

## Phenol- Safe Work Practices

Phenol (a.k.a. carboic 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*

<http://www.osha.gov/SLTC/healthguidelines/phenol/recognition.html>

*Occupational Exposure to Hazardous Chemicals in Laboratories.*

[http://www.osha.gov/pls/oshaweb/owadisp.show\\_document?p\\_table=standards&p\\_id=10106](http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=standards&p_id=10106)

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

<http://www.atsdr.cdc.gov/toxprofiles/tp.asp?id=148&tid=27>