transportation of ClO<sub>2</sub>, chlorine dioxide is generated on-site at the point-of-use. Halox SRE electrochemical systems use electricity in the unit's cassette(s) to generate a small amount of acid to convert a single precursor, sodium chlorite, into ClO<sub>2</sub> and NaCl. There is no acid to handle, no chlorine and no bleach. Halox generators produce up to 100 g/hr (5.5 lb/day) of ClO<sub>2</sub>.

Halox Accu-Cide chemical generators safely mix dilute sodium chlorite and acid to generate chlorine dioxide. No chlorine and no bleach are used. Accu-Cide generators are available in wall-mount or skid-mount configurations and produce up to 10 lb (4.5 kg) of ClO<sub>2</sub> per day.

When operated according to Halox guidelines, this Halox equipment generates a safe, dilute solution at a controlled, measurable rate that contains up to 550 ppm of chlorine dioxide. For specific sizing concentrations, please contact Halox Technical Service. Immediately after generation, the ClO<sub>2</sub> solution is fed directly to the water being treated. This self-contained system is safe to use and simple to operate.

### **Applications**

Cooling Towers and Loops: ClO<sub>2</sub> controls algae, planktonic bacteria, biofilm and scale for maximum efficiency of heat exchangers and ancillary equipment. ClO<sub>2</sub> is more stable than other oxidizing biocides and compatible with most water treatment chemistry. This "selective oxidation" makes ClO<sub>2</sub> ideal for systems with corrosion problems.

Potable Water: ClO<sub>2</sub> is EPA-approved for both pretreatment and final disinfection of drinking water. In pre-treatment, it effectively removes iron and manganese and promotes flocculation. It also removes taste and odor components as well as halogenated disinfectant byproduct precursors e.g. trihalomethanes (THM's). In post-treatment, it provides a lasting residual throughout the distribution system.

Food and Beverage: ClO<sub>2</sub> provides excellent microbiological control in flume waters, packaging operations and process disinfection. It is ideal for the washing of cut fruits, vegetables and poultry (FDA approved) as well as bottling and brewery applications. ClO<sub>2</sub> does not react with most "organics" in flume water, which makes it a very effective disinfectant. It also neutralizes foul smelling secondary and tertiary amines formed in the meat packing industry.

Waste Treatment and Odor Control: ClO<sub>2</sub> safely oxidizes phenols, cyanides, aldehydes, and mercaptans, reduced sulfur compounds and some pesticides. It is useful in both waste treatment and scrubber systems.



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