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| **Lab-Specific Standard Operating Procedure (LSOP)- Piranha Solution** | | | | | | | | | |
| Principal Investigator(PI)/Lab Manager: | | | | | | | | | |
| Building: | | | | | | Lab(s) Covered by LSOP: | | | |
| Department: | | | | | | Lab Phone Number(s): | | | |
| **Chemical** | | | **GHS Pictograms** | | **Definitions** | | | | |
| **Piranha Solution** | | | A picture containing text, sign, clipart  Description automatically generated  *A picture containing text, clipart, sign  Description automatically generated* | | **Oxidizing liquid** means a liquid which, while in itself not necessarily combustible, may, generally by yielding oxygen, cause, or contribute to, the combustion of other material.  **Serious eye damage** is the production of tissue damage in the eye, or serious physical decay of vision, following application of a test substance to the anterior surface of the eye, which is not fully reversible within 21 days of application.  **Skin corrosion** is the production of irreversible damage to the skin; namely, visible necrosis through the epidermis and into the dermis, following the application of a test substance for up to 4 hours. | | | | |
| **Hazard Awareness** | | | | | | | | | |
| Piranha solutions are typically used to remove organic residues from substrates. They may be acidic or basic. The traditional piranha solution is a 3:1 mixture of sulfuric acid and 30% hydrogen peroxide. Base piranha solutions are usually a 3:1 mixture of ammonium hydroxide with 30% hydrogen peroxide.  Piranha solutions are corrosive, strong oxidizers, extremely energetic, and potentially explosive. Direct contact with the eyes or skin may produce severe burns. Inhalation of vapors may produce tissue destruction of the mucous membranes, upper respiratory tract, and lungs. Piranha solutions **must never be stored in sealed containers** as the pressure build-up could lead to explosions. Explosions may also occur if greater than 50% hydrogen peroxide solutions are used or a large amount of organic material is dissolved in the solution. | | | | | | | | | |
| **SECTION 1. ADMINISTRATIVE CONTROLS** | | | | | | | | | |
| 1.1 | Lab-specific safety training must be provided by the principal investigator (PI) or other qualified personnel to all researchers working with piranha solution. Documentation of training is required. | | | | | | | | |
| 1.2 | Read the **safety data sheet (SDS)** for each component of piranha solution prior to use. | | | | | | | | |
| 1.3 | Whenever possible, find safer substitutes or reduce the quantity of piranha solution being used. | | | | | | | | |
| 1.4 | Researchers must not work alone with piranha solution. | | | | | | | | |
| 1.5 | Lab personnel must not leave piranha solution unattended when hot. | | | | | | | | |
| 1.6 | Experiments should be performed during normal business hours (i.e., 8:00 am-5:00 pm Mon-Fri) if possible. | | | | | | | | |
| 1.7 | An eyewash and safety shower must be in the immediate work area where piranha solution is used. | | | | | | | | |
| 1.8 | **Add additional administrative controls specific to the laboratory.** | | | | | | | | |
| **SECTION 2. ENGINEERING CONTROLS** | | | | | | | | | |
| 2.1 | Perform all operations with piranha solution in a properly functioning chemical fume hood. | | | | | | | | |
| 2.2 | Chemical fume hoods must be running between 80-120 linear feet/minute and tested by EHS within the last year. If the hood is not working properly, contact Facilities (486-3113) to repair the hood or EHS to retest (486-3613). | | | | | | | | |
| 2.3 | **Add additional engineering controls specific to the laboratory.** | | | | | | | | |
| **SECTION 3. WORK PRACTICES** | | | | | | | | | |
| 3.1 | ALWAYS add the hydrogen peroxide very slowly to the acid, never vice versa. Hydrogen peroxide concentrations must be kept below 30% and must never exceed 50%. | | | | | | | | |
| 3.2 | Always use glass containers. Piranha solutions can melt plastic and corrode metal. | | | | | | | | |
| 3.3 | Label glass containers with the words “Piranha Solution,” the full chemical names, and the appropriate hazard classes. | | | | | | | | |
| 3.4 | Prepare small amounts to be used for each application. Do not maintain a stock supply, due to the self-decomposition of hydrogen peroxide. | | | | | | | | |
| 3.5 | Never seal containers of piranha solutions. Use a vented cap. Airtight containers can build-up pressure from the self-decomposition of hydrogen peroxide and oxidation products of organic compounds, leading to container ruptures or explosions. | | | | | | | | |
| 3.6 | Never use piranha solution for routine cleaning. | | | | | | | | |
| 3.7 | Post a warning sign on or near the fume hood that states “Piranha Solution- Corrosive, Oxidizer”” to communicate the hazards to others working in the lab. The sign must also indicate the contact information of the person responsible for the piranha solution. | | | | | | | | |
| 3.8 | Do not store wash bottles containing organic compounds on the same work surface as the piranha solution. | | | | | | | | |
| 3.9 | Work with the fume hood sash lowered as much as possible. | | | | | | | | |
| 3.10 | Never remove hot piranha solution from the fume hood. | | | | | | | | |
| 3.11 | Do not add acids, bases, organic chemicals (e.g., acetone, methanol, isopropanol), or other incompatible substances to piranha solutions. Do not spray piranha solutions with water. | | | | | | | | |
| 3.12 | Never transport piranha solutions in beakers. | | | | | | | | |
| 3.13 | **Add additional work practices specific to the laboratory.** | | | | | | | | |
| **SECTION 4. PERSONAL PROTECTIVE EQUIPMENT** | | | | | | | | | |
| 4.1 | At a minimum, *American National Standards Institute* (ANSI) standard Z87.1- certified chemical splash goggles must be worn when working with piranha solution. | | | | | | | | |
| 4.2 | Gloves indicated in the safety data sheets (SDSs) for the specific concentrations of sulfuric acid (or ammonium hydroxide) and hydrogen peroxide must be worn while handling piranha solution. | | | | | | | | |
| 4.3 | A lab coat must be worn while working with piranha solution. Lab coats must be buttoned and fit properly to cover as much skin as possible. | | | | | | | | |
| 4.4 | Long pants or attire that cover the entire leg and closed-toed footwear that covers the entire foot must be worn when working with piranha solution. | | | | | | | | |
| 4.5 | Closed-toed footwear, which covers the entire foot, must be worn when working with piranha solution. | | | | | | | | |
| 4.6 | An acid-resistant apron, gloves with extended cuffs, and/or face shields are required when splashing is more likely or when required by the PI/Lab Manager. | | | | | | | | |
| 4.7 | **Add additional personal protective equipment requirements specific to the laboratory.** | | | | | | | | |
| **SECTION 5. STORAGE** | | | | | | | | | |
| 5.1 | **DO NOT STORE PIRANHA SOLUTIONS IN CLOSED CONTAINERS!** Oxygen released from self-decomposition of hydrogen peroxide and oxidation byproducts of organic compounds can cause the container to over-pressurize and explode. | | | | | | | | |
| 5.2 | Once cooled, store piranha solution in a one-liter glass container with a vented cap provided by EHS in a chemical fume hood. | | | | | | | | |
| 5.3 | **Add additional lines for storage requirements specific to the laboratory.** | | | | | | | | |
| **SECTION 6. SPILLS AND ACCIDENTS PROCEDURES** | | | | | | | | | |
| 6.1 | Evacuate the laboratory. | | | | | | | | |
| 6.2 | Close door(s) to lab and post a “**NO ENTRY**” sign(s) or other warning information on the door. | | | | | | | | |
| 6.3 | Call **911**. | | | | | | | | |
| 6.4 | Do not re-enter area until instructed to do so by UCFD or other emergency personnel. | | | | | | | | |
| 6.5 | Report accident to PI/Supervisor and EHS. | | | | | | | | |
| **SECTION 7. FIRST AID PROCEDURES** | | | | | | | | | |
| First Aid- Eyes | | | 1. Immediately move to the eyewash station, hold eyelids open and flush with water. Remove contact lenses while flushing (if applicable). 2. Have another person from the lab dial **911**. 3. Continue flushing the eyes until emergency personnel arrives. 4. Report incident to PI/Supervisor and EHS. | | | | | | |
| First Aid- Skin | | | 1. Immediately move to safety shower or other water source and begin rinsing affected area(s). 2. Remove contaminated clothing (if applicable) while flushing. Do not pull contaminated clothing over the head. 3. Have another person from the lab dial **911**. 4. Keep rinsing the affected area until emergency personnel arrive. 5. Report incident to PI/Supervisor and EHS. | | | | | | |
| First Aid- Inhalation | | | 1. Move to fresh air. 2. Dial **911.** 3. Report incident to PI/Supervisor and EHS. | | | | | | |
| First Aid- Other | | | **Describe additional first aid procedures based on hazards.** | | | | | | |
| **SECTION 8. PIRANHA SOLUTION WASTE MANAGEMENT** | | | | | | | | | |
| 8.1 | Prior to placing piranha solution in a waste container, allow the solution to completely react and cool down in a labeled, open-top glass container inside a fume hood for at least 24 hours. | | | | | | | | |
| 8.2 | Once cooled, Piranha solution wastes must be diluted and stored alone in a one-liter container with a vented cap provided by [**EHS**](mailto:ehs@uconn.edu). **NO OTHER CHEMICALS OR WASTES MAY BE ADDED TO PIRANHA SOLUTION WASTE.** | | | | | | | | |
| 8.3 | Piranha waste containers must be labeled with a hazardous waste label, full chemical names (**include any metals on the label if applicable**), estimated percentages of each chemical constituent, the applicable hazard classes, and the contact and building information. | | | | | | | | |
| 8.4 | Piranha solution wastes must be at least 50% water by volume and never exceed one liter. Wear the personal protective equipment indicated in the safety data sheets (e.g., splash goggles, chemical resistant gloves, etc.), work in a fume hood, and slowly add piranha solution to water. **NEVER ADD WATER TO PIRANHA SOLUTION**. | | | | | | | | |
| 8.5 | Piranha solution waste must be stored alone in a chemical fume hood at or near a green “Satellite Accumulation Area” sign. Secondary containment is recommended during storage. | | | | | | | | |
| 8.6 | Lab personnel must submit a [**chemical waste pickup request**](https://ehs.uconn.edu/regulated-waste-management/) through the EHS website to have the waste removed. | | | | | | | | |
| 8.7 | **Describe additional waste management procedures for piranha solution specific to the laboratory.** | | | | | | | | |
| **SECTION 9. DECONTAMINATION PROCEDURES (*Attach or insert steps. Add more lines as necessary).*** | | | | | | | | | |
| Equipment | | **Describe how equipment will be decontaminated after use (e.g., use manufacturer instructions, specifications, etc.).** | | | | | | | |
| Glassware | | **Describe how glassware contaminated with piranha solution will be decontaminated after use.** | | | | | | | |
| Work Area | | **Describe how the work area (e.g., fume hoods, trays, etc.) will be decontaminated after use.** | | | | | | | |
| Personal Hygiene | | **Describe how the researchers will decontaminate after procedure.** | | | | | | | |
| **SECTION 10. SPECIFIC PROCEDURE** | | | | | | | | | |
| **List or attach a copy of the steps and appropriate safety controls for procedures using piranha solution.** | | | | | | | | | |
| **SECTION 11A. LAB PERSONNEL APPROVAL** | | | | | | | | | |
| I have reviewed, understand and agree to follow this lab-specific standard operating procedure (LSOP) regarding piranha solution. Failure to follow the LSOP and lab-specific training guidelines for research with piranha solution is a violation of the [**University Health and Safety Policy**](http://policy.uconn.edu/2011/05/19/health-and-safety-policy/) and [**University Code of Conduct**](http://policy.uconn.edu/2011/05/17/employee-code-of-conduct/). Further approval from the PI is required if any of the following events occur:   * A change in amount (**Add volume**) or substitution of the chemicals in the procedure is planned * A change in the agreed-upon experimental set-up is planned * Signs of a failure in safety design or equipment are observed * Signs or symptoms of a chemical exposure to any personnel are observed * Unexpected and/or potentially dangerous experimental results occur (e.g., fire, uncontrolled buildup of heat and/or pressure, etc.) | | | | | | | | | |
| **Lab Personnel Name** | | | | **Lab Personnel Signature** | | | **Trainer Signature** | | **Training Date** |
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| **SECTION 11B. PRINCIPAL INVESTIGATOR/LAB MANAGER APPROVAL** | | | | | | | | | |
| *I approve the contents of the lab-specific standard operating procedure listed above regarding the use of piranha solutions.* | | | | | | | | | |
| **Principal Investigator/Lab Manager Signature:** | | | | | | | | **Date:** | |
| **A HARD OR ELECTRONIC COPY OF THE LSOP MUST BE READILY AVAILBALE IN THE LAB.** | | | | | | | | | |