

NDMRB-RA-121

Risk Assessment: Hydrogen Fluoride releasing reagents

Scope

Triethylamine trihydrofluoride (CAS 73602-61-6) and Hydrogen fluoride pyridine (62778-11-4) are reagent used in synthetic chemistry for the fluorination of alcohols and ketones and for the removal of silicon-containing protecting groups. They constitute a safer form of hydrogen fluoride source, however there are several risks associate with the use of these reagents. The scope of this RA is to guide users on how to manage risks during storage, handling and use of them.

Hydrogen fluoride itself is an extremely toxic and corrosive inorganic acid. Hydrofluoric (HF) acid burns require immediate and specialized first aid and medical treatment. Symptoms may be delayed up to 24 hours depending on the concentration of HF. After decontamination with water, further damage can occur due to penetration/absorption of the fluoride ion. Treatment should be directed toward binding the fluoride ion as well as the effects of exposure. Skin exposures can be treated with a 2.5% calcium gluconate gel repeated until burning ceases. More serious skin exposures may require subcutaneous calcium gluconate except for digital areas unless the physician is experienced in this technique, due to the potential for tissue injury from increased pressure. Absorption can readily occur through the subungual areas and should be considered when undergoing decontamination. Prevention of absorption of the fluoride ion in cases of ingestion can be obtained by giving milk, chewable calcium carbonate tablets or Milk of Magnesia to conscious victims. Conditions such as hypocalcemia, hypomagnesemia and cardiac arrhythmias should be monitored for, since they can occur after exposure. Consult a physician. Show this safety data sheet to the doctor in attendance. Hydrofluoric (HF) acid burns require immediate and specialized first aid and medical treatment. Symptoms may be delayed up to 24 hours depending on the concentration of HF. After decontamination with water, further damage can occur due to penetration/absorption of the fluoride ion. Treatment should be directed toward binding the fluoride ion as well as the effects of exposure. Skin exposures can be treated with a 2.5% calcium gluconate gel repeated until burning ceases. More serious skin exposures may require subcutaneous calcium gluconate except for digital areas unless the physician is experienced in this technique, due to the potential for tissue injury from increased pressure. Absorption can readily occur through the subungual areas and should be considered when undergoing decontamination. Prevention of absorption of the fluoride ion in cases of ingestion can be obtained by giving milk, chewable calcium carbonate tablets or Milk of Magnesia to conscious victims. Conditions such as hypocalcemia, hypomagnesemia and cardiac arrhythmias should be monitored for, since they can occur after exposure.

Triethylamine trihydrofluoride (CAS 73602-61-6) is a colourless to dark yellow liquid with boiling point of 70 °C. Handling in borosilicate glassware is possible up to 150 °C

Hydrogen fluoride pyridine also known as Olah's reagent (CAS 62778-11-4) is colourless to light yellow liquid stable up to 50°C. It must be stored at -20 °C.

Compatible materials: polyethylene, fluoro polymers (FEP, PFA, PTFE)

For further information on both reagents see: *e-EROS Encyclopedia of Reagents for Organic Synthesis*, Online ISBN: 9780470842898/ DOI: 10.1002/047084289X

Name of assessor:	Gian Filippo Ruda	Date of Assessment:	March 2018	Review Date:	March 2021
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Risk Matrix:

Risk Matrix		Likelihood			
		High	Medium	Low	Negligible
Consequence	Severe	High	High	Medium	Effectively Zero
	Moderate	High	Medium	Medium/low	Effectively Zero
	Insignificant	Medium/Low	Low	Low	Effectively Zero
	Negligible	Effectively Zero	Effectively Zero	Effectively Zero	Effectively Zero

Risk Assessment:

Hazard (Cause and consequence)	Affected Groups	Existing controls	Risk	Further Action
Accidental leak into lab space	All users	<p>Although the reduced HF vapor pressure in Triethylamine trihydrofluoride and hydrogen fluoride pyridine reduces the potential for exposure, extreme care should be used in handling this materials. Effects of exposure to HF are often delayed for several hours, but the burns are extremely painful and can be slow to heal. Exposure to these reagents should be treated in the same way as for HF. Thus users and coworkers should be familiar with and be prepared to administer the proper first aid treatment.</p> <p>Hydrogen fluoride pyridine must be stored in a tightly sealed container within a secondary plastic container and kept in a freezer.</p> <p>Triethylamine trihydrofluoride must be stored in a tightly sealed container within a secondary plastic container and kept in a dry, cool place.</p> <p>Both reagents must be always handled in a fume hood.</p> <p>PPE should be used all the time (double gloves) .</p> <p>In case of spillage inside the fume hood, they can be neutralized with Calcium chloride solution.</p>	Medium	<p>Only competent and approved staff members may use Triethylamine trihydrofluoride or Hydrogen fluoride pyridine..</p> <p>All staff who work with Triethylamine trihydrofluoride or Hydrogen fluoride pyridine must follow the instructions in the following RA and must sign off that they have read and understood all safety information regarding the use of Triethylamine trihydrofluoride or Hydrogen fluoride pyridine.</p> <p>Hazard warning signs should be used where relevant to indicate the presence of the HF sources (secondary containers)</p>

<p>Fatal if swallowed, in contact with skin or if inhaled</p>		<p>If inhaled move person into fresh air. If not breathing, give artificial respiration. Consult a physician.</p> <p>In case of small burns, treat the skin with a 2.5% calcium gluconate gel repeated until burning ceases.</p> <p>More serious skin exposures must be treated by experienced physician s.</p>		<p>Calcium gluconate gel must be present in the laboratory first aid kit.</p>
<p>HF causes sever skin burns and eye damage</p>	<p>All users</p>	<p>Full PPE should be used all the time (double gloves) .</p> <p>Calcium gluconate gel is included in the laboratory first aid kit.</p> <p>Skin exposures can be treated with a 2.5% calcium gluconate gel repeated until burning ceases.</p> <p>In case of skin contact take off contaminated clothing and shoes immediately. Wash off with soap and plenty of water. Take victim immediately to hospital. Consult a physician.</p> <p>In case of eye contact Rinse thoroughly with plenty of water for at least 15 minutes and consult a physician.</p>	<p>Medium</p>	<p>Full face shield, double gloves and fully closed labcoat must be used all the time</p>
<p>Fire Aqueous HF solutions can react exothermically with metals and release hydrogen gas</p>	<p>All users</p>	<p>Avoid contact with metals</p> <p>Extinguishing media Suitable extinguishing media Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.</p>	<p>Medium</p>	

Disposal	All users	All the waste must be collected into separated plastic containers and neutralized by treatment with an aqueous base or CaCl ₂ solutions. All the waste must be properly labelled in a tight seal container and handed for disposal.	Low	
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Signed By Author:

Approved by (sign and print):

Reviewed by:

Date of review: