SAFETY DATA SHEET

TEDIA®
High Purity Solvents

1000 Tedia Way
Fairfield, Ohio 45014
USA
Email: tedia@tedia.com
Web: 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

1, 4-DIOXANE

SDS No. M0085

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Product Name: 1,4-Dioxane
Synonyms: Diethylene Dioxide; Dioxyethylene Ether; p-Dioxane; Diox, Diethylene Ether, Glycol Ethylene Ether
Recommended Use: This product is recommended for laboratory and manufacturing use only. It is not recommended for drug, food or household use.

2. HAZARDS IDENTIFICATION

Classification:
Flammable Liquids: GHS Category 2
Eye Irritation: GHS Category 2A
Carcinogenicity: GHS Category 2
Specific Target Organ Toxicity, single exposure: GHS Category 3

Label Elements
Signal Word: DANGER!
Hazard Statements:
- H225 – Highly flammable liquid and vapor.
- H319 – Causes serious eye irritation.
- H333 – May be harmful if inhaled.
- H351 – Suspected of causing cancer.

Precautionary Statements:
- P210 – Keep away from heat/sparks/open flames/hot surfaces – No Smoking.
- P243 - Take precautionary measures against static discharge.
- P280 – Wear protective gloves/protective clothing/eye protection/face protection.
- P303+P361+P353 – If on skin or hair: Remove/take off immediately all contaminated clothing. Rinse skin with water/shower.

Emergency Overview

May be harmful if absorbed thought the skin. Causes irritation to eyes and respiratory tract. May cause cancer based on animal studies.. Highly flammable liquid and vapor. Vapor may cause flash fire. Static electrical hazard. May form explosive peroxides. Hygroscopic. Target Organs: Kidneys, liver, respiratory system, eyes and skin.

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.

3. COMPOSITION AND INFORMATION ON INGREDIENTS

Ingredient	CAS No	Percent	Hazardous
1, 4-Dioxane	123-91-1	>99%	Yes

4. FIRST-AID MEASURES

Inhalation: If inhaled, remove to fresh air. If breathing is labored or with coughing, give 100% supplemental oxygen. If not breathing, begin artificial respiration. Get medical aid.
Ingestion: If swallowed, get medical attention immediately; DO NOT induce vomiting unless directed by medical personnel. Never give anything by mouth to an unconscious person. Get medical aid.
Skin Contact: Immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Get medical aid if irritation persists. Wash clothing before reuse. Thoroughly clean shoes 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 attention immediately.
Notes to Physician: Treat symptomatically and supportively.

5. FIRE FIGHTING MEASURES

Flammability: Highly flammable liquid and vapor (GHS Category 2)
Auto-ignition Temperature: 180° C (356° F)
Flash Point: 12° C (53.6° F)
Flammable Limits: Lower Limit – 2.0 vol %, Upper Limit – 22.0 vol %
Products of Combustion: May decompose into carbon monoxide, carbon dioxide, or other noxious or toxic fumes in fire conditions.
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. Use water spray to keep fire exposed containers cool. Approach fire from upwind to avoid hazardous vapors and toxic decomposition products. May accumulate static electrical charge and ignite its own vapors. 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: May form explosive peroxides of unknown stability.
Fire Fighting Media: Use water spray, dry chemical, carbon dioxide, or alcohol-resistant foam.
National Fire Protective Association: Health - 2, 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

Clean up spills immediately. Avoid run-off into storm sewers and ditches which lead to waterways. Provide ventilation to the affected area and remove all ignition sources. Absorb spilled liquid with sorbent pads, socks, or other inert material such as

vermiculite, sand, or earth. Approach the spill from upwind and pick up absorbed material and place it in a suitable container. Use spark-proof tools and proper personal protective equipment as described in section 8.

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. 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 away from heat, sparks, and flame in a flammables area. 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 appropriate eye protection. Use appropriate protective 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 – 20 ppm TWA; Skin – potential significant contribution to overall exposure by cutaneous route
NIOSH – 500 ppm IDLH
OSHA Final PELs – 100 ppm TWA; 360 mg/m^3 TWA
OSHA Vacated PEL: 1, 4 Dioxane – 25 ppm TWA, 90 mg/m^3 TWA

9. PHYSICAL AND CHEMICAL PROPERTIES

Physical State and Appearance: Clear, colorless liquid.
Odor: Ethereal like
Odor Threshold: 24 ppm
Molecular Formula: $(CH_2)_4O_2$
Molecular Weight: 88.11
Auto-ignition Temperature: 180° C (356° F)
Flash Point: 12° C (53.6° F)
Flammable Limits: Lower Limit – 2.0 vol %, Upper Limit – 22.0 vol %
pH: Not available.
Boiling Point: 101° C @ 760 mm Hg
Freezing/Melting Point: -108.5° C
Decomposition Temperature: Not available
Specific Gravity: 1.0300 g/cm^3
Vapor Density (Air=1): 3
Vapor Pressure: 29 mm Hg @ 20° C.
Evaporation Rate (Ether = 1): 5.8
Viscosity: 0.012 cP 25° C
Solubility: Soluble

Conductivity: Nonconductive; Conductivity = 0.1 pS/m; Dielectric Constant = 2.2; Relaxation Time Constant = ~100 seconds (dissipation)

10. STABILITY AND REACTIVITY

Stability: Prolonged exposure to air may form peroxides. 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. This material should never be distilled to dryness.
Conditions to Avoid: Light, ignition sources, moisture, excess heat, evaporation to near dryness, confined spaces, electrical sparks.
Incompatibility With Various Substances: Strong oxidizing agents, strong acids.
Hazardous Decomposition Products: Carbon monoxide, carbon dioxide.
Hazardous Polymerization: Has not been reported.

11. TOXICOLOGICAL INFORMATION

Routes of Entry: Inhalation, skin absorption, skin contact
Acute Exposure Hazards:

INHALATION HAZARD: Effects due to exposure from inhalation may be delayed. High concentrations may cause central nervous system effects characterized by nausea, headache, dizziness, unconsciousness, and coma. Causes respiratory tract irritation. Vapor inhalation may cause severe respiratory irritation. May cause olfactory fatigue.
INGESTION HAZARD: May cause gastrointestinal irritation with nausea, vomiting, and diarrhea. May cause central nervous system depression characterized by excitement which may be followed by headache, dizziness, drowsiness, and nausea. Advanced stages of over exposure may cause collapse, unconsciousness, coma, and possible death due to reparatory failure.
SKIN CONTACT HAZARD: May cause skin irritation. May be absorbed through the skin in harmful amounts. Prolonged or repeated exposure may cause dermatitis. Animal studies have demonstrated that dioxane can be rapidly absorbed and cause incoordination and narcosis. Renal and hepatic lesions were also observed.
EYE CONTACT HAZARD: Causes eye irritation.

Chronic Exposure Hazards: May cause liver and kidney damage. Based on animal studies, may cause cancer.
Animal Toxicity:

Draize test, rabbit, eye: 100 mg Severe;
Draize test, rabbit, eye: 100 mg/24 hr Moderate;
Inhalation, mouse: LC50 = 37 g/m^3/2H;
Inhalation, rat: LC50 = 46 g/m^3/2H;
Oral, mouse: LD50 = 5300 mg/kg;
Oral, rabbit: LD50 = 2 g/kg;
Oral, rat: LD50 = 4200 mg/kg;
Rabbit, skin: LD50 = 7600 uL/kg;

Carcinogenicity: ACGIH: animal carcinogen with unknown relevance to humans. California: carcinogen, initial date 1/1/88; NTP: Suspect carcinogen; IARC: Group 2B carcinogen.
Epidemiology: Dioxane has been judged an animal carcinogen of such low potency so as to be of no practical significance as an occupational carcinogen based on rodent liver and lung tumors at or near the 10,000 ppm dietary level and the lack of such findings at inhalation exposure concentrations slightly above 100 ppm for 2 years. This conclusion is supported by the results of published epidemiological evaluations of workers exposed to 1,4-dioxane for up to 50 years.
Teratogenicity: See RTECS.
Reproductive Effects: No information available.
Mutagenicity: See RTECS.
Neurotoxicity: Dioxane at a concentration of 470 ppm caused convulsions or changes in the seizure threshold.

12. ECOLOGICAL INFORMATION

Ecotoxicity:

Fish: Bluegill/sunfish: LC50 = >10,000 mg/L; 96 Hr; static conditions, 23 degrees C;
Water flea Daphnia: EC50 = 163 mg/L; 48 Hr; static conditions; 20-21 degrees C, no data;

Environmental Fate: Terrestrial: Mobile in soil and will leach into groundwater. Aquatic: Will not hydrolyze but may volatilize. Atmospheric: Half-life of 7-9.6 hours. Experimental results of sunlight irradiated mixtures of dioxane/NO suggest similar half-lives. The reaction products of ethers with hydroxyl radicals are aldehydes and ketones. Will not bioconcentrate.
Special Remarks: 1,4-Dioxane has been found to be resistant to biodegradation and has been classified as relatively undegradable. 1,4-Dioxane is not expected to biodegrade rapidly on the environment.

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 (U108).

14. TRANSPORT INFORMATION

US DOT, IATA, IMO
Proper Shipping Name: Dioxane
Hazard Class: 3
UN Number: UN1165
Packing Group: II

Canada TDG
Additional Information: Flashpoint 12 C

15. REGULATORY INFORMATION

US Federal Regulations:
CERCLA Hazardous Substances: CAS# 123-91-1– 100 lb final RQ; 45.4 kg final RQ
SARA Section 302: Does not have a TPQ
SARA Codes: CAS# 123-91-1– delayed, fire
Section 313: 100 % Dioxane (CAS# 123-91-1) is subject to reporting under Section 313 of SARA Title III and 40 CFR 373.
Clean Air Act: CAS# 123-91-1 is listed as a hazardous air pollutant (HAP).
OSHA: Not considered highly hazardous by OSHA.

US State Regulations:
CAS# 123-91-1is on the following state right-to-know lists: California, New Jersey, Pennsylvania, Minnesota, and Massachusetts
California Prop 65: WARNING! This product contains 1,4-Dioxane, a chemical known to the sate of California to cause cancer.
California No Significant Risk Level: CAS# 123-91: 30 aeg/day NSRL

16. OTHER INFORMATION

Originally Prepared: 4/11/2006
Last Revised: 9/17/2014 – Updated pictograms, hazard categories, and hazard statements in Section 2.

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.

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