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EH&S FACT SHEET

Environment, Health and Safety Information for the Berkeley Campus

Corrosives (Acids and Bases)

Introduction

Acids and bases are some of the most common hazardous chemicals used in laboratories. They are useful in an array of different experiments, but caution must be used while working with these corrosive compounds. Whether the compound is on the extreme high or low end on the pH scale, proper steps must be taken to ensure your safety. This fact sheet provides information that should be incorporated into – or referenced in – written Standard Operating Procedures (SOP's) for laboratory processes that use corrosives.

Chemical Burns

The skin, eyes, and respiratory tract are three body parts that can be seriously damaged by corrosives. Exposure can be caused by:

- Splashes when pouring
- Spills while carrying containers
- Skin contact with contaminated containers or surfaces
- Splatters or mists from reactions
- Vapors from open or leaking containers
- Inhaling corrosive dusts

The severity of the resulting chemical burn depends on the concentration and the duration it is in contact with the body. While most acids tend to produce immediate pain at the site of contact and begin to harden the skin, most bases do not produce an immediate warning. Base burns can be much more severe due to a delay in pain which allows the base to sit on the skin longer and penetrate deeper. When bases make contact with the skin, they feel slippery (much like soap on the hands) and are harder to remove from the skin than acids.

Protective Measures

- Always wear appropriate personal protective equipment; as a minimum this should include long sleeve lab coat, pants, closed-toe shoes, impermeable gloves and proper eye protection. Check the Material Safety Data Sheet (MSDS) to see what material is suggested to protect against the specific corrosive.
- Eye protection must be worn when working with corrosives. Safety glasses offer impact and some splash protection but will not fully protect against chemical splash or from corrosive vapors. Safety goggles provide better splash protection and should be worn when working with concentrated corrosives. A face shield may be worn in conjunction with the proper safety goggles to better protect the eyes and face when pouring or working with large amounts of concentrated corrosives.
- Know where the emergency eyewash and safety shower are located and test the eyewash to verify it is working properly. Should there be an accidental exposure, remove contaminated clothing and flush exposed areas for a minimum of 15 minutes while someone else summons emergency medical assistance.

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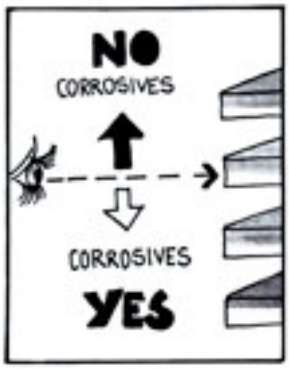
- Wear gloves when handling corrosives. Do not immerse your hands in corrosive liquids, use tools. Wear disposable lab gloves for protection against incidental exposures. Wear thicker reusable gloves to clean up spills or if there is likelihood of contact with corrosives. For more guidance on glove selection see http://www.ehs.berkeley.edu/healthsafety/gloveusage.html.
- Add acid to water, not water to acid; water to acid will cause acid to sputter at surface and will spray droplets of acid.
- Work in a fume hood to protect yourself and others from breathing corrosive vapors, mists or dusts, and position the glass sash between you and the chemical to use it as a shield.
- When working with hydrofluoric acid, keep the calcium gluconate antidote nearby. Follow recommendations described at http://www.ehs.berkeley.edu/pubs/factsheets/40hf.pdf.
- When corrosives are moved from the laboratory, the bottles should be placed in buckets or carriers which act as secondary protective containers. Use bottles that are plastic coated to reduce the chance of an accidental spill. See related requirements at http://ehs.berkeley.edu/images/ehs/pubs/17transportchem.pdf.

Fire Hazards

Although most corrosives are not flammable (glacial acetic acid is one exception), many can react with other corrosives or other chemicals to produce heat which can ignite materials or cause explosions. When working with oxidizing acids like nitric or perchloric acid, extra caution must be taken to avoid contact with organic material because enough heat may be generated to cause ignition. Oxidizing acids (i.e., nitric) in contact with flammable liquids can catch on fire or cause an explosion. Incompatible mixing can generate flammable or toxic gases.

Storage



Always properly label containers holding corrosives, including material name and hazard. One must store corrosives on low shelves at least below eye level. Acids and bases should never be stored together because they are incompatible. Mineral acids should be stored separate from organic acids, and oxidizing acids should be stored separate from non-oxidizing acids. Organic acids (i.e., acetic and formic acid) can be stored with flammables. One should check the MSDS to see what chemicals are incompatible. The following chart is not all-encompassing, but it displays some of the incompatibilities with some common acids and bases.

Acid/Base	Is incompatible and should not be mixed or stored with:
Acetic Acid	Chromic acid, nitric acid, hydroxyl compounds, ethylene glycol, perchloric acid, peroxides, permanganates.
Ammonia/Ammonia hydroxide	Ammonia forms explosive mixtures with oxygen, chlorine, bromine, fluorine, iodine, mercury, platinum and silver. Avoid contact with copper, aluminum, and their alloys. Avoid contact with sodium hydroxide, iron, and cadmium.
Bleach (sodium hypochlorite)	Acids, ammonia, drain cleaners.

Hydrochloric acid	Incompatible with amines, aluminum, ammonium hydroxide, calcium phosphide, isocyanates, metal acetylides, metal carbides, organic anhydrides, perchloric acid, sulfuric acid, vinyl acetate, and other materials. Inorganic acids generate flammable and/or toxic gases in contact with cyanides, dithiocarbamates, isocyanates, mercaptans, nitrides, nitriles, sulfides, and strong reducing agents. Additional gas-generating reactions occur with sulfites, nitrites, thiosulfates (to give H_2S and SO_3), dithionites (SO_2), and carbonates.
Nitric acid	Reacts with water or steam to form toxic and corrosive nitrous fumes. Reacts violently with reducing agents, bases, combustible materials, finely dispersed or powdered metals and metal alloys, acetic anhydride, acetone, acetylene, acrolein, acrylonitrile, alcohols, aliphatic amines, allyl chloride, ammonia, aniline, organic solvents, and many other substances and materials.
Potassium hydroxide	Acids, organic materials, metals, and moisture.
Sodium Carbonate	Acids, strong bases, strong oxidizers, fluorine, aluminum, zinc, phosphorous pentoxide.
Sodium hydroxide	Organic compounds, flammable liquids, nitro methane, and nitrous compounds.
Sulfuric acid	Potassium chlorate, potassium perchlorate, potassium permanganate (similar compounds of light metals, such as sodium and lithium). Reacts, possibly causing ignition or explosion, with many substances, including non-oxidizing mineral acids, organic acids, bases, reducing agents, acetic anhydride, acetone, acetonitrile, acrolein, acrylates, acrylonitrile, alcohols, aldehydes, alkylene oxides, ammonium hydroxide, bromine pentafluoride, butyraldehyde, carbides, chlorates, chlorosulfonic acid, cresols, cuprous nitride, diisobutylene, ethylene cyanohydrin, ethylene diamine, ethylene glycol, ethyleneimine, fulminates, glycols, hydrochloric acid, iodine heptafluoride, iron, isocyanates, ketones, lithium silicide, mercuric nitride, 2-methyllactonitrile, powdered metals, nitric acid, nitrotoluene, pentasilver, perchloric acid, phenols, phosphorus, picrates, potassium chlorate, potassium permanganate, propylene oxide, pyridine, rubidium acetylene, silver permanganate, sodium, sodium chlorate, sodium hydroxide, styrene monomer, zinc phosphide.

Disposal of Corrosives

- Only solutions in the range of pH 5-10 may be disposed of in the sink, and only if they are not reactive, ignitable, malodorous, lachrymatory or moderately toxic or highly toxic. See Campus drain disposal guidelines: http://ehs.berkeley.edu/images/ehs/pubs/draindisposal.pdf
- Waste solutions outside of the pH 5-10 range must be disposed through the Office of Environment, Health &Safety (EH&S) by following the instructions on the hazardous waste program page: http://ehs.berkeley.edu/hwp.
- Use appropriate containers, properly labeled, for corrosive waste. Improper labeling has led to laboratory accidents: http://ehs.berkeley.edu/hs/129-lessons-learned-at-uc-berkeley/347.html.