

Phenol-chloroform extractions are a commonly used technique for RNA preparation, often using the trade-name reagent TRIzol®. EH&S has developed the following chemical safety fact sheet for the some of the commonly-used hazardous materials used in phenol-chloroform extractions. Please note that there are many varieties of kits with a wide variety of reagents; this list is not all-inclusive, and may not be a direct match to any one reagent from any given kit.

1. General Guidance

- a. **DO NOT BLEACH ANY SOLUTIONS FROM RNA EXTRACTION.** Most of the chemicals used for RNA extraction will react with bleach, in some cases forming toxic gases as a result. Furthermore, the chemicals involved in the process inactivate any biological hazards, rendering the products non-biohazardous.
- b. Label all chemicals and solutions. Full chemical name and concentration is required for all hazardous materials, and is recommended where practical for nonhazardous materials to [prevent confusion](#).
- c. Unless otherwise noted, all work with the chemicals listed below should be performed in a certified *chemical fume hood*, regardless of quantity in use. Note that biosafety cabinets will NOT provide adequate respiratory protection for chemical fumes and vapors.
- d. For all the chemicals listed below, the following PPE is required when working with small quantities (e.g., pipetting): lab-appropriate street attire, fully-buttoned lab coat, safety glasses, and nitrile gloves. Any different or additional PPE required will be explicitly noted.
- e. All solutions containing any amount of the chemicals listed below must be collected as hazardous waste. Check the EH&S website for [further guidance](#).

2. [Phenol](#)

- a. Phenol, one of the two components of TRIzol®, is corrosive to the skin and eyes and is toxic by inhalation, ingestion, and dermal exposure.
- b. Contact with phenol will reduce the efficacy of nitrile gloves. Be alert for any exposure of your gloves to phenol, and if you observe an exposure, change gloves immediately, dispose of the contaminated gloves as hazardous waste, and wash your hands thoroughly with soap and water.
- c. When working with large quantities of phenol, butyl-rubber gloves should be worn instead of nitrile.

3. [Guanidinium thiocyanate](#)

- a. Guanidinium thiocyanate, one of the two components of TRIzol®, is corrosive to the skin and eyes and is toxic by inhalation, ingestion, and dermal exposure.
- b. If guanidinium thiocyanate is mixed with bleach, several toxic gases will be produced.

4. [Chloroform](#)

- a. Chloroform is carcinogenic, teratogenic, and toxic by inhalation and ingestion.
- b. Contact with chloroform will reduce the efficacy of nitrile gloves. Be alert for any exposure of your gloves to chloroform, and if you observe an exposure, change gloves immediately, dispose of the contaminated gloves as hazardous waste, and wash your hands thoroughly with soap and water.
- c. When working with large quantities of chloroform, fluorinated rubber gloves should be used instead of nitrile.

5. [Isoamyl](#), [isopropyl](#), and [ethyl](#) alcohols

- a. All three alcohols commonly used in RNA extraction are flammable. Isoamyl alcohol causes eye damage. 70% ethanol may have other hazards associated with it depending on possible additives (e.g., methanol).
  - b. All work with isoamyl alcohol should be performed in a *certified chemical fume hood*. Work with large quantities (>500 mL) of isopropyl and/or ethyl alcohols should be performed in a certified chemical fume hood. Note that biosafety cabinets will NOT provide adequate respiratory protection and may increase the risk of fire for work with flammable materials.
6. [Diethyl pyrocarbonate \(aka DEPC\)](#)
- a. DEPC is a combustible material and will react with a wide array of chemicals including strong acids, strong bases, ammonia, strong oxidizing agents, and strong reducing agents.
  - b. Avoid mixing DEPC with any chemicals not required for your procedure.
  - c. Contact with DEPC will reduce the efficacy of nitrile gloves. Be alert for any exposure of your gloves to 1-bromo-3-chloropropane, and if you observe an exposure, change gloves immediately, dispose of the contaminated gloves as hazardous waste, and wash your hands thoroughly with soap and water.
  - d. When working with large quantities of DEPC, butyl rubber gloves are recommended.
7. [1-bromo-3-chloropropane](#)
- a. While not as commonly used as the materials above, some RNA extraction procedures recommend the use of this material.
  - b. 1-bromo-3-chloropropane is toxic by inhalation and ingestion.
  - c. When working with large quantities of 1-bromo-3-chloropropane, butyl rubber gloves are recommended. Fluorinated rubber gloves are another suitable option.
  - d. Contact with 1-bromo-3-chloropropane will reduce the efficacy of nitrile gloves. Be alert for any exposure of your gloves to 1-bromo-3-chloropropane, and if you observe an exposure, change gloves immediately, dispose of the contaminated gloves as hazardous waste, and wash your hands thoroughly with soap and water.
8. [2-mercaptoethanol \(aka beta-mercaptoethanol aka BME\)](#)
- a. While not as commonly used as the materials above, some RNA extraction procedures recommend the use of this material.
  - b. 2-mercaptoethanol is flammable, corrosive to the skin and eye, a skin sensitizer (i.e., can cause allergies), and toxic by inhalation, ingestion, and particularly dermal exposure.
  - c. When working with 2-mercaptoethanol at any quantity above 1 mL, thick (0.6 mm) latex gloves or butyl rubber gloves should be worn.
  - d. Contact with 2-mercaptoethanol will reduce the efficacy of nitrile gloves. Be alert for any exposure of your gloves to 2-mercaptoethanol, and if you observe an exposure, change gloves immediately, dispose of the contaminated gloves as hazardous waste, and wash your hands thoroughly with soap and water.

If you have any questions about the safe handling and storage of these or other chemicals, please contact EH&S at (650) 723-0448 and ask to speak to a lab safety representative.