

WORKPLACE ENVIRONMENTAL EXPOSURE LEVEL[®]



Chlorosulfonic Acid (2016)

I. IDENTIFICATION

Chemical Name: Chlorosulfonic acid

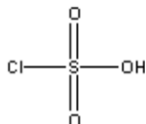
Synonyms: CSA, sulfuric chlorohydrin, sulfuric acid chlorohydrin, chlorosulfuric acid, monochlorosulfuric acid, monchlorosulfonic acid

CAS Number: 7790-94-5

DOT/UN Number: 1751⁽¹⁾

Molecular Formula: HSO₃Cl

Structural Formula:



II. CHEMICAL AND PHYSICAL PROPERTIES⁽²⁻⁸⁾

Physical State: colorless-to-straw-colored liquid (at room temperature)

Molecular Weight: 116.53

Conversion Factors: 1 mg/m³ = 0.21 ppm 1 ppm = 4.8 mg/m³

Melting Point: -80 °C (-112 °F)

Boiling Pt: 151 to 155 °C (305 to 311 °F) at 755 mm Hg

Vapor Pressure: 0.8 mm Hg at 30 °C (86 °F); 2.5 mm Hg at 37.7 °C (99.9 °F); 11 mm Hg at 60 °C (140 °F)

Saturated Vapor Concentration: 1050 ppm at 30 °C (5000 mg/m³)

Vapour Density (air =1): 4.0

Other Description: pungent

Odor threshold (hydrolysis prods.): 1.0 ppm, hydrogen chloride; 0.47 ppm sulphur dioxide

Flammability Limits: LFL - 3.3%; UFL - 37.7%

Flash Point: 249 °F (by SETA)

Specific Gravity: 1.75 at 20 °C

Solubility in Water: infinite

pH: <1

Stability and reactivity: hygroscopic and highly exothermic.

Heat of dissolution is 40.4 kcal/mole. In the presence of water or atmospheric moisture it hydrolyses to sulfuric and hydrochloric acids. It is corrosive to many metals and is a strong oxidizing agent. When heated it releases chlorine, hydrogen chloride, hydrogen and sulfur dioxide. It will also

react exothermically with organic materials and water and large quantities of dense white fumes may be released if not contained. It is susceptible to photooxidation via vapor phase reaction with photochemically produced hydroxyl radicals.

III. USES

Chlorosulfonic acid is used as a chemical intermediate for dyes, pesticides, and ion-exchange resins. It is used in: pharmaceuticals including sulfa drugs and saccharin; alkyl sulfate and alkylphenol ethoxylate sulfate surfactants; as a chlorosulfonating and condensing agent in organic synthesis; in the manufacture of synthetic detergents, anhydrous hydrogen chloride and smoke producing chemicals.^(4,7)

IV. ANIMAL TOXICITY DATA

A. Acute Toxicity

1. Lethality Data

Species	Route	LD ₅₀ Or LC ₅₀
Rat	Oral	50-40 mg/kg ^(7,8)
Rat	Inhalation (2-hr)	52.5 mg/m ³ ^(6,7)
Rat	Inhalation (4-hr)	1765 mg/m ³ ⁽¹¹⁾ 0.0385 mg/l ⁽⁷⁾
Guinea pig	Dermal	0.05-0.10 cc/kg (87.5-175 mg/kg) ⁽⁹⁾

2. Eye Irritation

Severe ocular irritation was seen in mice and rats.⁽³⁻⁷⁾

3. Skin Absorption

No data is available other than lethality listed above.

4. Skin Irritation

Highly irritating. Liquid chlorosulfonic acid produced burns, moderate edema, necrosis and strong erythema.^(3,4) At one week post-exposure, depressed black eschar, desquamation and moderate erythema. At two weeks post-exposure, small eschars and no hair.⁽¹⁰⁾

5. Skin Sensitization

No data available.

6. Acute Inhalation Toxicity

A rat 1-hr LC₁₀ was determined to be 926 mg/m³.⁽⁸⁻¹⁰⁾

B. Subacute Toxicity

No data available.

C. Subchronic Toxicity

No data available.

D. Chronic Toxicity/Carcinogenicity

No data available.

E. Reproductive/Developmental Toxicity

No data available.

F. Genotoxicity/Mutagenicity

No data available.

G. Metabolism/Pharmacokinetics

No data available.

H. Other

No data available.

V. HUMAN USE AND EXPERIENCE

Exposure to chlorosulfonic acid will be mainly occupational via inhalation and perhaps dermal contact. Based on the 1981-1983 National Occupational Exposure Survey, NIOSH estimated that approximately 3300 US workers are exposed annually to chlorosulfonic acid.⁽⁹⁾ Chlorosulfonic acid is extremely corrosive, giving off fumes which are irritating to the eyes, skin, and respiratory tract.⁽³⁾ Information suggests that chronic overexposure to vapors or mists of may corrode teeth.⁽¹²⁾ Respiratory effects are anticipated to be similar to those of hydrochloric acid and sulfuric acid.⁽⁴⁻⁷⁾

VI. RATIONALE

Chlorosulfonic acid reacts readily and rapidly with water to form hydrochloric acid (HCl) and sulfuric acid (H₂SO₄) (approximately 1:3 by weight and 1:1 by molarity respectively) and its toxicity is expected to be related primarily to the corrosiveness of these breakdown products which are acutely irritating to the eyes, skin, and respiratory tract and of which chronic over-exposure to vapors or mists may corrode teeth. Respiratory effects are anticipated to be similar to those of

hydrochloric acid and sulfuric acid. No specific WEEL value is recommended for CSA. It is recommended that existing occupational exposure levels for hydrochloric acid (HCl) and sulfuric acid (H₂SO₄) be referred to for best industrial hygiene practices.

VII. RECOMMENDED WEEL

None established. Refer to existing occupational exposure levels for hydrochloric acid (HCl) and sulfuric acid (H₂SO₄) for best IH practices.

This WEEL value was originally established in 1985 and updated in 2002. No significant new literature was identified for chlorosulfonic acid since the last revision (2002).

VIII. REFERENCES

- (1) American Society for Testing and Materials (ASTM). Corrosive Metal. In *ASTM Manual Series 10: A Guide to the Safe Handling of Hazardous Materials Accidents*. 2nd Edition; ASTM: Philadelphia, PA, 1990; p. 49.
- (2) 2184. Chlorosulfonic Acid. In *The Merck Index: An Encyclopedia of Chemicals, Drugs, and Biologicals*; O'Neil, M. J., Ed.; Royal Society of Chemistry, 2013; p. 373.
- (3) Daugherty, M. L.; Faust, R. A.; Francis, A. A.; Khanna, K.; Lu, P. Y. L. *Drinking Water Toxicity: Chlorosulfonic Acid*. NTIS/PB93- 122406; Human Risk Assessment Branch, U.S. Environmental Protection Agency (EPA); Washington, DC, 1992.
- (4) Lewis, R. J.; Sax, N. I. Chlorosulfonic Acid. In *Sax's Dangerous Properties of Industrial Materials*; Van Nostrand Reinhold: New York, 1996; pp. 184-195.
- (5) New Jersey Department of Health. *Hazardous Substance Fact Sheet for Chlorosulfonic Acid*.; New Jersey Department of Health and Senior Services: Trenton, NJ, 2004.
- (6) U.S. National Library of Medicine (NLM). *Hazardous Substance Database (HSDB): Chlorosulfonic Acid*; National Institutes of Health, Health & Human Services: Bethesda, MD, 2003.
- (7) OECD SIDS Program. *SIDS Initial Assessment Profile: Chlorosulfonic Acid*; Organization for Economic Cooperation and Development (OECD), UNEP Publications, 2006.
- (8) U.S. Department of Energy. *Environmental Assessment: Liquefied Gaseous Fuels Spill Test Facility Program Eleven*

Additional Chemicals; Office of Fossil Energy: Washington, DC, 1989.

(9) Eastman Kodak Company. *Initial Submission: Letter from Eastman Kodak Co., to USEPA Regarding Toxicity Studies of Chlorosulfuric Acid with Attachments and Cover Letter Dated 09/24/1992. EPA/OTS Doc #88-920008908; OTS0570953*; U. S. Environmental Protection (EPA): Washington, DC, 1992.

(10) Katz, G. V. *Acute Inhalation Toxicity and One- Hour LC50 Value of Chlorosulfonic Acid in the Rat. Ref. No. 236025T TX-87-58*.; Toxicology Sciences Section, Eastman Kodak Company: Rochester, NY, 1987.

(11) U.S. EPA. *Initial Submission: Acute Inhalation Toxicity Study of Chlorosulfonic Acid in Rats with Cover Letter 061592 EPA/OTS; Doc #88-920003964. NTIS/OTS0541018*.; 1992.

(12) Tuominen, M. L.; Tuominen, R. J.; Fubusa, F.; Mgalula, N. Tooth Surface Loss and Exposure to Organic and Inorganic Acid Fumes in Workplace Air. *Community Dent. Oral Epidemiol.* **1991**, *19*, 217–220.