

STANDARD OPERATING PROCEDURE FOR PIRANHA SOLUTION AND NANOSTRIP



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GENERAL

Piranha solution (a concentrated mixture of hydrogen peroxide and sulfuric acid) is highly oxidizing, corrosive, and extremely dangerous. It severely outgases and is a known cause of explosive bursting of waste bottles. Due to the corrosive properties, the risk of damage or severe injury from such an incident is substantial. The extreme oxidizing properties may result in violent reaction if mixed with organics or many other substances

Adhere to the following:

Only use glass, Teflon, or stainless steel containers and tweezers to handle Piranha.

Avoid the use of Piranha solution whenever possible. Other aqueous cleaning agents include ammonium peroxydisulfate, sodium hydroxide, sodium hydroxide + bleach, or potassium permanganate soak followed by dilute oxalic acid / hydrochloric acid mixture to remove any manganese dioxide deposits.

When Piranha solution must be used, mix only the absolute minimum quantity.

Comparable to Piranha Solution, Nanostrip is a commercially stabilized mixture of sulfuric acid and hydrogen peroxide. However, Nanostrip is still very dangerous and should be handled with the same precautions as Piranha Solution.

HAZARD IDENTIFICATION

The hazard classification for Piranha solution is as follows:

- Skin corrosion/irritation (Category 1A)
- Serious eye damage/irritation (Category 1)

The hazard classification for Nanostrip is as follows:

- Oxidizing Liquids (Category 3)
- Corrosive to Metals (Category 1B)
- Skin Corrosion/Irritation (Category 1B)
- Serious eye damage/eye irritation (Category 1)

PREPARATION

- Do not handle Piranha Solution or Nanostrip while working alone in the cleanroom area.
- Remove hand and wrist jewelry. Do not wear contact lens (Contact lens are not permitted in the cleanroom).
- Identify the locations of safety equipment (Eyewash and Shower station, Hazardous Waste Container, Emergency buttons and Phones).
- Save DPS emergency line 213-740-4321 into personal phone.
- Read the Safety Guideline and Material Safety Data Sheet for specific Piranha Solution and Nanostrip

- Wear all appropriate PPE (Safety Goggles, Face Shield, Rubber Apron, two layers of latex glove, long butyl gloves over the two layers of latex gloves, a final layer of neoprene gloves over the long butyl gloves).
- Ensure a dedicated Piranha Solution waste container is accessible to dispose contaminated clean-up material.
- When working with Piranha Solution or Nanostrip, restrict access to work area with sign labelled "Warning – Corrosive".
- Piranha Solution and Nanostrip must be prepared and handled under a fume hood. Prepare only the minimal amount of solution needed and use a beaker large enough to avoid overflow when sample is added to solution.
- Fume hood sash should be as low as possible and never raised above the indicated sash limit.
- Clearly label all containers with any liquids, including containers with water. Do not seal any containers with Piranha solution or Nanostrip.
- Labels must include User Name, Group (PI) Name, Contact Email or Phone Number, Chemical Name, and Chemical Formula.
- Do not store wash bottles containing organic compounds on the same work surface as the piranha solution.

PROCEDURE FOR PIRANHA SOLUTION

- A new Piranha solution must be prepared before each use. Do not store Piranha solution.
- Pour only the necessary amount of acid into the appropriate size beaker.
- Measure 3:1 ratio of 3 parts Sulfuric Acid and 1 part Hydrogen Peroxide.
- Slowly add Hydrogen peroxide to acid. DO NOT add acid to Hydrogen peroxide. Hydrogen peroxide concentrations must be below 30%.
- The solution may also be directly applied to the material, applying the sulfuric acid first, followed by the peroxide.
- Slowly place sample into beaker to avoid thermal shock.
- Set timer for 30 minutes.
- Move sample to a new beaker filled with DI water.
- Move the new beaker with sample into the sink and rinse with DI water.

PROCEDURE FOR NANOSTRIP

- While the hotplate is off, place beaker on hotplate in fume hood.
- Pour only the necessary amount of Nanostrip into the beaker.
- Place sample in beaker.
- Turn on hotplate and heat to 60C.
- Once target temperature is reached, set timer for 30 minutes.
- After 30 minutes, turn off hotplate and allow container to cool.
- Move sample to a new beaker filled with DI water.
- Move the new beaker with sample into the sink and rinse with DI water.

WASTE DISPOSAL

- **User must wait until solution has cooled.** Once cooled, dispose Piranha solution or Nanostrip into an dedicated Glass Bottle labelled: "PIRANHA OR NANOSTRIP WASTE ONLY – HAZARDOUS CHEMICAL WASTE"

- Use a vented cap to close the Glass Bottle. If you do not have a vented cap, Contact Staff and do **NOT** fully tighten the waste bottle with a regular cap.
- Do **NOT** add any acids or bases to the Piranha Solution or Nanostrip.
- Do **NOT** dispose of Piranha or Nanostrip contaminated waste in other Hazardous Chemical Waste containers with organic compounds (e.g., acetone, methanol, isopropanol).

SKIN AND EYE EXPOSURE

- For skin exposure, immediately flush with cool water for a minimum of 15 minutes. Remove contaminated clothing and footwear while rinsing.
- For eye exposure, forcibly hold eyes open and flush for at least 15 minutes. Continue flushing area with water if pain continues.
- Do not use neutralizing chemicals, creams, abrasives, or lotions.
- Contact DPS and alert cleanroom staff.

INHALATION EXPOSURE

- Move to location with fresh air.
- Obtain medical attention immediately if symptoms develop (coughing, shortness of breath, wheezing, burning in mouth or throat, or chest pain).
- Alert cleanroom staff and call DPS for medical assistance.

INGESTION

- Alert cleanroom staff and call DPS for medical assistance.
- If possible, determine what material was ingested by victim.
- If victim begins to vomit, turn head or entire body to one side to avoid choking.
- Do not induce the victim to vomit or drink any beverage unless instructed to by qualified medical personnel.

ACCIDENTAL SPILLS

- Minor spills can be cleaned with acid neutralizing loose absorbents. Wait for neutralization to complete and spill area is cooled. Check pH with test strips and dispose contaminated solid wastes in dedicated waste container for acids and etchants.
- For major spill emergencies, contact DPS first followed by cleanroom staff.
- Evacuate personnel from spill area and use signage to deny entry.

UNATTENDED EXPERIMENTS

- Chemicals may not be left unattended for more than 15 minutes.
- For unattended experiments longer than 15 minutes, notify cleanroom staff to get permission.
- The maximum time for unattended chemicals is one hour.
- Unattended chemicals require displayed signage at fume hood.

- The sign must contain the hazards of the experiment, the experimenter's name and contact information, responsible PI's name and contact information, expected date and time of disposal.
- For more information on unattended hazardous experiments, please refer to the [Unattended Hazardous Operations Fact Sheet](#).

EMERGENCY NOTIFICATION

- Notify the Department of Public Safety (DPS) at (213) 740-4321 or (323) 442-1000. For a non-emergency, dial (213) 740-6000.
- State the nature of the emergency (e.g., injury, hazardous materials or biohazards spill, fire) and provide details.
 - a) Location of injury/incident
 - b) Name(s) of injured and name(s) of witness(es)
 - c) Contact information (your name and call-back number)
 - d) Injury/incident summary
- Notify EH&S immediately at (323) 442-2200 or injuryprevention@usc.edu to report the injury/incident.
- Notify the cleanroom staff and your supervisor.

References

- [Chemical Hygiene Plan](#)

Contributors	Revised Date
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