

GuideSheet Guanidinium Thiocyanate

Guanidinium thiocyanate (see Figure 1) is a powerful chaotropic agent used most commonly in the extraction of DNA and RNA. By [disrupting hydrogens bonds](#), guanidinium thiocyanate denatures the nucleases which would normally cleave DNA and RNA (see Figure 2), thus preserving the extracts of interest.

Guanidinium thiocyanate¹ also aids in removing ribosomes from RNA extracts. It finds further application as a [protein folding reagent](#), though guanidinium chloride² is more common for this application.

When used for DNA/RNA extraction, guanidinium thiocyanate is commonly used in conjunction with phenol.

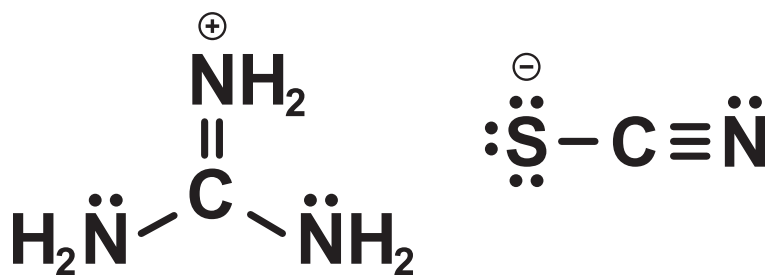


Figure 1. Chemical structure of guanidinium thiocyanate.

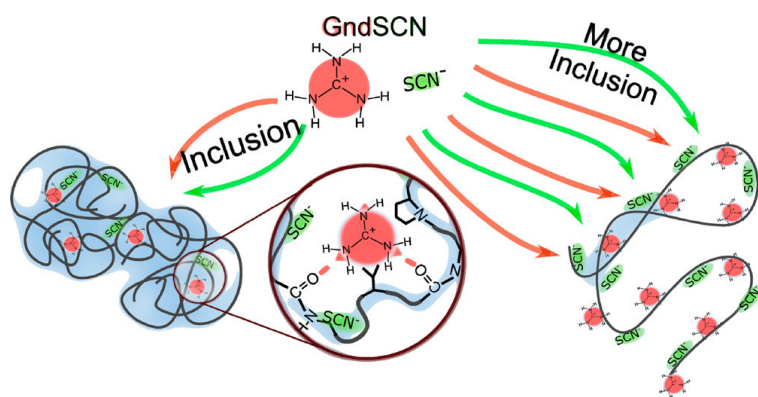


Figure 2. Diagram illustrating how guanidinium thiocyanate ions denature proteins. [Heyda, J. et al. Journal of the American Chemical Society 139, 863–870 \(2017\)](#)

WHAT I NEED TO KNOW

- Wear splash goggles when handling or working with all guanidinium thiocyanate solutions.
- All waste contaminated with guanidinium thiocyanate solutions (including proprietary mixtures such as such as TRIzol™) shall be disposed as CHEMICAL WASTE (see Figure 4).
- Separate guanidinium thiocyanate waste into its own properly labeled waste containers.
- DO NOT mix any guanidinium thiocyanate containing mixtures with bleach or with strong acids under any circumstances!

This mixture is often sold under the name TRIzol™, TRI Reagent™, QIAzol™, or as part of commercial DNA/RNA extraction kits (see Figure 3).



Figure 3: Common examples of guanidinium thiocyanate in the lab.

¹ Less correctly known as guanidine thiocyanate or guanidine isothiocyanate.

² aka guanidine hydrochloride



HAZARD DETAILS

Guanidinium thiocyanate is slightly toxic by all routes of exposure (GHS Category 4 Acute Toxicant), mildly corrosive to skin (Category 1C), but **highly corrosive to eyes** (Category 1). Therefore, appropriate eye protection (chemical splash goggles) shall always be used when handling guanidinium thiocyanate solutions.

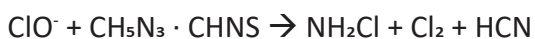
When using guanidinium thiocyanate in conjunction with phenol, follow all precautions in the [Phenol SOP](#) and [Phenol Safety Fact Sheet](#).



HAZARDOUS INCOMPATIBILITIES

A significant safety concern surrounding guanidinium thiocyanate is its ability to react with bleach.

Guanidine thiocyanate may react with bleach to release a range of very toxic gases (e.g., chloramine, chlorine, and hydrogen cyanide).



Low level exposure to these gases may result in mucous membrane irritation, dizziness, and nausea. Higher exposures may be fatal. Furthermore, DO NOT mix thiocyanate salts with strong acids as this may also release toxic gases (carbonyl sulfide, etc.).

HAZARD MITIGATION

- Ensure lab personnel using guanidinium thiocyanate-containing reagents study and understand this Guide Sheet and the Safety Data Sheet (SDS) for the reagent. Additionally, follow all precautions in the [Phenol SOP](#) and [Phenol Safety Fact Sheet](#) when using in conjunction with phenol.

- Work in a chemical fume hood when using guanidinium thiocyanate with phenol or if there is potential for creating aerosols or dust.
- Wear a lab coat, splash goggles, and gloves.
- If phenol is present, double-glove. NOTE: Refer to the *PPE: Glove Selection* section of the [Phenol SOP](#) to select phenol compatible gloves. For an overview of chemical resistant gloves, refer to the *Chemical Resistant Gloves* section of the [Chemical Hygiene Plan](#) (pg. 8.13).
- Remove contaminated gloves, lab coat, eye protection, and/or clothing immediately.** NOTE: Nitrile gloves contaminated with GT solutions containing phenol are susceptible to rapid phenol penetration and must be changed immediately.
 - Heavily contaminated PPE and clothing may need to be disposed of as hazardous waste.

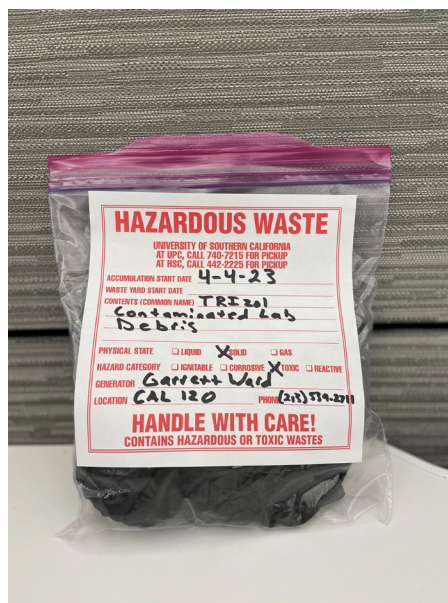


Figure 4: Example of proper waste labeling and disposal of TRIzol contaminated gloves, pipette tips, and test tubes.

