

Chlorine Dioxide

IRON & MANGANESE CONTROL

Iron & manganese are common problems associated with potable water treatment. Oxidation of iron & manganese with chlorine dioxide offers utilities a simple solution without compromising regulatory compliance.



- **Broad spectrum antimicrobial activity**
- **Effective over a wide pH range**
- **2.6 times the oxidizing capacity of chlorine**
- **Does not chlorinate or form halogenated DBPs**
- **Selective chemistry; no reaction with ammonia**
- **Easily implemented and fed to system**
- **Not temperature sensitive**
- **Residuals easily analyzed**
- **Bacteria, protozoa & virus inactivation**
- **Cost effective alternative**

Chlorine dioxide offers a realistic solution to intermittent or year-round iron and manganese problems. Iron and manganese concerns affect more water systems than almost any other water quality issue and are the root cause of most customer complaints received by water treatment facilities. The U.S. EPA established secondary maximum contaminant levels (SMCL) for iron at 0.3 mg/L and for manganese at 0.05 mg/L. These guidelines correspond to approximate concentrations at which iron and manganese will not cause aesthetic problems such as colored water, turbidity, staining and bad taste that would impact public acceptance. EPA has also issued a manganese health advisory at the 0.05 mg/L SMCL, where potential chronic health concerns at or below this level are unlikely to occur. SMCL are monitored and regulated at the state level and are not federally enforceable.

New regulations like the Stage One and Stage Two Disinfectant and Disinfection Byproduct (DBP) Rules, limiting trihalomethanes (THMs) and haloacetic acids (HAAs) levels have severely curtailed the use of traditional chlorine treatment resulting in the need to reevaluate iron and manganese treatment strategies.

Easy Solution

Chlorine dioxide instantaneously reacts with soluble iron Fe(II) & manganese Mn(II) to form insoluble Fe(III) and Mn(III,IV) precipitates that are easily removed by filtration. The use of chlorine dioxide will help optimize overall treatment efficiencies, including improved coagulation, reduced turbidities, improved particulate removals, increased CT Values and lower THMs and HAAs.

Versatile Disinfectant

Chlorine dioxide's use is not limited to just iron and manganese problems in potable water systems. This versatile disinfectant also can be used as a primary disinfectant in potable water, as it reduces or controls bacteria, viruses, cysts and algae while being effective over wide temperature and pH ranges. Using chlorine dioxide will help optimize overall treatment efficiencies, including improved coagulation, reduced turbidities, improved particulate removals, increased CT values and lower THMs and HAAs.

Chlorine dioxide, when used as an oxidant for iron and manganese reduction in potable water treatment, is a powerful oxidant with CT values second only to ozone in biocidal efficacy, but without the high capital expenditures and the ozonation byproducts. In addition, chlorine dioxide does not have the solids loading problem and the lengthy detention times associated with potassium permanganate. Using chlorine dioxide does not result in the formation of chlorinated or brominated disinfection byproducts like THMs or HAAs. A reduction byproduct of chlorine dioxide is chlorite ion, which is regulated under the Stage One and the Stage Two Disinfectant and Disinfection Byproduct (DBP) Rules at 1.0 mg/L maximum contaminant level (MCL). At typical dosage rates, chlorine dioxide can be used successfully to help control iron and manganese problems without exceeding the MCL.



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Stoichiometric Reactions

Chlorine dioxide's stoichiometric oxidation reactions with iron and manganese are:

- 1.2 mg/l ClO₂ to 1.0 mg/l Iron
- 2.5 mg/l ClO₂ to 1.0 mg/l Manganese

Low Capital / Easily Implemented

Chlorine dioxide cannot be shipped in a drum and must be generated on-site. An International Dioxide, Inc. (IDI), OXYCLHOR® on-site generator produces chlorine dioxide solution safely under vacuum and delivers the solution to the point of application. Chlorine dioxide is fed similarly to existing chlorine disinfection treatment systems often using the existing feed piping. The OXYCHLOR® generators use ADOX® sodium chlorite as the precursor solution to chlorine dioxide, which is available from IDI. There are numerous types of affordable generators available from IDI that can normally be installed in 1 - 2 days to meet your treatment needs.

Additional Uses

Chlorine dioxide's broad spectrum capabilities enable it to be used in a variety of potable water applications:

- Taste and Odor Control
- Improved Disinfection Credits (C x T)
- Trihalomethane (THMs) and Haloacetic Acids (HAAs) Control
- Color Removal and Algae Control
- Cryptosporidium Inactivation
- Nitrification Control
- Zebra Mussel Control

Approvals

The use of chlorine dioxide is approved by U.S. EPA's Office of Ground Water and Drinking Water. The ADOX® sodium chlorite precursor solutions carry U.S. EPA registrations and are ANSI/NSF Standard 60 Drinking Water Additive certified.

Information Available

International Dioxide, Inc., a DuPont Company, is a world-leading provider of chlorine dioxide products and related technology for disinfecting, sanitizing and odor control applications. IDI has specialized in chlorine dioxide technologies for over 60 years and is a leading supplier of chlorine dioxide technologies for a wide variety of markets. For additional information about International Dioxide's OXYCHLOR® chlorine dioxide generator systems and ADOX® sodium chlorite precursor solutions, please contact IDI's sales office.

Oxidation of ferrous iron by Chlorine Dioxide, pH 5.5 @ 2°C		
Percent of Stoichiometric	Reaction Time in Seconds	Residual Iron mg/L
125%	0	1.98
125%	5	0.13
125%	10	0.12
250%	0	1.63
250%	2 - 3	0.16
250%	10	0.11

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