

**ADOX[®] 750**

Version 6.0

Revision Date 10/11/2012

Ref. 130000043276

This SDS adheres to the standards and regulatory requirements of the United States and may not meet the regulatory requirements in other countries.

SECTION 1. PRODUCT AND COMPANY IDENTIFICATION

Product name : ADOX[®] 750
MSDS Number : 130000043276

Product Use : Water treatment chemical

Manufacturer : DuPont
1007 Market Street
Wilmington, DE 19898

Product Information : 1-800-441-7515 (outside the U.S. 1-302-774-1000)
Medical Emergency : 1-800-441-3637 (outside the U.S. 1-302-774-1139)
Transport Emergency : CHEMTREC: 1-800-424-9300 (outside the U.S. 1-703-527-3887)

Importer/Distributor : International Dioxide, Inc., A DuPont Subsidiary, 40 Whitecap Drive, North Kingstown, RI 02852

Telephone :

Other information : professional use

SECTION 2. HAZARDS IDENTIFICATION

Potential Health Effects

Skin

Sodium chlorite : May cause: Corrosion with pain, ulceration or blisters, cracking or peeling of skin.

Eyes

Sodium chlorite : Corrosive, may cause permanent eye injury if not promptly treated. May cause: Tearing, pain, redness, swelling, ulceration, visual impairment, or blindness..

Inhalation

**ADOX[®] 750**

Version 6.0

Revision Date 10/11/2012

Ref. 130000043276

Sodium chlorite : Causes respiratory tract irritation. May cause:, Cough, sneezing, runny nose, sore throat, or shortness of breath..

Repeated exposure
Sodium chlorite : Adverse effects from repeated ingestion may include: Gastrointestinal effects Abnormal decrease in number of red blood cells (anaemia) which could produce tiredness, rapid heartbeat, dizziness, pale skin, leg cramps, shortness of breath. altered blood chemistry

Target Organs
Sodium chlorite : Blood

Carcinogenicity
None of the components present in this material at concentrations equal to or greater than 0.1% are listed by IARC, NTP, or OSHA, as a carcinogen.

SECTION 3. COMPOSITION/INFORMATION ON INGREDIENTS

Component	CAS-No.	Concentration
Sodium chlorite	7758-19-2	7.5 %
Water	7732-18-5	92.5 %

SECTION 4. FIRST AID MEASURES

Skin contact : Take off contaminated clothing and shoes immediately. Wash off immediately with plenty of water. Call a poison control center or doctor for treatment advice.

Eye contact : Rinse immediately with plenty of water and seek medical advice.

**ADOX[®] 750**

Version 6.0

Revision Date 10/11/2012

Ref. 130000043276

- Inhalation : Move to fresh air. If not breathing, give artificial respiration. Call a poison control center or doctor for treatment advice.
- Ingestion : Call a poison control center or doctor for treatment advice. Do not induce vomiting without medical advice. Never give anything by mouth to an unconscious person.
- Notes to physician : Probable mucosal damage may contraindicate the use of gastric lavage.

SECTION 5. FIREFIGHTING MEASURES

- Flammable Properties
Flash point : not applicable
- Fire and Explosion Hazard : Drying of this product on clothing or combustible materials may cause fire.
- Suitable extinguishing media : Water
- Firefighting Instructions : Wear self-contained breathing apparatus (SCBA). Wear suitable protective equipment.

SECTION 6. ACCIDENTAL RELEASE MEASURES

NOTE: Review FIRE FIGHTING MEASURES and HANDLING (PERSONNEL) sections before proceeding with clean-up. Use appropriate PERSONAL PROTECTIVE EQUIPMENT during clean-up.

- Safeguards (Personnel) : Wear personal protective equipment. Avoid contact with the skin and the eyes.
- Spill Cleanup : Dilute with water. Pick up and transfer to properly labelled containers. After cleaning, flush away traces with water.
- Accidental Release Measures : Prevent material from entering sewers, waterways, or low areas. Do not allow to dry.



ADOX[®] 750

Version 6.0

Revision Date 10/11/2012

Ref. 130000043276

SECTION 7. HANDLING AND STORAGE

- Handling (Personnel) : Use only in well-ventilated areas.
Avoid contact with skin, eyes and clothing. Wash hands before breaks and at the end of workday.
- Handling (Physical Aspects) : Avoid letting the product become dry.
- Storage : Keep tightly closed in a dry, cool and well-ventilated place. Keep away from food, drink and animal feedingstuffs. Avoid heat, freezing and ultraviolet light.
Do not allow to dry.
Keep away from: Strong acids and oxidizing agents

SECTION 8. EXPOSURE CONTROLS/PERSONAL PROTECTION

- Engineering controls : Ensure adequate ventilation, especially in confined areas.
- Personal protective equipment
 - Respiratory protection : Where there is potential for airborne exposures in excess of applicable limits, wear approved respiratory protection with dust/mist cartridge.
 - Hand protection : Additional protection: Impervious gloves
 - Hand protection : Material: Polyvinyl chloride - PVC
 - Eye protection : Wear coverall chemical splash goggles. Additionally wear a face shield where the possibility exists for face contact due to splashing, spraying or airborne contact with this material.
 - Skin and body protection : Where there is potential for skin contact, have available and wear as appropriate, impervious gloves, apron, pants, jacket, hood and boots.
 - Protective measures : Avoid exposure - obtain special instructions before use. Wear suitable gloves and eye/face protection.
- Exposure Guidelines
Exposure Limit Values

**ADOX[®] 750**

Version 6.0

Revision Date 10/11/2012

Ref. 130000043276

Contains no substances with occupational exposure limit values.

None established.

SECTION 9. PHYSICAL AND CHEMICAL PROPERTIES

Form	: liquid
Color	: light yellow
Odor	: odourless, slight chlorine
pH	: > 11
Freezing point	: ca. -12 °C (10 °F)
Crystallization temperature	: ca. -6 °C (21 °F)
Boiling point	: ca. 104 °C (219 °F)
Vapour Pressure	: ca. 17.0 mm Hg at 20 °C (68 °F)
Density	: ca. 8.83 lb/gal
Specific gravity	: 1.051 - 1.059
Water solubility	: miscible

SECTION 10. STABILITY AND REACTIVITY

Stability	: Stable at normal temperatures and storage conditions. Decomposes on heating.
Conditions to avoid	: Stable under normal conditions. Decomposes on heating.
Incompatibility	: Strong acids and oxidizing agents Organic materials, chlorinated compounds, Reducing agents
Hazardous decomposition products	: Hazardous decomposition products: Chlorine , Chlorine dioxide...%
Hazardous reactions	: Contact with acids, organic materials, reducing agents and oxidizing agents will release toxic gases of chlorine and/or chlorine dioxide.

**ADOX[®] 750**

Version 6.0

Revision Date 10/11/2012

Ref. 130000043276

SECTION 11. TOXICOLOGICAL INFORMATION

Sodium chlorite

Dermal LD50 : 134 mg/kg , rabbit

Oral LD50 : 284 mg/kg , rat

Inhalation 4 h LC50 : 0.23 mg/l , rat

Skin irritation : Corrosive, rabbit

Eye irritation : Corrosive, rabbit

Skin sensitization : Animal test did not cause sensitization by skin contact., guinea pig

Repeated dose toxicity : Oral
rat
1 y
Target Organs: Blood
Gastrointestinal effects, Abnormal decrease in number of red blood cells, Abnormal decrease in red -blood -cell haemoglobin (hemoglobinemia)

Oral
rat
14 d
altered hematology, altered urinalysis results

Oral
Monkey
altered hematology, altered blood chemistry

Carcinogenicity : Animal testing did not show any carcinogenic effects.

Mutagenicity : Tests on bacterial or mammalian cell cultures did not show mutagenic effects.
Animal testing did not show any mutagenic effects.

Reproductive toxicity : Animal testing showed effects on reproduction at levels equal to or above those causing parental toxicity.

**ADOX[®] 750**

Version 6.0

Revision Date 10/11/2012

Ref. 130000043276

Teratogenicity : Animal testing showed effects on embryo-fetal development at levels equal to or above those causing maternal toxicity.

SECTION 12. ECOLOGICAL INFORMATION

Aquatic Toxicity

Sodium chlorite

96 h LC50 : Cyprinodon variegatus (sheepshead minnow) 105 mg/l

96 h ErC50 : Scenedesmus capricornutum (fresh water algae) 1 mg/l

48 h EC50 : Daphnia magna (Water flea) < 1.0 mg/l

96 h LC50 : Americamysis bahia (mysid shrimp) 0.65 mg/l

Environmental Fate

Sodium chlorite

Biodegradability : Readily biodegradable.

SECTION 13. DISPOSAL CONSIDERATIONS

Waste Disposal : Treatment, storage, transportation, and disposal must be in accordance with applicable federal, state/provincial, and local regulations.

Environmental Hazards : Empty containers should be taken to an approved waste handling site for recycling or disposal.
If recycling is not practicable, dispose of in compliance with local regulations.

SECTION 14. TRANSPORT INFORMATION

DOT UN number : 1908

Proper shipping name : Chlorite solution

Class : 8

7 / 9

**ADOX[®] 750**

Version 6.0

Revision Date 10/11/2012

Ref. 130000043276

IATA_C	Packing group	: III
	Labelling No.	: 8
	UN number	: 1908
	Proper shipping name	: Chlorite solution
IMDG	Class	: 8
	Packing group	: III
	Labelling No.	: 8
	UN number	: 1908
	Proper shipping name	: Chlorite solution
	Class	: 8
	Packing group	: III
	Labelling No.	: 8

Marine Pollutant

SECTION 15. REGULATORY INFORMATION

TSCA Status	: Listed.
SARA 313 Regulated Chemical(s)	: SARA 313: This material does not contain any chemical components with known CAS numbers that exceed the threshold (De Minimis) reporting levels established by SARA Title III, Section 313.
EPA Reg. No.	: 9150-8 In the United States this product is regulated by the US Environmental Protection Agency (EPA) under the Federal Insecticide, Fungicide and Rodenticide Act (FIFRA). It is a violation of Federal law to use this product in a manner inconsistent with its labeling. Read and follow all label directions. This product is excluded from listing requirements under EPA/TSCA.
California Prop. 65	: Chemicals known to the State of California to cause cancer, birth defects or any other harm: none known
NJ Right to Know Regulated Chemical(s)	: Substances on the New Jersey Workplace Hazardous Substance List present at a concentration of 1% or more (0.1% for substances identified as carcinogens, mutagens or teratogens): Sodium chlorite



ADOX[®] 750

Version 6.0

Revision Date 10/11/2012

Ref. 130000043276

SECTION 16. OTHER INFORMATION

The DuPont Oval Logo is a registered trademark of E.I. du Pont de Nemours and Company.

Contact person : MSDS Coordinator, DuPont Chemicals and Fluoroproducts, Wilmington, DE
19898, (800) 441-7515

The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text.

Significant change from previous version is denoted with a double bar.



ADOX® 750

7.5% AQUEOUS
SODIUM CHLORITE
SOLUTION



ADOX® 750

7.5% AQUEOUS SODIUM CHLORITE SOLUTION

ADOX® 750

7.5% AQUEOUS SODIUM CHLORITE SOLUTION

PRECURSOR FOR CHLORINE DIOXIDE
AND ACIDIFIED CHLORITE SOLUTIONS

ACTIVE INGREDIENTS:

Sodium Chlorite	7.5%
Other Ingredients	92.5%
TOTAL:	100.0%



INTERNATIONAL
DIOXIDE, INC.
A DuPont Company

FIRST AID

IF IN EYES: Hold eye open and rinse slowly and gently with water for 15-20 minutes. Remove contact lenses, if present, after the first 5 minutes, then continue rinsing eye. Call a poison control center or doctor for treatment advice.

IF ON SKIN OR CLOTHING: Take off contaminated clothing. Rinse skin immediately with plenty of water for 15-20 minutes. Call a poison control center or doctor for treatment advice.

IF SWALLOWED: Call poison control center or doctor immediately for treatment advice. Have person sip a glass of water if able to swallow. Do not induce vomiting unless told to do so by the poison control center or doctor. Do not give anything by mouth to an unconscious person.

IF INHALED: Move person to fresh air. If person is not breathing, call 911 or an ambulance, then give artificial respiration, preferably by mouth-to-mouth, if possible. Call a poison control center or doctor for further treatment advice.

For 24 hour emergency information on this product, call **Chemtrec at 1-800-424-9300** (US, Canada, Puerto Rico, Virgin Islands) 1-703-527-3887 (All Other Areas) Medical Emergency 1-800-441-3637 (outside U.S. 302-774-1000)

Have the product container or label with you when calling a poison control center or doctor, or going for treatment.

NOTE TO PHYSICIAN: Probable mucosal damage may contraindicate the use of gastric lavage.

FOR INDUSTRIAL USE ONLY

KEEP OUT OF REACH OF CHILDREN DANGER!

REG. NO. 9150-8

E.P.A. EST.No.	10183-MI-01	<input type="checkbox"/>
	53345-CAN-004	<input type="checkbox"/>
	53345-CN-001	<input type="checkbox"/>
	070124-LA-001	<input type="checkbox"/>
	41934-PA-002	<input type="checkbox"/>
	73015-OR-001	<input type="checkbox"/>
	87762-CA-001	<input type="checkbox"/>

NET CONTENTS _____ GAL.

PRECAUTIONARY STATEMENTS

HAZARDS TO HUMANS AND DOMESTIC ANIMALS

DANGER: Highly Corrosive. Cause irreversible eye damage and skin burns. May be fatal if inhaled. Harmful if swallowed or absorbed through skin. Do not get in eyes, on skin or clothing. May be fatal if swallowed. Do not get on bare hands. Wear goggles, face shield or safety glasses and neoprene gloves when handling this product. Wash thoroughly with soap and water after handling and before eating, drinking, chewing gum, using tobacco, or using the toilet. Remove and wash contaminated clothing at once to avoid a fire and wash separately before reuse. Avoid breathing fumes.

ENVIRONMENTAL HAZARDS

This pesticide is toxic to fish and other aquatic organisms. Do not discharge effluent containing this product into lakes, streams, ponds, estuaries, oceans or other waters unless in accordance with the requirements of a National Pollutant Discharge Elimination System (NPDES) permit and the permitting authority has been notified in writing prior to discharge. Do not discharge effluent containing this product to sewer systems without previously notifying the sewage treatment plant authority. For guidance, contact your State Water Board or Regional Office of the EPA.

PHYSICAL OR CHEMICAL HAZARDS

DANGER: This product becomes a fire or explosive hazard if allowed to dry. Strong oxidizing agent. Mix or dilute into water only. Mixing with acids, or alcohol, or other chemicals may cause evolution of chlorine or chlorine dioxide gas mixture which is toxic and may be explosive. Combustible materials contaminated with ADOX®750 may burn rapidly. Keep handling areas and equipment clean and free of oils, greases, combustibles and dust. Do not contaminate product with garbage, dirt, organic matter, paint products, solvents, acids, vinegar, beverages, oils, pine oils, dirty rags or other foreign matter. Do not expose to hot surfaces, sparks or open flame.

STORAGE AND DISPOSAL

DO NOT CONTAMINATE WATER, FOOD OR FEED BY STORAGE OR DISPOSAL

PESTICIDE STORAGE: Store upright in cool, dry and well-ventilated place. Avoid excessive heat or freezing. Protect from contact with other chemicals; avoid storage with organic chemicals, acids, reducers and combustible material. Keep container tightly closed when not in use. In case of spills, flush and drain promptly to sewer with large quantities of water. Do not allow liquid to dry out because this could present a fire hazard. If fire occurs, extinguish with large volume of water. Avoid exposure to high temperatures during storage. Store remote from other chemicals and combustible materials. Do not skid or slide drums.

PESTICIDE DISPOSAL: Pesticide wastes are acutely hazardous. Improper disposal of excess pesticide, spray mixture or rinsate is a violation of Federal Law. If these wastes cannot be disposed of by use according to the label instructions, contact your State Pesticide or Environmental Control Agency or the Hazardous Waste Representative at the nearest EPA Regional Office for guidance.

CONTAINER DISPOSAL:

Containers equal to or less than 5 gallons: Nonrefillable container. Do not reuse or refill this container. Triple rinse (or equivalent) promptly after emptying. Triple rinse as follows: Empty the remaining contents into application equipment or a mix tank and drain for 10 seconds after the flow begins to drip. Fill the container ¼ full with water and recap. Shake for 10 seconds. Pour rinsate into application equipment or a mix tank or store rinsate for later use or disposal. Drain for 10 seconds after the flow begins to drip. Repeat this procedure two more times. Then offer for recycling or reconditioning, or puncture and dispose of in a sanitary landfill, or incineration, or, if allowed by state and local authorities, by burning. If burned, stay out of smoke.

Containers over 5 gallons: Nonrefillable container. Do not reuse or refill this container. Triple rinse container (or equivalent) promptly after emptying. Triple rinse as follows: Empty the remaining contents into application equipment or a mix tank. Fill the container ¼ full with water. Replace and tighten closures. Tip container on its side and roll back and forth, ensuring at least one complete revolution, for 30 seconds. Stand the container on its end and tip back and forth several times. Turn the container over onto its other end and tip back and forth several times. Empty the rinsate into application equipment or mix tank or store rinsate for later use or disposal. Repeat this procedure two more times. Then offer for recycling or reconditioning, or puncture and dispose of in a sanitary landfill, or incineration, or, if allowed by state and local authorities, by burning. If burned, stay out of smoke.

EMERGENCY HANDLING: In case of contamination or decomposition, do not reseal container. Isolate in an open, well-ventilated area. Flood with large volumes of water. Cool unopened drums in vicinity by water spray.

DIRECTIONS FOR USE

It is a violation of Federal law to use this product in a manner inconsistent with its labeling.

†Not approved for use in California

METHOD OF APPLICATION

ADOX® 750 is a precursor for the generation of chlorine dioxide. DO NOT ADD ADOX® 750 directly to the system being treated. Chlorine dioxide solutions can be generated from ADOX® 750 by several common methods including:

1. The chlorine method which utilizes a ADOX® 750 and chlorine gas, or
2. The hypochlorite method which utilizes ADOX® 750, a hypochlorite solution and an acid or,
3. The Acid-Chlorite method which utilizes ADOX® 750 and an acid, or
4. The electrolytic method which utilizes ADOX® 750, with sodium chloride as needed.

ADOX® 750 can also be used to form acidified sodium chlorite solutions by mixing the product with Generally Recognized As Safe (GRAS) acids such as citric, phosphoric or acetic acid. Add the generated chlorine dioxide solution to a point in the system which ensures uniform mixing. Your International Dioxide, Inc. representative can guide you in the selection, installation and operation for feed systems.

APPLICATIONS

POTABLE WATER AND WASTEWATER DISINFECTION: For most municipal and other potable water systems, a chlorine dioxide residual concentration up to 2.0 ppm is sufficient to provide adequate disinfection. Typically, the target residual concentrations range from 0.20 – 0.75 ppm. Monitor the distribution system to ensure that the chlorite concentration does not exceed its maximum contaminant level (MCL) of 1 mg/L and that chlorine dioxide does not exceed its maximum residual disinfection level (MRDL) of 0.8 mg/L. For wastewater and sewage applications, residual chlorine dioxide concentrations up to 5.0 ppm are generally adequate.

†POTABLE WATER SYSTEMS: Nitrification: to control the build up of nitrification in the water distribution system. Utilize a chemical metering system to add this product so that the resulting dose of chlorine dioxide or sodium chlorite to control nitrification does not exceed the MRDL of 0.8mg/L for ClO₂, or the MCL of 1.0 mg/L for chlorite ion.

Use of this product in public water systems (drinking water utilities) triggers monitoring and compliance requirements under 40 CFR 141. Among other requirements the user of this product is required to conduct daily monitoring for chlorine dioxide and chlorite at the point of addition and to comply with standards for chlorine dioxide and chlorite. The user of this product is required to contact State or primary drinking water programs to determine specific monitoring, compliance, reporting, and record-keeping requirements in order to avoid adverse human health effects and/or non-compliance with such requirements.

FOOD PROCESSING PLANTS, DAIRIES, BOTTLING PLANTS AND BREWERIES, FOOD PLANTS PROCESS WATER: For microbial control in typical food processing water systems, such as flume transport, chill water systems, hydrocoolers, and other water systems, apply ADOX®750 through a chlorine dioxide generation system to achieve a chlorine dioxide residual concentration ranging from 0.25 to 3.0 ppm.

POULTRY PROCESSING WATER: Use ADOX®750 to generate chlorine dioxide for use as an antimicrobial agent in water used in poultry processing in an amount not to exceed 3 ppm residual chlorine dioxide as determined by an appropriate method.

AQUEOUS DISINFECTIONS SYSTEMS FOR CIP CLEANING: If the concentration of chlorine dioxide generated from ADOX®750 exceed 5.0 ppm, a potable water rinse should follow treatment. Care should be taken to ensure the biological and chemical quality of the potable water.

GENERAL INDUSTRIAL PROCESS WATER TREATMENT (OILFIELD INJECTION WATER, †WHITE WATER PAPER MILL SYSTEMS, AND RECIRCULATING COOLING TOWERS): For control of microbial slime, these systems will require a chlorine dioxide residual concentration ranging between 0.25 and 5.0 ppm.

†ONCE-THROUGH COOLING WATER SYSTEMS. Control of mollusks can be effectively accomplished using ADOX® 750 as directed in commercial and industrial once-through cooling water systems. ADOX®750 may be fed on a continuous or slug basis depending on the degree of system fouling. SLUG DOSE: Add 42 to 210 lbs. of chlorine dioxide per million gallons of water (5 to 25 ppm). CONTINUOUS DOSE: Add 2 to 16 lbs. of chlorine dioxide per million gallons of water (0.25 to 2 ppm).

IN FOOD PROCESSING FACILITIES

For use as a terminal food contact surface sanitizing rinse conforming to 40 CFR 180.940 paragraph (b) and (c) not requiring a subsequent potable water rinse. This solution may be used on hard surfaces such as dairy processing equipment, food processing equipment and utensils.

1. All equipment & utensils should be thoroughly cleaned to remove gross food particles and soil by preflush or pre-scrape and where necessary a pre-soak treatment. The surfaces or objects should then be cleaned with a detergent or cleaner followed by a potable water rinse before application of the sanitizing solution.
2. To prepare a 200 ppm chlorine dioxide sanitizing use solution add 1 oz. of ADOX® 750 to 2.5 gallons of water and then acidify to pH 2.6 with a Generally Recognized As Safe (GRAS) acid such as hydrochloric, citric, phosphoric or acetic acid or add 1 gram of Activator C or 9 grams of Activator K to the solution. Allow to stand for at least 15 minutes before use. Alternatively to minimize worker handling, an automated system can be utilized that will safely react ADOX® 750 with a GRAS Acid and safely dilute the solution to the 200 ppm chlorine dioxide sanitizing use solution.
3. Fill, immerse, circulate, wipe or spray the target surface with the sanitizing solution making sure the surface area is thoroughly wet for at least one minute. Hard to reach in-place equipment, pipes, closed vessels, etc. must be filled with the sanitizing solution to ensure contact of all surfaces. Use suitable breathing apparatus when spraying the solution on external equipment.
4. Allow the sanitizing solution to drain from all treated surfaces and air dry. Do not rinse treated surface.
5. The above solution may not be reused for sanitizing, but may be diluted 1:5 with water and used for cleaning of walls, floors and drains of the plant.

NOTICE: Seller expressly warrants that the product conforms to its chemical description. There are no warranties associated with the sale of the product either express or implied including, but not limited to, the warranties of fitness for a particular purpose or use.

Manufactured for:
INTERNATIONAL DIOXIDE, INC.
40 Whitecap Drive, North Kingstown, RI 02852

© 2011. E. I. du Pont de Nemours and Company. All rights reserved.
ADOX® is a registered trademark of International Dioxide Inc., a DuPont Company.

13-June-2013/P

Label: DuPont ADOX 750	Date: Feb 2012		
Size: 14"(w) x 8.5"(h)	Docket: 3459		
Prints:			
 Black	 Pantone 186C	 Pantone 124C	 Pantone 7405C
NOTE TO PRINTER - PLEASE CHECK TRAPPING AS SPOT COLOURS BUTT UP			



Sodium Chlorite Organic Odor Control with Chlorine Dioxide

Introduction

Chlorine dioxide (ClO₂) is effective as both a disinfectant and an oxidant in water and wastewater treatment. Its selective reactivity makes chlorine dioxide a powerful non-chlorinating oxidizing agent useful in many water treating applications for which chlorine and other oxidizing agents are unsuitable. Unlike most oxidants, chlorine dioxide may be used over a broad pH range to oxidize industrial odor causing compounds.

Application Description

A variety of odors are created or liberated in waste treatment applications. Odor causing compounds include inorganic gases and organic gases and vapors generated as a result of biological activity. Organic vapors may also originate from the direct discharge of industrial chemical wastes. Industrial odors can be caused by a variety of compounds, including inorganic and organic sulfides, organic sulfur compounds including mercaptans (the sulfur analog of alcohols (RSH)), organic disulfides (RSSR), (intermediate oxidation products of mercaptans), various amines, aldehydes, ketones, fatty acids, phenols and ammonia.

Reduced sulfur compounds and nitrogen-bearing amines tend to be the most odorous compounds because of their relatively low threshold concentrations (Figure 1).

Figure 1¹

Substance	Formula	Odor Threshold (mg/L)
Allyl mercaptan	CH ₂ :CHCH ₂ S H	0.0001
Ammonia	NH ₃	17
Amyl mercaptan	CH ₃ (CH ₂) ₄ SH	0.0003
Benzyl mercaptan	C ₆ H ₅ CH ₂ SH	0.0002
Crotyl mercaptan	CH ₃ (CH) ₂ CH ₂ SH	0.00003
Diphenyl sulfide	(C ₆ H ₅) ₂ S	0.0001
Ethyl mercaptan	C ₂ H ₅ SH	0.0003
Hydrogen sulfide	H ₂ S	0.0005
Indole	C ₆ H ₄ (CH ₂)NH	0.0001
Methyl mercaptan	CH ₃ SH	0.0005
Phenyl mercaptan	C ₆ H ₅ SH	0.0003
Propyl mercaptan	CH ₃ (CH ₂) ₂ SH	0.0005
Skatole	C ₉ H ₉ N	0.001
Thiocresol	CH ₃ C ₆ H ₄ SH	0.0001
<i>tert</i> -butyl mercaptan	(CH ₃) ₃ CSH	0.00008
Trimethylamine	(C H ₃) ₃ N	0.0004

The major sources of odorous substances such as mercaptans and substituted amines include the chemical and petroleum industries, coking

600-408 Sodium Chlorite 12/2014



Basic Chemicals

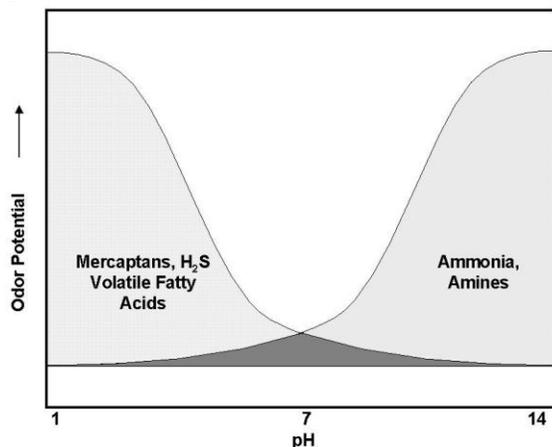
and sanitary processes, animal feedlots and rendering plants.

Treatment Alternatives

A variety of technologies have been used for the control of odors. Three of the more effective technologies include carbon adsorption, chemical addition (including oxidants), and wet chemical scrubbing. The effective approach to controlling odor requires a good understanding of the characteristics of the waste stream, the types of chemicals causing the odors and facility constraints.

The pH of a waste stream has a major effect on both the generation of odors and the necessary treatment protocol required. Some odor causing compounds are substantially more soluble in acidic media while others are more soluble in alkaline media (Figure 2). Thus, by the proper choice of pH of operation, and oxidant, many odors can be minimized or eliminated.

Figure 2: Effect of pH on Odor Generation



Chemical oxidation is best suited to moderate volume waste streams containing moderate to high strength pollutants and wastewater's with noxious odors, toxic compounds, and compounds which survive primary treatment processes.

To use oxidants, the odor must be dissolved, or be contained in a solid (sludge). In complex wastewater streams the odor causing compound may be absorbed in acidic or basic scrubbing solutions first which are then treated by chemical oxidation. Alkaline scrubbing solutions are effective for sulfides mercaptans, aldehydes/ketones. Acidic scrubbing solutions are effective for ammonia and amines.

Chemical Oxidation with Chlorine Dioxide

Chlorine dioxide is a powerful oxidant effective for the control of reduced sulfur compounds and secondary and tertiary amines.

Between pH 5 and 9, 4.5 mg/L of chlorine dioxide instantaneously oxidizes 1 mg/L of a mercaptan (expressed as sulfur) to the respective sulfonic acid (RSO₃H)/sulfonate compound, destroying the mercaptan odor. Similarly, chlorine dioxide reacts with organic sulfides and disulfides, destroying the original odor. Organic disulfides are split at the sulfur atoms and oxidized to sulfonic acid.

The oxidation of amines with chlorine dioxide depends on the pH of the reaction mixture and the degree of substitution of the amine. Between pH 5 and 9, an average of 10 mg/L of chlorine dioxide oxidizes 1 mg/L of a tertiary aliphatic amine (expressed as nitrogen), destroying the amine odor. At pH above 7, an average of 5 mg/L of chlorine dioxide oxidizes 1 mg/L of a secondary aliphatic amine (expressed as nitrogen), removing all traces of amine odor. The higher the pH of the reaction mixture (chlorine dioxide and tertiary and/or secondary aliphatic amines), the more rapidly oxidation proceeds.

Alternative Oxidants

- **Hydrogen Peroxide** does not destroy mercaptans and phenols unless catalyzed by ferrous sulfate. Hydrogen peroxide-

600-408 Sodium Chlorite 12/2014



Basic Chemicals

ferrous sulfate, which requires acidic pH's, has the lowest chemical cost, but results in high solids loading and increased disposal costs.

- **Chlorine** is the only oxidant that reacts with ammonia, however, halogenated by-products restrict use.
- **Potassium Permanganate** is a strong oxidant, which yields insoluble MnO₂ as a byproduct. This results in high solids loading and significant disposal costs.

Advantages of Chlorine Dioxide

- Chlorine dioxide reacts more rapidly and completely than other available oxidizers.
- Chlorine dioxide does not require pH adjustment and does not increase solids loading.
- Chlorine dioxide does not form THMs.

Feed Requirements

For industrial applications dosages will vary depending on the application. Dose rates may be determined by completing a chlorine dioxide demand study. For once-through systems, or systems where treated water may enter a US waterway, the concentration of residual chlorite ion should be monitored such that it does not exceed the requirements of the NPDES permit and is in compliance with local, state and federal regulations.

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.

Chlorine Dioxide Analysis

Residual chlorine dioxide concentrations should be determined by substantiated methods, which are specific for chlorine dioxide. Chlorine dioxide solutions can be analyzed by iodometric and amperometric titrations, and spectrophotometrically, with the standard DPD (N,N-diethyl-*p*-phenylenediamine) method. These methods are described in detail in *Standard Methods for the Examination of Water and Wastewater*³.

4500-ClO ₂ B	Iodometric Method
4500-ClO ₂ D	DPD-Glycine Method
4500-ClO ₂ E	Amperometric Method II

Further Information

More detailed information on sodium chlorite is available on request through the OxyChem Technical Service Department. Call or write:

Technical Service Department
OxyChem
Post Office Box 12283
Wichita, Kansas 67277-2283
800-733-1165 option #1
www.oxy.com

References

1. *Odor Control in Wastewater Treatment Plants*, WEF, Manual of Practice No 22, ASCE Manuals of Reports on Engineering Practice No 82., Page 8, (1995)
2. *Standard Methods for the Examination of Water and Wastewater*, APHA, AWWA and WEF, Washington, D.C. (20th Ed. 1998).

600-408 Sodium Chlorite 12/2014