Titration of n-BuLi

Standard Operating Procedure

Lab: LSS

Department: DRS

PI/Manager of Space:

Written By:

**Section 1: Overview**

**Type of SOP:** [x] Process [ ] Hazardous Material [ ] Hazardous Class of Chemicals [ ] Equipment

**Synopsis:**

*This SOP describes the titration of n-BuLi using a charge transfer complex indicator. This method is superior to other methods due to the bright red endpoint color.*

**Section 2: Risk Assessment Summary (Hazards and control measures)**

Materials:

|  |  |
| --- | --- |
| **Material (name, CAS #, other ID)** | **Hazards** |
| n-BuLi in hexanes (109-72-8) | Pyrophoric, flammable, reproductive toxin, corrosive, target organ tox. |
| Menthol (89-78-1) | Corrosive, target organ toxicity |
| 2,2ꞌ-bipyridyl (366-18-7) | Acute toxicity |
| Tetrahydrofuran (109-99-9) | Flammable, peroxide forming, carcinogen, target organ toxicity |
| Hexanes (110-54-3) | Flammable, health hazard |
| Acetone (67-65-1) | Flammable  |

Relevant References for Material Hazards:

|  |
| --- |
| All found on Aldrich.comn-BuLi –pdt # 230707 Menthol- pdt # M27722,2’-bipyridyl- pdt # D216305Tetrahydrofuran- pdt #401757Hexanes-pdt #320110Acetone-pdt #296090 |

Equipment hazards:

Equipment is considered low hazard.

Hazardous Conditions:

Conditions are considered low hazard.

Technique Hazards:

Transferring n-BuLi via syringe.

Rinsing excess n-BuLi from syringe.

Quenching excess n-BuLi.

Personal Protective Equipment

The following are in addition to proper dress for work in a laboratory:

Safety glasses (minimum);

Nitrile disposable gloves (minimum), fire retardant gloves under nitrile gloves are a possibility;

Flame resistant lab coat

Engineering Controls

This procedure is done in a chemical fume hood.

**Section 3: Procedures**

Three oven dried or flame dried 25 mL1-neck flasks equipped with a stir bar, rubber septum, and argon inlet needle are cooled to room temperature under argon (nitrogen can be used instead of argon). Each flask is then charged with ca. 200 mg of menthol by quickly removing the septum. The exact amounts of menthol are recorded for each of the three flasks. Ca. 5 mg of 2,2’-bipyridyl is then added to each flask by quickly removing the septum. The flasks are evacuated by shutting the inert gas off, opening to vacuum, closing to vacuum, and then carefully backfilling with argon (or nitrogen) to ensure an inert atmosphere. Dry THF (10 mL) is added to each flask via syringe. The solutions are stirred using magnetic stir plate.

**The addition of n-BuLi: If you have not previously used n-BuLi, please see an SOP on handling pyrophoric liquids or read the DRS pyrophorics safety guide.**

Draw n-BuLi into a 1-mL plastic syringe graduated with 0.01 mL increments. Record the amount present in the syringe then draw in inert gas to create an inert headspace. (Review the proper way to use a syringe, see DRS pyrophorics safety guide) n-BuLi is added dropwise to flask 1. You will notice a red color that quickly disappears. Once the red persists with a single drop of n-BuLi, the endpoint has been reached. Record the volume of n-BuLi left in the syringe. The syringe is then cleaned properly. To clean the syringe, the needle is put into a test tube filled with 5 mL of hexanes and solvent is drawn into the syringe and ejected a few times. The syringe is then rinsed with another 5 mL of fresh hexanes the same way, followed by acetone and then water. Allow the hexanes washes to be slowly quenched in air. You will notice a yellow/white residue form in the test tube.

The same procedure is followed for flask 2 and 3.

A few drops of saturated NH4Cl aqueous solution are added via syringe to all three flasks while they are still under an inert atmosphere to quench any excess n-BuLi.

\*Larger volumes of n-BuLi can be quenched by slowly pouring it onto dry ice in a plastic container and letting the dry ice evaporate overnight.

Calculating concentration:

Subtract the final from the initial volume to determine the volume of n-BuLi added to the flask.

Calculate the number of mmol of menthol in the flask. The mmol of menthol is equal to the mmol of n-BuLi at the end point.

$$\frac{mmol nBuLi}{mL nBuLi}=M of soution$$

An average molarity is calculated from titrating the contents of the three flasks. If one of the three flasks results in an outlier, additional titrations should be performed. Deviation from the average molarity should be recorded on the bottle.

**Section 4: Waste Disposal/Cleanup**

Quenching n-BuLi is described in the procedure above.

After all traces of n-BuLi have been properly quenched, the waste can be disposed of by separating any organic and aqueous materials and contacting DRS for pickup.

**Section 5: Emergency Response**

A dry powder fire extinguisher should be nearby.

Review the location of nearest safety shower before starting the procedure.

In case of a fire, identify two routes to exit the room.

**Section 6: Additional Information**

**Advice:**

1. Recrystallize the menthol prior to use.
2. The THF must be dry. Either distill from sodium/benzophenone or use solvent from a still that passes it through an activated alumina column.
3. Syringe needle will become clogged if they are not rinsed immediately following use.
4. Use a dry 20 gauge needle to transfer n-BuLi. This will maintain the integrity of the Sure/Seal.

**Checklist:**

[ ] Read (Material) Safety Data Sheets.

[ ] Another researcher is nearby or within sight and knows the hazards present.

[ ] Additional gloves are available in case one pair becomes contaminated.

[ ] All rinsing solvents have been poured before the pyrophoric material is used. This prevents large quantities of flammables from being inside the hood.

**References:**

* Handling Pyrophorics Safety Guide- DRS website
* Lin, H-S.; Paquette, L. A. *Synth. Commun.***1994**, *24*, 2503.

**Training Documentation**

Signing this document means that you have read and understand all aspects of this Standard Operating Procedure.

The supervisor is the person that acknowledges you took the training and understand the procedure. They can be a lab manager or researcher assigned by the PI to oversee this particular SOP.

|  |  |  |  |
| --- | --- | --- | --- |
| **Name (Printed)** | **Name (Signed)** | **Supervisor** | **Date** |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |