SAFETY DATA SHEET

Updated on 26/09/2024

1. Material Identification

Product Name : Cupric sulfate
Catalog Number : io-2053
CAS Number : 7758-98-7
Identified uses : Laboratory chemicals, manufacture of chemical compounds
Company : Ionz

>> R&D Use only

2. Hazards Identification

GHS Classification:

Flammable liquid (category 2)
Acute toxicity, oral (Category 3)
Acute toxicity, dermal (Category 3)
Acute toxicity, inhalation (Category 3)
Specific target organ toxicity, single exposure (Category 1)

Note

>> Pictograms displayed are for 98.8% (1194 of 1208) of reports that indicate hazard statements. This chemical does not meet GHS hazard criteria for 1.2% (14 of 1208) of reports.

Pictogram(s)

GHS Hazard Statements

>> H302 (96.1%): Harmful if swallowed [Warning Acute toxicity, oral]

>> H315 (78.7%): Causes skin irritation [Warning Skin corrosion/irritation]

>> H318 (20.3%): Causes serious eye damage [Danger Serious eye damage/eye irritation]

>> H319 (78.6%): Causes serious eye irritation [Warning Serious eye damage/eye irritation]

>> H400 (98.7%): Very toxic to aquatic life [Warning Hazardous to the aquatic environment, acute hazard]

>> H410 (98.7%): Very toxic to aquatic life with long lasting effects [Warning Hazardous to the aquatic environment, long-term hazard]

Precautionary Statement Codes

>> P264, P264+P265, P270, P273, P280, P301+P317, P302+P352, P305+P351+P338, P305+P354+P338, P317, P321, P330, P332+P317, P337+P317, P362+P364, P391, and P501

Health Hazards:

>> INGESTION: copper sulfate may induce severe gastroenteric distress (vomiting, gastroenteric pain, and local corrosion and hemorrhages), prostration, anuria, hematuria, anemia, increase in white blood cells, icterus, coma, respiratory difficulties, and circulatory failure. (USCG, 1999)

>> Excerpt from ERG Guide 151 [Substances - Toxic (Non-Combustible)]:

>> Non-combustible, substance itself does not burn but may decompose upon heating to produce corrosive and/or toxic fumes. Containers may explode when heated. Runoff may pollute waterways. (ERG, 2024)

>> Not combustible. Gives off irritating or toxic fumes (or gases) in a fire. Many reactions may cause fire or explosion. See Chemical dangers

3. Composition/Information On Ingredients

Chemical name : Cupric sulfate
CAS Number : 7758-98-7
Molecular Formula : CuO4S
Molecular Weight : 159.6100 g/mol

4. First Aid Measures

First Aid:

>> INGESTION: induce vomiting and administer gastric lavage; give a saline cathartic, fluid therapy, and transfusions if required; calcium disodium EDTA has been found moderately effective.

>> SKIN AND EYES: wash affected tissues with water. (USCG, 1999)

First Aid Measures

Inhalation First Aid

>> Fresh air, rest.

Skin First Aid

>> Rinse skin with plenty of water or shower. Refer for medical attention if skin irritation occurs.

Eye First Aid

>> First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then refer for medical attention.

Ingestion First Aid

>> Do NOT induce vomiting. Give one or two glasses of water to drink. Refer for medical attention .

5. Fire Fighting Measures

>> Excerpt from ERG Guide 151 [Substances - Toxic (Non-Combustible)]:

>> SMALL FIRE: Dry chemical, CO2 or water spray.

>> LARGE FIRE: Water spray, fog or regular foam. If it can be done safely, move undamaged containers away from the area around the fire. Dike runoff from fire control for later disposal. Avoid aiming straight or solid streams directly onto the product.

>> FIRE INVOLVING TANKS, RAIL TANK CARS OR HIGHWAY TANKS: Fight fire from maximum distance or use unmanned master stream devices or monitor nozzles. Do not get water inside containers. Cool containers with flooding quantities of water until well after fire is out. Withdraw immediately in case of rising sound from venting safety devices or discoloration of tank. ALWAYS stay away from tanks in direct contact with flames. For massive fire, use unmanned master stream devices or monitor nozzles; if this is impossible, withdraw from area and let fire burn. (ERG, 2024)

>> In case of fire in the surroundings, use appropriate extinguishing media.

6. Accidental Release Measures

Isolation and Evacuation:

Isolation and evacuation measures to take when a large amount of this chemical is accidentally released in an emergency.

>> Excerpt from ERG Guide 151 [Substances - Toxic (Non-Combustible)]:

>> IMMEDIATE PRECAUTIONARY MEASURE: Isolate spill or leak area in all directions for at least 50 meters (150 feet) for liquids and at least 25 meters (75 feet) for solids.

>> SPILL: Increase the immediate precautionary measure distance, in the downwind direction, as necessary.

>> FIRE: If tank, rail tank car or highway tank is involved in a fire, ISOLATE for 800 meters (1/2 mile) in all directions; also, consider initial evacuation for 800 meters (1/2 mile) in all directions. (ERG, 2024)

Spillage Disposal:

Methods for containment and safety measures to protect workers dealing with a spillage of this chemical.

>> Personal protection: particulate filter respirator adapted to the airborne concentration of the substance, protective clothing, protective gloves and safety goggles. Do NOT let this chemical enter the environment. Sweep spilled substance into covered containers. If appropriate, moisten first to prevent dusting. Then store and dispose of according to local regulations.

7. Handling And Storage

Safe Storage:

>> Well closed. Dry. Store only in original container. Store in an area without drain or sewer access.

Storage Conditions:

>> KEEP TIGHTLY CLOSED.

8. Exposure Control/ Personal Protection

>> 1.0 [mg/m3], as Cu

>> 1.0 [mg/m3], as Cu

>> 0.2 mg/m

MAK (Maximale Arbeitsplatz Konzentration)

>> (respirable fraction): 0.01 mg/m

Inhalation Risk:

>> Evaporation at 20 °C is negligible; a harmful concentration of airborne particles can, however, be reached quickly when dispersed, especially if powdered.

Effects of Short Term Exposure:

>> The substance is irritating to the eyes, skin and respiratory tract. The is severely irritating to the gastrointestinal tract. Exposure could cause haemolysis, kidneys and liver impairment.

Effects of Long Term Exposure:

>> Repeated or prolonged inhalation of the aerosol may cause effects on the lungs. The substance may have effects on the liver and kidneys, resulting in impaired functions.

Fire Prevention

>> NO contact with incompatible substances. See Chemical Dangers.

Exposure Prevention

>> PREVENT DISPERSION OF DUST!

Inhalation Prevention

>> Use local exhaust or breathing protection.

Skin Prevention

>> Protective gloves.

Eye Prevention

>> Wear face shield or eye protection in combination with breathing protection.

Ingestion Prevention

>> Do not eat, drink, or smoke during work. Wash hands before eating.

Exposure Control and Personal Protection

Maximum Allowable Concentration (MAK)

>> 0.01 [mg/m3], respirable fraction (Cu, inorganic cmpnds)[German Research Foundation (DFG)]

9. Physical And Chemical Properties

Molecular Weight:

>> 159.61

Exact Mass:

>> 158.881327

Physical Description:

>> Cupric sulfate appears as a white or off-white solid. Melting point 200 °C with decomposition. Non-combustible.

>> WHITE HYGROSCOPIC CRYSTALS.

Color/Form:

>> Grayish-white to greenish-white rhombic crystals or amorphous powder /SRP: somewhat wet/

Odor:

>> Pleasant odor

Boiling Point:

Melting Point:

Solubility:

>> Very soluble in hot water, soluble cold water

>> Solubility in water, g/l at 20 °C: 203 (freely soluble)

Density:

>> 2.29 at 59 °F (USCG, 1999) - Denser than water; will sink

>> 3.6 g/cm³

Autoignition Temperature:

>> Not flammable (USCG, 1999)

Decomposition:

>> When heated to decomposition it emits toxic fumes of /sulfur oxides/.

>> 650 °C. This produces toxic fumes of sulfur oxides (see ICSC 0074). Reacts violently with hydroxylamine. This generates fire hazard. Reacts with magnesium powder. This produces flammable/explosive gas (hydrogen - see ICSC 0001). Reacts with acetylene and potassium chlorate. This generates explosion hazard. Attacks some metals in the presence of water.

Refractive Index:

>> INDICES OF REFRACTION: 1.733, 1.724, 1.739

10. Stability And Reactivity

>> Soluble in water.

11. Toxicological Information

Toxicity Summary:

>> For healthy, non-occupationally-exposed humans the major route of exposure to copper is oral. The mean daily dietary intake of copper in adults ranges between 0.9 and 2.2 mg. ... In some cases, drinking water may make a substantial additional contribution to the total daily intake of copper, particularly in households where corrosive waters have stood in copper pipes. ... All other intakes of copper (inhalation and dermal) are insignificant in comparison to the oral route. Inhalation adds 0.3-2.0 ug/day from dusts and smoke. Women using copper IUDs are exposed to only 80ug or less of copper per day from this source. The homeostasis of copper involves the dual essentiality and toxicity of the element. Its essentiality arises from its specific incorporation into a large number of proteins for catalytic and structural purposes. The cellular pathways of uptake, incorporation into protein and export of copper are conserved in mammals and modulated by the metal itself. Copper is mainly absorbed through the gastrointestinal tract. From 20 to 60% of the dietary copper is absorbed, with the rest being excreted through the feces. Once the metal passes through the basolateral membrane it is transported to the liver bound to serum albumin. The liver is the critical organ for copper homeostatis. The copper is partitioned for excretion through the bile or incorporation into intra- and extracellular proteins. The primary route of excretion is through the bile. The transport of copper to the peripheral tissues is accomplished through the plasma attached to serum albumin, ceruloplasmin or low-molecular weight complexes. ... The biochemical toxicity of copper, when it exceeds homeostatic control, is derived from its effects on the structure and function of biomolecules, such as DNA, membranes and proteins directly or through oxygen-radical mechanisms. The toxicity of a single oral dose of copper varies widely between species. ... The major soluble salts (copper(II) sulfate, copper(II) chloride) are generally more toxic than the less soluble salts (copper(II) hydroxide, copper (II) oxide). Death is preceded by gastric hemorrhage, tachycardia, hypotension, hemolytic crisis, convulsions and paralysis. ... Long-term exposure in rats and mice showed no overt signs of toxicity other than a dose-related reduction in growth after ingestion ... The effects included inflammation of the liver and degeneration of kidney tubule epithelium. ... Some testicular degeneration and reduced neonatal body and organ weights were seen in rats ... and fetotoxic effects and malformations were seen at high dose levels. ... Neurochemical changes have been reported after oral administration ... A limited number of immunotoxicity studies showed humoral and cell-mediated immune function impairment in mice after oral intakes in drinking-water ... Copper is an essential element and adverse health effects /in humans/ are related to deficiency as well as excess. Copper deficiency is associated with anemia, neutropenia and bone abnormalities but clinically evident deficiency is relatively infrequent in humans. .. Except for occasional acute incidents of copper poisoning, few effects are noted in normal /human/ populations. Effects of single exposure following suicidal or accidental oral exposure have been reported as metallic taste, epigastric pain, headache, nausea, dizziness, vomiting and diarrhea, tachycardia, respiratory difficulty, hemolytic anemia, hematuria, massive gastrointestinal bleeding, liver and kidney failure, and death. Gastrointestinal effects have also resulted from single and repeated ingestion of drinking-water containing high copper concentrations, and liver failure has been reported following chronic ingestion of copper. Dermal exposure has not been associated with systemic toxicity but copper may induce allergic responses in sensitive individuals. Metal fume fever from inhalation of high concentrations in the air in occupational settings have been reported ... A number of groups are described where apparent disorders in copper homeostasis result in greater sensitivity to copper deficit or excess than the general population. Some disorders have a well-defined genetic basis. These include Menkes disease, a generally fatal manifestation of copper deficiency; Wilson disease (hepatolenticular degeneration), a condition leading to progressive accumulation of copper; and hereditary aceruloplasminemia, with clinical symptoms of copper overload. Indian childhood cirrhosis and idiopathic copper toxicosis are conditions related to excess copper which may be associated with genetically based copper sensitivity ... These are fatal conditions in early childhood where copper accumulates in the liver. ... Other groups potentially sensitive to copper excess are hemodialysis patients and subjects with chronic liver disease. Groups at risk of copper deficiency include infants (particularly low birth weight/preterm babies, children recovering from malnutrition, and babies fed exclusively with cow's milk), people with maladsorption syndrome (e.g., celiac disease, sprue, cystic fibrosis), and patients on total parenteral nutrition. Copper deficiency has been implicated in the pathogenesis of cardiovascular disease. The adverse effects of copper must be balanced against its essentiality. Copper is an essential element for all biota ... At least 12 major proteins require copper as an integral part of their structure. It is essential for the utilization of iron in the formation of hemoglobin, and most crustaceans and molluscs possess the copper-containing hemocyanin as their main oxygen-carrying blood protein. ... A critical factor in assessing the hazard of copper is its bioavailablity. Adsorption of copper to particles and complexation by organic matter can greatly limit the degree to which copper will be accumulated ... At many sites, physiochemical factors limiting bioavailability will warrant higher copper limits. ...

Carcinogen Classification:

This section provides the International Agency for Research on Cancer (IARC) Carcinogenic Classification and related monograph links. In the IARC Carcinogenic classification, chemicals are categorized into four groups: Group 1 (carcinogenic to humans), Group 2A (probably carcinogenic to humans), Group 2B (possibly carcinogenic to humans), and Group 3 (not classifiable as to its carcinogenicity to humans).

>> No indication of carcinogenicity to humans (not listed by IARC).

Health Effects:

>> People must absorb small amounts of copper every day because copper is essential for good health, however, high levels of copper can be harmful. Very-high doses of copper can cause damage to your liver and kidneys, and can even cause death. Copper may induce allergic responses in sensitive individuals. (L278, L279)

Exposure Routes:

>> The substance can be absorbed into the body by inhalation of its aerosol and by ingestion.

>> Oral (L277) ; inhalation (L277) ; dermal (L277)

Inhalation Exposure

>> Cough. Sore throat.

Skin Exposure

>> Redness. Pain.

Eye Exposure

>> Redness. Pain. Blurred vision.

Ingestion Exposure

>> Abdominal pain. Burning sensation. Nausea. Vomiting. Diarrhoea. Shock or collapse.

>> Breathing high levels of copper can cause irritation of the nose and throat. Ingesting high levels of copper can cause nausea, vomiting, diarrhea, headache, dizziness, and respiratory difficulty. (L278, L279)

Adverse Effects:

An adverse effect is an undesired harmful effect resulting from a medical treatment or other intervention.

>> Occupational hepatotoxin - Secondary hepatotoxins: the potential for toxic effect in the occupational setting is based on cases of poisoning by human ingestion or animal experimentation.

>> Methemoglobinemia - The presence of increased methemoglobin in the blood; the compound is classified as secondary toxic effect

Toxicity Data:

>> LD50: 300 mg/kg (Oral, Rat) (L341) LD50: 20 mg/kg (Intraperitoneal, Rabbit) (L341) LD50: 43 mg/kg (Subcutaneous, Rat) (L341) LD50: 49 mg/kg (Intravenous, Rat) (L341)

Minimum Risk Level:

The minimal risk level (MRL) is an estimate of the amount of a chemical a person can eat, drink, or breathe each day without a detectable risk to health

>> Acute Oral: 0.01 mg/kg/day (L134) Intermediate Oral: 0.01 mg/kg/day (L134)

Treatment:

Treatment when exposed to toxin

>> EYES: irrigate opened eyes for several minutes under running water. INGESTION: do not induce vomiting. Rinse mouth with water (never give anything by mouth to an unconscious person). Seek immediate medical advice. SKIN: should be treated immediately by rinsing the affected parts in cold running water for at least 15 minutes, followed by thorough washing with soap and water. If necessary, the person should shower and change contaminated clothing and shoes, and then must seek medical attention. INHALATION: supply fresh air. If required provide artificial respiration.

Interactions:

>> THE IV INDUCED STIMULATION OF ALPHA-ADRENERGIC NERVOUS SYSTEM BY CUPRIC SULFATE WAS PARTIALLY ATTENUATED BY PRETREATMENT OF SHEEP WITH METHYSERGIDE. PHENOXYBENZAMINE COMPLETELY BLOCKED THE EFFECTS OF CUPRIC SULFATE & TREATMENT WITH PROPRANOLOL ENHANCED THE EFFECTS.

Antidote and Emergency Treatment:

>> Basic treatment: Establish a patent airway. Suction if necessary. Watch for signs of respiratory insufficiency and assist ventilations if necessary. Administer oxygen by nonrebreather mask at 10 to 15 L/min. Monitor for shock and treat if necessary ... . For eye contamination, flush eyes immediately with water. Irrigate each eye continuously with normal saline during transport ... . Do not use emetics. For ingestion, rinse mouth and administer 5 ml/kg up to 200 ml of water for dilution if the patient can swallow, has a strong gag reflex, and does not drool. Administer activated charcoal ... . /Copper and related compounds/

Human Toxicity Excerpts:

>> A ... NUMBER OF CASES OF ACUTE POISONING IN MAN FROM INGESTING COPPER SULFATE, SOME OF THEM FATAL, HAVE BEEN REPORTED ... FROM NEW DELHI ... . THE REPORT CONCERNS 48 HOSPITALIZED PATIENTS & 5 AUTOPSY CASES, 2/3 MALE, MOSTLY BETWEEN THE AGES OF 16 & 25 YR. DOSAGE ESTIMATES RANGED FROM 1 TO 12 G ... SWALLOWED IN WATER. SYMPTOMS ... WERE ... METALLIC TASTE, BURNING IN EPIGASTRIUM, & REPEATED VOMITING. IN MORE SEVERE CASES, DIARRHEA (14 PATIENTS) APPEARED ON THE FIRST OR SECOND DAY & LASTED 24 HR; 20 ... SHOWED BLOOD IN GI TRACT FROM INJURY TO GASTRIC MUCOSA, LEADING TO ULCERATION IN SEVERE CASES. SUPPRESSION OF URINE FOLLOWED JAUNDICE ... . LIVER BIOPSY SHOWED CENTRILOBULAR NECROSIS & BILIARY STASIS. HYPERTENSION LEADING TO SHOCK ... CONSIDERED BAD PROGNOSTIC SIGN: 3 OF 4 DIED. COMA DEVELOPED IN 4, PRESUMABLY DUE TO UREMIA FROM RENAL INJURY, & DEATHS OCCURRED IN 7 (14.6%).

Non-Human Toxicity Excerpts:

>> IN ANIMALS INGESTION OF 3 OZ OF 1% SOLN OF CUPRIC SULFATE WILL PRODUCE INTENSE INFLAMMATION OF GASTROINTESTINAL TRACT, WITH SYMPTOMS OF ABDOMINAL PAIN, VOMITING, & DIARRHEA.

Non-Human Toxicity Values:

>> LD50 Rat oral 300 mg/kg body weight LD50 Rabbit Oral 125 mg/kg body weight LD100 Mouse Oral 50 mg/kg body weight /from table/

Protein Binding:

In this section, "protein binding" refers to the degree to which medications attach to plasma proteins (i.e., proteins within the blood, such as human serum albumin, lipoprotein, glycoprotein and globulins). A drug's efficiency may be affected by the degree to which it binds to plasma proteins. The less bound a drug is, the more efficiently it can traverse cell membranes or diffuse.

>> About 80 percent of the absorbed copper is bound to liver metallothionein; the remainder is incorporated into cytochrome c oxidase or sequestered by lysosomes. The bioavailability of copper from the diet is about 65-70% depending on a variety of factors including chemical form, interaction with other metals, and dietary components.

12. Ecological Information

ICSC Environmental Data:

>> The substance is very toxic to aquatic organisms. The substance may cause long-term effects in the aquatic environment. Bioaccumulation of this chemical may occur along the food chain, for example in fish. It is strongly advised not to let the chemical enter into the environment.

13. Disposal Considerations

Spillage Disposal

>> Personal protection: particulate filter respirator adapted to the airborne concentration of the substance, protective clothing, protective gloves and safety goggles. Do NOT let this chemical enter the environment. Sweep spilled substance into covered containers. If appropriate, moisten first to prevent dusting. Then store and dispose of according to local regulations.

Disposal Methods

>> SRP: At the time of review, criteria for land treatment or burial (sanitary landfill) disposal practices are subject to significant revision. Prior to implementing land disposal of waste residue (including waste sludge), consult with environmental regulatory agencies for guidance on acceptable disposal practices.

>> Group III Containers (both combustible and non-combustible) that previously held organic mercury, lead, cadmium, arsenic, or inorganic pesticides should be triple rinsed, punctured and disposed of in a sanitary landfill. Non-rinsed containers should be encapsulated and buried at a specially designated landfill site. /Organic mercury, lead, cadmium, arsenic, or inorganic pesticides/

>> The following wastewater treatment technologies have been investigated for copper (II) sulfate: activated carbon.

>> Add slowly to a large container of water. Stir in slight excess of soda ash. Let stand for 24 hr. Decant or siphon into another container and neutralize with 6 M HCl. ... The sludge may be added to landfill. Recommendable methods: Precipitation, solidification, & landfill. Peer-review: ... Copper can be recovered by cation exchange. (Peer-review conclusions of an IRPTC expert consultation (May 1985))

14. Transport Information

DOT

Cupric sulfate

Reportable Quantity of 10 lb or 45

IATA

Cupric sulfate

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15. Regulatory Information

Federal Drinking Water Standards:

Federal drinking water standards (e.g. maximum containment level (MCL)) for this chemical. These standards are legally enforceable.

>> EPA 1300 ug/l (Action Level) /Copper/

Federal Drinking Water Guidelines:

Federal drinking water guidelines (e.g. maximum containment level (MCL)) for this chemical. In general, these guidelines are recommendations and not legally enforceable.

>> EPA 1000 ug/l /Copper/

Clean Water Act Requirements:

The Clean Water Act (CWA) of 1972 establishes the basic structure for regulating discharges of pollutants into the waters of the United States and regulating quality standards for surface waters. Under CWA, the U.S. Environmental Protection Agency (EPA) developed the Toxic Pollutant List (40 CFR Part 401.15) and the Priority Pollutant List (40 CFR Part 423, Appendix A). These lists are to be used by EPA and States to develop the Effluent Guidelines regulations and ensure water quality criteria and standards.

>> Toxic pollutant designated pursuant to section 307(a)(1) of the Federal Water Pollution Control Act and is subject to effluent limitations. /Copper and cmpd/

Regulatory Information

The Australian Inventory of Industrial Chemicals

>> Chemical: Sulfuric acid, copper(2+) salt (1:1)

REACH Registered Substance

>> Status: Active Update: 22-12-2022 https://echa.europa.eu/registration-dossier/-/registered-dossier/15416

>> Status: Cease Manufacture Update: 06-05-2018 https://echa.europa.eu/registration-dossier/-/registered-dossier/24414

New Zealand EPA Inventory of Chemical Status

>> Copper (II) sulphate, basic: Does not have an individual approval but may be used under an appropriate group standard

New Zealand EPA Inventory of Chemical Status

>> Sulfuric acid, copper(2+) salt: Does not have an individual approval but may be used as a component in a product covered by a group standard. It is not approved for use as a chemical in its own right.

New Zealand EPA Inventory of Chemical Status

>> Copper sulphate: Does not have an individual approval but may be used under an appropriate group standard

16. Other Information

Other Safety Information

Chemical Assessment

>> IMAP assessments - Sulfuric acid, copper(2+) salt (1:1): Human health tier I assessment

"The information provided is believed to be accurate but is not comprehensive and should be used as a reference. It reflects our current knowledge and is intended for safety guidance related to the product. This document does not constitute a warranty of the product's properties. Ionz is not responsible for any damages resulting from handling or contact with the product incorrectly."