# NOSB Materials Database

## Identification

**Common Name** **Coppers, fixed** **Chemical Name**

**Other Names** fixed copper, copper hydroxides, basic sulfates, oxychlorides and oxides.

**Code #: CAS** 7758-98-7 (Copper Sulfate) **Code #: Other** 20427-59-2 (Copper Hydroxide)

**N. L. Category** Synthetic Allowed **MSDS** **yes (Kocide)**

## Chemistry

**Family**

**Composition** Copper sulfate: $CuSO_4$, copper hydroxide: $Cu(OH)_2$, copper oxide: CuO.

**Properties** Blue crystals, granules, or powder.($CuSO_4$). Light blue powder with characteristic copper odor ($Cu(OH_2)$). Not very soluble in water. pH 8.9.

**How Made**

Copper Sulfate is made by oxidizing copper turnings (from mining copper ore) in (special) furnaces in a current of air. The mass is then dissolved in sulfuric acid. and then purified. Copper (II) Oxide is made the same way only without the sulfuric acid, or it can be made by ignition of copper (II) nitrate or the basic carbonate. Copper (II) Hydroxide is obtained by electrolyzing a copper anode in an electrolyte containing sodium sulfate and trisodium phophate.

## Use/Action

**Type of Use** Crops

**Use(s)** Disease control in tree fruit and vegetables.
Many of the other fixed coppers are less caustic and thus safer for the applicator than copper sulfate.

**Action** The toxic action of copper is attributed to its abiltiy to denature (change) the properties of cellular proteins and to deactivate enzyme systems in fungi and algae.

**Combinations**

## Status

**OFPA** 6517 (c) (1) (B)(i) synthetic on list as copper

**N. L. Restriction** Must be used in a manner that prevents accumulation of copper in the soil. Fixed coppers must be exempt from tolerance by the EPA.

**EPA, FDA, etc**

**Safety Guidelines** wear protective clothing **Directions**

**Registration** **State Differences**

**Historical status** OFPANA allowed

**Internationl status** IFOAM ok; CODEX ok ($CuSO_4$)

# OFPA Criteria

**2119(m)1: chemical interactions**

Corrosive to metals, incompatible with strong oxidizers, reacts vigorously with reducing agents. Solutions of sodium hypobromite are decomposed by catalytic action of cupric ions.

**2119(m)2: toxicity & persistence**

–Excess copper is toxic to plants, with symptoms being disturbances in transpiration, water regulation, and cell membrane permeability. Also root stunting and reduced growth vigor.
–Breaks down into its components of calcium, sulfur, water, and copper easily in the soil. These are then adsorbed or recombined in the soil solution. Non-persistent as compounds, but copper itself is relatively immobile in soil and can persist and accumulate.

**2119(m)3: manufacture & disposal consequences**

All the manufacturing issues of copper mining will be relevant as well as the extraction processes.

**2119(m)4: effect on human health**

Chronic exposure- repeated ingestion of copper salts has produced hemolytic anemia, impaired immune response, liver, kidney, lung, and spleen damage and death in animals. Moderately acute toxicity to humans; LD50 (oral) 1000 mg/kg in rats. No carcinogen status, corrosive- eyes and ingestion; irritant- inhalation and skin. Acute toxicity if ingested, may cause gastroenteric pain, blue discoloration of bums and tongue, prostration, loss of consciousness, convulsions, may affect the liver, kidneys, and blood. The hazards are almost entirely associated with application and not with human consumption of any residues on food.

**2119(m)5: agroecosystem biology**

While copper is an essential nutrient for plants in balanced amounts, excess residues in manure or organic waste materials may accumulate in soils and effect microorganisms and earthworms. Copper forms a variety of inorganic and organic complexes in the soil environment. How soluble any of the copper is (and thus potentially phytotoxic) is dependent on pH, the amount of organic matter in the soil, and other factors. Some bacteria have evolved mechanisms to regulate copper uptade and resist copper toxicity.

**2119(m)6: alternatives to substance**

Lime sulfur, silica, kelp, baking soda, plant nutrition, resistant varieties, cultural controls(pruning & sanitation), teas, microbial fungicides. Many of above have limited effect and are scientifically untested.

**2119(m)7: Is it compatible?**

# References

McMurtry,-M.J., "Avoidance of sublethal doses of copper and zinc by tubificid oligochaetes." J-Great-Lakes-Res. [Toronto] : International Association for Great Lakes Research. 1984. v. 10 (3) p. 267-272.
**CN: DNAL GB1627.G8J6**

Miller,-W.P.; Martens,-D.C.; Zelazny,-L.W., "Short-term transformations of copper in copper-amended soils." J-Environ-Qual. Madison, Wis. : American Society of Agronomy. Apr/June 1987. v. 16 (2) p. 176-181.
**CN: DNAL QH540.J6**

Boyer, J. et al. 1994. Copper Fungicides and Certifiable Organic Produce: a Report to the Maine Organic Farmers and Growers Association. PSE 546 Chemistry of Soils paper.

See also attached.

# COPPER REFERENCES

## COPPER HYDROXIDE

AU: Menkissoglu,-O.; Lindow,-S.E.
TI: Chemical forms of copper on leaves in relation to the bactericidal activity of cupric hydroxide deposits on plants.
SO: Phytopathology. St. Paul, Minn. : American Phytopathological Society. Oct 1991. v. 81 (10) p. 1263-1270.
**CN: DNAL 464.8-P56**
AB: The total amount of copper, the amount of soluble but complexed copper, and the concentration of free Cu2+ ions on the surface of navel orange and bean leaves treated with different amounts of Cu(OH)2 or Bordeaux mixture were determined under field conditions. Total copper deposits decreased with time after spray application with apparent first-order kinetics with a half-life of approximately 45 and 35 days on navel orange and bean leaves, respectively. The concentration of soluble but complexed copper, however, increased for 20-30 days following spray application and comprised approximately 25 and 10% of the total copper on treated navel orange and bean leaves, respectively. Thus, even though very low concentrations of Cu2+ are present on leaves, copper-sensitive strains are killed by the concentrations of free Cu2+ present on leaves. Soluble but complexed forms of copper, while abundant on leaves, have no significant toxicity towards strains of P. syringae.

AU: Rhoads,-F.M.; Olson,-S.M.; Manning,-A.
TI: Copper toxicity in tomato plants.
SO: J-Environ-Qual. Madison, Wis. : American Society of Agronomy. Apr/June 1989. v. 18 (2) P. 195-197.
**CN: DNAL QH540.J6**
AB: Copper (Cu)-containing fungicides and bactericides are used extensively for disease control on staked tomatoes (Lycopersicon esculentum Mill.) in North Florida. Since Cu moves very little in most soils, the potential for Cu buildup in tomato fields is substantial over a period of continuous tomato culture. The purpose of this research was to determine the Cu levels of soil and plant tissue, which are associated with reduced growth, and the influence of soil acidity on Cu uptake and growth response of tomatoes to soil Cu.

AU: Hare,-J.D.
TI: Suppression of the Colorado potato beetle, Leptinotarsa decemlineata (Say) (Coleoptera:Chrysomelidae), on solanaceous crops with a copper-based fungicide.
SO: Environ-Entomol. College Park, Md. : Entomological Society of America. Aug 1984. v. 13 (4) p. 1010-1014.
**CN: DNAL QL461.E532**
LA: English

## COPPER OXYCHLORIDE

AU: Gadoury,-D.M.; Pearson,-R.C.; Riegel,-D.G.; Seem,-R.C.; Becker,; & Pscheidt.
TI: Reduction of powdery mildew and other diseases by over-the-trellis applications of lime sulfur to dormant grapevines.
SO: Plant-dis. [St. Paul, Minn., American Phytopathological Society]. Jan 1994. v. 78 (1) p. 83-87.
**CN: DNAL 1.9-P69P**

AU: Mosch,-J.; Klingauf,-F.; Zeller,-W.
TI: On the effect of plant extracts against fireblight (Erwinia amylovora).
SO: Acta-Hortic. Wageningen : International Society for Horticultural Science. June 1990. (273) p. 355-361.
**CN: DNAL 80-AC82**
AB: First studies on the efficacy of plant extracts against the fireblight pathogen Erwinia amylovora were undertaken under in vitro- and in vivo conditions. Under field conditions 3 of these effective

extracts from B. vulgaris, R. typhina, M. aquifolium and one from Allium sativum showed in prophylactic sprayments against blossom blight on Cotoneaster salicifolius var. floccosus a significant control up to 53%, but were usually less efficient than the bactericides Streptomycin (100 ppm) and copper-oxychloride (1%) used for comparison. From two plant extracts a possible resistance induction effect is discussed.

TI: Is copper oxychloride still valid for decay control? Seed treatment. E ancora valido l'ossicloruro di rame per combattere la carie.
SO: Sementi-Elette. Bologna, Edagricole. Nov/Dec 1981. v. 27 (6) p. 5-6.
**CN: DNAL 61.8-SE53**
LA: Italian; Summary in: English

AU: Ramakrishnan,-C-K
TI: On the use of copper oxychloride in controlling leaf-fall and fruit-rot of oranges
SO: Agr-Res-J-Kerala, Mar 1970, 7 (1): 51-52.
**CN: DNAL 22-AG823**

## MISCELLANEOUS COPPER

Alva, A.K. 1993. Copper contamination of sandy soils and effects on young Hamlin orange trees. Bulletin of Environmental Contamination and Toxicology, 51: 857-864.

Aoyama, M.; Itaya, S.; and Otawa, M. 1993. Effects of copper on the decompostion of plant microbial biomass, and beta-glucosidase activity in soils. Soil Science and Plant Nutrition, 39: 557-566.

Baker, D.E. 1990. Copper. pp. 151-176 *in* Heavy metals in soils, Alloway, B.J. ed.

Committee on Medical and Biologic Effects of Environmental Pollutants. 1977. Copper. National Academy of Sciences: Washington, D.C. 115 pp.

Griffin

# MATERIAL SAFETY DATA SHEET

**EMERGENCY ASSISTANCE**
**GRIFFIN:** 912/242-8635
**CHEMTREC:** 800/424-9300

DATE: 11/93


## SECTION 1 NAME AND HAZARD SUMMARY

MATERIAL NAME: Kocide® 101

Hazard summary (as defined by OSHA Hazard Communication Standard, 29 CFR 1910.1200):

Physical Hazards: None

Health Hazards: Inhalation, Irritant (skin and mucous membrane), Corrosive (eye - causes irreversible eye damage), Poisoning by copper salts may affect the liver and kidneys.

Read the entire MSDS for a more thorough evaluation of the hazards.

| SECTION 2 INGREDIENTS | % | TLV (ACGIH) |
|---|---|---|
| Copper Hydroxide (CAS #20427-59-2) | 77 | 1 mg/m³ (Dusts and Mists as Copper) |

Ingredients not precisely identified are proprietary or nonhazardous. Values are not product specifications.

## SECTION 3 PHYSICAL DATA

Appearance and odor: Light blue powder with characteristic copper odor.

Boiling point: No data

Melting point: Decomposes

Density: 8 - 12 lb/ft³

Solubility in water: Disperses to form an emulsion. Cupric hydroxide is insoluble in cold water and decomposes in hot water.

Vapor pressure (mmHg at 20°C): No data

Vapor density (air = 1): No data

Percent volatile by volume: No data

pH: 8.9

Griffin Corporation
P.O. Box 1847, Rocky Ford Road
Valdosta, GA 31603-1847, U.S.A.
Phone: (912) 242-8635
Telex U.S.: 682-7210 GRIFFIN
Telex Intl.: 686-8694 GRIFINTL
Fax: 912-244-5813

## SECTION 4 FIRE AND EXPLOSION HAZARD DATA

Flash point: Not applicable
Autoignition temperature: No data
Flammable limits (STP): No data

Extinguishing media:
Dry chemical, carbon dioxide, water spray or foam.

Special fire fighting protective equipment:
Wear protective clothing and self-contained breathing apparatus.

Unusual fire and explosion hazards:
Negligible fire hazard when exposed to heat or flame.

## SECTION 5 REACTIVITY DATA

Stability:
Stable under normal conditions.

Incompatibility (materials to avoid):
None known.

Hazardous decomposition products:
Decomposes to CuO and $H_2O$ above 140° F.

Hazardous polymerization:
Will not occur.

## SECTION 6 HEALTH HAZARDS INFORMATION AND FIRST AID

Inhalation:

Acute exposure — Acute inhalation $LC_{50}$ 0.56 mg/L. May cause irritation of the mucous membranes. Exposure to copper fume may result in metallic taste, nausea, vomiting, and metal fume fever with chills, fever, aching muscles, dry throat and headache.

Chronic exposure — Repeated or prolonged inhalation of dust, mist or fumes of copper and copper salts may cause irritation of the upper respiratory tract and occasionally ulceration and perforation of the nasal septum.

First Aid — Remove victim to fresh air. If not breathing give artificial respiration preferably mouth-to-mouth. Get medical attention immediately.

Skin contact:

Acute exposure — Acute dermal $LD_{50}$ (rabbits) > 2000 mg/kg. May cause irritation. Many copper salts cause itching, eczema and, rarely, sensitization reactions in previously exposed persons.

Chronic exposure — Repeated or prolonged exposure may cause dermatitis. Rarely, sensitization to copper may occur.

First Aid — Remove contaminated clothing and shoes. Wash with plenty of soap and water until no evidence of chemical remains (approximately 15 - 20 minutes). Get medical attention.

Eye contact:

Acute exposure — May cause severe irritation with possible tissue damage and corneal opacification.

Chronic exposure — Depending on concentration and duration of contact, repeated or prolonged exposure may result in symptoms as in acute exposure.

## SECTION 6 HEALTH HAZARDS INFORMATION AND FIRST AID *(Cont'd.)*:

Eye contact *(Cont'd.)*

First Aid — Hold eyelids open and flush with water, until no evidence of chemical remains (at least 15 - 20 minutes). Get medical attention.

Ingestion:

Acute exposure — Oral $LD_{50}$ (rats) > 874 mg/kg. Ingestion of copper salts may result in irritation of the gastrointestinal tract, nausea, vomiting, salivation, gastric pain, hemorrhagic gastritis, diarrhea, capillary damage, liver and kidney damage, and central nervous system stimulation followed by depression. Jaundice, pain in the liver, and hemolytic anemia have been reported following acute human poisonings.

Chronic exposure — Repeated ingestion of copper salts may result in anemia, liver and kidney damage.

First Aid — Drink promptly a large quantity of milk, egg white, gelatin solution, or if these are not available, large quantities of water. Unless extensive vomiting has occurred, empty the stomach by gastric lavage with water, milk, sodium bicarbonate solution of a 0.1% solution of potassium ferrocyanide. (Gosselin, **Clinical Toxicology of Commercial Products, 5th Ed.).** Administration of gastric lavage should be performed by qualified medical personnel. Probable mucosal damage may contraindicate use of gastric lavage.

## SECTION 7 SPILL, LEAK AND DISPOSAL PROCEDURES

Steps to be taken in case material is released or spilled:

Sweep up and place in suitable (fiberboard) containers for later disposal.

Disposal method:

Do not reuse container. Disposal of material, wash water, spill residue, and container must be by methods consistent with local, state and federal regulations.

## SECTION 8 SPECIAL PROTECTION INFORMATION

Ventilation:

Provide local exhaust ventilation and/or general dilution ventilation to meet published exposure limits.

Protective clothing:

Applicators and other handlers must wear long-sleeved shirt and long pants, waterproof gloves and shoes plus socks.

Eye protection:

Wear protective eyewear to prevent contact with this substance.

## SECTION 9 SPECIAL PRECAUTIONS AND COMMENTS

Store below 35°C (95°F). Average shelf life under proper storage conditions is 2 years. Store in a clean, dry area. Do not store near feed, food, or within the reach of children.

This information herein is given in good faith but no warranty, expressed or implied, is made.