

Occupational Health Guideline for Oxalic Acid

INTRODUCTION

This guideline is intended as a source of information for employees, employers, physicians, industrial hygienists, and other occupational health professionals who may have a need for such information. It does not attempt to present all data; rather, it presents pertinent information and data in summary form.

SUBSTANCE IDENTIFICATION

- Formula: HOCCOOH-2H₂O
- Synonyms: Oxalic acid dihydrate; ethanedioic acid
- Appearance and odor: Colorless, odorless solid.

PERMISSIBLE EXPOSURE LIMIT (PEL)

The current OSHA standard for oxalic acid is 1 milligram of oxalic acid per cubic meter of air (mg/m³) averaged over an eight-hour work shift.

HEALTH HAZARD INFORMATION

• Routes of exposure

Oxalic acid can affect the body if it is inhaled, comes in contact with the eyes or skin, or is swallowed. It may slowly enter the body through the skin.

• Effects of overexposure

1. Short-term Exposure: Exposure to either solid or liquid oxalic acid can cause severe burns of the skin, eyes, and linings of the respiratory tract. A number of deaths have occurred from swallowing oxalic acid. The symptoms appear rapidly and include shock, collapse, and convulsive seizures. Such cases may also have marked kidney damage.

2. Long-term Exposure: Prolonged or repeated skin contact with oxalic acid solutions may cause pain and discoloration of the fingers. This may go on to gangrene.

3. Reporting Signs and Symptoms: A physician should be contacted if anyone develops any signs or symptoms

and suspects that they are caused by exposure to oxalic acid.

• Recommended medical surveillance

The following medical procedures should be made available to each employee who is exposed to oxalic acid at potentially hazardous levels:

1. Initial Medical Screening: Employees should be screened for history of certain medical conditions (listed below) which might place the employee at increased risk from oxalic acid exposure.

—Chronic respiratory disease: In persons with impaired pulmonary function, especially those with obstructive airway diseases, the breathing of oxalic acid might cause exacerbation of symptoms due to its irritant properties.

—Skin disease: Oxalic acid is a primary skin irritant. Persons with pre-existing skin disorders may be more susceptible to the effects of this agent.

—Kidney disease: Oxalic acid may cause kidney damage. Special consideration should be given to exposing those with impaired renal function.

—Eye disease: Oxalic acid is a severe eye irritant and may cause tissue damage. Those with pre-existing eye problems may be at increased risk from exposure.

2. Periodic Medical Examination: Any employee developing the above-listed conditions should be referred for further medical examination.

• Summary of toxicology

Oxalic acid as a dust or in solution irritates the eyes, mucous membranes, and skin. There is little reported information on industrial exposures, although chronic inflammation of the upper respiratory tract has been described in a worker exposed to hot vapors (probably an aerosol) arising from oxalic acid. Solutions are irritating to the skin after prolonged exposure and may cause localized pain, with cyanosis of the fingers and even gangrenous changes. Splashes in the eye produce epithelial damage from which recovery is usually prompt. Fatalities have been reported following ingestion of as little as 5 g; the onset of symptoms is rapid, including those of shock, collapse, and convulsions;

These recommendations reflect good industrial hygiene and medical surveillance practices and their implementation will assist in achieving an effective occupational health program. However, they may not be sufficient to achieve compliance with all requirements of OSHA regulations.

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there may be marked renal damage, with deposition of calcium oxalate in the lumen of the renal tubules.

CHEMICAL AND PHYSICAL PROPERTIES

• Physical data

1. Molecular weight: 126.1
2. Boiling point (760 mm Hg): Sublimes at 149– 160 C (300– 320 F) with partial decomposition
3. Specific gravity (water = 1): 1.5
4. Vapor density (air = 1 at boiling point of oxalic acid): 4.3
5. Melting point: 101.5 C (215 F)
6. Vapor pressure at 20 C (68 F): Less than 0.001 mm Hg
7. Solubility in water, g/100 g water at 20 C (68 F): 10
8. Evaporation rate (butyl acetate = 1): Data not available

• Reactivity

1. Conditions contributing to instability: Heat
2. Incompatibilities: Contact with strong oxidizers may cause fires and explosions. Contact with silver compounds may form explosive silver oxalate salt.
3. Hazardous decomposition products: Toxic gases and vapors (such as formic acid and carbon monoxide) may be released in a fire involving oxalic acid.
4. Special precautions: None

• Flammability

1. Flash point: None by standard tests
2. Autoignition temperature: Data not available
3. Flammable limits in air, % by volume: Data not available
4. Extinguishant: Water spray, dry chemical, or carbon dioxide

• Warning properties

Grant reports that "oxalic acid, a crystalline solid, readily soluble in water, has caused burns of the human eye in a few instances when solutions accidentally came in contact with the eye. The injury has been epithelial, and recovery has been prompt, the epithelium regenerating usually within two days . . ." Grant observed that the application of a 5% solution for 30 seconds to rabbit eyes caused "coagulation of the epithelium, but the cornea recovered within six days." Since oxalic acid is readily soluble in water, the dust and mists of solutions of this material are treated as eye irritants for the purposes of this guideline. No quantitative information is available concerning the concentrations which produce eye irritation.

MONITORING AND MEASUREMENT PROCEDURES

• General

Measurements to determine employee exposure are best taken so that the average eight-hour exposure is based on a single eight-hour sample or on two four-hour samples. Several short-time interval samples (up to 30

minutes) may also be used to determine the average exposure level. Air samples should be taken in the employee's breathing zone (air that would most nearly represent that inhaled by the employee).

• Method

At the time of publication of this guideline, no measurement method for oxalic acid had been published by NIOSH.

RESPIRATORS

• Good industrial hygiene practices recommend that engineering controls be used to reduce environmental concentrations to the permissible exposure level. However, there are some exceptions where respirators may be used to control exposure. Respirators may be used when engineering and work practice controls are not technically feasible, when such controls are in the process of being installed, or when they fail and need to be supplemented. Respirators may also be used for operations which require entry into tanks or closed vessels, and in emergency situations. If the use of respirators is necessary, the only respirators permitted are those that have been approved by the Mine Safety and Health Administration (formerly Mining Enforcement and Safety Administration) or by the National Institute for Occupational Safety and Health.

• In addition to respirator selection, a complete respiratory protection program should be instituted which includes regular training, maintenance, inspection, cleaning, and evaluation.

PERSONAL PROTECTIVE EQUIPMENT

• Employees should be provided with and required to use impervious clothing, gloves, face shields (eight-inch minimum), and other appropriate protective clothing necessary to prevent repeated or prolonged skin contact with oxalic acid or liquids containing oxalic acid.

• If employees' clothing may have become contaminated with oxalic acid or liquids containing oxalic acid, employees should change into uncontaminated clothing before leaving the work premises.

• Clothing contaminated with oxalic acid should be placed in closed containers for storage until it can be discarded or until provision is made for the removal of oxalic acid from the clothing. If the clothing is to be laundered or otherwise cleaned to remove the oxalic acid, the person performing the operation should be informed of oxalic acid's hazardous properties.

• Employees should be provided with and required to use dust- and splash-proof safety goggles where there is any possibility of oxalic acid or liquids containing oxalic acid contacting the eyes.

• Where there is any possibility that employees' eyes may be exposed to oxalic acid or liquids containing oxalic acid, an eye-wash fountain should be provided within the immediate work area for emergency use.

SANITATION

- Skin that becomes contaminated with oxalic acid should be promptly washed or showered to remove any oxalic acid.
- Eating and smoking should not be permitted in areas where oxalic acid or liquids containing oxalic acid are handled, processed, or stored.
- Employees who handle oxalic acid or liquids containing oxalic acid should wash their hands thoroughly before eating, smoking, or using toilet facilities.

COMMON OPERATIONS AND CONTROLS

The following list includes some common operations in which exposure to oxalic acid may occur and control methods which may be effective in each case:

Operation	Controls
Use in metal cleaning and polishing operations for automobile radiators, boilers, and railroad cars to remove carbonaceous deposits from steel	Local exhaust ventilation; general dilution ventilation; personal protective equipment
Use in textile cleaning and bleaching operations for rust, ink, and stain; bleaching of cotton and other fabrics; removal of discoloration from bleeding dyes; use as a sour in treatment of woolen and other piece goods; use in stripping and finishing operations in textile manufacture	Local exhaust ventilation; general dilution ventilation; personal protective equipment
Use in bleaching and tanning of hides in leather manufacture	Local exhaust ventilation; general dilution ventilation; personal protective equipment
Use during miscellaneous bleaching operations of wood, rosin, and cork	Local exhaust ventilation; general dilution ventilation; personal protective equipment

Operation

Use in manufacture of household and industrial cleaning and bleaching agents for metal and wood cleaning, cleaning preparations, disinfectants, and wax and grease removal

Use in metallurgical processing of tin and extraction and purification of rare earth and actinide metals

Use in synthesis of other chemicals for manufacture of dyes, blue-print photography, and acids and starch hydrolysis

Use in extraction and purification operations for chemicals, natural gums, and tall oil

Use in lithography and photoengraving operations; use as an analytical reagent; use in manufacture of inks and lacquers; and in synthesis of pharmaceuticals

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EMERGENCY FIRST AID PROCEDURES

In the event of an emergency, institute first aid procedures and send for first aid or medical assistance.

• Eye Exposure

If oxalic acid or liquids containing oxalic acid get into the eyes, wash eyes immediately with large amounts of water, lifting the lower and upper lids occasionally. Get medical attention immediately. Contact lenses should not be worn when working with this chemical.

• Skin Exposure

If oxalic acid or liquids containing oxalic acid get on the skin, promptly flush the contaminated skin with water. If oxalic acid or liquids containing oxalic acid penetrate through the clothing, remove the clothing immediately and flush the skin with water. If irritation persists after washing, get medical attention.

• Breathing

If a person breathes in large amounts of oxalic acid, move the exposed person to fresh air at once. If breathing has stopped, perform artificial respiration.

Keep the affected person warm and at rest. Get medical attention as soon as possible.

- **Swallowing**

When oxalic acid or liquids containing oxalic acid have been swallowed and the person is conscious, give the person large quantities of water immediately to dilute the oxalic acid. Do not attempt to make the exposed person vomit. Get medical attention immediately.

- **Rescue**

Move the affected person from the hazardous exposure. If the exposed person has been overcome, notify someone else and put into effect the established emergency rescue procedures. Do not become a casualty. Understand the facility's emergency rescue procedures and know the locations of rescue equipment before the need arises.

SPILL AND DISPOSAL PROCEDURES

- Persons not wearing protective equipment and clothing should be restricted from areas of spills until cleanup has been completed.

- If oxalic acid is spilled, the following steps should be taken:

1. Ventilate area of spill.

2. For small quantities, sweep onto paper or other suitable material, place in an appropriate container and burn in a safe place (such as a fume hood). Large quantities may be reclaimed; however, if this is not practical, dissolve in a flammable solvent (such as alcohol) and atomize in a suitable combustion chamber equipped with an appropriate effluent gas cleaning device.

- Waste disposal methods:

Oxalic acid may be disposed of:

1. By making packages of oxalic acid in paper or other flammable material and burning in a suitable combustion chamber equipped with an appropriate effluent gas cleaning device.

2. By dissolving oxalic acid in a flammable solvent (such as alcohol) and atomizing in a suitable combustion chamber equipped with an appropriate effluent gas cleaning device.

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RESPIRATORY PROTECTION FOR OXALIC ACID

Condition	Minimum Respiratory Protection* Required Above 1 mg/m ³
Particulate Concentration	
50 mg/m ³ or less	A high efficiency particulate filter respirator with a full facepiece. Any supplied-air respirator with a full facepiece, helmet, or hood. Any self-contained breathing apparatus with a full facepiece.
500 mg/m ³ or less	A Type C supplied-air respirator with a full facepiece operated in pressure-demand or other positive pressure mode or with a full facepiece, helmet, or hood operated in continuous-flow mode.
Greater than 500 mg/m ³ or entry and escape from unknown concentrations	Self-contained breathing apparatus with a full facepiece operated in pressure-demand or other positive pressure mode. A combination respirator which includes a Type C supplied-air respirator with a full facepiece operated in pressure-demand or other positive pressure or continuous-flow mode and an auxiliary self-contained breathing apparatus operated in pressure-demand or other positive pressure mode.
Fire Fighting	Self-contained breathing apparatus with a full facepiece operated in pressure-demand or other positive pressure mode.

*Only NIOSH-approved or MSHA-approved equipment should be used.

