INDIANA UNIVERSITY

Laboratory Safety Guideline

Urethane

Introduction

Synonyms: Ethyl carbamate, Ethyl urethane, Carbamic acid ethyl ester, o-Ethylurethane, Ethyl aminoformate, Leucethanem, Leucethane, Leucothane, Pracarbamine, Uretan.

Formula: $C_3H_7NO_2$ ($NH_2COOC_2H_5$)

Melting point: 48-50° C

Boiling point: 182-184° C

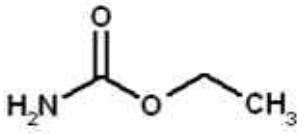
CAS Number: 51-79-6

Density: 1.056

Molecular Weight: 89.09

Water Solubility: Slightly soluble

Comments: Colorless crystalline powder.



Uses

Urethane is used alone or in combination with other drugs to produce anesthesia in laboratory animals. Urethane provides an extended period of anesthesia without great physiological change and produces minimal cardiovascular and respiratory depression. Urethane also produces a much stronger degree of analgesia than many other anesthetics.

Synthesis

Urethane is produced by the action of ammonia on ethyl chloroformate or by heating urea nitrate and ethyl alcohol:

$$ClCOOC_2H_5 + 2NH_3 \rightarrow NH_2COOC_2H_5 + NH_4Cl$$

Hazards

National Fire Protection Association (NFPA) Hazard Rating

Health	2
Flammability	1
Reactivity	0

Urethane has been classified as a mutagen (Lewis, 2004) and as a Group 2A carcinogen by the International Agency of Research on Cancer (IARC) and is identified as a “Select Carcinogen” by the US Occupational Safety and Health Administration (OSHA).

All Select Carcinogens, reproductive toxins (mutagens and teratogens), and chemicals with a high degree of acute toxicity are known as “Particularly Hazardous Substances” under the OSHA laboratory standard 1910.1450, Occupational Exposure to Hazardous Chemicals in Laboratories. See Standard Operating Procedure (SOP) 3.8 in the Laboratory Chemical Safety Plan (LCSP).

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These chemicals (Particularly Hazardous Substances) must be handled in a closed system (i.e. syringe) or containment (i.e. fume hood). Warning signs must be posted and provisions for decontaminating the area and waste removal must be provided.

Urethane is readily absorbed through the skin, can target multiple organs, suppress bone marrow, readily crosses the placenta, and induces fetal tumor formation. Urethane is also a moderate irritant and may cause chemical conjunctivitis.

Safety Precautions

Consult the MSDS provided by the manufacturer. The range of urethane related health hazards listed above makes it necessary for Principal Investigators to prepare Standard Operating Procedures (SOP's) which will identify proper administrative controls, engineering controls, personal protective equipment (PPE), work methods, and waste disposal procedures, to eliminate or reduce the risk of urethane exposure.

Pregnant females should not handle urethane due to its fetotoxic potential. All procedures that have the potential for urethane exposure should be performed n a fume hood utilizing proper sash height for added protection. Urethane procedures should be conducted by a well-trained individuals that know the potential hazards associated with urethane. Syringes used for urethane injection should be safety engineered devices.

Urethane must be used in a designated urethane work area where no food or drink is allowed. A door sign must be in place indicating that there are carcinogens in the lab.

Areas where urethane is being used should be cleaned immediately following each task upon completion using a soap/water solution.

Emergency eyewash and shower should be easily accessible and nearby (ANSI Z-358.1).

Personal Protective Equipment (PPE)

All personnel should wear appropriate Personal protective Equipment (PPE). The appropriate PPE consists of:

- Examination gloves (nitrile gloves are an effective barrier for short-term exposure to urethane). Users should wash hands after removing their gloves to further reduce the risk of urethane exposure.
- Safety glasses or goggles (ANSI Z-87 approved)
- Lab coat
- Appropriate laboratory attire
- Half face respirator when aerosol exposure hazard exists (or if not handled in a containment, i.e. fume hood or ventilated dump station).

Storage

Urethane should be stored in a tightly closed container in a well ventilated area. Separate from chemical oxidizers.

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Waste Disposal

Concentrated urethane must be disposed of as a hazardous chemical waste and disposed of by EHS. If the waste is in a very dilute concentration (i.e. <1%) it can be disposed to the sanitary sewer with copious amounts of additional water during disposal.

Research on the presence of urethane in animal excreta is inconclusive. Based on limited available information, it is acceptable to dispose of metabolized urethane contaminated animal bedding as non-hazardous solid waste.

- The animal bedding must be changed or emptied under a fume hood or a ventilated dump station
- Wear all appropriate Personal Protective Equipment (PPE) during handling.
- Bags should be closed and secured with a wire tie or tape before removing from the ventilated dump station or fume hood.
- Contaminated PPE should be bagged and placed in the facility dumpster for disposal.
- Bags may be labeled “Urethane” and “Non-Hazardous Waste” and placed in the facility dumpster.

All animal carcasses should be packaged, labeled, frozen, and collected for disposal as medical waste. See Biohazardous Waste Disposal Policy at:

http://www.ehs.indiana.edu/bio_waste.shtml.

Emergency Exposure Procedure

If urethane contacts the eyes, immediately flush with copious amounts of cold water for at least 15 minutes. For skin contact, immediately wash the affected area with soap and copious amounts of cold or cool water.

If a person inhales urethane vapors or dust, move them to an area where they can breathe fresh air. After any exposure, refer to the instructions for medical consultation in the Laboratory Chemical Safety Plan (LCSP) and be sure to provide the MSDS to the attending physician.

Spill Response Procedure

Major Spills:

Notify all lab occupants of spill. Evacuate the room or immediate area and notify the Office of Environmental Health and Safety Management (EHS) for assistance with the clean-up. Post a sign telling others to not enter the area.

Provide as much information and assistance as possible to the spill responders. If the spill enters the sink or floor drains please notify EHS (856-6311) immediately during normal business hours. If spill occurs after normal business hours please notify IUPD (855-4111).

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Minor Spills:

Don proper PPE (listed above) during clean-up. Only clean up small spills if you are aware of the safety precautions for handing urethane and have the proper safety equipment to do so, otherwise contact EHS.

Isolate the area by closing laboratory doors and evacuate the immediate area if necessary. Confine and contain the spill. Cover the spill with appropriate absorbent material (can be located in chemical spill kit provided by EHS personal).

Sweep solid material into dust pan and place in a sealed plastic container. Decontaminate area with soap and water after cleanup and place residue in a plastic bag or another sealed plastic container. Contact EHS for disposal.

For assistance contact EHS:

855-6311

M-F: 8:00 am-5:00 pm

References

Carcinogenic Action of Ethyl Urethane on Rats, Jaffe W. G., Cancer Research 7, 107-112, 1947.

Sax's Dangerous Properties of Industrial Materials, Lewis Sr., R. J., 2004.

The Carcinogenic Action and Metabolism of Urethane and n-Hydroxyurethane, Mirvish S. S., Advances in Cancer Research, 11, 1-42, 1968.

Safe Storage of Laboratory Chemicals, 2nd Edition, Piptone, David, ed., Toronto: John Wiley & Sons, Inc., 1991.

Urethane, Material Safety Data Sheet, Product No. U2500, Sigma Aldrich Chemical Company.

Perinatal Carcinogenesis by Urethane, Vesselinovitch S. D., Mihailovich N., Rao K. and Itze L., Cancer Research 31, 2143-2147, 1971.

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