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Chlorine dioxide

The quest for the disinfectant replacement of chlorine resulted in several possible candidates. Although no one disinfectant is perfect, Chlorine dioxide is a very good alternative due to its characteristics.

1. What is stabilised Chlorine dioxide?

Like ozone and chlorine, chlorine dioxide is an oxidizing biocide and not a metabolic toxin. This means that chlorine dioxide kills microorganisms by disruption of the transport of nutrients across the cell wall, not by disruption of a metabolic process. Stabilised chlorine dioxide is ClO2 buffered in an aqueous solution. Adding an acid to the required concentration activates the disinfectant.

2. How does it work?

Of the oxidizing biocides, chlorine dioxide is the most selective oxidant. Both ozone and chlorine are much more reactive than chlorine dioxide, and they will be consumed by most organic compounds. Chlorine dioxide however, reacts only with reduced sulphur compounds, secondary and tertiary amines, and some other highly reduced and reactive organics. This allows much lower dosages of chlorine dioxide to achieve a more stable residual than either chlorine or ozone. Chlorine dioxide, generated properly (all chlorine dioxide is not created equal), can be effectively used in much higher organic loading than either ozone or chlorine because of its selectivity.

3. How effective is it?

The effectivety of chlorine dioxide is at least as high as chlorines, though at lower concentrations. But there are more and important advantages.

1. The bactericidal efficiency is relatively unaffected by pH values between 4 and 10;
2. Chlorine dioxide is clearly superior to chlorine in the destruction of spores, bacteria's, viruses and other pathogen organisms on an equal residual base;
3. The required contact time for ClO2 is lower;
4. Chlorine dioxide has better solubility;
5. No corrosion associated with high chlorine concentrations. Reduces long term maintenance costs;
6. Chlorine dioxide does not react with NH3 or NH4+;
7. It destroys THM precursors and increases coagulation;
8. ClO2 destroys phenols and has no distinct smell;
9. It is better at removing iron and magnesia compounds than chlorine, especially complex bounds;

4. How is it applied?

Chlorine dioxide can be used in two ways. The first is the on-site generation through a special process. The second is the possibility to order Chlorine dioxide in its stabilised form (SCD).

SCD is activated on-site whenever its usage is desirable. It can be dosed into an existing or new process where disinfection is required.
This makes it an easy-to-use, safe and versatile disinfectant.
The dosing system is compact, safe, flexible and low on maintenance.

Where is it applied?

Legionella prevention and control

In the prevention and control of legionnaires disease causing microbes, chlorine dioxide has taken an eminent roll. The specific characteristics of the disinfectant make sure ClO2 gets the job done where others fail.

Biofilm in the piping can protect legionella from most of the disinfectants.

Chlorine dioxide however removes the biofilm and kills the bacteria, spores and viruses.

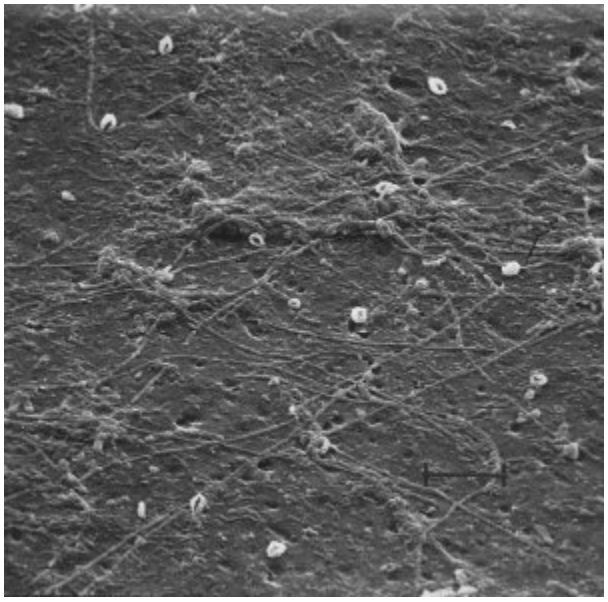
Other advantages are:

1. The bactericidal efficiency is relatively unaffected by pH values between 4 and 10;
2. The required contact time for ClO2 is lower;
3. Chlorine dioxide has better solubility;
4. Chlorine dioxide does not react with NH3 or NH4+;
5. It destroys THM precursors and increases coagulation;
6. ClO2 destroys phenols and has no distinct smell;

Biofilm removal and control

A biofilm is a layer of microorganisms contained in a matrix (slime layer), which forms on surfaces in contact with water. Incorporation of pathogens in biofilms can protect the pathogens from concentrations of biocides that would otherwise kill or inhibit those organisms freely suspended in water.

Biofilms provide a safe haven for organisms like Listeria, E. coli and legionella where they can reproduce to levels where contamination of products passing through that water becomes inevitable.



Legionella in biofilm (©Vernagene)

It has been proven beyond doubt that chlorine dioxide removes biofilm from water systems and prevents it from forming when dosed at a continuous low level. Hypochlorite on the other hand has been proven to have little effect on biofilms.

Cooling towers treatment

Cleaning and disinfecting cooling towers is essential for several reasons. Most of which are well known. Clean pipes mean higher heat exchange efficiency, pump lifetime improvement and lower maintenance costs.

Most people however, are unfamiliar with the fact that cooling towers pose a possible health risk. The high temperature condition is ideal for the growth of several pathogen organisms (like legionella).

The usage of chlorine dioxide comes with several advantages:

- It is a very powerful disinfectant and biocide;
- It prevents and removes biofilm;
- Unlike chlorine, Chlorine dioxide is effective at pH between 4 and 10. No dumping and filling with fresh water required;
- The corrosive effects of chlorine dioxide are minimal compared to the corrosive effects of plain tap water;
- The bactericidal efficiency is relatively unaffected by pH values between 4 and 10.
- Acidisation, therefore is not required;
- Chlorine dioxide can be used as a spray. All parts therefore, can easily be reached;
- And last but not least: less environmental impact.

Scrubbers

Scrubbers are similar in design to cooling towers. The primary difference between the two is that scrubbers are pressurized systems, while cooling towers are vacuum systems. Scrubber's re-circulate water and spray it across the top of the system, counter-currently to the airflow. The function of re-circulating water is to absorb odour-causing species from the air.

Chlorine dioxide added to the re-circulated water reacts rapidly with odour-causing species that have been absorbed in the water, as well as those species that remain in the air. Usually, a very low chlorine dioxide residual, around 0.2-ppm, is sufficient to ensure odour control.

Potable water disinfection

Chlorine dioxide has been used for years in potable water disinfection (US since 1944). The need arose when it was discovered that chlorine and similar products formed some dangerous DPD's (disinfection by-products) like THM (trihalomethanes).

Since then many UK and US based water companies have started using ClO2. There are however more reasons to use chlorine dioxide:

1. The bactericidal efficiency is relatively unaffected by pH values between 4 and 10;
2. Chlorine dioxide is clearly superior to chlorine in the destruction of spores, bacteria's, viruses and other pathogen organisms on an equal residual base;
3. The required contact time for ClO2 is lower;
4. Chlorine dioxide has better solubility;
5. No corrosion associated with high chlorine concentrations. Reduces long term maintenance costs;
6. Chlorine dioxide does not react with NH3 or NH4+;
7. It destroys THM precursors and increases coagulation;
8. ClO2 destroys phenols and has no distinct smell;
9. It is better at removing iron and magnesia compounds than chlorine, especially complex bounds;

Vegetables washing

Chlorine dioxide is an excellent product for washing vegetables. The ability to kill spores, viruses and fungi at low concentrations is essential.

ClO2 is a proven product that can be used to solve several food-related problems. It does not affect taste, odour or appearance. It is safe to use and complies with food regulations. Below are some examples where chlorine dioxide has been applied.

- Apples: control of E.Coli and listeria bacteria's
- Potatoes: protection against "late blight" and "silver scurf"
- Lettuce, celeries and onions: compared to hypochlorite the vitamin-c content resulted higher and the potassium content lower
- Citrus fruits: protection against "green mould" and "sour rot" proved to be successful at several pH values, low concentrations and limited contact time.

Hot and cold water systems

The advantages in using chlorine dioxide with hot and cold water systems have already been shown at the descriptions on biofilm and legionella. There are however more advantages:

1. The bactericidal efficiency is relatively unaffected by pH values between 4 and 10;
2. Chlorine dioxide is clearly superior to chlorine in the destruction of spores, bacteria's, viruses and other pathogen organisms on an equal residual base (even cryptosporidium and giardia);
3. The required contact time for ClO2 is lower;
4. Chlorine dioxide has better solubility;
5. No corrosion associated with high chlorine concentrations. Reduces long term maintenance costs;
6. Chlorine dioxide does not react with NH3 or NH4+;
7. It destroys THM precursors and increases coagulation;
8. ClO2 destroys phenols and has no distinct smell;
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http://www.lenntech.com/library/clo2/chlorine-dioxide.htm