Vulcan CHEMICALS

TECHNICAL DATA SHEET

TECHNICAL & ENVIRONMENTAL SERVICES 1-800-873-4898

Technical Sodium Chlorite (EPA Registered) For Chlorine Dioxide Generation

Chlorine dioxide, a powerful oxidizing agent, can be efficiently and economically generated when sodium chlorite is either chlorinated or acidified, or both, under appropriate pH and temperature conditions. The chlorine dioxide may result naturally from process conditions, or may be produced by means of an external generator. Commonly, solutions of 25% active sodium chlorite or less are used to charge chlorine dioxide generators.

Vulcan Technical Sodium Chlorite is an excellent source of chlorine dioxide. Technical Sodium Chlorite is available in dry form or as a 50% or 31.25% solution. Chemical and physical proprieties are given in Tables 1, 2, and 3.

Table 1
Properties of
Technical Sodium Chlorite

Sodium Chlorite, min (%)	79
Sodium Chloride, (%)	5 - 16
Inert Ingredients, mixture of sodium salts and water	balance
Appearance	white flakes
Bulk Density (lb/ft^3)	
Loose	53
Packed	69

Table 2
Properties of
Technical Sodium Chlorite Solution 50

Sodium Chlorite, Min (%)	38
Sodium Chloride, (%)	1.5 - 7.5
Inert Ingredients, mixture of other sodium salts (%)	3 - 4
Water (%)	55 - 61
Appearance	slightly cloudy, pale yellow
Density @ 35°C (lb/gal)	11.7
Crystallization Point (°C)	25

Table 3
Properties of
Technical Sodium Chlorite Solution 31.25

Sodium Chlorite, Min (%)	25
Sodium Chloride, (%)	1 - 4.5
Inert Ingredients, mixture of other sodium salts (%)	3 - 4
Water (%)	68 - 74
Appearance	clear, pale, yellow
Density @ 25°C (lb/gal)	10.4
Crystallization Point (°C)	-7

EPA Registration

When used as the parent chemical for on-site production of chlorine dioxide in pesticidal applications, sodium chlorite is governed by the Federal Insecticide, Fungicide and Rodenticide Act (FIFRA), as amended. This means that the sodium chlorite sold for this purpose must be registered as a pesticide with the United States Environmental Protection Agency, under a label or labels containing these uses.

Pesticidal uses of chlorine dioxide generated by sodium chlorite are biocidal, disinfective or sanitizing in nature. Examples of such uses are: as a bactericide or slimicide in treatment of drinking water, processing plant flume water and rinse water in produce packing facilities; as a slimicide in recirculating cooling waters; and as a microbicide in oil recovery operations.

Vulcan technical sodium chlorite products are registered for these applications under the following EPA Registration Numbers:

5382-41 Technical Sodium Chlorite, Solution 50
5382-42 Technical Sodium Chlorite
5382-43 Technical Sodium Chlorite, Solution 31.25

Generation of Chlorine Dioxide

Chlorine dioxide can be generated by activating technical sodium chlorite ($NaClO_2$) with an oxidizing agent or an acid. The most common oxidant is chlorine. It may be reacted in solution or in its gaseous form with sodium chlorite.

The principal reaction of sodium chlorite with chlorine is:

$$2NaClO_2 + Cl_2 \rightarrow 2ClO_2 + 2NaCl$$

Stoichiometrically, 1.68 lbs of dry technical sodium chlorite reacts with 0.5 lbs of chlorine to produce 1.0 lb of chlorine dioxide. The reaction is usually carried out by dissolving the chlorine in a chlorinator and then bringing it into contact with a solution of $NaClO_2$ in a reaction column. A slight excess of chlorine will insure that the reaction solution has a pH of 2-4 and will produce chlorine dioxide with high efficiency.

If chlorine is not readily available, chlorine dioxide can also be prepared by mixing sodium hypochlorite bleaching solution with sodium chlorite and acid:

$$2NaClO_2 + NaOCl + H_2SO_4 \rightarrow$$
$$2ClO_2 + NaCl + Na_2SO_4 + H_2O$$

Although sulfuric is shown as the acid, other inorganic acids may be used. Numerous other acids, oxidizers, and available chlorine compounds are potential activators for chlorine dioxide generation from sodium chlorite. Again, a slight excess of acid is employed to adjust pH to 2-4. Hydrochloric acid is reportedly the most efficient producer of chlorine dioxide.

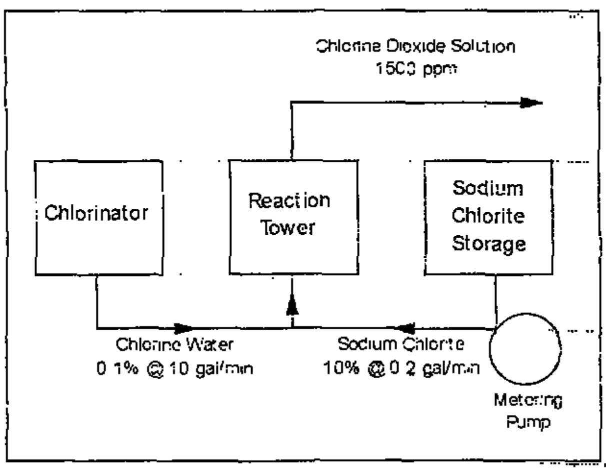

Figure 1
Chlorine Dioxide Generator

Where efficiency is not critical, chlorine dioxide can also be generated simply by acidifying a solution of sodium chlorite in modified generators.

$$5NaClO_2 + 4HCl \rightarrow 4ClO_2 + 2H_2O + 5NaCl$$

This reaction illustrates the easiest method for generating chlorine dioxide. However, concentrated acid should never be mixed with concentrated sodium chlorite solutions. This can cause rapid generation of chlorine dioxide gas, potentially resulting in a explosion.

Commercial generators are available based on the chemistry described in these equations. The ease of generation of chlorine dioxide in a closed system is shown in Figure 1, using activation by chlorine as an example.

A 0.1% Cl_2 solution is fed from the chlorinator at 10 gal/min and mixed with a 10% $NaClO_2$ solution pumped at 0.2 gal/min into a reaction tower filled with Raschig rings. The resulting product contains about 1500 ppm of chlorine dioxide, which can be introduced in the system for water treatment.

Chlorine Dioxide Applications

Chlorine dioxide has a variety of commercial uses. In all of the following applications, sodium chlorite is used to generate it.

Treatment of Potable Water. Chlorine dioxide has long been used to remove tastes and odors in potable water. It is also used in the disinfection of water, particularly where trihalomethanes are of concern. And it oxidizes soluble manganese and iron compounds, eliminating a major cause of stained sinks and fixtures.

Bacterial Control in Oil Wells and Petroleum Systems. A patented use for chlorine dioxide is to treat water that is or will be contaminated with petroleum oil. Many such mixtures contain sulfite-reducing bacteria that form undesirable sulfide compounds. Chlorine dioxide oxidizes these sulfides to sulfates, while preventing or substantially retarding the formation of colloidal sulfur.

Bacterial Slime Control in Paper Mills. Some of the major operational problems in paper and paperboard production are caused by proliferation of microbiological organisms in white water and stock systems. An oxidizing biocide, chlorine dioxide can control microbiological growths, which cause paper malodors and discoloration, deterioration of felts, equipment corrosion, fouling of pipes and showers, and paper quality problems such as spots, specks and holes.

Food Processing. Chlorine Dioxide is highly effective for microbiological control in organically contaminated flume waters. Control of microbiological growths is necessary to insure food product safety and quality. Chlorine Dioxide has also found application in cherry bleaching.

Algae Control in Cooling Towers. Chlorine dioxide efficiently and economically controls microbiological growths in industrial cooling waters under conditions unfavorable to chlorine. It is the primary microbiological control agent in systems with high pH, ammonia-nitrogen contamination, or persistent slime problems.

Treatment of Wastes. Chlorine dioxide is used to disinfect sewage and plant wastes. It destroys phenolics, simple cyanides and sulfides by oxidation.

Stripping Dyestuffs from Textiles. Chlorine dioxide removes dyestuffs from textiles with a minimum offiber degradation. However, its effectiveness depends upon the dyestuff and the type of fabric. This method also provides a good bottom for redyeing.

Upgrading of Fats and Oils. Chlorine dioxide is effective in bleaching fats. The process is simple and low cost. And since it eliminates the need for a filter medium, it produces a higher yield than other methods. (About 30% of the weight of the filter residue, which is generally discarded, is tallow.) Problems such as storage and handling of the filter medium and disposal of filter residues are eliminated as well.

Bleaching of Natural Foliage. Chlorine dioxide is used for removing color from natural foliage. The foliage can then be used in the white state or it can be dyed. Degradation of cellulosic structure is minimal.

Safety and Handling

The following summary of health and safety information is not intended to be complete. For complete information, read the current Material Safety Data Sheet (MSDS). To obtain a MSDS, contact Vulcan Technical & Environmental Services.

Toxicological Properties

Sodium chlorite is toxic by ingestion. Sodium chlorite may cause anemia by oral exposure and has low toxicity by dermal exposure. Dry sodium chlorite has an oral LD_{50} (rat) of 165 mg/kg and sodium chlorite solutions have an oral LD_{50} (rat) of 350 mg/kg. Sodium chlorite dry and solution products have a dermal LD_{50} (rabbit) of greater than 2 g/kg. Sodium chlorite can produce severe irritation or burns to the skin and eyes. Corneal damage can occur if not washed immediately from the eyes.

Personnel Protection

When handling sodium chlorite solutions, chemical goggles, face shield, neoprene gloves, apron, and boots should be worn. Wear a NIOSH/MSHA approved acid gas respirator with a dust/mist filter if any exposure is possible. Additionally, for dry sodium chlorite, wear an chemically impervious suit. Local exhaust is required where exposure to dust or mist might occur. If sodium chlorite is spilled on clothing, remove and wash contaminated clothing at once to avoid the potential of fire.

First Aid

Eyes: Immediately flush eyes with large amounts of water for at least 15 minutes while frequently lifting the upper and lower eyelids. Consult a physician immediately.

Skin: Remove contaminated clothing. Immediately flush exposed skin areas with large amounts of waterfor at least 15 minutes. Consult a physician if burning or irritation of the skin persists. Contaminated clothing must be laundered before re-use.

Ingestion: DO NOT induce vomiting. Drink large quantities of water. Consult a physician immediately. DO NOT give anything by mouth if the person is unconscious or having seizures.

Inhalation: Move patient to fresh air and monitor for respiratory distress. If cough or difficulty in breathing develops, administer oxygen, and consult a physician immediately. In the event that breathing stops, administer artificial respiration and obtain emergency medical assistance immediately.

Notes to Physician: Chlorine dioxide vapors are emitted when this product contacts acids or chlorine. If these vapors are inhaled, monitor patient closely for delayed development of pulmonary edema which may occur up to 48-72 hours post-inhalation.

Following ingestion, neutralization and use of activated charcoal is not indicated.

Storage and Handling

Do not contaminate sodium chlorite with incompatible materials such as dirt, organic matter, oxidizers, reducing agents, chemicals, soap products, solvents, acids, paint products, or combustible materials. Do not store or transport sodium chlorite with incompatible materials. Contamination may start a chemical reaction with generation of heat and emission of chlorine dioxide (a poisonous, explosive gas). A fire or explosion may result. Rinse empty containers thoroughly with water and dispose of in accordance with label instructions.

Dry sodium chlorite. Do not expose to moisture during storage. Store in the original container, in a cool, dry, well ventilated area away from direct sunlight. Always replace cover tightly. Mix only into water using a clean, dry metal scoop reserved for this product alone.

Keep away from flame or any burning material (such as a lighted cigarette). If fire occurs, extinguish with plenty of water. Cool any unopened drums near the fire by spraying water on them.

Sodium chlorite solutions. Store in clean, closed, non-translucent containers. Exposure to sunlight or ultra-violet light will reduce product strength.

Do not allow solution to evaporate to dryness; this product becomes a fire or explosion hazard if allowed to dry and can ignite in contact with combustible materials.

Spill and Leak Procedures

In the event of a spill or leak, remove all sources of ignition. Wear NIOSH/MSHA approved positive pressure, self contained breathing apparatus with a chemically impermeable, fully encapsulated suit. Follow OSHA regulations for respirator use (see 29 CFR 1910.34).

Sodium chlorite, dry, is a fire or explosion hazard if contaminated with combustible material. Clean up in a manner to avoid contamination. Spilled material should be picked up, by using a clean, dry, scoop or shovel and placed into a clean, dry, container.
Do not return spilled material to the original container. Isolate the recovery container outside or in a well ventilated area and hold for proper waste disposal. Do not seal the container. Flush any residual material with large quantities of water.

Sodium chlorite, solution, also becomes a fire or explosion hazard if allowed to dry and can ignite on contact with combustible material. Continue to keep damp. Contain spilled material by diking or absorbing with clay, soil or non-flammable commercial absorbents. Do not return spilled material to original container. Place in a clean container and isolate outside or in a well ventilated area. Do not seal the container. Flush any residual material with large quantities of water.

Disposal

Spill residues may be a hazardous waste as defined in 40 CFR 261. The EPA hazardous waste designation for dry sodium chlorite waste would be D001 and sodium chlorite solution waste would have the waste designation of D002. As a hazardous waste, it will be subject to the Land Disposal Restrictions under 40 CFR 268 and must be managed accordingly. As a hazardous waste solution or solid, it must be disposed of in accordance with local, state, and federal regulations in a permitted hazardous waste treatment, storage and disposal facility.

Shipping Information

Technical Sodium Chlorite is available in 100-lb drums. Technical Sodium Chlorite Solution 50 is available in tank trucks. Technical Sodium Chlorite Solution 31.25 is available in 55 gallon drums, 275-gallon non-returnable totes and tank trucks.

Further Information

More detailed information on sodium chlorite is available on request through the Vulcan Chemicals Technical and Environmental Services Department. Call or write the Technical and Environmental Services Department, Vulcan Chemicals, P.O. Box 530390, Birmingham, Alabama 35253-0390, 800/873-4898.

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Food Plant Process Water Treatment

Application Description

Flume water is used to transport fruits and vegetables during processing. Dirt and organic compounds leached from the fruit and vegetables provide nutrients for microorganisms. As food processing plants recycle more water, organic loading and microbiological growth increases.

Chlorine dioxide generated from sodium chlorite is effective for use in controlling microbiological growth in flume water and other food processing water systems such as chill water systems and hydrocoolers. Unlike chlorine, it does not form chlorinated organic compounds. Chlorine dioxide is effective over a wide pH range

Feed Requirements

The required dosages will vary with process conditions and the degree of contamination present. Depending on the requirements of the specific water system, sodium chlorite should be applied continuously or intermittently through a chlorine dioxide generating system to achieve a chlorine dioxide residual concentration between 0.25 and 5.0 ppm.

Water, containing up to 5 ppm residual chlorine dioxide may be used for rinsing uncut and unpeeled fruits and vegetables provided that the treatment is followed by a potable water rinse.

Water, containing up to 1 ppm residual chlorine dioxide may be used for rinsing cut or peeled potatoes provided that the treatment is followed by a potable water rinse.

Method of Feed

Sodium chlorite is converted to chlorine dioxide through a chlorine dioxide generator. 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 surface of the water to prevent volatilization of the chlorine dioxide.

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:*

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

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Industrial Cooling Water Treatment

Application Description

Chlorine dioxide is effective in the control of microbiological growths in industrial cooling waters under conditions unfavorable to chlorine. It is particularly effective in systems having a high pH, ammonia-nitrogen contamination, persistent slime problems, or where the microbial contamination is aggravated by contamination with vegetable or mineral oils, phenols or other high chlorine-demand producing compounds.

Unlike chlorine, chlorine dioxide does not react with organic materials to form trihalomethanes. Chlorine dioxide does not significantly hydrolyze in water, thus it retains biocidal activity over a broad pH range. Chlorine dioxide is non-reactive with ammonia and nitrogen compounds and with most treatment chemicals (corrosion and scale inhibitors) present in cooling water systems

Feed Requirements

For control of bacterial slime and algae in industrial recirculating and one-pass cooling systems, the required dosages will vary depending on the exact application and the degree of contamination present. The required chlorine dioxide residual concentrations range between 0.1 and 5.0 ppm. Chlorine dioxide may be applied either continuously or intermittently. The typical chlorine dioxide residual concentration range is 0.1 - 1.0 ppm for continuous doses, and 0.1 - 5.0 ppm for intermittent doses. The minimum acceptable residual concentration of chlorine dioxide is 0.1 ppm for a minimum one minute contact time.

Method of Feed

Sodium chlorite is converted to chlorine dioxide through a chlorine dioxide generator. Chlorine dioxide solutions should be fed to the cooling tower drip pan (cold water well) or other feed point that permits adequate mixing and uniform distribution. The feed point should be well below the water level to prevent volatilization of the chlorine dioxide.

Chlorine Dioxide Analysis

Residual chlorine dioxide concentrations should 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:*

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

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Potable Water Treatment

Application Description

Chlorine dioxide (ClO_2) is used as both an oxidant and a disinfectant in drinking water treatment. It has several distinct chemical advantages which complement the traditional use of chlorine in potable water treatment.

Unlike chlorine, chlorine dioxide does not react with naturally-occurring organic materials to form trihalomethanes. Chlorine dioxide does not significantly hydrolyze in water, thus it retains biocidal activity over a broad pH range, Chlorine dioxide is non-reactive with ammonia and most nitrogen-containing compounds. It is an effective agent in controlling taste and odor compounds including phenolics, sulfides, and various algae-related organics. It is also used to oxidize iron and manganese compounds.

Feed Requirements

The required dosages will vary with source water conditions and the degree of contamination present. For most municipal and other potable water systems, a chlorine dioxide residual concentration of up to 2 ppm is sufficient to provide adequate disinfection. Normal target residual concentrations are in the 0.20 - 0.75 ppm range. Chlorine dioxide must be applied at a sufficient residual concentration for a sufficient contact time (C•T Value) to achieve the required disinfection. The concentration of total residual oxidants (chlorine dioxide, chlorite ion and chlorate ion) should be monitored such that it does not exceed 1.0 ppm in the distribution system.

Method of Feed

Sodium chlorite is converted to chlorine dioxide through a chlorine dioxide generator. 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. Do not apply sodium chlorite directly to potable water. Avoid co-incident feeding of ClO_2 with lime or powdered activated carbon.

Chlorine Dioxide Analysis

Residual chlorine dioxide concentrations must be determined by substantiated methods which are applicable to drinking water. Two suitable methods are published in *Standard Methods for the Examination of Water and Wastewater:*

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

Measurement of total residual oxidant ions (chlorite and chlorate) must be determined by a more specific ion chromatographic method which incorporates standards for each species.

USEPA Test Method 300.0

References

Guidance Manual for Compliance With the Filtration and Disinfection Requirements for Public Water Systems Using Surface Water Sources, 1990, American Water Works Association, Denver, CO

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Bacterial Slime Control In Paper Mills

Application Description

Some of the major operational problems in paper and paperboard production are caused by proliferation of microbiological organisms in white water and stock systems. The nutrients and temperatures normally found in white water systems encourage microorganism growth. As microorganisms grow, they form slime deposits on screens, wires and other equipment, necessitating frequent cleanup. If not removed, these deposits can dislodge and appear in the paper as spots, holes or tears. The microbes can also impart undesirable properties to the finished paper, such as unacceptably high spore counts or offensive odors. Microorganisms can also greatly accelerate the corrosion of metal surfaces and parts, leading to premature replacement of equipment.

As a broad-spectrum, oxidizing biocide, chlorine dioxide generated from sodium chlorite is effective for use in controlling microbiological growth in white water paper mill systems. Because of the industry trend towards conversion from acid to alkaline papermaking, biocides must be effective at a higher pH. Unlike chlorine, chlorine dioxide's bacterial efficiency is unaffected by pH. Although chlorine dioxide is non reactive with ammonia or nitrogen compounds, it may oxidize some sheet additives such as wet strength resins or retention aids.

Feed Requirements

The required dosages will vary with the degree of microbiological and process contamination present. Depending on the specific requirements of the system, sodium chlorite should be applied continuously or intermittently through a chlorine dioxide generating system to achieve a chlorine dioxide residual concentration between 0.1 and 5.0 ppm. Intermittent treatments should be repeated as often as necessary to maintain control.

Method of Feed

Sodium chlorite is converted to chlorine dioxide through a chlorine dioxide generator. Chlorine dioxide solutions should be applied to the processing system in a manner that permits adequate mixing and uniform distribution. In many systems, this may require multiple feed points. The feed points must be carefully selected to provide effective microbial control at critical points within the mill system. Feed points should be well below the surface of the water to prevent volatilization of the chlorine dioxide.

Chlorine Dioxide Analysis

Residual chlorine dioxide concentrations should 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:*

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

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Mollusk Control in Water Systems

Application Description

The recent invasion by various foreign mollusks (Zebra Mussels, Asiatic Clams and others) into domestic inland waterways has led to the biofouling of water intake facilities at electric power generation stations and other industrial sites. If not controlled, these infestations can completely clog water intake facilities and lead to plant shutdowns.

Chlorine dioxide generated from sodium chlorite may be used for mollusk control in commercial and industrial recirculating and one-pass cooling water systems. Chlorine dioxide has been found to be an effective control agent both for adult mollusks, to remove existing infestations, and their free-swimming larvae (veligers) to prevent settling and re-infestation. Unlike chlorine, chlorine dioxide does not react with organic materials to form trihalomethanes.

Feed Requirements

The required dosages will vary with the system type, system conditions, the degree of water contamination present and the desired level of control. Depending on the extent of the infestation, sodium chlorite may be applied either continuously or intermittently through a chlorine dioxide generating system to achieve the necessary chlorine dioxide residual concentration.

Veliger Control: Maintain a continuous chlorine dioxide residual of 0.1 - 0.5 ppm.

Intermittent Dose: Apply chlorine dioxide to obtain a chlorine dioxide residual concentration of 0.2 - 25 ppm. Repeat as necessary to maintain control.

Continuous Dose: Maintain a chlorine dioxide residual concentration of up to 2 ppm.

Method of Feed

Sodium chlorite is converted to chlorine dioxide through a chlorine dioxide generator. Chlorine dioxide solutions should be applied at the inlet to the feed system in a manner that permits adequate mixing and uniform distribution. Feed points should be well below the surface of the water to prevent volatilization of the chlorine dioxide.

All discharges of treated water must be in compliance with the applicable regulatory limits.

Chlorine Dioxide Analysis

Residual chlorine dioxide concentrations should 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:*

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

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Bacterial Control in Oil Wells and Petroleum Systems

Application Description

Chlorine dioxide is effective in the remediation of bacterial and sulfide contamination commonly found in oilfield production, injection and disposal fluids. Sulfides ($S^=$) are formed by the metabolism of anaerobic *sulfate reducing bacteria* found in oil well water handling systems. These sulfides react with iron to form insoluble iron sulfide, which together with the bacterial biofilm act as plugging agents. The sulfides can also result in sour crude oil which is of lower quality and more expensive to refine.

Chlorine dioxide is used for two purposes in this application. First, as a chemical oxidant to oxidize the sulfides to sulfates, thus preventing the formation of colloidal sulfur or iron sulfide which can plug the well, and,
second, as a biocide to kill the bacteria which produce the sulfides.

The performance of chlorine dioxide is unaffected by pH or by the presence of other organic materials.

Feed Requirements

The required dosages will vary with process conditions. Sodium chlorite may be applied either continuously or intermittently through a chlorine dioxide generating system to oil well production water as it is separated from the oil, and before it is re-injected into the well.

For continuous feeds, chlorine dioxide may be applied at dosages slightly higher than sulfide's oxidative demand as determined by a demand study. For intermittent treatment, chlorine dioxide should be applied at a shock dosage of 200 - 3000 ppm.

Method of Feed

Sodium chlorite is applied through a chlorine dioxide generator. Chlorine dioxide solutions should be fed where adequate mixing and uniform distribution can be accomplished. Multiple treatment points may be required in some cases. The feed point should be below the water level to prevent volatilization of the chlorine dioxide.

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:*

4500-ClO_2 B Iodometric Method
4500-ClO_2 E Amperometric Method I

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Wastewater Treatment

Application Description

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 does not significantly hydrolyze in water, thus it retains biocidal activity over a broad 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.

Feed Requirements

The required dosages will vary with water conditions and the degree of contamination present. For most municipal and other wastewater systems, a chlorine dioxide residual concentration of up to 5 ppm is sufficient to provide adequate disinfection.

For sulfide odor control, between pH 5-9, a minimum of 5.2 ppm (wt) of chlorine dioxide should be applied to oxidize 1 ppm of sulfide (measured as sulfide ion). For phenol destruction, at pH less than 8, 1.5 ppm chlorine dioxide will oxidize 1 ppm phenol; at pH greater than 10, 3.3 ppm chlorine dioxide will oxidize 1 ppm phenol.

Method of Feed

Sodium chlorite is converted to chlorine dioxide through a chlorine dioxide generator. 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 ClO_2 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:*

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

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