Phenol- Safe Work Practices

Phenol (a.k.a. carboxylic acid, hydroxybenzene, benzenol) is a common chemical used for tissue preservation and DNA/RNA extractions. In laboratories, phenol can be found as a component in commercial reagents (e.g. QIAzol, TRIzol) or in prepared mixtures (e.g. chloroform: phenol). Pure phenol appears as white or clear, acicular crystals that turn pink or reddish on exposure to air and light. When pure, phenol has a sweet, tar-like odor that is readily detected at low concentrations (0.05 ppm in air). It is soluble in alcohol, glycerol, petroleum, and, to a lesser extent, water. Though phenol is commonly used in laboratories, it can be extremely hazardous upon ingestion, inhalation or contact with the skin or eyes.

Hazards

**Acute Toxicity**- Phenol may be fatal if ingested, inhaled or absorbed through the skin. Ingestion of as little as 1 gram can be fatal to humans. Acute exposures can lead to shock, coma, convulsions, cyanosis and death, usually through respiratory failure.

**Germ Cell Mutagenicity**- Limited evidence suggests that phenol may induce heritable mutations in the germ cells of humans. In limited animal studies, phenol has been reported to be toxic to embryos and fetuses.

**Flammability**- Phenol is considered a Category 4 flammable liquid by the Occupational Safety & Health Administration (OSHA) having a flashpoint of 79°C (174.2°F). During fires, phenol may decompose into hazardous carbon monoxide and carbon dioxide.

**Skin Corrosion**- Phenol is readily absorbed through the skin leading to severe burns. Burns are often painless due to the anesthetic-like properties of the chemical. Absorption of phenol by the skin is enhanced when chloroform is also present. Skin contact results in burns, edema, blisters, visible cell necrosis and gangrene.

**Serious Eye Damage**- Irreversible damage, including whitening of the cornea and blindness, can occur from contact with the eyes.

**Target Organ Toxicity**- Upon single or repeated exposures, phenol acts as a systemic toxin leading to damage in the central nervous system, kidneys, liver, pancreas and spleen. Symptoms of exposure include headache, nausea, dizziness, difficulty swallowing, diarrhea, vomiting, shock, convulsions or death.
Safe Work Practices

- Read the **safety data sheet (SDS)** for phenol prior to use.
- Eliminate, substitute a less toxic chemical or reduce the quantity being used if possible.
- Work with phenol in a chemical fume hood.
- Wear personal protective equipment as indicated in the safety data sheet or the lab’s **workplace hazard assessment form (WHA)**.
- Avoid working alone when using phenol.
- Avoid contact with heat, flames and ignition sources. Hot liquid phenol will attack aluminum, magnesium, lead and zinc metals.
- Never heat or melt phenol in an incubator, microwave, drying oven or similar appliance. The flammable vapors created are highly toxic at just a few parts per million (ppm) and potentially explosive at concentrations of 3% to 10% in air.
- Any laboratory using phenol (or any corrosive/caustic chemical) must have an emergency eyewash station/shower accessible within 10 seconds or located within 100 feet.
- Always wash hands thoroughly after handling phenol, even if gloves are used.

Storage

- Keep in a tightly closed container.
- Keep out of direct sunlight.
- Protect from physical damage.
- Store in a cool, dry, ventilated area away from sources of heat or ignition.
- Store separately from strong oxidizing agents, strong bases, strong acids, halogens and other incompatible materials.
- Store containers on shelves below eye level.
Additional Resources

*Occupational Safety and Health Guideline for Phenol*

*Occupational Exposure to Hazardous Chemicals in Laboratories.*

*Agency for Toxic Substances and Disease Registry- Toxicological Profile for Phenol*