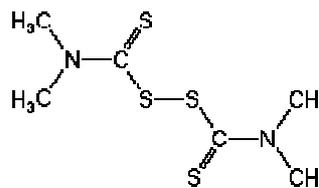
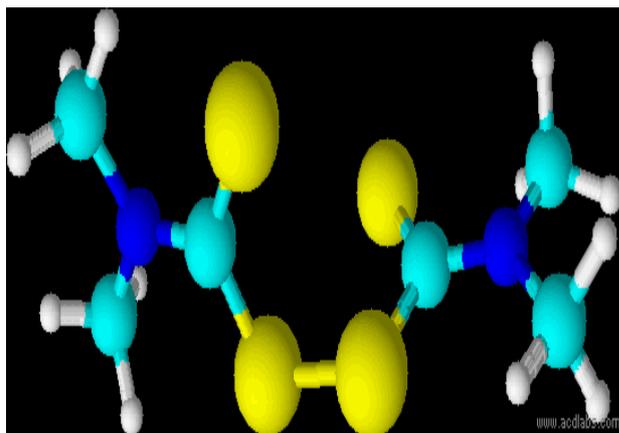


Thiram

Bis-(dimethylthiocarbamoyl)-disulfid



1. Structure



Yellow: Sulfur
Dark blue: Nitrogen
Light blue: Carbon
White: Hydrogen

Special Features in the Structure:

Disulfidbrücke
(symmetry)

2. Properties

Thiram has the form of yellow or light kristalls at room temperature. Water solves no Thiram, ethanol solves it bad. It is soluble in acetone, benzene, chloroform and disulfide. When thiram is finely dispersed in the air, there is an acute danger of explosion. After exceeding the melting point the material decompose in the several oxides.

3. Physical properties

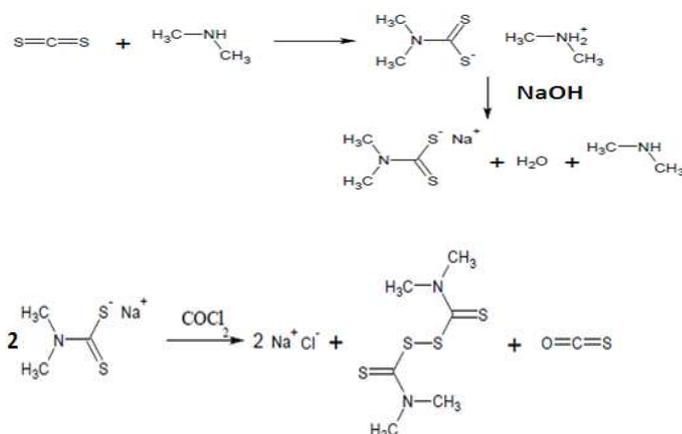
CAS-Number:	137-26-8
Molar mass:	240,44 g/mol
Density ρ :	1,29 g/cm ³
Melting point:	155-156°C
Boiling point:	129°C bei 26,6 hPa
Lethal dose:	LD ₅₀ =560 mg/kg (Rat, oral)

4. History

Thiram is authorized in USA as a Pesticide since 1948.

The first investigation of the impact of thiram have been made in the 1960s.

5. Synthesis



The synthesis of Thiram is a two step mechanism. The first step is the Reaction of carbon disulfide mit dimthylamine. This reaction take place in caustic soda. The product of this step is Sodium-n-dimethyldithiocarbamate, dimethylamine and water. The second step is an oxidation. This oxidation is made with oxidants like phosgene, hydrogen peroxide or elementary iodine. The product of the oxidation is Thiram, but there can be different other products.

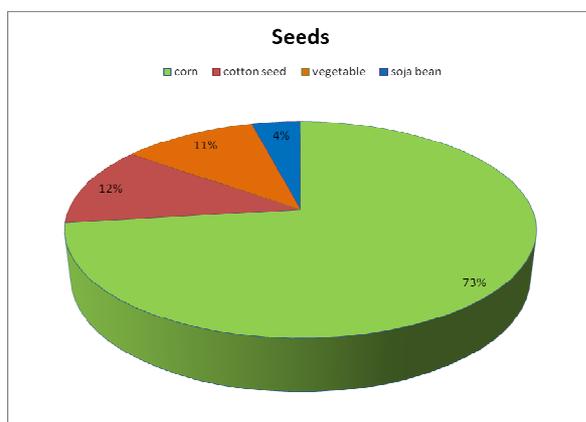
6. Usage

Thiram is used as a fungicide, which prevent the seedlings to get fungal diseases. The most usage of Thiram is the protection for apple seedlings, peaches and strawberries. Besides the seeds will be protected with Thiram. Another usage of Thiram is to keep away animals, who can damage the seeds. For example rabbits, rodents and deers.

In Austria the usage of thiram is forbidden, in Germany it's only usable against damping-off diseases from germ and in Switzerland you can use it as protection of deer and as a wound closure means.

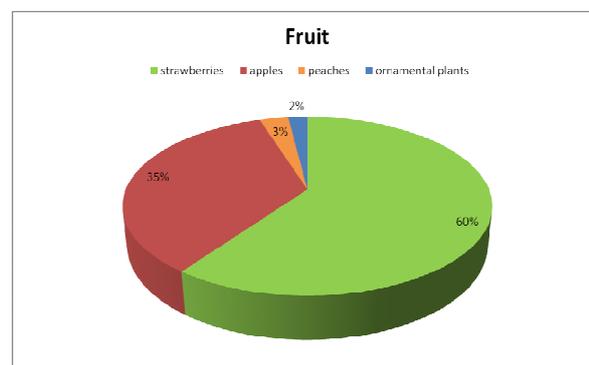
Based on the available data (USA) 165.000 t/a of Thiram is utilized for prevent 35.000 hectare of strawberries, apples and peaches. Yearly nearly 631.000 t/a of the material is spread over nearly 1.300.000.000 t/a of seeds to prevent them.

The diagram below shows the use of the substance for seeds: grain (73%), cotton seeds(12%), vegetables (11%) und soja beans(4%).



For the protection of fruits the next diagram shows the uses in percent: strawberries(60%), apple (35%) und peaches(3%). The 2% which is

not named with fruits is used for protectiong ornamental plants



The staates with the most usage of thiram are Florida, Michigan, New Jersey, New York, Oregon, Pennsylvania and Washington.

7. Effects

For Humans Thiram is some toxic. (cancer kategorie A4 (for human beeings not cancerogen)), In larger dose or long lasting exposition thiram can trigger allergies as well as it can damage the liver.

Dermal absorption has as a consequenze red skin and pain at the affeceted areas.

Oral Absorption or Inhalation of Thiram there can be cough, dizziness, confusion, and neck pain and headaches.

Besides people noticed a loss of sex drive and liver and thyroid damage in animal testings with rats.

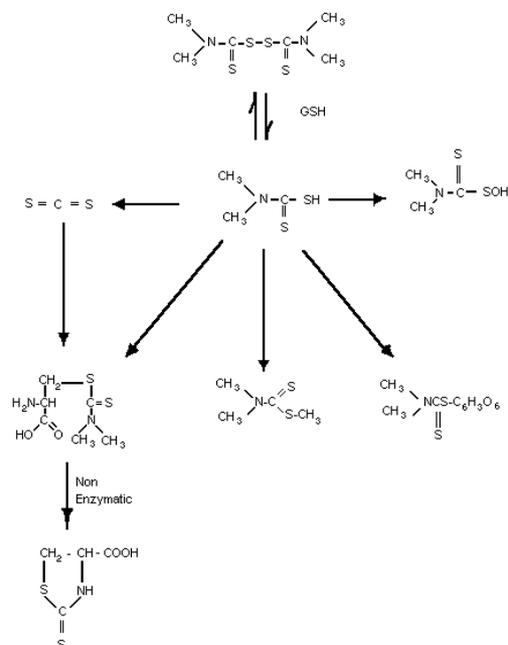
Drinking Alcohol the effects of humans is increased. If you drink alcohol there will be much more oxygen radical in the liver and the acetaldehyd syndrome is noticed. This Syndrome increased the formation of a liver cancer.

In cooperation with nitrosed reagents thiram can formed N-Nitrosamines, which can be carcinogenic Chronical damage form the

chemical are shown in the liver, urin and in the bloodstream.

If you use thiram, you will notice that solvents decrease or increase the danger of Thiram.

Figure 1. The metabolic pathway of thiram in rats



Thiram is not solvable in water, so as a matter of fact the kidney have to change the structure to a structure which is solvable in water. The Diagramm above shows the metabolic pathway of thiram in rats. The first step is the split of the disulfide bond with glutathion. The product is a Thiocarbon acid. Afterwards the metabolism can happenend like it's shown above.

8. Literature

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