ASRC Standard Operating Procedure:

Piranha Clean

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Principle of Operation

To clean organic residues off substrates.

<u>Danger:</u> Piranha waste involves oxygen gas which can pressurize and break sealed containers. Do not store mixed Piranha in a sealed container. It is very important that you reset and start the Piranha waste timer on the fume hood whenever you dump Piranha waste in the acid carboy so the cleanroom staff can determine whether or not the Piranha waste is safe for disposal.

Material Requirements

<u>Equipment</u>:

substrate, two glass beakers, graduated cylinder, and stainless steel tweezers

- *<u>Warning</u>: Pirahna attacks organics, including most plastics. It will react violently with polyethylene and polypropylene tweezers and containers. It will also react violently with organic solvents such as acetone and isopropanol.*

<u>Chemicals</u>:

Sulfuric Acid (H_2SO_4 96%) and Hydrogen Peroxide (H_2O_2 30%)

<u>Personal Protective Equipment</u>:

Trionic gloves on top of nitrile gloves, vinyl apron with sleeves, safety glasses and face-shield

Procedure

Piranha Clean

1. Get two glass beakers that will fit your samples for processing from the "Piranha Supplies" drawer in the glassware rack along the wall to the right of the hood – one should be labeled "Water Only" and the other should be labeled "Piranha Only".
2. Get a glass graduated cylinder from the "Piranha Supplies" drawer in the glassware rack.
3. Rinse both beakers and the graduated cylinder with DI water prior to beginning the process.
4. Fill the "Piranha Only" labeled beaker with DI water so that the water level will submerge the entire substrate, and then pour the DI water from the "Piranha Only" container into the graduated cylinder to measure the amount of solution you'll need to submerge your sample. Note that you should only use as much piranha solution as you need to clean your sample. Piranha produces oxygen gas as it reacts, so using excessive amounts of piranha can create an explosion hazard.
5. Stand the beaker labeled "Water Only" to be used for rinsing the sample on a cleanroom wipe in the hood and fill it with DI water so that the water level will cover the entire substrate.
6. Blow the beaker labeled "Piranha Only" semi-dry with the N_2 gun and place it on a cleanroom wipe in the hood.
7. Pour the DI water from the graduated cylinder into the sink, then blow it semi-dry with the N_2 gun and place it on a cleanroom wipe in the hood.
8. Carefully pour sulfuric acid into the graduated cylinder to measure out the amount you need and then pour the sulfuric acid into the beaker labeled "Piranha Only".
9. Rinse out the graduated cylinder with DI water in the sink, then blow it semi-dry with the N_2 gun and place it on a cleanroom wipe in the hood.
10. If you plan to heat the piranha solution for the duration of the clean, place the beaker of sulfuric acid on the hotplate and set it to 80°C. **Never set the hotplate higher than 100°C.** The reaction of sulfuric acid with hydrogen peroxide is exothermic, generating

heat exceeding 100°C. The only reason to heat the solution is to maintain a temperature of 80°C, which is optimal for cleaning applications.

11. Carefully pour hydrogen peroxide into the graduated cylinder to measure out the amount that is 1/3 of the amount of sulfuric acid you measured out if you are doing a 3:1 mixture.
12. Slowly pour the hydrogen peroxide into the sulfuric acid. The solution will immediately begin to bubble and generate heat as it reacts.
13. Place your sample into the piranha using tweezers and agitate the solution slightly in order to ensure that it has mixed thoroughly.
14. Allow your samples to sit in the Piranha clean for 10-20 minutes to remove all organics. Make sure there is a label with your name, the date and chemical contents next to it, and leave the Badger slot for the hood enabled while your chemicals remain in the hood.
15. Rinse out the graduated cylinder with DI water in the sink, then blow it semi-dry the N_2 gun and place it on a cleanroom wipe in the hood.

DI Water Rinse

1. When the clean is complete, remove your sample from the piranha solution with tweezers. *It is often best to use a small trickle of DI water from one of the DI water guns to break the surface tension of the piranha solution as you remove your sample so don't recoat your sample with contaminants as you take it out. Only use a small trickle as you do not want to add too much water (sulfuric acid reacts with water) and you don't want to splash piranha outside of the beaker.*
2. Transfer the sample carefully to the DI water rinse beaker. Make sure to leave the tweezers in the rinse beaker as well.
3. Let the sample and tools soak in DI water for 1 minute.
4. Turn off the hotplate heating the piranha solution so that it can begin to cool down.
5. Remove the sample from the rinse beaker with the tweezers.
6. Rinse the sample with DI water in the hood sink, holding it in the water stream for approximately 10 seconds or more.

Sample Dry

1. After the water rinse is finished, blow the sample dry with the N_2 gun.

Cleanup

1. Allow the hot piranha to cool to close to room temperature before disposing of the solution. If you are going to leave the mixture unattended, make sure it remains properly labeled and the Badger slot is still enabled.
2. Carefully pour the piranha solution into the waste container designated for piranha waste in the back of the hood.
3. Rinse the beaker with DI water multiple times (typically 3 times or more) in the sink and then blow it as dry as possible with the N_2 gun. **DO NOT pour rinse water in the waste containers.**

4. Dump the DI rinse beakers into the sink in the hood. **DO NOT pour rinse water in the waste containers.**
5. Rinse the beaker with DI water multiple times (typically 3 times or more) in the sink and then blow it as dry as possible with the N_2 gun.
6. Return all glassware to its proper storage location.

Accident Procedure

Contact

- Skin: Remove contaminated clothing, wash skin with soap and water. **If there is any irritation, get immediate medical attention.**
- Eye: Immediately flush with water for at least 15 minutes while lifting upper and lower eyelids occasionally. **Get immediate medical attention.**
- Ingestion: Do not induce vomiting. **Get immediate medical attention.**
- Inhalation: Remove to fresh air. Resuscitate if necessary. Take care not to inhale any fumes released from the victim's lungs. **Get immediate medical attention.**

Spills

Small Spill Within the Hood

If a small spill occurs and is fully contained within the hood:

- Wipe up the spill using appropriate wipes and dispose of them in the designated waste container.
- If wipes are insufficient, use the absorbent pads stored in the bottom right corner of the hood.
- If you are unsure how to clean up the material or feel uncomfortable doing so, **notify staff immediately**.

Medium or Large Spill Within the Hood - Always staff

If the spill requires neutralization or use of an absorbent pillow from the spill kit:

- **Notify staff immediately.**
- If the spill occurs **after hours**, contact cleanroom staff and post a message on Slack to alert other users **not to use the hood** until it has been properly cleaned and cleared by staff.

Any Spill Outside the Hood

If a spill occurs outside the hood:

1. **Notify cleanroom staff immediately.**
2. **Evacuate the immediate area** (typically the entire bay containing the hood).
3. If the spill occurs **after hours**, contact cleanroom staff and post a message on Slack to alert others. The cleanroom will remain closed until staff can safely manage the spill.

Revision History:

- Version 0.0 – Created September 8th, 2017
- Version 1.0 – Revised May 22, 2025
- Version 1.1 - Revised June 27, 2025