



◆ SECTION 1 INTRODUCTION

Material Ferric Chloride Solution, ca 100%

Synonyms ferric chloride hexahydrate, flores martis, iron (III) chloride, iron perchloride, iron sesquichloride, iron trichloride

Chemical Formula $FeCl_3$, $FeCl_3 \cdot 6H_2O$ (ferric chloride hexahydrate)

CAS Number 7705-08-0

DOT Classification Corrosive, UN2582, Listed as a Hazardous Material for Transportation (49 CFR 172.101)

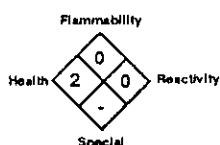
EPA Classification Listed as a CERCLA Hazardous Substance (40 CFR 302.4), and *not* listed as a RCRA Hazardous Waste (40 CFR 261.33), a SARA Extremely Hazardous Substance (40 CFR 355), or a SARA Toxic Chemical (40 CFR 372.65)

OSHA Classification Listed as an Air Contaminant (29 CFR 1910.1000, Table Z-1-A, as soluble iron salts)

NFPA Hazard Rating Not found

Genium Hazard Rating

- 4 = Extreme
- 3 = High
- 2 = Moderate
- 1 = Slight
- 0 = Minimum



HMIS

- H 2
- F 0
- R 0

Description A greenish-black solution of $FeCl_3$, which may have a slightly hydrochloric acid odor. $FeCl_3$ is derived by various methods: by the action of chlorine on ferrous sulfate or chloride; by the reaction of chlorine gas on red hot iron, obtained from spent steel pickling liquors; or as a by-product of titanium dioxide manufacture by the chlorine process. $FeCl_3$ also occurs in nature as the mineral molysite. Used in photoengraving, photography, purifying factory effluents and deodorizing sewage, manufacture of other iron salts, pigments and inks, chlorination of silver and copper ores; as a catalyst in organic reactions, a mordant in dyeing and printing textiles, an oxidizing agent in dye manufacture, and a clinical reagent (for determining amino acids in urine).

Overview Ferric chloride solution (acidic) is irritating and corrosive to the eyes, skin, and mucous membranes. Avoid contact with skin, eyes, and clothing and breathing vapor or mist, especially if ferric chloride solution is heated. Wear safety glasses or goggles and protective clothing when working with ferric chloride solution. This material has a variety of school applications, including the etching of printed circuitry for electronics projects and as a reagent in the chemistry laboratory.

Manufacturer Always request an up-to-date MSDS from your chemical supplier. That sheet should include the manufacturer and their emergency phone numbers. This *Manual's* Resources/Manufacturers Index lists some larger manufacturers and available emergency phone numbers.

◆ SECTION 2 USE AND STORAGE DATA

Preliminary Planning Considerations *Plan and provide for safe disposal of all school-generated chemical waste.* Check applicable regulations prior to use. Whenever possible, substitute less hazardous materials. Investigate the feasibility

of microscale chemistry experiments to reduce the quantity required and disposal concerns. Review Sections 3, 4, and 5 prior to using this material. Only use in or near acid-resistant materials and surfaces such as rubber, PVC, glass, ceramic, and various plastics. Provide adequate ventilation or restrict use to fume hood to avoid exceeding the TLV (Sec. 4). Contact lens use when handling chemical materials is controversial. In some cases, soft lenses can actually protect eyes from chemicals. In other cases, chemical entrapment is presumed a possible hazard. Particles adhering to contact lens surfaces can cause corneal damage. For safety, wear safety glasses or goggles and appropriate protective clothing (e.g., polycarbonate and butyl rubber gloves, lab coats) to work with ferric chloride solution. Employees and students should know the location of eyewash and shower facilities near chemical use areas. Check and document that eyewash stations and safety showers are working properly.

Usage Precautions and Procedure Before using, *read this material's container label* and follow all precautions. Do not smoke in usage or storage areas. Practice good housekeeping to avoid unintentionally mixing incompatibles. Do not allow chemical residue or dust buildup in lab or work areas. Keep ferric chloride away from notebooks, textbooks, and personal belongings to avoid transporting chemical residues from the lab/work area. After working with chemical materials, and before eating, drinking, or smoking, always wash hands and face. Remove and launder contaminated clothing before reusing.

Additional Data Ferric chloride is stable at room temperature under normal handling and storage conditions. It does not polymerize. Its incompatibilities include nylon, alkalis, and oxidizers. Ferric chloride solutions are corrosive to most metals except titanium and tantalum.

Preferred Storage Location and Methods Store in tightly closed and properly labeled containers in a cool, well-ventilated area out of direct sunlight and away from incompatibles. Store small quantities in polyethylene bottles. Keep well closed. Discard if solution becomes cloudy. If polyethylene is unavailable, store in glass bottles and refrigerate. Solution may leach alkali from the glass and rubber stoppers forming a yellow ferric oxide precipitate. To separate incompatible chemicals, store by chemical family, not by alphabetical name. Protect all chemical containers from physical damage. Prohibit smoking in chemical storage areas. Purchase amounts sufficient for one year's use or less.

◆ SECTION 3 SPILL/DISPOSAL PROCEDURES

If Spilled Ventilate spill area. Evacuate students from spill area until cleanup is complete. Promptly and thoroughly clean up spilled material. Cleanup personnel should protect against vapor or mist inhalation and skin or eye contact. For liquid (solution) spills, cover with an inert solid absorbent (vermiculite, dry sand, etc.) and scoop into appropriate containers (with secure lid) for disposal in accordance with existing regulations. As needed, dike spill area with inert absorbent material to contain spill. Do not release to sewers

School Materials Safety Manual: No. 20 Ferric Chloride Solution

or waterways. Ferric chloride is harmful to aquatic life in very low concentrations. Rinse spill area with sodium bicarbonate or soda ash solution. Spill may be neutralized with agricultural lime (slaked lime) or crushed limestone if landfill disposal is being considered.

Disposal of Small Quantities Handle emptied containers carefully since residues may remain. Always check regulations before disposal. Investigate recycling or reclamation rather than landfill disposal. Precipitate as the sulfide, adjusting the pH of the solution to 7 to complete precipitation. Filter the insolubles and dispose of them in a hazardous waste site. Destroy any excess sulfide with sodium hypochlorite. Neutralize the solution before flushing down the drain. If these methods are not practical, feasible, or in accord with existing regulations, contact your supplier or a licensed disposal contractor for specific treatment/disposal procedures.

Disposal of Larger Amounts Contact your supplier or a licensed disposal company.

Follow all applicable local, state, and Federal regulations for all waste disposal.

◆ SECTION 4 HEALTH HAZARDS

Ferric chloride solution is irritating and corrosive to the eyes, skin, and mucous membranes. Ingestion may cause kidney and liver damage. The estimated fatal dose in man for soluble ferric salts is 30 g.

1991 OSHA PEL 8-hr TWA: 1 mg/m³ (Soluble Iron Salts)

1992-93 ACGIH TLV 8-hr TWA: 1 mg/m³ (Soluble Iron Salts)

1990 NIOSH REL 10-hr TWA: None established

1985-6 Toxicity Data Rat, oral, LD₅₀: 1872 mg/kg caused changes in motor activity, muscle contraction or spasticity, and coma.

Carcinogenicity Not listed by the IARC, NTP, or OSHA
Acute Effects Inhalation of vapors irritates the eyes, nose, and throat. Skin contact is irritating. Prolonged contact with the eyes has caused a local brown discoloration of the conjunctiva. Ingestion causes irritation of the mouth and stomach and possible abdominal pain, vomiting, diarrhea, rapid and weak pulse, and low blood pressure (symptoms appear 10 to 60 min after ingestion). Cyanosis, secondary shock, and coma have occurred from ingestion of iron salts. Type and degree of symptoms depend on the percentage of ferric chloride in solution.

Chronic Effects Prolonged or repeated skin contact causes skin staining, irritation, and dermatitis.

◆ SECTION 5 FIRST AID PROCEDURES

Eye Contact Promptly flush eyes with plenty of running water for at least 15 min, including under eyelids. Get prompt medical attention.

Skin Contact After flushing with large amounts of water, wash exposed areas with soap and water. For reddened or blistered skin, get prompt medical attention.

Inhalation Remove victim from area of exposure to fresh air and support breathing as necessary.

Ingestion Contact a poison control center.* Never give

anything by mouth to an unconscious or convulsing person. Unless otherwise advised, give that conscious and alert person water or milk to drink. Get prompt medical attention.

Get proper in-school, paramedic, or community medical attention and support.

* See listings on pages 2-8 of *Resources/Manufacturers Index*.

◆ SECTION 6 FIRE PROCEDURES AND DATA

Fire Hazards For fires involving large quantities, firefighters should wear appropriate protective clothing and respirators. Because fire may produce toxic thermal decomposition products, a self-contained breathing apparatus (SCBA) is recommended.

Flash Point and Method Noncombustible

Autoignition Temperature Noncombustible

Flammability Limits in Air (vol. %) None reported

Hazardous Decomposition Products Thermal oxidative decomposition of ferric chloride solution can produce toxic and irritating hydrogen chloride gas.

Extinguishing Media Because ferric chloride solution is noncombustible, use extinguishing agents suitable for surrounding fire such as dry chemical, carbon dioxide (CO₂), water spray, and foam.

◆ SECTION 7 PHYSICAL DATA

Boiling Point (30% Solution) approximately 223 °F (106 °C)

Freezing Point (30% Solution) -58 °F (-50 °C)

Vapor Pressure (30% Solution) 40 mm Hg at 95 °F (35 °C)

Solubility in Water Soluble

Other Solubilities Alcohol, acetone, ether, and glycerol; slightly soluble in carbon disulfide

pH <1 (30%), 2.0 (0.1 molar aqueous solution), ACIDIC

Molecular Weight 162.22 (FeCl₃), 270.32 (FeCl₃ · 6H₂O)

Specific Gravity (H₂O = 1) 1.3-1.5 (30%-45% Solution)

Average Crystallization Temperature -58 °F (-50 °C), 30%; 7 °F (-14 °C), 39%; 48 °F (9 °C), 45%

Absolute Viscosity (cP) at 80 °F (26.7 °C) 4.1, 30%; 6.8, 37.5%; 12.7, 45%

References 1, 73, 100, 101, 103, 124, 126, 127, 136, 153, 159, 162, 163, 164, 168; Genium's *Material Safety Data Sheets Collection*, No. 19 (6/92)

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