## Standard Operating Procedure

# **Piranha Solution[[1]](#footnote-1)**

**(Piranha Etch)**

## Overview

Piranha solution, also known as piranha etch, is a mixture of sulfuric acid (H2SO4) and hydrogen peroxide (H2O2).As such, it is both a strong corrosive and a strong oxidizer. It has the following hazards:

* **Fire Hazard**
* **Explosion hazard**
* **Intense Heat Generation**
* **Splash hazard**
* **Container rupture/failure hazard (due to pressure build-up)**
* **Strongly Corrosive liquid and vapor (skin burn, mucous membrane irritation)**

***Piranha solutions are extremely energetic and may result in explosion or skin burns if not handled with extreme caution.***

## Special Handling and Storage Concerns

**Personal Protective Equipment**

*Complete protection of the eyes and skin is essential.*

* Flame resistant lab coat.
* Neoprene or Nitrile exams gloves worn under non-disposable Neoprene or Nitrile gloves (double glove) is recommended.
* ANSI Z87.1-compliant safety goggles. Safety goggles *and* a face shield is recommended.

**Special Storage Requirements**

Prepare Piranha solution immediately prior to using. Never store solution for long periods. Piranha solution stored in a closed container will likely explode.

Prepare no more volume of solution than can be safely neutralized by researchers if spilled (< 1 L).

Always use glass (preferably Pyrex) containers. Plastics will react with the solution.

Dispose of used piranha promptly as hazardous waste.

**NOTE:**  Vented caps, such as those provided by EH&S, will not vent quickly enough to avoid an explosion when dealing with fresh piranha solution, or piranha solution that is currently reacting with organic residue. **Containers with vented caps should be considered closed containers and therefore avoided as noted above. Only cap piranha waste containers with these vented caps, and then only immediately before waste pickup. Waste pickup should be requested only after the piranha solution has cooled and decomposition has stopped.**

**Engineering Controls**

*Fume Hood:* Use only in a fume hood with the sash between you and the solution

*Secondary Containers:*  Use secondary containment at all times.

**Special Handling Considerations**

*Danger signs during Piranha use:*

* *Solution foaming or smoking: can indicate presence of destabilizing contaminants. Suspend work until solution has stabilized.*
* *Formation of an organic phase/layer).* ***Can indicate the formation of the very explosive triacetone triperoxide (TATP) from contamination with acetone****. Evacuate the laboratory and contact emergency responders.*

Clear workspace of all organic solvents, including squirt bottles.

Use a Pyrex vessel/container.

Generally, one always adds acid to water**.** Piranha is the exception. Add H2O2 to the acid to reduce risk of splattering.

Addition of anything to the solution should be done with great care, as exothermic reaction and gas generation can cause extreme heat and bubbling/splattering.

When the operation is complete, do not leave the Piranha solution unattended until it has cooled to room temperature.

**Decontamination**

Use soap and water. Do not use organic solvents to clean area.

## Waste Management

DO not mix with other hazardous waste streams. Schedule waste pickup immediately after completion of the operation, and after the solution has cooled and decomposition has stopped. Seal container with vented cap only immediately before waste pickup.

## First Aid and Emergencies

**Spill**

Allow spilled solution to cool and for decomposition to stop. Use water to dilute, then neutralize with sodium carbonate or bicarbonate, lime, or other acid spill neutralize. Do not use organic solvents to clean area.

**Fire**

Standard firefighting measures apply. Do not use water.

**Personnel Exposure**

Make absolutely sure that you know the location of the safety shower/eyewash unit!

*Skin or eye contact:* Remove contaminated attire. Wash skin with soap and water. Flush area with water for 15 minutes. Get medical attention immediately.

*Inhalation:* Move person to fresh air. Get medical attention if symptoms persist.

*Ingestion:* Rinse mouth with water. Get medical attention immediately.

## Laboratory Specific Information

**Prior Approval Required**

[ ]  **NO**

[ ]  **YES (describe):**

**Designated Area**

[ ]  **Entire Laboratory Area**

[ ]  **Other (describe):**

**Experimental Conditions of Use**

**Temperature Range:**

**Pressure Range:**

**Scale Range:**

**Other Relevant Details:**

1. Schmidt, H. G. *ACS Chem Health Saf*. **2022**, *29*(1), 54-61. [↑](#footnote-ref-1)