

# Standard Operating Procedure

## Diethyl Ether

*This SOP is not complete until it has been signed and dated by the PI and relevant lab personnel.*

Print a copy and insert into your  
*Laboratory Safety Manual and Chemical Hygiene Plan.*  
Refer to instructions for assistance.

<b>Department:</b>	Chemistry & Biochemistry – Chemical Engineering
<b>Date SOP was written:</b>	December 14, 2012
<b>Date SOP was approved by PI/lab supervisor:</b>	January 18, 2013
<b>Principal Investigator:</b>	Prof. Susannah Scott
<b>Internal Lab Safety Coordinator/Lab Manager:</b>	Stephanie Goubert-Renaudin
<b>Lab Phone:</b>	805-893-8941
<b>Office Phone:</b>	805-893-7403
<b>Emergency Contact:</b>	EH&S 24 hour line: 805-893-3194 <i>(Name and Phone Number)</i>
<b>Location(s) covered by this SOP:</b>	ESB 3324 and 3328 <i>(Building/Room Number)</i>

**Type of SOP:**     Process             Hazardous Chemical             Hazardous Class

### Purpose

Diethyl ether is a Peroxide Forming Chemical (PFC). It forms explosive mixtures with air. Ether peroxides are contact explosives when dry. Diethyl ether is also extremely flammable. The auto-ignition temperature of diethyl ether is 160°C (320°F) and can therefore it can be ignited by a hot surface without a flame or spark. If not stored and handled properly, this can pose a serious threat to the health and safety of laboratory personnel, emergency responders and chemical waste handlers. Hence, it is important to follow safety protocols to handle this chemical.

Diethyl ether is a common laboratory solvent used in liquid-liquid extractions. It is particularly important as a solvent in the production of cellulose plastics such as cellulose acetate.

## Physical & Chemical Properties/Definition of Chemical Group

CAS#: 60-29-7

Class: **Highly Flammable and Peroxide Former**

Molecular Formula: C<sub>4</sub>H<sub>10</sub>O

Form (physical state): Liquid

Color: colorless

Boiling point: 34.6°C

## Potential Hazards/Toxicity

Prolonged storage of diethyl ether could lead to the formation of explosive peroxides. It has also been shown to have mutagen effects. Causes skin, eye, and respiratory tract irritation. Inhalation of vapors may cause narcosis, nausea, loss of consciousness, dizziness and drowsiness. May cause digestive tract irritation and central nervous effects through ingestion. Symptoms include headache, excitement, fatigue, nausea, vomiting, stupor, and coma.

## Personal Protective Equipment (PPE)

### Respiratory Protection

Use a full-face respirator with organic vapor cartridges as a backup to engineering controls. When a respirator is the sole means of protection, use a full-face supplied air respirator.

Respirators should be used only under any of the following circumstances:

- As a last line of defense (i.e., after engineering and administrative controls have been exhausted).
- When Permissible Exposure Limit (PEL) has exceeded or when there is a possibility that PEL will be exceeded.
- Regulations require the use of a respirator.
- An employer requires the use of a respirator.
- There is potential for harmful exposure due to an atmospheric contaminant (in the absence of PEL)
- As PPE in the event of a chemical spill clean-up process

Lab personnel intending to use/wear a respirator mask must be trained and fit-tested by EH&S. This is a regulatory requirement.

### Hand Protection

When handling diethyl ether, laminate film, polyvinyl alcohol, neoprene or nitrile gloves are recommended.

**NOTE:** Consult with your preferred glove manufacturer to ensure that the gloves you plan on using are compatible with diethyl ether

Refer to glove selection chart from the links below:

[http://www.ansellpro.com/download/Ansell\\_8thEditionChemicalResistanceGuide.pdf](http://www.ansellpro.com/download/Ansell_8thEditionChemicalResistanceGuide.pdf)

OR

<http://www.allsafetyproducts.biz/page/74172>

OR

<http://www.showabestglove.com/site/default.aspx>

OR

<http://www.mapaglove.com/>

### **Eye Protection**

Wear safety goggles or a face shield to protect from splash hazards and chemical vapors.

### **Skin and Body Protection**

Wear full-length pants, closed-toe shoes, and a flame-resistant lab coat.

### **Hygiene Measures**

Avoid contact with skin, eyes and clothing. Wash hands before breaks and immediately after handling the product.

### **Engineering Controls**

Work with this chemical in a certified ventilated fume hood or a glove box.

### **First Aid Procedures**

#### **If inhaled**

Move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

#### **In case of skin contact**

Take off contaminated clothing immediately. Wash off with soap and plenty of water for 15 minutes. Take victim immediately to hospital. Consult a physician.

#### **In case of eye contact**

Rinse thoroughly with plenty of water for at least 15 minutes, occasionally lifting the upper and lower eyelids. Get medical aid immediately. Continue to wash eyes during transport to the hospital.

#### **If swallowed**

Do not induce vomiting. Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

### **Handling and Storage Requirements**

**Precautions for safe handling** Be sure there are no white crystals forming on the outside of the bottle. Work in an area with adequate ventilation. When handling the chemical, use it away from shock, friction, and open flames. Prevent electric static build-up with a grounding cable. Wash thoroughly after handling.

**Conditions for safe storage** Please label the date received and the date opened, prior to working with diethyl ether. If there are white crystals around the cap of the bottle, do not attempt to move the bottle and call EH&S immediately. The white crystals are a sign of explosive peroxide formation and needs to be removed from the lab by a professionally trained person. Keep the chemical in a tightly sealed container in dry and well-ventilated area. Containers of diethyl ether should be protected from physical damage, direct sunlight, and ignition sources. It should be stored separately from strong oxidizing agents, strong acids, halogens, interhalogens, sulfur and sulfur compounds.

## Spill and Accident Procedure

### Chemical Spill Dial **9-911** and EH&S (805-893-3194)

**Spill** – Assess the extent of danger. Help contaminated or injured persons. Evacuate the spill area. Avoid breathing vapors. If possible, confine the spill to a small area using a spill kit or absorbent material. Keep others from entering contaminated area (e.g., use caution tape, barriers, etc.).

**Small (<1 L)** – If you have training, you may assist in the clean-up effort. Use appropriate personal protective equipment and clean-up material for chemical spilled. Double bag spill waste in clear plastic bags, label and take to the next chemical waste pick-up.

**Large (>1 L)** – Dial **9-911** from campus phones (and **805-893-3446** from a cell phone) and EH&S (893-3194) for assistance.

**Chemical Spill on Body or Clothes** – Remove clothing and rinse body thoroughly in emergency shower for at least 15 minutes. Seek medical attention. *Notify supervisor and EH&S immediately.*

**Chemical Splash Into Eyes** – Immediately rinse eyeball and inner surface of eyelid with water from the emergency eyewash station for 15 minutes by forcibly holding the eye open. Seek medical attention. *Notify supervisor and EH&S immediately.*

### Medical Emergency Dial **9-911**

**Life Threatening Emergency, After Hours, Weekends and Holidays** – Dial **9-911** (or 805-893-3446 from a cell phone) or go to the Emergency Room of Goleta Valley Cottage Hospital at 351 South Patterson Avenue, Goleta (Phone number: 805-967-3411) *Note: All Serious injuries must be reported to EH&S within 8 hours.*

**Non-Life Threatening Emergency** – Go to the Student Health Building, Building 588 (phone number: 893-5361, hours: M, T, R, F 8am-4.30pm, W 9am - 4.30pm, R 5pm to 7pm by appointment). After hours go to the Emergency Room of Goleta Valley Cottage Hospital at 351 South Patterson Avenue, Goleta (Phone number: 805-967-3411) *Note: All serious injuries must be reported to EH&S within 8 hours.*

**Needle stick/puncture exposure** (as applicable to chemical handling procedure) – Wash the affected area with antiseptic soap and warm water for 15 minutes. For mucous membrane exposure, flush the affected area for 15 minutes using an eyewash station. Page the needle stick nurse and then enter your extension. After hours go to the nearest emergency room: the Emergency Room of Goleta Valley Cottage Hospital at 351 South Patterson Avenue, Goleta (Phone number: 805-967-3411). *Note: All needle stick/puncture exposures must be reported to EH&S within 8 hours.*

## Decontamination/Waste Disposal Procedure

Wearing proper PPE, please decontaminate equipment and bench. Please dispose of the used diethyl ether as hazardous waste in the appropriate waste containers. Call EH&S if assistance is needed (805-893-3194)

### Label Waste

- Affix an on-line hazardous waste tag on all waste containers using UCSB EH&S website as soon as the first drop of waste is added to the container

### Store Waste

- Store hazardous waste in closed containers, in secondary containment and in a designated location
- Waste must be under the control of the person generating & disposing of it

#### **Dispose of Waste**

- Dispose of regularly generated chemical waste within 90 days
  - Call EH&S
  - Empty Containers
    - Dispose as hazardous waste if it once held extremely hazardous waste (irrespective of the container size)
    - Consult waste pick-up schedule
- Prepare for transport to pick-up location

- Check on-line waste tag
- Write date of pick-up on the waste tag
- Use secondary containment

#### **Safety Data Sheet (SDS) Location**

SDS can be found online: <http://ehs.ucsb.edu/units/labsfty/labrsc/chemistry/lchemmsdsacc.htm>

#### **Protocol/Procedure**

In our laboratory, diethyl ether is used a solvent.

Diethyl ether containers are stored in a ventilated cabinet and are kept sealed at all times when not in use.

Diethyl ether is a peroxide generator: upon exposure to air, peroxide can gradually form, and become contact explosive when dry. As a consequence, diethyl ether should not be stored longer than 6 months after opening, or one year after purchase. Date the containers upon delivery AND upon opening. Disposal as hazardous waste has to be then organized.

Diethyl ether should be tested every 3 months with peroxide test strip located in the lab. If the test is positive, diethyl ether has to be discarded. If peroxide crystals are observed on the containers, do not touch the crystals, do not move the container due to explosion risk. Immediately contact the Lab manager and/or EHS for waste disposal.

Due to its high volatility, when not handled in a glove box, diethyl ether has to be handled within a ventilated fume hood, on a cleared space. During handling, PPE is required at all time, including at least nitrile or polyvinyl alcohol gloves, a lab coat and safety goggles. Gloves have to be changed as soon as contaminated. Due to its high flammability, diethyl ether is kept away from all sources of ignition.

Diethyl ether has to be disposed as hazardous waste in the appropriate waste container, which has to be kept closed at all times.

**NOTE: Any deviation from this SOP requires approval from PI.**

#### **Documentation of Training (signature of all users is required)**

- Prior to conducting any work with diethyl ether, designated personnel, i.e. approved users listed below, must provide training to his/her laboratory personnel specific to the hazards involved in working with this substance, work area decontamination, and emergency procedures.

- The Principal Investigator must provide his/her laboratory personnel with a copy of this SOP and a copy of the SDS provided by the manufacturer.
- The Principal Investigator must ensure that his/her laboratory personnel have attended appropriate laboratory safety training or refresher training as required by EH&S.

I have read and understand the content of this SOP:

Name	Signature	Trainer	Date
<b>Prof. Susannah Scott</b>			
Stephanie Goubert-Renaudin			
Gary Kwanyi Ng			
Alessandro Gallo			
Anthony Crisci			
Haibo Yu			
Taeho Hwang			
Bethany Wigington			
Daniel Coller			
Zachary Jones			
Youhong Wang			
Jinghong Zhou			
Jason Fendi			