

Phenol

Phenol is an organic aromatic compound used in the production of phenolic resins, caprolactam and bisphenol A (e.g., intermediates in the manufacture of nylon and epoxy resins), and as a slimicide, disinfectant, and in medicinal products. In laboratories, phenol is used primarily with chloroform for DNA and RNA extractions. It 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 red upon exposure to air and light. It has a sweet, tar-like odor that is readily detected at low concentrations (0.05 ppm in air). Phenol is soluble in alcohol, glycerol, petroleum, and water. It is incompatible with various materials including, but not limited to, certain plastics, rubber, and various metals and alloys. Symptoms of exposure include cough, headache, dizziness, difficulty breathing, diarrhea, muscle weakness, nausea, vomiting, shock, coma, convulsions, or respiratory arrest.

Hazards

Acute Toxicity- Phenol is toxic 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 and Health Administration (OSHA) having a flashpoint of 79°C (174.2°F). During fires, phenol may decompose into hazardous carbon oxides.

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, and skin.

Standard Operating Procedures

- Ensure EHS training and lab-specific training have been completed.
- 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.
- Develop a standard operating procedure to communicate the hazards and safe work practices.
- Work with phenol in a chemical fume hood.
- Wear personal protective equipment indicated in the safety data sheet or the workplace hazard assessment form (WHA). Lab coats are required to minimize dermal contact.
- Avoid working alone with 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.
- Ensure an emergency eyewash and shower station is accessible within 10 seconds.
- Always wash hands thoroughly after handling phenol, even if gloves are used.
- Learn and follow emergency procedures if an accident occurs.

Storage

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

Resources

- Environmental Protection Agency Phenol
- Agency for Toxic Substances and Disease Registry- Toxicological Profile for Phenol