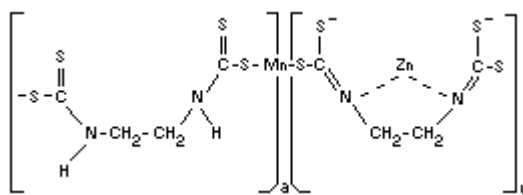


# Mancozeb



**Chemical name:** Mancozeb

**Other names:** ethylenebis {dithio-}, manganese zinc complex, Carbamic acid, manganous zinc salt, Dithane M-45, Mancozebe, Mankoceb, mankozeb, Manzate 200, Zinc manganese ethylenebisdithiocarbamate, etc.

**Compound:**  $(C_4H_6N_2S_4Mn)_a \cdot (C_4H_4N_2S_4Zn)_y$

**CAS Number:** 8018-01-7

**Pesticide type:** fungicide

## Characteristics

A fungicide belonging to a subclass of carbamate pesticides called dithiocarbamates (ethylene bisdithiocarbamates - EBDC). It is a combination of two other chemicals of this class, maneb and zineb. It affects the nervous system through its main metabolite, carbon disulfide (inhibits enzyme activity by complexing with metal-containing enzymes). First registered in the United States in 1948, mancozeb is marketed by the trade names Dithane, Manzeb, Nemispot and Manzane.

## Use

It is used to protect fruits, nuts, field crops. 5,6 million pounds of mancozeb are used annually, with the greatest use on potatoes and apples. In California it is one of the top chemicals used on onions (1,69 pounds/acre), pears (2,85 pounds/acre) and grapes. It is also used for seed treatment of cotton, potatoes, corn, safflower, sorghum, peanuts, tomatoes, flax, and cereal grains. It is available as dusts, liquids, water dispersible granules or as wettable powders.

Non-farmland uses: available for use in homes and nurseries, for flowers, ornamental trees, shrubs, golf courses. Also used in forests to control fungal diseases in conifer and fir trees.

## Possible hazards and regulation

Causes skin sensitization, chronic skin disease observed in exposed workers.

It is on PAN Bad Actors chemicals list, as it has many negative characteristics: potentially ground water contaminator, suspected endocrine disruptor, developmental or reproductive toxic.

In the USA, EPA included mancozeb on its Hazardous Air Pollutants list.

In Sweden, there were concerns about EBDCs since 1990s. Mancozeb was classified as carcinogenic and severely restricted there. In Norway, it was phased out by 2000.

EC Directive 2005/72/EC classifies mancozeb as active substance. The impurity ethylene thiourea considered to be of toxicological concern. As a result, Member States must pay attention to the potential for groundwater contamination, residues in food and evaluate the dietary exposure of consumers. They must also pay attention to the protection of birds, mammals, aquatic organisms. Conditions of authorisation must include risk mitigation measures.

In 1987, EPA issued a second Notice of Initiation of Special Review of the EBDC pesticides because of health concerns caused by ETU. In 1992 it was concluded that dietary risks of EBDCs exceeded the benefits for the uses for which they were registered. Issued new registration standards.

## Toxicity

EPA toxicity class: IV – practically nontoxic

The major concern is its primary metabolite, ethylenethiourea (ETU) which causes thyroid and

carcinogenic effects and birth defects in animals (at very high levels)

#### Toxicity to humans

It can affect the nervous system. Symptoms of exposure range from fatigue, headache, blurred vision to nausea. At high doses slurred speech, confusion or slowed heartbeat are common. In one study a worker developed a rash as well as inflammation of the eyelid after handling seedlings which had been treated with mancozeb.<sup>1</sup> In another study prolonged low-level exposure to mancozeb affected several aspects of immune function and association existed between mancozeb and neural tube defects.<sup>2</sup>

#### Acute toxicity limits

Nontoxic via the oral route with oral LD50 greater than 5000 mg/kg to greater than 11200 mg/kg in rats. Via the dermal route nontoxic as well (LD50 greater than 10000 mg/kg in rats).

#### Chronic toxicity:

No effects apparent in rats fed 5mg/kg/day in long term. A major concern is the generation of ETU in the course of mancozeb metabolism, which can also be produced during cooking (toxic effect is greatly increased by the process of heating or cooking the foods that have been sprayed with mancozeb).

#### Reproductive effects:

May reduce fertility, but no indication of embryotoxic effects when tested on rats, so unlikely to produce reproductive effects in humans.

#### Ecological effects

Slightly toxic to birds, moderately to highly toxic to fish and aquatic organisms – much more toxic to warmwater fish than to coldwater fish - (48-hour LC50 are 9mg/L in goldfish, 4,0 mg/L in carp), not toxic to honeybees (LC50 0,193 mg/bee). Not poisonous to plants.

#### Carcinogenicity

Listed by the State of California as a chemical known to cause cancer in humans. Studies from 1980s showed it could increase tumor incidence. Recently shown that it can damage DNA and initiate tumors in fetal cells.<sup>3</sup>

California Prop 65 Known Carcinogens – yes

U.S. EPA Carcinogens – B2 – probable

TRI Carcinogen – yes

In a study, workers at a lawn-care company were found to have a higher number of deaths from a type of blood cancer called non-Hodgkin's lymphoma. Two workers who died from it had worked at a branch where mancozeb had not been used. In another study, rates of deaths from thyroid were found to be higher among men in a region where mancozeb was used. No clear evidence.

**Mutagenity:** found to be mutagenic in one set of tests, while in another it did not cause mutations

**Bioaccumulation:** because mancozeb hydrolyses rapidly, it does not bioconcentrate in aquatic organisms

**Mobility:** low mobility

#### **Persistence and degradability in environment:**

Rapidly degraded in the environment by hydrolysis, oxidation, photolysis and metabolism. Low soil persistence (field half-life 1-7 days), rapidly and spontaneously degrades to ETU which persists longer (5-10 weeks). ETU suspected of being mobile in soils, however detected (at 0,016 mg/L) in only 1 out of 1295 drinking water wells. Half-life in water 1-2 days. Low potential to volatilize into the air. It might be found associated with air-borne particulates or as spray drift. In 1993, in a potato

field in California, 54% of samples had detectable residues, ranging from 0,29 to 1,81 g/m<sup>3</sup>

In a study, effects of mancozeb on C and N mineralization were measured in soil. Mancozeb caused significant decrease of nitrification to 11,2% and 5,6% in arable and grassland soil proving that potential risk exists to soil microorganisms and their activities in soils treated routinely by mancozeb.<sup>4</sup>

### **Limits**

0,03 mg/kg/day (INCHEM – 0 – 0,025) – ADI: acceptable daily intake for humans

USA – 65ppm: peanut, sugar beet, 25ppm: cereals, 10ppm: apples, celery, pears, papayas, less than 7ppm: most vegetables, flour, 0,5ppm: kidney, liver, peanuts, corn, cottonseed

Czech Republic (Vyhláška č.381/2007 Sb.) - celery: 0,3 mg/kg, vegetables: 0,2 – 3 mg/kg, meat, liver, dairy products: 0,05 mg/kg, strawberries: 10 mg/kg.

**Hazard Symbol** : Xi Irritant

Dangerous for the environment

### **Risk Phrases** :

R37 Irritating to respiratory system.

R43 May cause sensitisation by skin contact

### **Safety Phrases** :

S2 Keep out of reach of children

S8 Keep container dry

S24/25 Avoid contact with skin and eyes

S46 If swallowed, contact a doctor or Poisons Information Centre immediately and show this container or label

### **References**

<sup>1</sup> Edwards, I. R., Ferry, D. G. and Temple, W. A. Fungicides & related compounds, In Handbook of Pesticide Toxicology. Hayes, W. J. and Laws, E. R., Eds. Academic Press, New York, NY, 1991.4-2

<sup>2</sup> Journal of Environmental and Public Health, volume 2009, Article ID 412054, Total Pesticide Exposure Calculation among Vegetable Farmers in Benguet, Philippines

<sup>3</sup> Shukla, Y. & A. Arora. Transplacental carcinogenic potential of the carbamate fungicide mancozeb. Environ Pathol Toxicol Oncol. 2001;20(2):127-31.

<sup>4</sup> Černohlávková, Jitka - Jarkovský, Jiří - Hofman, Jakub. Effects fungicides mancozeb and dinocap on carbon and nitrogen mineralization. *Ecotoxicology and Environmental Safety*. ISSN 0147 -6513, 2009, vol. 72, no. 1, s. 80 -85.

U.S. Environmental Protection Agency. Pesticide Fact Sheet Number 125: Mancozeb. Office of Pesticides and Toxic Substances, Washington, DC, 1987.4-10

U.S. Environmental Protection Agency. Guidance for the Registration of Pesticide Products Containing Maneb as the Active Ingredient. Washington, DC, 1988.4-11

### **Links**

<http://environmentalcommons.org/cetos/criticalhabitat/mancozeb.pdf>

[http://www.pesticideinfo.org/Detail\\_Chemical.jsp?Rec\\_Id=PC35080](http://www.pesticideinfo.org/Detail_Chemical.jsp?Rec_Id=PC35080)

<http://extoxnet.orst.edu/pips/mancozeb.htm>

<http://www.inchem.org/documents/jmpr/jmpmono/v067pr22.htm>

<http://www.kendon.com.au/Catalogue/MSDS/horticultural/MancozebFungicide.htm>

[http://www.epa.gov/oppsrrd1/REDS/factsheets/mancozeb\\_fact.pdf](http://www.epa.gov/oppsrrd1/REDS/factsheets/mancozeb_fact.pdf)



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