

Standard Operating Procedure

Perchloric Acid

Purpose

Perchloric acid is the inorganic compound with the formula HClO_4 . Usually encountered as an aqueous solution, this colorless compound is a strong acid comparable in strength to sulfuric acid and nitric acid. It is a powerful oxidizer, but its aqueous solutions up to 70% are remarkably inert, only showing strong acid properties and no other oxidizing properties. Above concentrations of appr. 70% the speed of oxidizing reactions rapidly increases with increasing acid concentration. It is useful for preparing perchlorate salts, especially ammonium perchlorate, an important rocket fuel. Perchloric acid is also dangerously corrosive and readily forms explosive mixtures.

Perchloric acid is mainly produced as a precursor to ammonium perchlorate, which is used as rocket fuel. The growth in rocketry has led to increased production of perchloric acid. Several million kilograms are produced annually. It is one of the strongest Brønsted-Lowry acids. Despite hazards associated with the explosiveness of its salts, the acid is often preferred in certain syntheses.

Physical & Chemical Properties/Definition of Chemical Group

CAS#:	7601-90-3
Class:	<u>Produces explosive salts, crystals and perchlorate residues</u>
Molecular formula:	HClO_4
Boiling Point:	203 °C @ 760 mm Hg
Melting Point:	-18 °C
Decomposition Temperature:	Not available

Potential Hazards/Toxicity

EMERGENCY OVERVIEW: Appearance: clear, colorless liquid. Causes digestive and respiratory tract burns. Causes eye and skin burns. Strong oxidizer. Contact with other material may cause a fire. Heating may cause an explosion. Contact with other material may cause explosion. Corrosive to metal.

Highly important danger information!

In addition to being a corrosive liquid, while not combustible, under some circumstances perchloric acid may act as an oxidizer and/or present an explosion hazard. Perchloric crystals, or perchloric acid in crystalline form, is an extremely dangerous inorganic compound. The crystals are sometimes formed due to condensation inside of ventilation hoods in chemical labs or in bottles stored for extended periods in the lab. Among the principle hazards are that the perchlorite crystals are subject to exploding on impact.

Organic materials are especially susceptible to spontaneous combustion if mixed or contacted with perchloric acid. Under some circumstances, perchloric acid vapors form perchlorates in duct work, which are shock sensitive.

Target Organs: Eyes, thyroid, skin, mucous membranes.

Potential Health Effects:

Eye: Causes eye burns.

Skin: Causes skin burns.

Ingestion: Harmful if swallowed. Causes gastrointestinal tract burns.

Inhalation: Causes severe respiratory tract irritation with possible burns.

Chronic: Prolonged or repeated skin contact may cause dermatitis.

Personal Protective Equipment (PPE)

Respirator Protection

Respirators should be equipped with acid gas cartridges.

Respirators should be used only under any of the following circumstances:

- As a last line of defense (i.e., after engineering and administrative controls have been exhausted).
- When Permissible Exposure Limit (PEL) has exceeded or when there is a possibility that PEL will be exceeded.
- Regulations require the use of a respirator.
- An employer requires the use of a respirator.
- There is potential for harmful exposure due to an atmospheric contaminant (in the absence of PEL)
- As PPE in the event of a chemical spill clean-up process

Lab personnel intending to use/wear a respirator mask must be trained and fit-tested by EH&S. This is a regulatory requirement.

Hand Protection

Nitrile or viton gloves are recommended.

NOTE: Consult with your preferred glove manufacturer to ensure that the gloves you plan on using are compatible with hydrochloric acid.

Refer to glove selection chart from the links below:

http://www.ansellpro.com/download/Ansell_8thEditionChemicalResistanceGuide.pdf

OR

<http://www.allsafetyproducts.biz/page/74172>

OR

<http://www.showabestglove.com/site/default.aspx>

OR

<http://www.mapaglove.com/>

Eye Protection

Safety glasses or chemical splash goggles. Goggles are preferred, but required at high acid concentrations.

Skin and Body Protection

Lab personnel working with the chemical need to wear full-length pants or its equivalent, closed-toe footwear with no skin being exposed, and a lab coat.

Hygiene Measures

Wash hands after working with the substance.

Engineering Controls

Facilities storing or utilizing this material should be equipped with an eyewash facility and a safety shower. Any procedure involving heating of perchloric acid must be conducted in a perchloric acid fume hood, with the sash down. No organic materials should be stored in the perchloric acid hood.

First Aid Procedures

If inhaled

Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waistband. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. **WARNING:** It may be hazardous to the person providing aid to give mouth-to-mouth resuscitation when the inhaled material is toxic, infectious or corrosive. Seek immediate medical attention.

In case of skin contact

In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Cold water may be used. Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention immediately.

In case of eye contact

Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Cold water may be used. Get medical attention.

If swallowed

Do NOT induce vomiting. Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician

Special Handling and Storage Requirements

Handling: Wash thoroughly after handling. Remove contaminated clothing and wash before reuse. Use spark-proof tools and explosion proof equipment. Avoid contact with clothing and other combustible materials. Do not get on skin or in eyes. Do not ingest or inhale. Use only with adequate ventilation. Do not allow perchloric acid to come into contact with strong dehydrating agents (concentrated sulfuric acid, anhydrous phosphorous pentoxide, etc.). Keep the quantities of perchloric acid handled at the bare minimum for safety. Perchloric acid should be handled in a masonry building with concrete or tile floors. Handling acid on wooden floors is dangerous, especially after the acid has dried. The wooden floor will then become sensitive to ignition by friction. Perchloric acid mist and vapor can condense in ventilation systems to form metallic perchlorates, which can be explosive. Inform laundry personnel of contaminant's hazards.

Storage: Do not store near combustible materials. Store in a tightly closed container. Store in a cool, dry, well-ventilated area away from incompatible substances. Avoid storage on wood floors. Perchloric acid should be stored segregated from all other chemicals & inside secondary containment (such as pyrex baking dish). It must not be stored near organic acids, near bases, or near other organic or flammable material. Shelves and floor material should be non-combustible and acid-resistant. Protect from freezing.

Spill and Accident Procedure

Chemical Spill Dial 9-911 and 228-7864

Spill – Assess the extent of danger. Help contaminated or injured persons. Evacuate the spill area. Avoid breathing vapors. If possible, confine the spill to a small area using a spill kit or absorbent material. Keep others from entering contaminated area (e.g., use caution tape, barriers, etc.).

Small (<1 L) – If you have training, you may assist in the clean-up effort. Use appropriate personal protective equipment and clean-up material for chemical spilled. Double bag spill waste in clear plastic bags, label and take to the next chemical waste pick-up.

Large (>1 L) – Dial 9-911 and EH&S at 228-7864 for assistance.

Chemical Spill on Body or Clothes – Remove clothing and rinse body thoroughly in emergency shower for at least 15 minutes. Seek medical attention. *Notify supervisor and EH&S at 228-7864 immediately.*

Chemical Splash Into Eyes – Immediately rinse eyeball and inner surface of eyelid with water from the emergency eyewash station for 15 minutes by forcibly holding the eye open. Seek medical attention. *Notify supervisor and EH&S at 228-7864 immediately.*

Medical Emergency Dial 9-911 or 228-7864

Life Threatening Emergency, After Hours, Weekends And Holidays – Dial 9-911 *Note: All serious injuries must be reported to EH&S at 228-7864 within 8 hours.*

Non-Life Threatening Emergency – Go to the Olivewood Meadows Occupational Health 374 Olive during regular business hours. All other times report to Mercy Medical Center 315 Mercy Ave. *Note: All serious injuries must be reported to EH&S at 228-7864 within 8 hours.*

Needle stick/puncture exposure (as applicable to chemical handling procedure) – Wash the affected area with antiseptic soap and warm water for 15 minutes. For mucous membrane exposure, flush the affected area for 15 minutes using an eyewash station. Go to the Olivewood Meadows Occupational Health 374 Olive during regular business hours. All other times report to Mercy Medical Center 315 Mercy Ave. *Note: All needle stick/puncture exposures must be reported to EH&S at 228-7864 within 8 hours.*

Decontamination/Waste Disposal Procedure

Spills may be neutralized with sodium bicarbonate or baking soda. Do not dispose of Perchloric acid by pouring down drains followed by copious amounts of water without neutralization.

General hazardous waste disposal guidelines:

Label Waste

- Affix an on-line hazardous waste tag on all waste containers using the Online Tag Program <http://otp.ucop.edu/> as soon as the first drop of waste is added to the container

Store Waste

- Store hazardous waste in closed containers, in secondary containment and in a designated location
- Double-bag dry waste using transparent bags
- Waste must be under the control of the person generating & disposing of it

Dispose of Waste

- Dispose of regularly generated chemical waste within 90 days
- Call EH&S at 228-7864 for questions
- Empty Containers
 - Dispose as hazardous waste if it once held extremely hazardous waste (irrespective of the container size) A list can be found at <http://ehs.ucla.edu/Pub/ExtremelyHazardousWaste.pdf>

Prepare for transport to pick-up location

- Check on-line waste tag
- Use secondary containment

Safety Data Sheet (SDS) Location

Online SDS can be accessed at <http://ehs.ucmerced.edu/material-safety-data-sheets>.

Protocol/Procedure

Add small amounts (i.e. dropwise) to lower pH of electrodeposition solution.

NOTE

Any deviation from this SOP requires approval from PI.

Documentation of Training (signature of all users is required)

- Prior to conducting any work with hydrochloric acid, designated personnel must provide training to his/her laboratory personnel specific to the hazards involved in working with this substance, work area decontamination, and emergency procedures.
- The Principal Investigator must provide his/her laboratory personnel with a copy of this SOP and a copy of the SDS provided by the manufacturer.
- The Principal Investigator must ensure that his/her laboratory personnel have attended appropriate laboratory safety training or refresher training within the last one year.

I have read and understand the content, requirements, and responsibilities of this SOP:

Name	Signature	Date
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