Sulfuric Acid

Standard Operating Procedure

Revision Date: 10/11/23

Laboratory Director (LD) Approval is Required Prior to Performing this Procedure

This standard operating procedure (SOP) outlines the handling and use of sulfuric acid. 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 sulfuric acid. *All laboratory workers must read and understand the*[*Laboratory Emergencies SOP*](https://ehs.umich.edu/wp-content/uploads/2022/05/LaboratoryEmergencyProceduresSOP.docx)*prior to commencing any work in a laboratory.*

# Description [Provide additional information as it pertains to your research protocol]

Sulfuric acid (CAS # 7664-93-9) is a mineral acid composed of the elements sulfur, oxygen, and hydrogen. It is an oily, colorless, and odorless viscous liquid. Sulfuric acid is used in the manufacturing of fertilizers and other chemicals, petroleum refining, and automobile batteries.

Synonyms include: Hydrogen sulfide, oil of vitriol

## Process [Write the steps for using the chemical in your research protocol]

# Potential Hazards [Provide additional information as it pertains to your research protocol]

* Ignition or explosions may occur if sulfuric acid comes in contact with many metals, carbides, chlorates, perchlorates, permanganates, bases, and reducing agents.
* Concentrated sulfuric acid is stable, but may violently react with water, inorganic substances, and many organic compounds due to its powerful dehydrating, oxidizing (when in the concentrated form), and sulfonating properties.
* Sulfuric acid is noncombustible, but can cause finely divided combustible substances to ignite.
* Sulfuric acid (especially dilute) reacts with most metals to produce hydrogen gas which is flammable and potentially explosive.
* Concentrated sulfuric acid is highly corrosive and can cause severe burns upon skin contact or permanent loss of vision upon eye contact. Dilute sulfuric acid is still a skin and eye irritant, but health effects are usually not as severe.
* Sulfuric acid mist severely irritates the eyes, skin, and respiratory tract. Higher inhalation exposures may lead to temporary lung irritation with breathing difficulty.
* Sulfuric acid reacts with many substances to generate highly toxic products, so be aware of any toxic products produced by your reaction. Examples include carbon monoxide formation from reaction with formic or oxalic acid, HCN formation with cyanide salts, and SO2 and Br2 formation with sodium bromide.
* Chronic exposure to sulfuric acid mist may lead to bronchitis, skin lesions, conjunctivitis, and erosion of teeth.
* The MIOSHA Permissible Exposure Limit (PEL) is 1.0 mg/m3 as an 8-hour time-weighted average (TWA).

Contact EHS for assistance in performing an exposure assessment.

# Engineering Controls [Provide additional information as it pertains to your research protocol]

An eyewash and safety shower must be available in the immediate work area for any work with corrosive materials.

Sulfuric acid must be handled in a chemical fume hood if there is any potential for inhalation exposure (including any mists generated either mechanically or from vapor).

# Work Practice Controls [Provide additional information as it pertains to your research protocol]

* When diluting, the acid should always be added to water slowly, in small amounts.
* Purchase sulfuric acid in the smallest containers that are practical for lab use.
* Purchase in shatter-resistant containers if available (such as PVC-coated glass).
* Work with the smallest practicable amount and lowest practicable concentration.
* Once work with sulfuric acid is complete, decontaminate the area by wiping it down with a soap and water solution.

# Personal Protective Equipment [Provide additional information as it pertains to your research protocol]

* Goggles, lab coat, chemical-resistant gloves, long pants (or other clothing covering the entire leg) and closed toe shoes.
* Sulfuric acid will readily penetrate standard nitrile laboratory gloves. Gloves suitable for handling sulfuric acid 30-70% include:  butyl rubber, natural rubber, neoprene rubber, polyvinyl chloride (PVC), Viton®, Viton®/butyl rubber ([understanding glove selection](https://www.ccohs.ca/oshanswers/prevention/ppe/gloves.html)). If handling larger quantities of sulfuric acid, wear elbow length PVC gloves over a pair of nitrile gloves.
* Face shield and acid-resistant apron are recommended if working with a larger volume (>200ml) or potential for splash exists.

# Transportation and Storage [Provide additional information as it pertains to your research protocol]

* Transport corrosives in secondary containment, preferably a polyethylene or other non-reactive acid/solvent bottle carrier.
* Store away from incompatibles, including organic materials, reducing agents, combustibles, metals, acids, carbides, chlorates, perchlorates, permanganates, bases, and moisture.
* Store in well-ventilated areas with secondary containment, such as a non-reactive plastic bin.
* Store below eye level.
* Store away from metal (unless the metal has a corrosion-proof coating), and do not store under the sink.
* Avoid storing on the floor. If storing on the floor is necessary, use secondary containment.

# Waste Disposal [Provide additional information as it pertains to your research protocol]

Because most spent, unused, and expired chemicals/materials are considered hazardous wastes, they must be properly disposed of. **Do not dispose of chemical wastes by dumping them down a sink, flushing in a toilet or discarding in regular trash containers, unless authorized by Environment, Health & Safety Hazardous Materials Management (EHS-HMM)**. Contact EHS-HMM at (734) 763-4568 for waste containers, labels, manifests, waste collection and for any questions regarding proper waste disposal. Also, refer to the EHS [Hazardous Waste](http://ehs.umich.edu/haz-waste/) Web page for more information.

# Training of Personnel

All personnel shall read and fully adhere to this SOP when handling sulfuric acid.

# Certification

I have read and understand the above SOP. I have received prior approval from my Lab Director to perform this procedure. I agree to contact my Lab Director if I plan to modify this procedure.

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### Major Revisions (Tracking purposes only -- Do not print as part of SOP)

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| Date | Revision |
| 03-23-18 | Put into EHS format, changed department name, and fixed links. Revised Spill Procedure section (AKJ). |
| 04-09-18 | Revised formatting (AKJ). |
| 04-23-18 | Changed injury type and action from paragraph to table format (AKJ). |
| 03-04-19 | Updated links, certification and format (DML). |
| 05-15-20 | Updated editing rights to headings (RSH) |
| 05-16-22 | Removed section on Exposures/Unintended Contact (LGS) |
| 10-10-23 | Added content to the Description section, edited the Potential Hazards and the  Personal Protective Equipment section, and added references (SMW). |

**References**

National Academies of Sciences, Engineering, and Medicine. 1995. Prudent Practices in the Laboratory: Handling and Disposal of Chemicals. Washington, DC: The National Academies Press. <https://doi.org/10.17226/4911>.

Canadian Centre for Occupational Health and Safety (2023, 06/13). <https://www.ccohs.ca/oshanswers/prevention/ppe/gloves.html>

*NIOSH pocket guide to chemical hazards. (2010). [Cincinnati, Ohio] : Washington, DC :U.S. Dept. of Health and Human Services, Public Health Service, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health*

*Cameo Chemicals (Version 2.8.1) [Mobile App]*