Chemical safety fact sheet: Cyanides

The acutely toxic cyanide anion (CN⁻) is present in certain laboratory chemicals, occurs naturally in a number of foods and plants and is produced by certain bacteria, fungi and algae.

Inorganic cyanides such as sodium cyanide (NaCN) and potassium cyanide (KCN) produce toxic, flammable hydrogen cyanide gas (HCN) slowly on contact with moisture and rapidly on contact with acids. HCN is a colourless gas with a bitter almond odour, detectable at 1-5 ppm. NaCN and KCN are both white solids, odourless when dry. In damp air, cyanide salts may have a slight HCN odour. Not everyone can detect it and a person’s sense of smell, subject to fatigue, can fail to detect it over time.

Whether researchers use cyanide compounds (‘cyanides’) as reagents or generate cyanides in situ, the same cyanide precautions must be followed.

Hazards

Cyanides are acutely toxic to humans, in that they act as chemical asphyxiants, disabling the biochemistry of cellular respiration even in the presence of adequate oxygen levels in the blood. ³

Liquid or gaseous HCN and inorganic compounds of cyanide can enter the body through inhalation, ingestion or absorption through the skin or eyes. Cyanide salts are readily dissolved and absorbed upon contact with moist mucous membranes.

Improper handling may lead to:

- Eye, skin or inhalation exposure to HCN gas, which is generated when cyanides salts come in contact with acids or acid salts, carbon dioxide (e.g., in air), moisture or water.
- Mild cyanide poisoning, with symptoms of dizziness, nausea and drowsiness.
- Moderate cyanide poisoning, with convulsions, vomiting, unconsciousness and cyanosis.
- Severe cyanide poisoning, resulting in seizure, deep coma, and respiratory arrest.

Review the Safety data sheet of your cyanide compound and acquire your lab-specific training before beginning work.

Mandatory control measures

- Exposure prevention is the priority, but all cyanide users must be fully aware of first aid response measures. See Emergency procedures below and prepare a ‘grab and go’ package to provide to emergency room personnel in case of exposure.
- Do not work alone or during off hours. Make sure you have a buddy in the laboratory who is aware that you are using a cyanide compound and knows the emergency procedures.
- Prepare and use cyanides only in a properly functioning chemical fume hood. A “Danger – Cyanide in use” sign must be displayed on the fume hood when samples are left unattended.
- Review or create a laboratory specific procedure for the process in which a cyanide compound is to be used and incorporate information from this document. Update the procedure as the process changes.
- Wear a lab coat.
- Wear splash-proof goggles.
• Wear long impermeable gloves suited to your specific cyanide compound (e.g., PVC, nitrile or neoprene) over a pair of disposable nitrile gloves. Long gloves should cover the hands, wrists and forearms.
• Wear long pants and closed-toe shoes.

Safe handling and use

• Purchase the smallest amount of cyanide compound needed.
• Minimize the scale of the reaction to minimize the amount of cyanide compound required.
• Use absorbent liners or shallow pans on the work surface to ease cleanup of any drips or spills.
• Prepare cyanide compound and use it only in a properly functioning chemical fume hood. Position the fume hood sash between you and the reaction.
• Ensure cyanide salts do not come in contact with acids or moisture, to prevent HCN generation.
• Store containers tightly closed in a dry, well-ventilated place, separate from acids, oxidizers, flammables, water and aqueous solutions. Use secondary containment.

Waste handling

• Small quantities (up to 50 mg) of residual cyanide salts may be deactivated if appropriate to your process. Refer to literature for details and dispose of deactivated residue as hazardous waste. ³
• Collect waste streams containing residual cyanide compound as hazardous waste. Take extreme care to not mix cyanide-containing waste with incompatibles (e.g., acid).
• Collect liquids containing cyanides in a compatible container and apply a chemical waste label.
• Collect contaminated gloves, absorbent pads and any other items with trace contamination in a double plastic bag and apply a chemical waste label indicating “Contains cyanide residue.”
• Empty containers should be triple rinsed with water and the rinsate collected as hazardous waste. Deface the label and place rinsed containers in the correct non hazardous waste stream.
• Submit a request for waste pickup through the online system.

Emergency procedures

Ensure you know the location of the nearest emergency eyewash, safety shower and chemical spill kit. Inform your supervisor and complete an incident report after any incident.

Grab and go package: it is strongly recommended to print out the following resources so they are ready to take to the hospital in case of exposure:

• Cyanide compound Safety data sheet.
• SFU safety fact sheet for cyanides (this document).
• Your lab specific procedure (if available).

First aid response

• For all exposure scenarios, ask a coworker to call 911 and Campus Security at 778-782-4500 and advise of cyanide poisoning, amount of exposure, exposure route (skin, eyes or respiratory), and time since exposure.
• Skin contact: With gloved hand(s), remove contaminated clothing, and wash the affected area with soap and copious, tepid running water or the nearest safety shower for 15 min. Seek immediate medical attention.
• **Eye contact**: Immediately flush eyes with water for 15 min. Seek immediate medical attention.
• **Inhalation**: Move person to fresh air. **Do not** provide mouth-to-mouth resuscitation. Seek immediate medical attention.

**Spill response**

• Alert others and clear the immediate area where the spill occurred.
• **Only attempt cleanup if you have been trained, are equipped and feel comfortable to do so.**
• Retrieve the laboratory spill kit and put on additional PPE as necessary.
• Scoop up dry waste into a heavy (high mil) plastic bag.
• Use an absorbent pad to handle liquid spills.
• Finish cleaning the area with water and paper towel.
• Place all residue and cleanup materials in a double heavy (high mil) plastic bag, discard any disposable PPE, then seal the bags and apply a chemical waste label, indicating “cyanide compound name spill cleanup”.
• Submit a request for waste pickup through the online system.
• **For large spills that require assistance or any spill outside of the fume hood**, evacuate all personnel from the laboratory and post a warning on the laboratory to restrict access. Call Campus Security at 778-782-4500.

**References**