Chlorine Dioxide Advantages Over Chlorine Bleach

General

Chlorine dioxide (ClO_2) is dissolved gas in water which acts as a broad spectrum microbiocide in both the water and vapor phases. Sodium Hypochlorite (Chlorine Bleach) is commonly confused with ClO_2 due to both compounds having “chlorine” in their trade names when, in fact, the reaction chemistries, effectiveness, and associated byproducts are vastly different.

Reaction Chemistry

ClO_2 achieves its disinfection through electron transfer, meaning that it is a pure oxidizer. The byproducts of ClO_2 reacting with biological matter include mostly chlorite, chlorate, and salt. Bleach, on the other hand achieves its disinfection through chlorination. Chlorination of biological matter leads to the formation of disinfection byproducts (DBPs), particularly trihalomethane (THM). THMs are a recognized carcinogen by the USEPA.

Effectiveness

ClO_2 is a more effective sanitizer in water with high levels of organic matter and other dissolved solids because it selectively reacts with biological matter, largely ignoring interferences. Bleach reacts indiscriminately and is impacted by the presence of organics and other dissolved and particulate interferences.

ClO_2 is safer than bleach because it doesn’t produce harmful byproducts like THMs that can form when bleach reacts with organic matter in water. It is also NOT mutagenic or carcinogenic in humans.

ClO_2 is less harmful to the environment than bleach because it breaks down into harmless byproducts like water, oxygen, and common table salt. Further, it breaks down quickly has a reduced impact on soil and does not add toxic deposits to the ground

ClO_2 General Advantages

- ClO_2 is effective against a wider range of pathogens, including bacteria, viruses, and even some parasites that can resist chlorine
- Chlorine's efficacy can be reduced in water with high or low pH levels. Chlorine dioxide remains effective across a broader pH range

ClO_2 General Advantages

- ClO_2 can help control biofilm, a slimy layer of microorganisms that can harbor pathogens, and be difficult to eradicate with chlorine alone.
- Chlorine dioxide is generally less corrosive to pipes and equipment compared to chlorine bleach.
- Unlike chlorine bleach, which can react with organic matter in water to produce harmful disinfection byproducts (THMs and HAAs), chlorine dioxide doesn't create these carcinogens.

Feature	ClO_2	Bleach
DBP Formation	Low	High
Effectiveness	Broad Spectrum	Some pathogens resistant
pH Range	Wide (4-12)	>7pH less effective
Biofilm Control	Effective	Less Effective
Corrosivity	Low	High

Specific concentrations of ClO_2 are used for different applications. Your Valent Water Technologies field engineer will work with you to establish these concentrations as well as test for efficacy.

Regulatory Considerations

There is no reportable spill quantity associated with maintaining ClO_2 at 0.3% concentration or less on site. Exposure limits are as follows:

OSHA PEL	0.1ppm-TWA
OSHA PEL	0.3ppm-STEL
ACGIH TLV	0.1ppm-TWA
ACGIH TLV	0.3ppm-STEL