**** **** **** AZIDES **** ****

# Introduction

Azides are chemicals which contain an azido group, a linear arrangement of three nitrogen atoms (N3-).

* Inorganic azides:
  + Alkali metal azides – e.g. sodium azide used as a preservative, mutagen, biocide, assay reagent and the propellant in automotive airbags
  + Heavy metal azides – as detonators and rocket propellants
* Organic azides:
* Used for chemical synthesis
* Very sensitive to friction and impact. Explosively decompose under heat, light or pressure

Caution should be exercised when using all azides due to high toxicity and the potential for violent reactions. *This fact sheet is not intended to replace the Safety Data Sheet provided by the manufacturer.*

# Hazards

* Azides present both physical and health hazards.
* Both organic and inorganic azides can be heat and shock sensitive and can explosively decompose with little input of external energy.
* Organic azides are considered as explosives whenever azido compounds having a C /N ratio of < 3.
* Azide anions can form highly toxic, shock sensitive and explosive compounds when interacting with many incompatible materials including but not limited to:
  + halogenated hydrocarbons (e.g. dichloromethane, chloroform, other halogenated aliphatic or benzylic solvents)
  + carbon disulfide
  + dimethyl sulfate
  + heavy metals and their salts
  + bromine
  + acids
* Azides have a high level of acute and chronic toxicity.
  + Azide anion has a similar toxicity as that of cyanide ion (LD50 = 27 mg/kg for rats).
* Azide anion functions by inhibiting the uptake of oxygen. As such, precautions should be taken when handling azide compounds capable of liberating azide anions.
* Sodium Azide – Hazards
* Sodium azide has a higher acute toxicity comparable to that of sodium cyanide.
* Exposure to sodium azide can result in rapid breathing, restlessness, dizziness, weakness, headache, nausea, vomiting, rapid heart rate, red eyes, clear drainage from the nose, coughing, skin burns, blisters, convulsions, and respiratory failure.
* Sodium azide reacts with acids or hydrolyzes with water to form hydrazoic acid an explosively unstable toxic gas which present a serious inhalation hazard.
* Violent decomposition of sodium azide occurs when heated to 275°C or greater.

# Best practices

* Keep solid azide material wet or soaked with solvent as long as possible. When mixed with liquids, explosives are normally desensitized (phlegmatized) by reducing the sensitivity to mechanical stress.
* Do not store organic azides with Carbon to Nitrogen ratio smaller than 3 but greater than 1 in its highest purity form. If storage is necessary, store in the dark in a solution below room temperature.
* Do not use metal spatulas or metal gripping devices when working with azides. Items made of metal transfer stronger mechanical stress to the azides than that of wood or Teflon.
* Do not expose organic azides to ground glass joints as the glass-on-glass friction may cause the azide to decompose explosively.
* Bottles containing pure powders or solutions of sodium azide at 5% or greater must be opened and handled only in a chemical hood.
* Avoid activities causing friction (e.g. grinding, scratching, strong agitation) and generating heat when working with azides.
* Regularly clean work areas handling azides to prevent buildup of azides and inadvertent reactions with incompatible materials.
* Use secondary containers when handling and transporting azides to prevent spills. Purchase pre-mixed stock solution of sodium azide when using as preservative agent.
* Evaluate the hazards in procedures using azides and write standard operating procedures based on the assessment.
* Conduct dry runs to eliminate safety problems that may arise before azides are actually used.
* Use the smallest amount of azide possible for your experiment.
* **STORE AZIDES AWAY FROM ALL OTHER CHEMICALS!**

# Controls

* Personal protective equipment must be worn, including a lab coat, safety glasses, and gloves with adequate chemical resistance.
* Conduct the experiment behind a blast shield in a fume hood with the sash positioned as low as possible. If use of a blast shield is not feasible, use a face shield.
* Clearly label your containers, and post a sign on the fume hood as notification that there is an azide experiment in progress.

# Disposal

* Organic azide waste should be placed in a separate, explicitly-labeled container designated solely for azide waste.
* Never dispose solutions of sodium azides and other alkali metal azides down the drain. Explosive salts can be formed if solutions containing sodium azide or other alkali metal azides are disposed of in drains made of piping or solder containing heavy metals such as Pb, Fe, Cu, Ag.
* Extra caution must be taken to make certain that azide waste does not come in contact with acid. Acids will protonate the azide ion and from the highly-toxic hydrogen azide (toxicity similar to that of hydrogen cyanide).
* Empty containers of azides should be disposed of as hazardous waste. Request pick-up by OEHS.

# Exposure response & contacts:

* **Contact with eyes:** immediately flush with copious amounts of tepid water for at least 15 minutes.
* **Skin contact:** immediately wash the affected area with copious amounts of tepid water.
* **Principal Investigator (PI):**
* **WSU Public Safety:** 313-577-2222, emergency transportation
* **Henry Ford Occupational Health – Harbortown**

3300 East Jefferson, Suite 100

Detroit MI 48207

(313) 656-1618

Monday – Friday 8:00 AM to 6:30 PM

* **Detroit Receiving Hospital - Emergency Room:** 313-745-3355

**Henry Ford Hospital – Emergency Room**: 313-916-8742

Available outside of occupational health clinic hours

* **Office of Environmental Health and Safety:** 313-577-1200, spills or clean-up

# References

1. National Research Council. (2011). Working with Chemicals. In Prudent Practices in the Laboratory (p. 136). Washington, D.C.: The National Academies Press.
2. Bräse, S., et al. “Organic Azides: An exploding diversity of a unique class of compounds” Angew. Chem. Int. Ed., 2005, 44, 5188
3. [Facts About Sodium Azide](https://emergency.cdc.gov/agent/sodiumazide/basics/facts.asp). Retrieved from CDC