Wastewater Disinfection with Chlorine Dioxide

Chlorine dioxide (ClO_2) is effective as both a disinfectant and an oxidant in wastewater treatment. It has several distinct chemical advantages compared to the traditional use of chlorine in wastewater treatment.

Chlorine dioxide is a broad-spectrum microbiocide effective over a wide pH range. Chlorine dioxide is non-reactive with ammonia and most nitrogen-containing compounds, and thus is effective at lower dose levels than chlorine. It destroys phenolics, simple cyanides and sulfides by oxidation. For odor control, chlorine dioxide will oxidize sulfides without the formation of colloidal sulfur. It is also used to oxidize iron and manganese compounds.

Application Description

Chlorine dioxide is an extremely effective disinfectant and bactericide, equal or superior to chlorine on a mass dosage basis. Its efficacy has been well documented[1] in the laboratory, in pilot studies and in full-scale studies using potable and wastewater. Unlike chlorine, chlorine dioxide does not hydrolyze in water. Therefore, its germicidal activity is relatively constant over a broad pH range. At pH 6.5, doses of 0.25 mg/L of chlorine dioxide and chlorine produce comparable one-minute kill rates for the bacterium *Escherichia coli*. At pH 8.5, chlorine dioxide maintains that same kill rate, but chlorine requires five times as long. Thus, chlorine dioxide should be considered as a primary disinfectant for high pH, lime-softened waters.

Chlorine dioxide is as effective as chlorine in destroying coliform populations in wastewater effluents, and is superior to chlorine in the treatment of viruses commonly found in secondary wastewater effluents (Figure 4). When Poliovirus I and a native coliphage were subjected to these two disinfectants, a 2 mg/L dose of chlorine dioxide produced a much lower survival rate than did a 10 mg/L dose of chlorine[2]. Chlorine dioxide has also been shown to be effective in killing other infectious bacteria such as *Staphylococcus aureus* and *Salmonella*.

When applied for disinfection (as opposed to oxidation), a disinfectant must provide specified levels of microorganism kills or inactivations as measured by reductions of coliforms, heterotrophic plate count organisms and *Legionella* bacteria.

Application Note

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Feed Requirements

The required dosages will vary with water conditions, the severity of contamination, and the degree of control desired. For wastewater and sewage applications, residual chlorine dioxide concentrations up to 5 mg/L are generally adequate.

For more information on dosage requirements specific to your application contact your Siemens Representative.

Method of Feed

Chlorine dioxide is a gas produced by activating sodium chlorite with an oxidizing agent or an acid source. Sodium chlorite is converted to chlorine dioxide through a chlorine dioxide generator and applied as a dilute solution. Chlorine dioxide solutions should be applied to the processing system at a point, and in a manner, which permits adequate mixing and uniform distribution. The feed point should be well below the water level to prevent volatilization of the chlorine dioxide. Avoid co-incident feeding of chlorine dioxide with lime or powdered activated carbon.

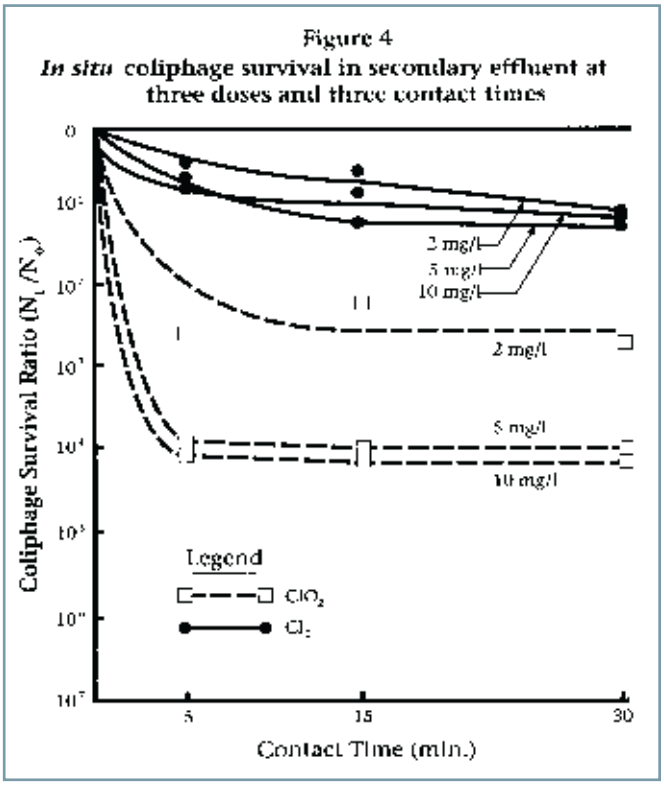
Chlorine Dioxide Analysis

Residual chlorine dioxide concentrations must be determined by substantiated methods, which are specific for chlorine dioxide. Two suitable methods are published in Standard *Methods for the Examination of Water and Wastewater*[3]:

4500-ClO_2 D	DPD-Glycine Method
4500-ClO_2 E	Amperometric Method II

References

1. Aieta, E.M. and Berg, J.G., "A Review of Chlorine Dioxide in Drinking Water Treatment," *JAWWA*, 78:6:62 (June, 1986).
2. Roberts, P.V., Aieta, E.M., Berg, J.D., and Chow, B.M.,"Chlorine Dioxide for Wastewater Disinfection: A Feasibility Evaluation," Stanford University, EPA-600/281-092 (1981).
3. *Standard Methods for the Examination of Water and Wastewater*, APHA, AWWA and WEF, Washington, D.C. (20th Ed.. l998).



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