

# PIRANHA SOLUTION

## Hazard Description

Piranha solution (also known as Piranha Etch) can be made in acidic or basic forms. The acidic form consists of sulphuric acid mixed with hydrogen peroxide in a 3:1 ratio. The basic form consists of sulphuric acid mixed with ammonium hydroxide in a 3:1 ratio. Mixing/creating the acidic version of piranha generates significant amounts of heat, which does not happen when creating the basic form. Other hazards include:

- 1.) Corrosion risk – piranha solution is extremely corrosive to metals, skin, and mucous membranes. Inhaled vapours will irritate the respiratory tract.
- 2.) Fire/explosion risk – piranha solution reacts violently with organic and combustible items.

Signs of danger include:

- 1.) Foaming or smoking during mixing or afterwards may indicate contamination with an organic or other source of instability.
- 2.) Formation of an organic phase in at any stage of use. This is very dangerous, and the solution should be left alone and not moved.

## Prior to Working with Piranha Solution

- Complete a research-specific laboratory risk assessment.
- Ensure that a standard operating procedure (SOP) is created, posted, trained, and approved by the supervisor on the process.
- Ensure that all required materials are available in case of a spill or emergency, and for waste collection.
- **Note that working alone is prohibited when working with Piranha solution.**

## Preparation

- Clean out the fume hood. Ensure there is no hazardous waste or organic wash bottles left in the fume hood that could lead to a reaction.
- Never work alone. Ensure that someone else will be present when using the Piranha solution.
- Leave the hot Aqua Regia solution in an open container until cool.
- Ensure that all necessary PPE is present including splash goggles, a face shield, a lab coat, a neoprene apron, and appropriate gloves (e.g., Rubber, Butyl, Neoprene or Viton). Gloves should be free of potential contamination. Use new gloves, or gloves dedicated for work with Piranha.
- For small spills, follow regular spill procedures.

## Handling

- Always use an open glass container that is prelabelled that it contains Piranha solution. Piranha solution will melt plastic containers.
- Mix the solution in a hood with the sash between you and the solution. Wear chemical splash goggles, a face shield, a lab coat, a neoprene apron, and appropriate gloves.
- Complete all the work within the fume hood. Never transport Piranha solutions between rooms.
- Very slowly add the hydrogen peroxide to the acid (not the acid to the hydrogen peroxide and not quickly). Mixing in an ice bath is recommended.
- Never store Piranha solutions. Mix up only what you need, then destroy it after each use. The hydrogen peroxide will self-decompose which leads to an ineffective, but dangerous solution.
- Piranha solution can become very energetic and potentially explode. It will likely get very hot (greater than 100°C). Never pick up the glass container with your gloves, it can burn your hand and leave you likely to spill.
- For small spills, [regular spill techniques](#) can be used.
- For large spills, evacuate the area and call the Special Constables Service for support from the Spills Team.

## After Work

- Leave the piranha solution (in the prelabelled open-face glass container) to cool for 12 hours before disposal. Place a sign on the fume hood to ensure that no one else uses the fume hood until the solution is disposed of.

## Emergency Procedures

Always review the SDS of the purchased product for manufacturer-specific recommendations. Look at SDS for other modes of exposure.

<b>Contacts</b>	
<b>Emergency: 911</b>	
UW Special Constables: 519-888-4911 or ext. 22222 Poison Control: 1-800-268-9017	
Whenever 911 is called, if possible, UW Special Constables should also be informed to make them aware of the emergency on campus and allow them to support as needed. Ask them to meet the paramedics and direct them to the incident location.	
Inhalation	<ul style="list-style-type: none"><li>▪ Remove the individual from the contaminated area</li><li>▪ Call 911 for transport to the hospital</li><li>▪ Corrosive substances may cause severe lung damage if inhaled</li><li>▪ Perform CPR and artificial respiration if necessary</li></ul>
Skin Contact	<ul style="list-style-type: none"><li>▪ Call 911 for transport to the hospital</li><li>▪ Remove contaminated clothing and quickly but gently wipe material off skin</li><li>▪ Flush with water</li></ul>
Eye Contact	<ul style="list-style-type: none"><li>▪ Call 911 for transport to the hospital</li><li>▪ Flush eyes using an eyewash station for a minimum of 15 minutes</li></ul>

## Storage

Storage of Piranha Solution is prohibited. Mix a fresh solution for each use. Excess solutions should be neutralized. Neutralization of Piranha is exothermic and an ice bath should be used to control the temperature. It should only be performed in a fume hood wearing the PPE described above.

- 1.) Dilute Piranha solution to a concentration of less than 10% by adding the solution slowly to water.
- 2.) Add a concentrated solution of sodium hydroxide or sodium carbonate a few millilitres at a time while vigorously stirring until the pH reaches between 4 and 10. Note - if using carbonates as a neutralizing agent, be aware that bubbling and foaming may occur, leading to additional splash and spill hazards.
- 3.) Once at a pH of 4-10, the solution can be disposed of via a drain that leads to the sanitary sewer system with copious amounts of water.

## Hazardous Waste

- Piranha solution must be neutralized by the lab and disposed of down the drain with copious amounts of water. If other materials are present in the waste (such as heavy metals), then the solution should be neutralized and then brought down to the waste facility for disposal.

## References

- 1.) <https://ehs.princeton.edu/book/export/html/513>
- 2.) [https://www.concordia.ca/content/dam/concordia/services/safety/docs/EHS-DOC-019\\_PiranhaSolutionGuidelines.pdf](https://www.concordia.ca/content/dam/concordia/services/safety/docs/EHS-DOC-019_PiranhaSolutionGuidelines.pdf)
- 3.) <https://pubs.acs.org/doi/epdf/10.1021/acs.chas.1c00094>