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DATA SHEET ON PESTICIDES

No. 70

ETHOPROPHOS



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CLASSIFICATION:

Primary use: Nematicide
Secondary use: Insecticide
Chemical group: Organophosphorus
compound
Date issued: July 1988

1.0 GENERAL INFORMATION

1.1 COMMON NAME: ethoprophos (E-ISO, F-ISO, BSI) ethoprop (ANSI, ES)

1.1.1 Identity

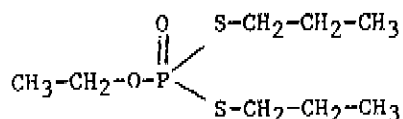
IUPAC and CAS No. 1: O-ethyl S,S-dipropyl phosphorodithioate

CAS Reg. No.: 13194-48-4

Molecular formula: C₈H₁₉O₂PS₂

Relative molecular mass: 242.3

Structural formula:



1.1.2 Synonyms: ENT 27 318, Ethoprop, Jolt^R, Mocap^R, Propfos^R, VC9-104.

1.2 SYNOPSIS: Ethrophos is a broad spectrum, non-cumulative and non-systemic organophosphorus pesticide that is extremely toxic to mammals. It is a direct cholinesterase inhibitor, with excellent contact action. It has moderate residual activity and is not phytotoxic.

1.3 SELECTED PROPERTIES

1.3.1 Physical characteristics: Ethoprophos is a clear, pale yellow liquid having a boiling point of 86-91 °C (27.7 Pa) density (d₂₀) of 1.094.

- 1.3.2 Solubility: In water, 750 mg/L (at 25 °C) very soluble in organic solvents.
- 1.3.3 Stability: Ethoprophos is very stable in acid aqueous medium up to 100 °C, but is rapidly hydrolysed in alkaline media at 25 °C and above.
- 1.3.4 Vapour pressure: 46.7 Pa at 26 °C.
- 1.4 AGRICULTURE, HORTICULTURE AND FORESTRY
- 1.4.1 Common formulations: Ethoprophos is available in an emulsifiable concentrate, 700 g a.i./L and in granular preparations, 60-150 g/kg.
- 1.4.2 Susceptible pests: These include wire worms, nematodes and corn rootworms and soil inhabiting arthropods.
- 1.4.3 Use pattern: It is almost exclusively recommended as a pre-plant, soil application for tobacco, sweet potatoes, bananas, plantains, cabbage, corn, pineapple, sugar cane, soybeans, peanuts, cucumber, snap and lima beans, potatoes and commercial turf.
- 1.4.4 Unintended effects: It is not phytotoxic when used as directed.
- 1.5 PUBLIC HEALTH USE: No recommended use.
- 1.6 HOUSEHOLD USE: No recommended use.
- 2.0 TOXICOLOGY AND RISKS
- 2.1 TOXICOLOGY - MAMMALS
- 2.1.1 Absorption route: Ethoprophos may be absorbed from the gastrointestinal tract, through the intact skin, and by inhalation of spray mist and dusts.
- 2.1.2 Mode of action: Ethoprophos is a direct inhibitor of cholinesterases through phosphorylation of the esteratic site of the enzyme. Accumulation of acetylcholine at the nerve synapses and myoneural junctions causes toxic effects.
- 2.1.3 Excretion products: Following oral administration of ¹⁴C-labelled ethoprophos to rats, O-ethyl-S-propyl phosphorothioic acid, O-ethyl-phosphoric acid and desethyl ethoprophos were the major urinary metabolites. The urine also contained traces of methyl propyl sulfide, methyl propyl sulfoxide and methyl propyl sulfone. In vitro hepatic microsome and supernatant preparations produced similar degradation products, ethoprophos was de-ethylated in the presence of glutathione.

2.1.4 Toxicity, single dose:Oral LD₅₀:

Rat (M)	62 mg/kg b.w.;	technical material in corn oil
Rat (F)	33 mg/kg b.w.;	technical material in corn oil
Mouse (M,F)	31 mg/kg b.w.;	technical material in water
Rabbit (F)	33 mg/kg b.w.;	technical material, vehicle unknown

Dermal LD₅₀:

Rat (M,F)	226 mg/kg b.w.;	technical material in water
Rabbit	26 mg/kg b.w.;	technical material, vehicle unknown
Mouse	18 mg/kg b.w.;	technical material in acetone
Pig	327 mg/kg b.w.;	technical material, no vehicle

Inhalation LC₅₀: (4 hour)

Rat	250 mg/L air
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Most susceptible species: Probably mice.

2.1.5 Toxicity, repeated doses: No information available.2.1.6 Dietary studies

Short-term: In a 90 day study in rats, using dose levels of 0.3, 1.0 or 100 ppm in diet a no-effect level could not be demonstrated since brain cholinesterase activity depression was recorded at the low-dose level. Growth depression was also observed at the high-dose level.

In a similar dog study cholinesterase depression was observed at the lowest dose level, 1.0 ppm in a diet. The incidence of myocardial lesions was increased at the high-dose level, 100 ppm, relative to control values, however, the lower dose group was not examined for this effect.

Long-term: In a rat study test animals (60/sex/group) were selected from among pups of first generation control and treatment group litters of a reproduction study (see reproduction section below). The treatment group pups were first placed on a diet containing ethoprophos 4.5, 9.0 and 18.0 ppm for 12 weeks, then 49, 98 and 196 ppm for the remainder of the 109 week study. The only adverse effects observed were plasma and brain cholinesterase activity depression at all dose levels. However, erythrocyte cholinesterase activity was not changed at any dose level.

2.1.7 Supplementary studies of toxicity

Carcinogenicity: After 109 weeks of dietary exposure the incidence of thyroid C-cell adenoma was significantly increased among male rats in the high dose group (see 2.1.6).

Teratogenicity: In rats, dose levels of 0.16, 1.6 and 16.0 mg/kg b.w. of ethoprophos administered daily by gavage caused an increased incidence of incomplete vertebral ossification in 43, 39 and 58 percent of the treatment group litters respectively. An increased incidence in rudimentary and extra ribs was also observed at 1.6 mg/kg b.w./day.

In a gavage study in rabbits, an increased total incidence of skeletal variants, per foetus, was observed at all ethoprophos dose levels (0.125, 0.5 and 2 mg/kg b.w./day). However, since no single variant change was observed to be increased, a teratogenic no-effect level was estimated to be 2.0 mg/kg b.w./day for ethoprophos in rabbits.

Reproduction: In a three generation study, rats were fed ethoprophos at dose levels of 60.5, 131 or 262 ppm. The no-adverse effect level was observed to be 60.5 ppm for parental growth depression at higher doses in all generations. There were no other compound related adverse effects which were consistently observed in all generations.

Mutagenicity: Ethoprophos was not observed to have any mutagenic potential in two *in vitro* studies, an unscheduled DNA synthesis test in primary rat hepatocytes at (25 μ l/ml) and in a mouse lymphoma specific-locus mutation assay at 0.237 nl/ml, nor in an *in vitro* male rat cytogenetic study at 20 mg/kg b.w./day for five days.

Neurotoxicity: In two studies ethoprophos could not be evaluated for delayed neurotoxic effects due to study inadequacies.

Primary irritation: Skin and eye irritation effects could not be adequately evaluated due to high mortality of test animals following administration of recommended dose levels.

2.1.8 **Modification of toxicity:** No published information available.

2.2 TOXICOLOGY - MAN: No published information available.

2.3 TOXICITY, NON MAMMALIAN SPECIES

2.3.1 **Fish, LC₅₀:**

Goldfish	13.6 ppm (96 hours)
Bluegill	2.07 ppm (96 hours)
Rainbow trout	13.8 ppm (96 hours)

2.3.2 **Birds**

Oral LD₅₀:

Mallard	12.6 mg/kg b.w.;	technical material
Pheasant	4.2 mg/kg b.w.;	technical material
Chicken	6.1 mg/kg b.w.;	technical material

Dermal LD₅₀:

Mallard 10 mg/kg b.w.; technical material

2.3.3 Other species: Not toxic to bees.

3.0 FOR REGULATORY AUTHORITIES - RECOMMENDATIONS OF COMPOUND

3.1 RECOMMENDED RESTRICTIONS ON AVAILABILITY

(For definition of categories see the Introduction to Data Sheets).

Liquid formulations of 70% and over, Category 2

Other liquid formulations, Category 3

Solid formulations (granules) of 10% and over, Category 3

3.2 TRANSPORTATION AND STORAGE

All formulations: Should be transported and stored in clearly labelled impermeable containers under lock and key, secure from access by unauthorized persons and children. No food or drink should be stored in the same compartment.

3.3 HANDLING

All formulations: Full protective clothing (see 4.3) should be used by those handling the compound. Adequate washing facilities should be available at all times during the handling and should be close to site of handling. Eating, drinking and smoking should be prohibited during handling and before washing after handling.

3.4 DISPOSAL AND/OR DECONTAMINATION OF CONTAINERS

Container must be decontaminated and then crushed and buried below topsoil. Care must be taken to avoid subsequent contamination of water sources. Decontamination of containers in order to use them for other purposes should not be permitted.

3.5 SELECTION, TRAINING AND MEDICAL SUPERVISION OF WORKERS

All formulations: Pre-employment medical examination of workers is necessary. Workers suffering from active hepatic or renal diseases should be excluded from contact with ethoprophos. Pre-employment and periodic blood cholinesterase tests for workers are desirable. Special account should be taken of the workers' mental ability to comprehend and follow instructions. Training of workers in techniques to avoid contact is essential.

3.6 ADDITIONAL REGULATIONS RECOMMENDED IF DISTRIBUTED BY AIRCRAFT

All formulations: No recommended aerial applications.

3.7 LABELLING

All formulations

"DANGER - POISON"
(skull and cross-bones insignia)

Ethoprophos is an organophosphorus compound which inhibits cholinesterase. It is of very high toxicity. Contact with the skin, inhalation of dust or spray, or swallowing may be fatal.

Wear protective gloves, clean protective clothing, and a respirator when handling this material. Bathe immediately after work. Ensure that containers are stored under lock and key. Empty containers must be disposed of in such a way as to prevent all possibility of accidental contact with them. Keep the material out of reach of children and well away from foodstuffs, animal feed and food containers.

In case of contact, immediately remove contaminated clothing and wash the skin thoroughly with soap and water; for eye contact, flush with water for 15 minutes. If poisoning occurs, call a physician. Atropine sulfate is a recommended antidote, repeated doses may be necessary. Artificial resuscitation may also be needed.

3.8 RESIDUES IN FOOD

Maximum residue limits - The Joint FAO/WHO Meeting on Pesticides Residues has been unable, in the absence of an acceptable daily intake, to recommend maximum residue limits, but has proposed guidelines for residues in a limited number of foods.

4.0 PREVENTION OF POISONING IN MAN AND EMERGENCY AID

4.1 PRECAUTIONS IN USE

4.1.1 General: Ethoprophos is an organophosphorus pesticide of very high toxicity. It is absorbed through the intact skin by inhalation of dust and fine spray mist and from the gastrointestinal tract. Most formulations should be handled by trained personnel wearing protective clothing.

4.1.2 Manufacture and formulations - T.L.V.: No information available. Closed systems and forced ventilation may be required to reduce, as much as possible, the exposure of workers to the chemical.

4.1.3 Mixers and applicators: When opening the container and when mixing, protective impermeable boots, clean overalls, gloves and a respirator should be worn. Mixing, if not mechanical, should always be carried out with a paddle of appropriate length. The applicator should wear an impermeable hat, protective clothing, boots and gloves. The applicator should avoid working in spray mist and avoid contact by the mouth. Particular care is needed when equipment is being washed after use. All protective clothing should be washed separately from other laundry immediately after use, including the insides of gloves. Splashes must be washed immediately from the skin, or eyes, with large quantities of water. Before eating, drinking, or smoking, hands and other exposed skin should be washed.

- 4.1.4 Other associated workers (including flagmen in aerial operations): Persons exposed to ethoprophos and associated with its application should wear protective clothing and observe the precautions described above in 4.1.3 under "Mixers and applicators".
- 4.1.5 Other populations likely to be affected: With good application practice, subject to 4.2 below, other persons are not likely to be exposed to hazardous amounts of ethoprophos.
- 4.2 **ENTRY OF PERSONS INTO TREATED AREA**: Unprotected persons should be kept out of application sites for at least one day.
- 4.3 **DECONTAMINATION OF SPILLAGE AND CONTAINERS**: Residues in containers should be emptied in a diluted form into a pit, taking care to avoid contamination of ground waters. A soakage pit should be provided for the rinsings. Decontaminated containers should not be used for any purpose. Spillage of ethoprophos and its formulations should be removed by washing with 5% sodium hydroxide solution and then rinsing with large quantities of water. Impermeable gauntlets should be worn during this work.
- 4.4 **EMERGENCY AID**
- 4.4.1 Early symptoms of poisoning: Early symptoms of poisoning may include excessive sweating, headache, weakness, giddiness, nausea, vomiting, hypersalivation, stomach pains, blurred vision, slurred speech and muscle twitching. Later, there may be convulsions and coma.
- 4.4.2 Treatment before person is seen by a physician, if these symptoms appear following exposure: The person should stop work immediately, remove contaminated clothing, wash the affected skin with soap and water, and flush the area with large quantities of water. If swallowed, and if the person is conscious, vomiting should be induced. In the event of collapse, artificial resuscitation should be given, bearing in mind that if mouth-to-mouth resuscitation is used, vomit may contain hazardous amounts of ethoprophos.
- 5.0 **FOR MEDICAL AND LABORATORY PERSONNEL**
- 5.1 **MEDICAL DIAGNOSIS AND TREATMENT IN CASES OF POISONING**
- 5.1.1 General information: Ethoprophos is an organophosphorus pesticide of very high mammalian toxicity. It is readily absorbed from the gastrointestinal tract, through intact skin, and by inhalation of dust or fine spray mist.
- 5.1.2 Symptoms and signs: Initial symptoms of poisoning may include excessive sweating, headache, weakness, giddiness, nausea, hypersalivation, vomiting, stomach pains, blurred vision, slurred speech and muscle twitching. More advanced symptoms of poisoning may include convulsions, coma, loss of reflexes and loss of sphincter control.

5.1.3 **Laboratory:** The most important finding is reduction of activity of blood cholinesterases. Urinary levels of organic phosphorus containing metabolites may also be used as a measure of exposure. Neither method is specific for ethoprophos.

5.1.4 **Treatment:** If the pesticide has been ingested, unless the patient is vomiting, rapid gastric lavage should be performed using 5% sodium bicarbonate. For skin contact, the skin should be washed with soap and water. If the compound has entered the eyes, they should be washed with large quantities of isotonic saline or water.

Persons without signs of respiratory insufficiency but with manifest peripheral symptoms should be treated with 2-4 mg of atropine sulfate by intravenous injection and 1 000 mg pralidoxime chloride or 250 mg of toxogonin (adult dose) by slow intravenous injection. More atropine may be given as needed. Persons with severe intoxication, with respiratory difficulties, convulsions and unconsciousness should immediately be provided with ventilatory support and given atropine and a reactivator. In such severe cases 4-6 mg of atropine sulfate should be given initially followed by repeated doses of 2 mg at 5-10 minute intervals. Diazepam may be given to control convulsions. The patient's condition including respiration, blood pressure, pulse frequency, salivation, and convulsions should be carefully observed as a guide to further administration of atropine. If the patient is cyanotic, oxygen should be given at the same time as atropine sulfate. The airways should be kept free and artificial resuscitation should be applied if required, preferably by mechanical means.

Contraindications are morphine, barbituates, phenothiazine and central stimulants of all kinds. Pralidoxime and toxogonin alone are not regarded as effective antidotes in ethoprophos poisoning.

5.1.5 **Prognosis:** If the acute toxic effect is survived and adequate artificial resuscitation has been given as needed, the chances of complete recovery are good. However, in very severe cases, particularly if respiratory support has been inadequate, prolonged anoxia may give rise to permanent brain damage.

5.1.6 **References of previously reported cases:** No published information.

5.2 SURVEILLANCE TESTS

<u>Test</u>	<u>Normal level*</u>	<u>Action level*</u>	<u>Symptomatic level*</u>
Plasma cholinesterase	100%	50%	variable
Whole blood or erythrocyte cholinesterase	100%	70%	usually 40%

* Expressed as percentage of pre-exposure activity.

5.3 LABORATORY METHODS

5.3.1 Detection and assay of compound: Thin layer chromatography and gas-liquid chromatography methods have been used to analyse ethoprophos in technical products and its formulations. Analysis of residues in plant and animal tissues may be performed by gas chromatography and flame photometry methods.

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5.3.2 Other tests in case of poisoning: Blood cholinesterase activity, particularly erythrocyte provide the most useful diagnosis of poisoning. Urine metabolites may also be determined in order to give an indication of exposure. For methods, see section 5.3.1.

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