



UNIVERSITY OF
ARKANSAS

Facilities Management
Environmental Health & Safety

STANDARD OPERATING PROCEDURE

n-Butyllithium

| | |
|---|--|
| Department | |
| Principal Investigator | |
| Office Phone | |
| Office Location | |
| Laboratory Manager | |
| Lab Phone | |
| Locations covered by this SOP | |
| Research Start Date | |
| Expected Length of Research (months) | |
| Date SOP was Written | |
| SOP Version Number | |
| Date of Latest Revision | |
| Sections Revised/Modified | |

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

This SOP is meant to be an extension and companion to the University's Chemical Hygiene Plan (CHP) and the relevant laboratory's Laboratory Safety Manual.

SCOPE

The purpose of this Standard Operating Procedure (SOP) is to describe the standard procedures to be followed for the safe use of the particularly hazardous substance n-Butyllithium.

INTRODUCTION

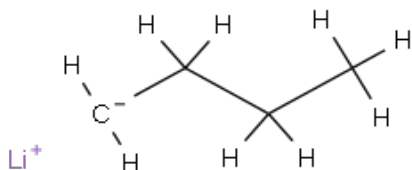
n-Butyllithium is

RESPONSIBILITIES

It is the responsibility of the research project's Principal Investigator (PI) in coordination with the Laboratory Manager (as appropriate) to ensure the project is properly equipped and procedures are correctly followed during the course of work with this chemical. Personnel are responsible for reading and understanding information regarding proper use of equipment and procedures prior to participation in the project and obtaining the appropriate training. Additionally, the PI will review and annually update the SOP through the end of the research project.

PHYSICAL AND CHEMICAL PROPERTIES

Chemical Structure



Molecular Formula: C₄H₉Li

Synonym(s): Lithium-1-butanide

CAS# : 109-72-8

Physical State: Liquid

Appearance: Is a solid which is often placed in solution with a hydrocarbon and the solution is a colorless or slightly yellow transparent liquid.

Odor: Not characterized

pH: Unknown

Melting Point/Boiling Point: -95 °C/80-90°C

Special Hazards from Substance or Mixture: Will ignite spontaneously in air and will react violently with water to release flammable and/or explosive gases.

HAZARDS/TOXICOLOGY

NFPA 704



GHS Pictogram(s)



GHS Signal Word: Danger

Category/Classification: Flammable liquids (Category 2), Pyrophoric liquids (Category 1), Substances and mixtures, which in contact with water, emit flammable gases (Category 2), Skin corrosion (Category 1B), Serious eye damage (Category 1), Reproductive toxicity (Category 2), Specific target organ toxicity - single exposure (Category 3), Central nervous system, Specific target organ toxicity - repeated exposure, Inhalation (Category 2), Aspiration hazard (Category 1), Acute aquatic toxicity (Category 2), Chronic aquatic toxicity (Category 2)

Toxicology: OSHA TWA – None established

Rat LD50 subcutaneous

Stability/Reactivity: Stable under recommended storage conditions

Incompatible Materials: Strong acids and strong oxidizing agents. Reacts violently with water, chlorine, fluorine, perchlorates.

EXPOSURE LIMITS, DETECTION, SIGNS, AND SYMPTOMS

The Occupational Safety and Health Administration has not established a permissible exposure limit (PEL). This should not be taken that its use does not present hazards. On the contrary, because of its characteristics to ignite spontaneously in air and react violently with water this chemical possesses a substantial safety hazard. This is even more reason that all appropriate health and safety aspects of its use should be understood and followed.

n-Butyllithium is extremely destructive to tissue of the mucous membranes and upper respiratory tract, eyes, and skin. Inhalation may provoke the following symptoms: spasm, inflammation and edema of the bronchi, spasm, inflammation and edema of the larynx, aspiration or inhalation may cause chemical pneumonitis, and pulmonary edema. Symptoms of exposure may include burning sensation, coughing, wheezing, laryngitis, shortness of breath, headache, nausea, and vomiting.

ENGINEERING CONTROLS

Local Exhaust

Fume Hood

Location in lab:

Glove Box

Location in lab:

Biosafety Cabinet

Location in lab:

Clean Bench

Other:

The glove box in room _____ has been certified for use. It is critical anytime n-Butyllithium is in use it is inside the glove box and the glove box is fully functioning. This should be checked routinely. Incompatible materials should be removed from the glove box anytime n-Butyllithium is present.

ADMINISTRATIVE CONTROLS

This SOP, the relevant manufacturer specific Safety Data Sheet (SDS, Appendix B), and any other pertinent documentation must be reviewed before the chemical is used. Note it is important that the manufacturer specific SDS is reviewed and kept with this SOP as the chemical properties may be different depending on the chemical formulation and mixture.

All policies, procedures, and recommendations in the University Chemical Hygiene Plan (CHP) must be followed in addition to this SOP as this document is considered an extension of the CHP.

TRAINING

Everyone working under the subject protocol, or having access to the laboratory during the protocol, should be trained on the CHP, this SOP and associated information (See Appendix A)

SPECIFIC LABORATORY PROCEDURES AND PRACTICES

Handling, Preparation and Use

1) Perform all preparation of n-Butyllithium solutions in the glove box and dispose of any waste material IAW with this SOP and Appendix C.

2) Ensure all personnel working with n-Butyllithium are familiar with glove box operations and have reviewed the appropriate operations and maintenance documentation.

Inspect the glove box before each use and ensure it is properly functioning and the work area is free of all aqueous, combustible and oxidizing materials.

5) Place all contaminated disposable items in a hazardous waste bag or container IAW Appendix C

8) Know the location of the nearest fire extinguisher, eyewash, and safety shower before beginning work.

9) Never work alone. Make sure there is another worker present who is also trained in the n-Butyllithium SOP.

Keep combustible materials, including paper towels and Kim wipes, away from pyrophoric reagents.

Keep a supply of dry sand, or other appropriate non-combustible material, nearby to contain and remove spilled materials.

Ensure all glassware and other equipment involved in the procedure are clean and dry. Glassware should be heated in an oven or by a heat gun to remove moisture and cooled in an inert atmosphere.

It is better to do multiple transfers of small volumes than attempt to handle larger quantities.

Perform a “dry run” to identify and resolve possible hazards before conducting the actual procedure.

Syringes

1. Choose the size based on 2X the largest volume transfer.
2. Glass syringes with Teflon-tipped plungers (gastight) syringes are best as simple glass syringes are more prone to causing gas bubbles. However, use of glass syringes will require rinsing and quenching of materials for reuse.
3. Disposable plastic syringes have a good seal on the plunger and work well but should not be reused.
4. Syringes MUST have needle-lock mechanism (Luer-Lok) to prevent separation of needle and syringe.

Syringes should be dried before employed. The syringe should be dried in an oven for at least 2 hr. at 120°C, placed in a desiccator to cool to ambient temperature, then purged with a stream of inert gas.

Ensure the syringe is leak-free before use by inserting the needle into a rubber stopper. It should be possible to compress the syringe to half its original volume without any leaks. The needle can be left in the rubber stopper when not in use to prevent the entry of air.

Syringe Transfer Methods (Only for 50 mL or less)

1. Clamp the reagent container firmly. A small amount of positive pressure in the reagent container will be needed in order to draw the reagent into a syringe.
2. Flush dry syringe with inert gas, depress the plunger and insert the needle into the Sure/Seal bottle.
3. Insert an inert gas line with low positive pressure (1-2 psi). Ensure that excess pressure is released through a mineral oil bubbler that is attached to the gas line. Simply sticking a needle through the septum, or using a balloon to relieve pressure, is not safe for pyrophoric reagents.
4. Draw the reagent slightly more than you need initially. Be careful to pull only very gently on the plunger as pulling too strongly can cause leaks and create air bubbles. Always keep a good grip on BOTH the needle and the plunger to ensure that neither comes off.
5. Gently pull the plunger to draw liquid into the syringe. Pulling too hard or too fast can cause air bubbles to enter between the plunger and syringe body.

Flip the syringe needle-up, so that the inert gas bubbles rise to the top (a long needle is needed for this). It is best to avoid allowing the reagent in the bottle to come into contact with the

septum to prevent degradation. Tap the syringe a couple of times and look to make sure all the air/gas has been collected at the tip.

Push the plunger down to eject the inert gas and excess reagent back into the reagent vessel, stopping once the volume needed for the experiment is reached.

Pull the needle into the headspace of the reagent bottle and draw a small amount of inert gas into the syringe. This prevents spilling, and very importantly protects the liquid from exposure to air during transfer.

6. The desired volume of reagent in the syringe is quickly transferred to the reaction apparatus by puncturing a rubber septum.

Cleaning Pyrophoric Reagents from Needles and Syringes

1. Rinse the syringe by inserting the needle end into an inert non-reacting solvent such as hexane into the syringe and then drawing the solvent into the syringe.
2. Pump and expel at least 3 times.
3. Perform second rinse in an alcohol such as isopropanol.
4. Again pump and expel at least 3 times.
5. Syringe and needle are now safe to clean with water.
6. Dispose of wash solvent with other hazardous waste solvents.

PERSONAL PROTECTIVE EQUIPMENT

All personal protective equipment (PPE) recommended here is considered in addition to that outlined in the CHP. Relevant links to help determine the appropriate PPE can be found at the EH&S website (www.enhs.uark.edu).

Body

- Lab Coat

- Flame Resistant Lab Coat
- Barrier Lab Coat
- Disposal Tyvek (full sleeves)
- Splash Apron
- Shoe Cover
- Other:

Gloves

- Latex
- Nitrile
- Butyl Rubber (thickness: 0.3 mm)
- Neoprene
- Silver Shield
- Cold Weather
- Double Gloves
- Other:

Eyes

- Safety Glasses/Goggles
- Face Shield
- Other:

Respiratory

- None needed
- N-95 Respirator
- Half-Face Respirator
- Full-Face Respirator (Cartridge: Organic Vapor + P100 cartridges (3M #60926))
- SCBA
- Tethered

A respirator is not required when the PEL will not be reached. Respirators should only be used when all other controls are not sufficient or when regulations specifically require their use. If a PEL does not exist, respirators can be used to prevent harmful exposure from air contaminants. If a potential exposure hazard cannot be eliminated, please contact the EH&S Respiratory Protection Program administrator (479-575-5448) to discuss respiratory protection or to enroll in the program. Program enrollment includes medical evaluation, training and fit testing for an appropriate respirator IAW Occupational Safety and Health Administration (OSHA) Respiratory Protection Standard (29 CFR 1910.134).

Hygiene

Avoid contact with eyes, skin, and clothing. Wash hands before each break and before leaving the laboratory or other designated area.

Environmental

Take precautions to prevent all spills and/or releases. Do not let product enter drains.

EMERGENCY PROCEDURES

Phone Numbers

Emergency: 911

EH&S: 479-575-5448

UAPD: 479-575-2222

Pat Walker Health Center: 479-575-4451

In an emergency, call 911.

Fire

In the case of a fire, call 911. Pull the nearest fire alarm and alert others in the area to evacuate. Stay in a safe location near the scene and be available when emergency responders arrive to provide information about the incident and answer questions. Once you are in a safe location, notify your supervisor and the EH&S department immediately. Tell them the chemical(s) detailed in this SOP are involved in a fire.

Medical

For non-emergency medical care contact Pat Walker Health Center or your personal physician. For emergencies, call 911. Avoid further contamination while assisting victim.

Exposure

- Inhalation: Move into a fresh air location. Consult a physician.
- Ingestion: Do NOT induce vomiting. Rinse mouth with water. Consult a physician.
- Injection: For sharps injury (needle stick or subcutaneous exposure), scrub exposed area thoroughly using warm water and antiseptic soap for 15 minutes and consult a physician.
- Eye Contact: Rinse with plenty of water for at least 15 minutes in an emergency eyewash station. Consult a physician. Continuing rinsing eyes during transport to hospital.
- Skin Contact: Remove any contaminated clothing. Wash with plenty of water for at least 15 minutes in an emergency shower station. Consult a physician. Take victim to hospital immediately.

Spills

Spills must be cleaned up immediately by properly protected and trained personnel. All other persons should leave the area. Clean up spills using the content of the on-site spill kit. Do not attempt to clean up any spill if not trained or comfortable. If the spill is out of control or a person is injured, exposed, or suspected of being exposed, leave the area and call 911 immediately then notify your supervisor and EH&S. Once you are in a safe location, notify your supervisor and the EH&S department immediately. Tell them the chemical(s) detailed in this SOP are involved in a spill.

Spills Inside Glove Box

- 1) If the spill is in a fume hood, close the sash and secure the area.
- 2) Immediately eliminate/remove all nearby ignition sources.
- 3) Notify your supervisor and EH&S.
- 4) Adhere to all required PPE detailed in this SOP.
- 5) Cover spilled liquids with dry sand, or other appropriate non-combustible material with absorbent pads.
- 6) Use clean, non-sparking tools to collect absorbed material and place into loosely-covered metal or plastic containers ready for disposal.
- 7) Double bag all waste in plastic bags labeled with a Hazardous Waste label from EH&S. Keep waste away from incompatible materials. Submit a pick-up request on the EH&S website (www.enhs.uark.edu) for a hazardous waste pick-up.

SPECIAL HANDLING AND STORAGE REQUIREMENTS

Precautions for safe handling: Do not over purchase; only purchase what can be safely stored in the laboratory and always use the smallest amount possible. Avoid contact with skin and eyes. Avoid inhalation of vapor or mist and ingestion. Keep away from sources of ignition. Only use in designated area. Do not transport or ship n-Butyllithium before contacting EH&S for arrangements.

Conditions for safe storage: Keep the material under inert atmosphere when not in use. And keep container tightly closed and in a dry and area. Reseal open containers and keep upright. Refer to the manufacturer specific SDS for storage instructions.

DISPOSAL AND DECONTAMINATION

Follow EH&S waste storage, labeling, and pick-up procedures outlined in the CHP and Appendix C.

Ensure all wastes are kept under the control of the person generating and disposing.

All waste must be placed in individual bags and grouped by similarity (i.e., disposable liners and bedding in one bag, PPE in one bag, etc)

Each bag will be individually numbered, and the contents of each bag (i.e. PPE, bedding, sharps containers, etc) noted on the label placed on the exterior of the 30-gallon poly drum waste container

Empty vials, syringes, pipette tips, and other containers with n-Butyllithium are a hazardous waste and should not be placed in a sharps container. A container specific for the n-Butyllithium sharps and other waste items is required and will be kept in the designated fume hood. Each container must be labeled in accordance with Appendix C.

Re-usable utensils, glassware, and other surfaces contaminated with n-Butyllithium must be decontaminated at the end of the laboratory work session. Complete this inside the glove box before removing any of the items. Dispose of all n-Butyllithium contaminated waste as hazardous.

Small amounts of unused/spilled materials must be destroyed by careful quenching of the residue. Transfer the materials to an appropriate reaction flask for hydrolysis and/or neutralization. Dilute significantly with an unreactive solvent such as heptane or toluene and place the flask in an ice water cooling bath. Slowly add isopropanol to quench pyrophoric materials. Upon completion, add methanol as a more reactive quenching agent to ensure completion. Finally, add water dropwise to make sure there are no pockets of reactive materials. Dispose of as hazardous waste.

There will be a total of three different containers provided to be used for all the hazardous waste. A one (1) gallon plastic bucket will be used strictly for broken glass. A sharps container will be used strictly for syringes and needles. Ziplocks, plastic bags, and a thirty (30) gallon poly blue drum will be used for all other waste and packed in accordance with Appendix C.

Areas where n-Butyllithium is prepared and/or administered must be cleaned and decontaminated immediately following each procedure.

NOTE

Any deviation from, or modification/revision of this SOP, requires the approval from the PI, EH&S, and pertinent committee representation.

CURRENT PERSONNEL

| Name | Date Assigned |
|------|---------------|
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |

Principal Investigator SOP Approval

Print name

Signature

Approval Date _____

DOCUMENTATION OF TRAINING

Prior to conducting any work with the chemical(s) detailed in this SOP, the PI must

- Provide all laboratory personnel with appropriate training on the procedures and all specific hazards.
- Provide all personnel with a copy of the SOP and the manufacturer specific safety data sheet (SDS) and any other pertinent documentation for the chemical(s) detailed in this SOP.
- Ensure that all laboratory personnel have received all appropriate training and are current with any necessary refreshers.

I have read and understand the content of this SOP, completed lab/procedure specific training, and reviewed the SDS and all other provided pertinent documentation:

| Name | Title/Representing | Signature | Date |
|------|--------------------|-----------|------|
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |

SOP ANNUAL REVIEW

| Name | Title/Representing | Signature | Date |
|------|--------------------|-----------|------|
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |

ADDITIONAL RESOURCES

Appendix A: Specific Training

Appendix B: Manufacturer Specific Safety Data Sheet (SDS)

Appendix C: Chemical/Biological Mixed Waste Packing and Labeling Instructions