

# MATERIAL SAFETY DATA SHEET



1000 Tedia Way  
Fairfield, Ohio 45014  
USA  
Email: [tedia@tedia.com](mailto:tedia@tedia.com)  
Web: [www.tedia.com](http://www.tedia.com)

24-Hour Emergency Number (CHEMTREC)  
USA: 800-424-9300  
International: 703-527-3887

All non-emergency numbers should be directed  
to Customer Service at 800-PURITY1

## OXIDATION SOLUTION (IODINE IN PYRIDINE, THF, AND WATER) MSDS No. M0221

### 1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Product Name: Oxidation Solution (Iodine in Pyridine, Tetrahydrofuran, and Water)

Product Catalog Number(s): OB9909, OB9910, OB9911, OB9912, OB9913, OB9914, OB9920, OB9921

Synonyms: Oxidation Solution, Oxidizing Solution

Recommended Use: This product is recommended for laboratory and manufacturing use only. It is not recommended for drug, food or household use.

### 2. COMPOSITION AND INFORMATION ON INGREDIENTS

<u>Ingredient</u>	<u>CAS No</u>	<u>Percent</u>	<u>Hazardous</u>
Tetrahydrofuran	109-99-9	70-90%	Yes
Pyridine	110-86-1	<20%	Yes
Water	7732-18-5	<20%	No
Iodine	7553-56-2	<2.5%	Yes

### 3. HAZARDS IDENTIFICATION

DANGER! CAUSES SEVERE EYE AND SKIN IRRITATION WITH POSSIBLE BURNS. MAY BE HARMFUL IF SWALLOWED, INHALED, OR ABSORBED THROUGH SKIN. CAUSES RESPIRATORY TRACT IRRITATION. STENCH. MAY CAUSE CENTRAL NERVOUS SYSTEM DEPRESSION. HIGHLY FLAMMABLE LIQUID AND VAPOR! OXIDIZER. MAY FORM EXPLOSIVE PEROXIDES. HYGROSCOPIC (ABSORBS MOISTURE FROM THE AIR). TARGET ORGANS: BLOOD, KIDNEYS, CENTRAL NERVOUS SYSTEM, RESPIRATORY SYSTEM, LIVER, EYES, SKIN, AND MUCOUS MEMBRANES.



#### **Acute Exposure Hazards:**

Inhalation Hazard: Inhalation of high concentrations may cause central nervous effects characterized by nausea, headache, dizziness, unconsciousness, and coma. Inhalation may cause coughing, irritation of the mucous membranes and respiratory tract, difficulty breathing, and loss of consciousness. Prolonged exposure may result in dizziness and general weakness. Other symptoms reported with acute exposure to pyridine nervousness, insomnia, and loss of appetite.

Ingestion Hazard: May cause gastrointestinal irritation with nausea, vomiting, and diarrhea. May cause liver and kidney damage. May cause central nervous system depression with excitement followed by headache, drowsiness, nausea, and vomiting. Advanced stages may cause collapse, unconsciousness, coma, and possible death. Effects may be delayed.

Skin Contact Hazard: Causes skin irritation. May be harmful if absorbed through the skin. Effects may be delayed. May cause smarting of the skin and first-degree burns after short exposure. Material is readily absorbed through the skin.

Pyridine and THF have been determined not to be skin sensitizers.

Eye Contact Hazard: Contact may cause severe eye irritation and possible burns. Vapors may cause eye irritation. May cause reversible damage.

Chronic Exposure Hazards: Repeated or prolonged exposure may cause dermatitis. Prolonged or repeated eye contact may cause conjunctivitis. Chronic inhalation and ingestion may cause effects similar to those of acute inhalation and ingestion. May cause liver, lung, and kidney damage. Exposures to pyridine that are too low to produce overt clinical symptoms can cause liver damage and repeated low-level exposures can cause cirrhosis. Feeding studies in rats produced blood effects like changes in clotting factors. THF data shows carcinogenic activity in the liver and kidneys of lab animals. Kidney tumors were by a mechanism that has no relevance in humans.

#### HMIS Rating:

Health – 2\* Flammability – 3 Physical Hazard – 1 PPE – User supplied

NOTE: HMIS ratings use a numbering scale that ranges from 0 - 4 to indicate the degree of hazard. A value of zero means the chemical presents no hazard while a value of four indicates a high hazard. These ratings are based on the inherent properties of this chemical under expected conditions of normal use and are not intended to be used in emergency situations. PPE is determined by the user based on their needs and conditions.

## 4. FIRST-AID MEASURES

Inhalation: Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical aid.

Ingestion: Do not induce vomiting unless directed to by medical personnel. If vomiting occurs naturally, have victim lean forward. Never give anything by mouth to an unconscious person. Get medical attention immediately.

Skin Contact: Remove any contaminated clothing. Wash skin with plenty of water for at least 15 minutes. Get medical attention. Wash clothing before reuse.

Eye Contact: Check for and remove contact lenses. Immediately flush eyes with plenty of water for at least 15 minutes, lifting lower and upper eyelids occasionally. Get medical help immediately.

Notes to Physician: Treat symptomatically and supportively. Persons with skin problems or liver, kidney, lung, or blood diseases may be at increased risk from exposure to this product.

## 5. FIRE FIGHTING MEASURES

Flammability: Highly flammable liquid and vapor (GHS Category 2)

Auto-ignition Temperature: 321° C (609.6° F)

Flash Point: -14° C (62.6° F)

Flammable Limits: Lower Limit – 1.8 vol %, Upper Limit – 12.4 vol %

Products of Combustion: May decompose into irritating and highly toxic gases under fire conditions (nitrogen oxides, carbon monoxide, and carbon dioxide).

Specific Fire Hazards: As in any fire, always wear self-contained breathing apparatus in pressure-demand (MSA/NIOSH approved or equivalent), and full protective gear. Vapors may form explosive mixtures with air. Use water spray to keep fire exposed containers cool. Approach fire from upwind to avoid hazardous vapors and toxic decomposition products. Vapors are heavier than air and may travel to a source of ignition and flash back. Vapors can spread along the ground and collect in low or confined areas.

Specific Explosion Hazards: Not available.

Fire Fighting Media: Solid streams of water may be ineffective and spread the fire. Use dry chemical, carbon dioxide, water spray, or alcohol-resistant foam. For larger fires, use water spray, fog, or alcohol-resistant foam. Cool containers with flooding quantities of water and well after fire is out.

National Fire Protective Association: Estimated Health - 3, Flammability - 3, Reactivity - 1

NOTE: NFPA ratings use a numbering scale that ranges from 0 - 4 to indicate the degree of hazard. A value of zero means the chemical presents no hazard while a value of four indicates a high hazard. They are for use by emergency personnel to address the hazards that are presented by short term, acute exposure to this product under fire, spill, or similar emergencies. Ratings involve data and interpretations that may vary from company to company.

## 6. ACCIDENTAL RELEASE MEASURES

Use water spray to reduce vapors. Water spray may reduce vapors but still not prevent ignition in closed spaces. Absorb spilled liquid with sorbent pads, socks, or other inert material such as vermiculite, sand, or earth. Use spark-proof tools. Provide ventilation to the affected area and remove all ignition sources. Evacuate unnecessary personnel and approach the spill from upwind. Pick up absorbed material and place it in a suitable container. Always use proper personal protective equipment as described in section 8. Collect run-off and isolate for proper disposal.

## 7. HANDLING AND STORAGE

Precautions: Always use proper personal protective equipment as described in section 8. Wash thoroughly after handling. Ground and bond containers when transferring material. Use spark-proof tools and explosion proof equipment. Avoid contact with eyes, skin, and clothing. Remove contaminated clothing and wash before reuse. Empty containers contain product residue (liquid and vapor) and can be dangerous. Keep container tightly closed and away from heat, spark, and flame. Do not pressurize, cut, weld, braze, solder, drill, grind, or expose empty containers to heat, sparks, or open flames. Use with adequate ventilation. Avoid breathing vapor or mist.

Storage: Keep in a flammables area away from direct sunlight and all sources of ignition and oxidizing materials. Keep in a tightly closed container. Store in a cool, dry, well-ventilated area away from incompatible substances. Store in a cool place in the original container and protect from sunlight and moisture. Keep under a nitrogen blanket. Keep from contact with oxidizing materials. Containers should be dated when opened and tested periodically for the presence of peroxides. Should crystals form in a peroxidizable liquid, peroxidation may have occurred and the product should be considered extremely dangerous. In this instance, the container should only be opened remotely by professionals. All peroxidizable substances should be stored away from heat and light and be protected from ignition sources.

## 8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Engineering Controls: Use explosion-proof ventilation equipment. Facilities storing or using the material should be equipped with eyewash station and a safety shower. Use adequate general or local exhaust ventilation to keep airborne concentrations below the permissible exposure limits.

Personal Protection: Wear protective chemical goggles or other appropriate eye protection. Use butyl rubber gloves and protective clothing to prevent skin exposure. A respiratory protection program that meets OSHA 29 CFR 1910.134 and ANSI Z88.2 requirements or European Standard EN 149 must be followed whenever possible. Always use a NIOSH or European Standard EN 149 approved respirator when necessary.

Exposure Limits:

ACGIH – 50 ppm TWA; 100 ppm STEL; Skin – potential significant contribution to overall exposure by cutaneous route  
NIOSH – 200 ppm TWA; 590 mg/m<sup>3</sup> TWA; 2000 ppm IDLH  
OSHA Final PELs – 200 ppm TWA; 590 mg/m<sup>3</sup> TWA

Exposure Limits (Pyridine):

ACGIH – 1 ppm TWA;  
NIOSH – 5 ppm TWA; 15 mg/m<sup>3</sup> TWA; 1000 ppm IDLH  
OSHA Final PELs – 5 ppm TWA; 15 mg/m<sup>3</sup> TWA

Exposure Limits (Iodine):

ACGIH – 0.1 ppm ceiling;  
NIOSH – 0.1 ppm TWA; 1 mg/m<sup>3</sup> TWA; 2 ppm IDLH  
OSHA Final PELs – 0.1 ppm TWA; 1 mg/m<sup>3</sup> TWA

## 9. PHYSICAL AND CHEMICAL PROPERTIES

Physical State and Appearance: Colorless to dark yellow liquid.

Odor: Sweetish odor mixed with penetrating fish-like odor

pH: 7.0 to 11.5

Boiling Point: 6° C @ 760 mm Hg (Tetrahydrofuran)

Freezing/Melting Point: -108.5 to -60° C

Decomposition Temperature: Not available

Specific Gravity: 0.89 to 1.035 g/cm<sup>3</sup>

Vapor Density (Air=1): 2.5 to 2.73

Vapor Pressure: 0.4 to 145 mm Hg @ 20° C.

Evaporation Rate (Butyl acetate = 1): <1 for Tetrahydrofuran

Viscosity: 0.48 to 0.95 mPa at 20° C

Solubility: Soluble

## 10. STABILITY AND REACTIVITY

Stability: Under normal storage conditions, peroxidizable compounds can form and accumulate peroxides which may explode when subjected to heat or shock. This material is most hazardous when peroxide levels are concentrated by distillation or evaporation. THF should never be distilled to dryness.

Conditions to Avoid: Incompatible materials, ignition sources, excess heat, light, moisture, evaporation to near dryness, and confined spaces.

Incompatibility With Various Substances: Strong oxidizing agents, acids, ammonia, powdered metals, alkali metals, carbon dioxide, oxygen, bromine, metal halides, lithium tetrahydroaluminate, borane, sodium aluminum hydride, sodium tetrahydroaluminate, caustic alkalis.

Hazardous Decomposition Products: Carbon monoxide, carbon dioxide, irritating and toxic fumes.

Hazardous Polymerization: May occur in Tetrahydrofuran.

## 11. TOXICOLOGICAL INFORMATION

Routes of Entry: Inhalation, skin absorption, skin contact

Animal Toxicity (Pyridine):

Draize test, rabbit, skin: 500 mg/24H Mild;

Inhalation, rat: LC50 = 28,500 mg/m<sup>3</sup>/1H;

Oral, mouse: LD50 = 1500 mg/kg;

Oral, rat: LD50 = 891 mg/kg;

Skin, rabbit: LD50 = 1121 mg/kg;

Skin, rabbit: LD50 = 1 g/kg;

Animal Toxicity (Tetrahydrofuran):

Inhalation, rat: LC50 = 21,000 ppm/3H;

Oral, rat: LD50 = 1650 mg/kg;

Animal Toxicity (Iodine):

Oral, rat: LD50 = 14 mg/kg;

Carcinogenicity:

Pyridine: ACGIH: Confirmed animal carcinogen with unknown relevance for humans; California: carcinogen, initial date 5/17/02; Not listed as carcinogens by IARC and NTP.

Tetrahydrofuran: ACGIH: Confirmed animal carcinogen with unknown relevance to humans.

Epidemiology: No information found.

Teratogenicity: Pyridine cause muscle/skeleton effects when injected into developing chickens but was not teratogenic in frogs at sub lethal doses. The relevance of these studies to human reproduction is unclear. THF related animal data shows developmental effects only at exposure levels producing other toxic effects in the adult animal.

Reproductive Effects: Iodine: LDLo: 28 mg/kg; Investigated as a reproductive effector. THF related animal testing for reproductive effects shows no change in reproductive performance.

Mutagenicity: Pyridine's mutagenicity potential is equivocal. It was reported to be both positive and negative in Salmonella typhimurium strains. It was not mutagenic in tests for chromosome aberrations, but it did give weak positive results in tests that detect sister chromatid exchanges. THF has not produced damage in mammalian cell cultures or animals. It has not been tested for its ability to cause permanent genetic damage in reproductive cells of mammals (not tested for heritable genetic damage).

Neurotoxicity: No information found.

## 12. ECOLOGICAL INFORMATION

Ecotoxicity (Pyridine):

Fish: Fathead minnow: LC50 = 106 mg/L, 96H, flow-through, no data available.

Ecotoxicity (Tetrahydrofuran):

Fish: Fathead minnow: 2160 mg/L; 94 Hr; flow through bioassay (pH 7.5);

Water flea Daphnia: EC50 = 5930 mg/L; 24 Hr;

THF is not expected to adsorb to suspended matter in water based on its measured Koc values. This compound should volatilize from water surfaces. An estimated BCF value of 1 suggests that THF will not bioconcentrate in aquatic organisms.

Environmental Fate (Pyridine):

Terrestrial: Should have very high mobility. It is absorbed to acid clay to a moderate extent. Complete degradation in one soil occurred in less than 8 days.

Aquatic: Should biodegrade after an acclimation period and can be lost through volatilization.

Atmospheric: Exists in vapor phase based on a vapor pressure of 20.8 mm Hg and reacts slowly with photochemically produced hydroxyl radicals with experimental half-lives of 32 and 16 days in clean and moderately polluted atmospheres, respectively. Bioconcentration in aquatic animals should not be significant.

Environmental Fate (Tetrahydrofuran): If released to the atmosphere, tetrahydrofuran will exist solely in the vapor phase and is degraded in the atmosphere by reaction with photochemically-produced hydroxyl radicals and nitrate radicals with half-lives of about 1 and 3 days, respectively. Measured Koc values of 23 and 18 indicate that THF will have very high mobility in soil.

Special Remarks: Do not empty into drains.

### 13. DISPOSAL CONSIDERATIONS

Material that cannot be saved for recovery or recycling should be managed in an appropriate and approved waste facility. Processing, use or contamination of this product may change the waste management options. Waste generators must decide if discarded material is a hazardous waste. State and local disposal regulations may differ from federal disposal definitions found in 40 CFR 261.3. Dispose of container and unused contents in accordance with federal, state and local requirements. This material is a "U" listed waste (Pyridine - U196; THF - U213).

### 14. TRANSPORT INFORMATION

US DOT

Proper Shipping Name: Flammable liquid, n.o.s. (Pyridine, Tetrahydrofuran)

Hazard Class: 3

UN Number: UN1993

Packing Group: II

Canada TDG

Proper Shipping Name Flammable liquid, n.o.s. (Pyridine, Tetrahydrofuran)

Hazard Class: 3

UN Number: UN1993

Packing Group: II

Additional Information: Flashpoint -14C

International (Water, I.M.O.)

Proper Shipping Name: Flammable liquid, n.o.s. (Pyridine, Tetrahydrofuran)

Hazard Class: 3

UN Number: UN1993

Packing Group: II

International (Air, I.C.A.O.)

Proper Shipping Name: Flammable liquid, n.o.s. (Pyridine, Tetrahydrofuran)

Hazard Class: 3

UN Number: UN1993

Packing Group: II

### 15. REGULATORY INFORMATION

US Federal Regulations:

TSCA: All components of this material are listed on the TSCA Inventory.

Health and Safety Reporting List: CAS# 110-86-1: Effective 10/4/82, Sunset 10/4/92.

Chemical Test Rules: CAS# 109-99-9 – 40 CFR 799.5115

Section 12b: CAS# 109-99-9 – Section 4, 1% de minimis concentration.

TSCA Significant New Use Rule: Does not have an SNUR under TSCA.

CERCLA Hazardous Substances: CAS# 110-86-1– 1000 lb/454 kg final RQ; CAS# 109-99-9 – 1000 lb final RQ; 454 kg final RQ

SARA Section 302: Does not have a TPO

SARA Codes: CAS# 110-86-1– immediate, delayed, fire; CAS# 7553-56-2 – acute, chronic, fire; CAS# 109-99-9 – immediate, fire, reactive;

Section 313: CAS# 110-86-1 is subject to SARA Title III Section 313 and 40 CFR 373 reporting requirements.

Clean Air Act: This material contains no hazardous air pollutants (HAP). This material contains no Class 1 Ozone Depleters. This material contains no Class 2 Ozone Depleters.

Clean Water Act: This material contains no Hazardous Substances. This material contains no Priority Pollutants. It has no Toxic Pollutants.

OSHA: Not considered highly hazardous by OSHA.

#### US State Regulations:

All components can be found on the following state right-to-know lists: California, New Jersey, Pennsylvania, Minnesota, and Massachusetts

California Prop 65: This product contains pyridine, a chemical known to the state of California to cause developmental reproductive toxicity. California No Significant Risk Level: Not listed

#### Canada:

DSL/NDSL: CAS# 110-86-1 and CAS# 109-99-9 are listed on Canada's DSL list.

WHMIS: This product has a WHMIS classification of B2, D2B. This product has been classified in accordance with hazard criteria of the Controlled Products Regulations and this MSDS contains all the information required by those regulations.

Ingredient Disclosure List: CAS# 110-86-1 and CAS# 109-99-9 are listed on Canada's Ingredient Disclosure List.

#### DSCL (EEC):

Hazard Symbols: Xn; Xi, F

Risk Phrases: R11 – Highly Flammable; R19 – May form explosive peroxides; R20/21/22 – Harmful by inhalation, in contact with skin, and if swallowed; R-34 – Causes burns; R36/37 – Irritating to eyes and respiratory system.

Safety Phrases: S16 – Keep away from sources of ignition-no smoking; S26 – In case of contact with eyes, rinse immediately with plenty of water and seek medical advice; S28A – After contact with skin, wash immediately with plenty of water; S29: Do not empty into drains; S33: Take precautionary measures against static discharges; S36 - Wear suitable protective clothing; S45 - In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible).

WGK (Water Danger/protection): CAS# 110-86-1: 2; CAS# 109-99-9: 1

## 16. OTHER INFORMATION

Originally Prepared: 7/21/2008

Last Revised: 4/22/2010

The information contained herein is based on current knowledge and experience; no responsibility is accepted that the information is sufficient or correct in all cases. Users should consider these data only as a supplement to other information gathered by them and must make independent determinations of suitability and completeness of information from all sources to assure proper use and disposal of these materials and the safety and health of employees and customers and the protection of the environment.

TEDIA COMPANY, INC. MAKES NO REPRESENTATIONS OR WARRANTIES, EITHER EXPRESS OR IMPLIED, INCLUDING WITHOUT LIMITATION ANY WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE WITH RESPECT TO THE INFORMATION SET FORTH HEREIN OR THE PRODUCT TO WHICH THE INFORMATION REFERS. ACCORDINGLY, TEDIA COMPANY, INC. WILL NOT BE RESPONSIBLE FOR DAMAGES RESULTING FROM USE OF OR RELIANCE UPON THIS INFORMATION.