



## Piranha Solution

***Principal Investigator (PI) Approval is Required Prior to Performing this Procedure***

### Description

*This standard operating procedure outlines the handling and use of piranha solution. Review this document and supply the information required in order to make it specific to your laboratory. In accordance with this document, laboratories should use appropriate controls, personal protective equipment, and disposal techniques when handling piranha solution.*

**Piranha solution is highly energetic and has many potential hazards. A less hazardous solution/process should be used if possible.**

### Potential Hazards

- An explosion or sudden release can result from storing piranha in a closed container due to pressure buildup. Never store piranha for later use, especially in a closed container.
- Piranha is incompatible with organic materials (including acetone, isopropyl alcohol, nylon, etc.), acids, and bases. Piranha is a very powerful oxidizer and can cause organic materials to spontaneously ignite.
- It will react with most metals and release flammable hydrogen gas (remember it is also an oxidizer), as well as provide enough heat for ignition if not handled properly.
- When the solution is made (or comes in contact with organic materials) the reaction is exothermic. This reaction can heat to over 100°C.
- Piranha is highly corrosive and its acidic vapors cause a severe inhalation hazard which can be destructive to the mucosal membranes and result in severe burns.
- Skin or eye exposure to piranha solution can cause severe burns.
- The MIOSHA Permissible Exposure Limit (PEL) and ACGIH Threshold Limit Value (TLV) for sulfuric acid are both 1 mg/m<sup>3</sup> as an 8-hour time-weighted average.
- The MIOSHA PEL and ACGIH TLV for hydrogen peroxide are both 1 ppm as an 8-hour time-weighted average.

### Engineering Controls

- An eyewash and safety shower must be available in the immediate work area for any work with piranha.
- Always prepare and use piranha solutions inside a fume hood with the sash between you and the solution. This helps prevent inhalation hazards and provides some protection in case of an explosion.
- Label fume hoods with signage such as "Caution, Piranha Solution in Fume Hood, Highly Energetic and Corrosive".

### Work Practice Controls

- Designate areas where piranha solutions are stored or manipulated.
- Only make and use piranha in glass or Pyrex containers (the solution is incompatible with plastic).
- Only prepare enough solution for immediate use. Due to its extreme reactivity it has a relatively short usage life.

- It is recommended that you add hydrogen peroxide to sulfuric acid very slowly (adding the smaller amount to the larger amount). If the hydrogen peroxide concentration exceeds 50% an explosion could occur; adding the hydrogen peroxide to the acid avoids this situation. Mixing this solution should be done with extreme caution.
- Do not mix piranha with incompatible materials including acids, bases, and organic solvents (acetone, isopropyl alcohol, etc.). Do not store bottles/materials containing organic compounds or other incompatibles in the fume hood with piranha.

### Personal Protective Equipment (PPE)

- Wear closed-toe shoes (non-mesh upper), lab coat, safety goggles, acid apron, and chemical-resistant gloves when working with piranha.
- Sulfuric acid penetrates standard nitrile laboratory gloves in 5 minutes or less. Heavy rubber gloves are recommended when working with piranha.
- No exposed jewelry should be worn including necklaces, rings, metallic bracelets, or hair bands.
- Exposed skin should be minimized.

### Transportation and Storage

Piranha etches should not be stored. Only make enough solution for immediate use.

Never cap piranha waste unless it has cooled overnight or to room temperature (inside the fume hood). When storing spent piranha etches for waste pickup, these containers should always be placed in secondary containment that is acid resistant.

### Waste Disposal

After use, allow solution to cool in a labeled container inside a fume hood. The container will need to have a piranha waste cap which allows the solution to vent and avoid bottle pressurization.

Waste solution must be cooled overnight or to room temperature prior to waste storage/disposal. You can cap the container only after the waste solution has cooled completely.

Waste piranha etches should only be kept in glass containers having a plastic safety containment coating on the exterior surface. These containers are designed to prevent material loss in the event of cracking or breaking. These containers and venting caps are available from EHS at (313) 593-0921. When calling EHS you need to request the piranha waste bottles and piranha caps. While waiting for pickup, piranha waste must be stored in the described container.

Do not add any other materials to piranha waste. Label the waste container "For Piranha Solution Disposal ONLY – Do Not Add Other Types of Chemicals."

### Exposures/Unintended Contact



*If the employee is in need of emergency medical attention, call 911 immediately.*



- In case of *skin contact*: Flush the skin with copious amounts of water for at least 15 minutes. Seek medical attention (see below).

- In case of *eye contact*: Immediately flush eyes with copious amounts of water while holding eyelids open. Place ice packs on the eyes while in transit to medical facility (see below).
- In case of *inhalation*: Assist conscious persons to an area with fresh, uncontaminated air. Seek medical attention (see below).

\*NOTE: Symptoms may be delayed up to 24 hours.

Report all work related accidents, injuries, illnesses or exposures to WorkConnections within 24 hours by completing and submitting the [Illness and Injury Report Form](#). Follow the directions on the WorkConnections website [Forms Instructions](#) to obtain proper medical treatment and follow-up.

Complete the [EHS Laboratory Incident and Near-Miss Report](#) form.

#### **TREATMENT FACILITIES:**

##### **Midwest Medical Center -- *Campus Employees (including student employees)***

Mon-Fri 7:30 am - 4:30 pm

**9301 Middlebelt Road**

Romulus, MI 48174

Phone: 734-941-1000

After hours - go to:

##### **Midwest Medical Center**

Open 24/7

4700 Schaefer

Dearborn, MI 48126

Phone: 313-581-2600

##### **Henry Ford Medical Center-Fairlane -- *University students (non-life threatening conditions)***

19401 Hubbard Drive

**Dearborn, MI 48126**

**Phone: 313-928-8278**

Click [here](#) for more information.

#### **Spill Procedure**

- When a spill occurs, ***personal safety should always come first.***
- Alert and clear everyone in the immediate area where the spill occurred.
- Use proper personal protective equipment as indicated above.
- Collect residue, place in container and contact EHS (313) 593-0921 for proper disposal.

If less than 200 ml of spent solution (no longer evolving gases) is spilled in the fume hood, lab personnel can soak up spill with absorbent/neutralizer for acid spills. Dispose of absorbent material as solid hazardous waste. Wipe contaminated area again with soap and water solution.

If reactive solution (still evolving gases) is spilled in the fume hood, close the sash, leave the lab and call Public Safety at (313) 593-5333 or 911 from a campus phone to request assistance from EHS. Do not take any action to cover the spill.

Post a warning on the lab and do not allow others to enter. Have a person available that has knowledge of the incident and laboratory to assist emergency personnel.

If any piranha solution is spilled OUTSIDE of the fume hood, open the hood sash fully, leave the lab and call Public Safety at 911 to request assistance from EHS. Do not take any action to cover the spill. Post a warning on the lab and do not allow others to enter. Have a person available that has knowledge of the incident and laboratory to assist emergency personnel.

#### **MAJOR CHEMICAL SPILL**

- Attend to injured or contaminated persons and remove them from exposure.
- Alert people in the laboratory to evacuate.
- **Call Public Safety at (313) 593-5333 or 911 from a campus phone immediately for assistance.**
- Close doors to affected area.
- Post warnings to keep people from entering the area.
- Have person available that has knowledge of incident and laboratory to assist emergency personnel.

#### **Additional Spill Links:**

- [Chemical Spill Control Information](#)

Report all emergencies, suspicious activity, injuries, spills, and fires to Public Safety by calling at (313) 593-5333 or 911 from a campus phone. Register with the University of Michigan-Dearborn [Emergency Alert System](#).

#### **Training of personnel**

All personnel are required to complete the ***Comprehensive Laboratory Safety*** session (BLS009 or equivalent) via [MyLINC](#). Furthermore, all personnel shall read and fully adhere to this SOP when handling piranha solution.

#### **Certification**

I have read and understand the above SOP. I agree to contact my Supervisor or Lab manager if I plan to modify this procedure.

Name	Signature	UM ID #	Date

Principal Investigator \_\_\_\_\_

Revision Date \_\_\_\_\_