

# **E X T O X N E T**

## **Extension Toxicology Network**

A Pesticide Information Project of Cooperative Extension Offices of Cornell University, Michigan State University, Oregon State University, and University of California at Davis. Major support and funding was provided by the USDA/Extension Service/National Agricultural Pesticide Impact Assessment Program.

**P**esticide  
**I**nformation  
**P**rofile

**Ethion**

Publication Date: 9/93

## **TRADE OR OTHER NAMES**

Trade names include Ethanox, Ethiol, Hylemox, Nialate, Rhodiocide, Rhodocide, RP-Thion, Tafethion, Vegfru Fosmite.

## **INTRODUCTION**

Ethion is an organophosphate pesticide used to kill aphids, mites, scales, thrips, leafhoppers, maggots and foliar feeding larvae. It may be used on a wide variety of food, fiber and ornamental crops, including greenhouse crops, lawns and turf. Ethion is often used on citrus and apples ([1](#), [5](#)). It is mixed with oil and sprayed on dormant trees to kill eggs and scales. Ethion may also be used on cattle. It is available in dust, emulsifiable concentrate, emulsifiable solution, granular and wettable powder formulations. Products containing ethion must bear the signal word "Warning" ([2](#)). EPA has established re-entry intervals of from 2 to 30 days, depending on the crop, for ethion ([8](#)).

Ethion is one of a class of insecticides referred to as organophosphates. These chemicals act by interfering with the activities of cholinesterase, an enzyme that is essential for the proper working of the nervous systems of both humans and insects. Please refer to the Toxicology Information Brief on cholinesterase-inhibition for a more detailed description of this topic.

## **TOXICOLOGICAL EFFECTS**

### **ACUTE TOXICITY**

Ethion is highly toxic by inhalation, dermal exposure, and ingestion. Like most organophosphates, ethion is readily absorbed through the skin. Skin which has come

in contact with this material should be washed immediately with soap and water and all contaminated clothing should be removed. It may cause contact burns (11). Ethion is almost non-volatile at normal temperatures, but when it is used as a spray, it is easily inhaled (14). If ethion is inhaled, runny nose and a sensation of tightness in the chest are common complaints(12). Persons with respiratory ailments, recent exposure to cholinesterase inhibitors, impaired cholinesterase production, or with liver malfunction may be at increased risk from exposure to ethion. High environmental temperatures or exposure of ethion to visible or UV light may enhance its toxicity (6).

Ethion may be very irritating to the eye. It caused slight inflammation and redness in the eye and skin, both of which cleared within 48 hours. Ethion is not a skin sensitizer (8).

The organophosphate insecticides are cholinesterase inhibitors. They are highly toxic by all routes of exposure. When inhaled, the first effects are usually respiratory and may include bloody or runny nose, coughing, chest discomfort, difficult or short breath, and wheezing due to constriction or excess fluid in the bronchial tubes. Skin contact with organophosphates may cause localized sweating and involuntary muscle contractions. Eye contact will cause pain, bleeding, tears, pupil constriction, and blurred vision. Following exposure by any route, other systemic effects may begin within a few minutes or be delayed for up to 12 hours. These may include pallor, nausea, vomiting, diarrhea, abdominal cramps, headache, dizziness, eye pain, blurred vision, constriction or dilation of the eye pupils, tears, salivation, sweating, and confusion. Severe poisoning will affect the central nervous system, producing incoordination, slurred speech, loss of reflexes, weakness, fatigue, involuntary muscle contractions, twitching, tremors of the tongue or eyelids, and eventually paralysis of the body extremities and the respiratory muscles. In severe cases there may also be involuntary defecation or urination, psychosis, irregular heart beats, unconsciousness, convulsions and coma. Death may be caused by respiratory failure or cardiac arrest (6).

Some organophosphates may cause delayed symptoms beginning 1 to 4 weeks after an acute exposure which may or may not have produced immediate symptoms. In such cases, numbness, tingling, weakness and cramping may appear in the lower limbs and progress to incoordination and paralysis. Improvement may occur over months or years, but some residual impairment will remain (6).

The amount of a chemical that is lethal to one-half (50%) of experimental animals fed the material is referred to as its acute oral lethal dose fifty, or LD50. The oral LD50 for pure ethion in rats is 208 mg/kg. The oral LD50 for technical ethion in rats is 13 to 191 mg/kg, and 40 mg/kg in mice and guinea pigs (2, 6). The dermal LD50 in rats is 62 mg/kg, 915 mg/kg in guinea pigs, and 890 mg/kg in rabbits (6).

The lethal concentration fifty, or LC50, is that concentration of a chemical in air or water that kills half of the experimental animals exposed to it for a set time period. The 4-hour LC50 for ethion in rats is 0.864 mg/l (2).

## **CHRONIC TOXICITY**

In a chronic toxicity study with rats fed 0, 0.1, 0.2 or 2 mg/kg/day for 18 months, decreased cholinesterase levels occurred in the high dose group. No other toxic effects were observed. The NOEL for this study was 0.2 mg/kg (9).

Repeated or prolonged exposure to organophosphates may result in the same effects as acute exposure including the delayed symptoms. Other effects reported in workers repeatedly exposed include impaired memory and concentration, disorientation, severe depressions, irritability, confusion, headache, speech difficulties, delayed reaction times, nightmares, sleepwalking and drowsiness or insomnia. An influenza-like condition with headache, nausea, weakness, loss of appetite, and malaise has also been reported (6).

### **Reproductive Effects**

A 3-generation reproduction study with rats given dietary doses as high as 1.25 mg/kg/day did not show any ethion related reproductive effects (8, 9). Once in the bloodstream, ethion may cross the placenta (6).

### **Teratogenic Effects**

When rats were given doses of 0, 0.2, 0.6 or 2.5 mg/kg on days 6 to 15 of pregnancy, developmental effects were seen only in the highest dose tested. In fetuses of the high dose group, there was an increased incidence of delayed ossification of the pubic bones. The developmental NOEL in this study was 0.6 mg/kg. When rabbits were given doses of 0, 0.6, 2.4 or 9.6 mg/kg on days 6 to 18 of pregnancy, fetuses from the highest dose tested exhibited an increased incidence of fused sternal bones. The developmental NOEL in this study was 2.4 mg/kg (9).

### **Mutagenic Effects**

Assays on gene mutation, structural chromosomal aberration, and unscheduled DNA synthesis indicate that ethion is not mutagenic (8, 9).

### **Carcinogenic Effects**

Ethion was not found to be carcinogenic in rats and mice (8). There was no increase in the incidence of tumors in rats fed dietary doses as high as 2 mg/kg/day for 18 months. No evidence of carcinogenicity was observed in mice fed dietary doses of up to 1.2 mg/kg/day for 2 years (9).

### **Organ Toxicity**

Ethion primarily affects the nervous system through cholinesterase inhibition, by which there is a deactivation of cholinesterase, an enzyme required for proper nerve functioning.

### **Fate in Humans and Animals**

The literature reviewed is not specific, but ethion is probably degraded in the same general way as other organophosphates.

## **ECOLOGICAL EFFECTS**

### **Effects on Birds**

Ethion is highly toxic to practically non-toxic to birds, depending on the species. Ethion is highly toxic to songbirds (LD50 in Red-winged blackbirds is 45 mg/kg). It is moderately toxic to medium sized birds such as bobwhite quail (LD50 is 128.8 mg/kg) and starlings (>304 mg/kg). Ethion is practically non-toxic to larger upland game birds (ring-necked pheasant) and waterfowl (mallard duck) (9).

Because ethion is persistent in the environment and because it is stored in plant and animal tissues, EPA is concerned that ethion may adversely affect bird reproduction. EPA has called for studies on the effects of ethion on bird reproduction (9).

### **Effects on Aquatic Organisms**

Ethion is very highly toxic to freshwater and marine fish and to freshwater invertebrates (7, 8). The 96-hour LC50 for ethion in rainbow trout is 500 ug/l (2). The acute LC50 in Atlantic silversides is 49 ppb, 49 ppb in bluegill sunfish, and in 720 ppb cutthroat trout and flathead minnows. The LD50 for freshwater invertebrates is 0.056 to 7.7 ppb, depending on the species, and 5.6 to 49 ppb for marine and estuarine invertebrates. Ethion accumulates in the tissues of fish (8, 9).

### **Effects on Other Nontarget Species**

Ethion is practically non-toxic to honeybees. Its LD50 is 20.55 ug/bee (8, 9).

## ENVIRONMENTAL FATE

The major metabolite of ethion is carbon dioxide (8).

### Breakdown of Chemical in Soil and Groundwater

Ethion adsorbs strongly to soil particles and it is nearly insoluble in water. It is therefore unlikely to leach or contaminate groundwater (3). In soil, ethion is subject to microbial degradation. It is resistant to hydrolysis, except in alkaline conditions (pH 9 or above) (4, 8). Ethion is broken down in acids and bases. It is very slowly broken down in the air (7).

Under laboratory conditions, the soil half-life of ethion was 1.3 to 8 weeks, but in a greenhouse with an organic soil, it was more persistent, with half-lives of 16 to 49 weeks, depending on the degree of watering. When used repeatedly, ethion residues in soil will increase from one year to the next (4).

### Breakdown of Chemical in Water

Ethion is almost insoluble in water (7). In open waters, it is likely to adsorb to suspended particles and bottom sediments. The persistence half-life of ethion varied from 4 to 22 weeks when tested in three different natural waters under laboratory conditions. It breaks down slowly in irrigation canal water (half-life = 26 days) (J. Agric. Food Chem. 31 (4):704.1983). Its hydrolysis half-lives at 25 degrees C are 63, 58, 25 and 8.4 weeks at pHs 5, 6, 7 and 8, respectively. The half-life was 1 day at pH 10 and 30 degrees C. Microbial degradation of ethion may be insignificant in open waters. Volatilization be important only in shallow, rapidly moving streams. Photo-oxidation may occur in sunlight. Bioconcentration of ethion may be significant (4).

### Breakdown of Chemical in Vegetation

No information found.

## Physical Properties and Guidelines

Pure ethion is a colorless to light brown or pale yellow liquid with no odor (2, 6). Technical ethion has a very disagreeable odor. Ethion is stable under normal temperatures and pressures if kept in a closed container, but it may oxidize slowly if exposed to air. Ethion will hydrolyze in the presence of bases, acids or lime (6). Thermal decomposition of ethion may release toxic gases such as diethylsulfide, sulfur dioxide, carbon monoxide, carbon dioxide, and phosphorus pentoxide (2).

Major tranquilizers (phenothiazines and thioxanthenes) may enhance the toxicity of organophosphates (Martin. Hazards of Medication. 1971).

Persons who work with organophosphate materials for long periods of time should have frequent blood tests of their cholinesterase levels. If the cholinesterase level falls below a critical point, no further exposure should be allowed until it returns to normal (10).

Protective clothing must be worn when using ethion. Before removing gloves, wash them with soap and water. Always wash hands, face and arms with soap and water before smoking, eating or drinking. After work, remove all work clothes and shoes. Shower with soap and water. Wear only clean clothes when leaving the job. Wash contaminated clothing and equipment with soap and water after each use. Keep contaminated work clothes separate from regular laundry (8).

### Exposure Guidelines:

0.4 mg/m<sup>3</sup> OSHA TWA (skin) (6)

0.4 mg/m<sup>3</sup> ACGIH TWA (skin) (6)

0.4 mg/m<sup>3</sup> NIOSH Recommended TWA (skin) (6)

### Physical Properties:

**CAS #:** 563-12-2

**Specific gravity:** 1.215 - 1.230 at 20 degrees C (2, 15)

**Solubility in water:** practically insoluble (2)

**Solubility:** Soluble in ethyl alcohol, methyl alcohol and most organic solvents (1, 5). Slightly soluble in acetone, chloroform, kerosene, 1% methyl ethyl ketone, methylated naphthalene, benzene and xylene (15). Miscible in aromatic solvents (16).

**Boiling point:** 164 - 165 degrees C at 0.3 mm Hg (2); 302 degrees F (150 degrees C), decomposes (6)

**Melting point:** 12 - 15 degrees C (2, 15); 10 degrees F (-12 degrees C) (6)

**Flash point:** 176 degrees C (2)

**Vapor pressure:** 1.5 x 10 to the minus 6 power mm Hg at 20 degrees C (5).

**Koc:** 8890 g/ml (3)

**Oil:** water partition coefficient - 5.073 (J. Environ. Sci. Health part B. B18 (6):667-83.1983).

**pH:** 5.1 in an equal volume of water (8)  
**Chemical class/use:** organophosphate insecticide

## BASIC MANUFACTURER

FMC Corp.  
Agricultural Chemicals Group  
2000 Market St.  
Philadelphia, PA 19103

### Review by Basic Manufacturer:

Comments solicited: November, 1992  
Comments received:

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