

45639-168

PM 03

4/1/98

Revised: 03/05/98

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**THIODAN® TECHNICAL**  
An Insecticide For Formulating Use Only

**ACTIVE INGREDIENT:**

Endosulfan (Hexachlorohexahydromethano-2,4,3-benzodioxathiepin-3-oxide)...95%

INERT INGREDIENTS: ..... 5%  
TOTAL 100%

KEEP OUT OF REACH OF CHILDREN

**DANGER - PELIGRO  
POISON**

**ACCEPTED**  
APR - 1 1998  
Under the Federal Insecticide, Fungicide, and Rodenticide Act as amended, for the pesticide registered under EPA Reg. No. 45639-168

**STATEMENT OF PRACTICAL TREATMENT**

**IF ON SKIN:** Remove contaminated clothing and wash affected areas with soap and water. Get medical attention.

**IF IN EYES:** Flush eyes for at least 15 minutes with water. Call physician immediately.

**IF INHALED:** Remove victim to fresh air. Apply artificial respiration if indicated. Get medical attention.

**IF SWALLOWED:** Call a physician or Poison Control Center immediately. Drink 1 or 2 glasses of water and induce vomiting by touching the back of the throat with finger. Repeat until vomit fluid is clear. Do not induce vomiting or give anything by mouth to a person who is unconscious or convulsing.

**NOTE TO PHYSICIANS:** Endosulfan is a central nervous system stimulant absorbable by mouth, inhalation, or through contact with skin. It may cause convulsions. There is no specific antidote. Diazepam I.V. is the drug of choice. Barbituric acid derivatives such as Phenobarbital may be used additionally. A neuromuscular blocking agent may be used if convulsions persist. This type of drug may be used only if complete control of respiration can be maintained. Epinephrine derivatives are absolutely contraindicated.

In case of Medical Emergencies of Health and Safety Inquiries, or in Case of Fire, Leaking, or Damaged Containers, Information may be Obtained by Calling- (800) 228-5639 Extension 202.

See other panels for additional precautionary information.

EPA REG. NO.: 45639-168

EPA EST. NO.:

AgrEvo USA Company  
2711 Centerville Road  
Wilmington, DE 19808

NET CONTENTS:

**PRECAUTIONARY STATEMENTS  
HAZARDS TO HUMANS  
AND DOMESTIC ANIMALS**

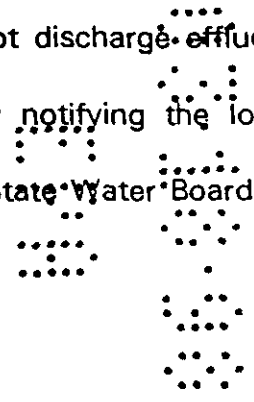
**DANGER**

Fatal if swallowed, inhaled or absorbed through skin. Do not breathe vapors. Do not get in eyes, on skin or on clothing. During formulating and loading operations wear clean synthetic rubber gloves, protective clothing (such as coveralls, socks and shoes), protective eyewear, and a pesticide respirator with either an organic vapor-removing cartridge with a prefilter approved for pesticides (MSHA/NIOSH approval number prefix TC-23C), or a canister approved for pesticides (MSHA/NIOSH approval number prefix TC-14G). Wash thoroughly with soap and water after handling and before eating or smoking. Wash all contaminated clothing with soap and hot water before reuse.

**ENVIRONMENTAL HAZARDS**

This product is toxic to fish, birds and other wildlife.

Do not discharge effluent containing this product directly into lakes, streams, ponds, estuaries, oceans or other waters unless in accordance with the requirements of a National Pollutant Discharge Elimination System (NPDES) permit and the permitting authority has been notified in writing prior to discharge. Do not discharge effluent containing this product into sewer systems without previously notifying the local sewage treatment plant authority. For guidance, contact your State Water Board or Regional Office of the Environmental Protection Agency.



**DIRECTIONS FOR USE**

It is a violation of Federal Law to use this product in a manner inconsistent with its labeling.

**STORAGE AND DISPOSAL**

**PESTICIDE STORAGE:** Keep out of reach of children and animals. Store in original containers only. Store in a cool, dry, well ventilated place and avoid excess heat. Carefully open containers. After partial use, replace lids and close tightly. The solid technical is sensitive to moisture, acids, and bases. Decomposition will generate sulfur dioxide and endosulfan alcohol. Care should be exercised by workers entering the storage area since there is a possibility that sulfur dioxide may be present. Do not put concentrate or dilute material into food or drink containers. Do not contaminate other pesticides, fertilizers, water, food or feed by storage or disposal.

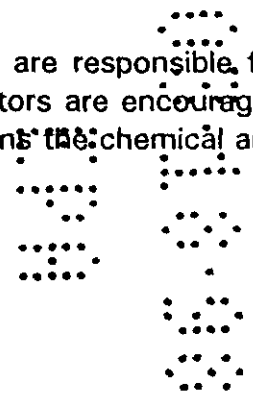
**In case of spill:** avoid contact, isolate area and keep out animals and unprotected persons. Confine spills.

**To confine spill:** If liquid, dike surrounding area or absorb with sand, cat litter or commercial clay. If dry material, cover to prevent dispersal. Place damaged package in a holding container. Identify contents.

**PESTICIDE DISPOSAL:** Pesticide wastes are acutely hazardous. Improper disposal of excess pesticide, spray mixture, or rinsate is a violation of Federal Law. If these wastes cannot be disposed of by use according to label instructions, contact your State Pesticide or Environmental Control Agency, or the Hazardous Waste representative at the nearest EPA Regional Office for guidance.

**CONTAINER DISPOSAL:** Triple rinse (or equivalent). Then offer for recycling or reconditioning, or puncture and dispose of in a sanitary landfill, or by other procedures approved by state and local authorities. Do not cut or weld metal containers.

**FORMULATOR INFORMATION:** Formulators using this product are responsible for obtaining EPA registration for their formulated products. Formulators are encouraged to contact AgrEvo for the Thiodan® Technical Bulletin which contains the chemical and physical data for the technical.

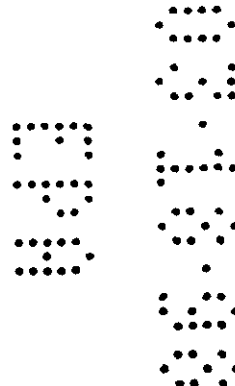




**Field and Vegetable Crops:**

- Barley
- Beans (Succulent & Dry, except lima)
- Blueberries
- Broccoli
- Brussels Sprouts
- Cabbage
- Carrots
- Cauliflower
- Celery
- Collards
- Corn, sweet (for fresh vegetable use only)
- Cotton
- Cucumbers
- Eggplants
- Grapes
- Kale
- Lettuce
- Melons
- Mustard Greens
- Oats
- Peas (Succulent)
- Peppers
- Pineapples
- Potatoes
- Pumpkins
- Rape Seed
- Rye
- Spinach
- Squash (Summer and Winter)
- Strawberries
- Sugarcane
- Sweet Potatoes
- Tea
- Tobacco
- Tomatoes
- Turnip Greens
- Wheat

Thiodan is a registered trademark of Hoechst Ag.



**IMPORTANT: READ BEFORE USE**

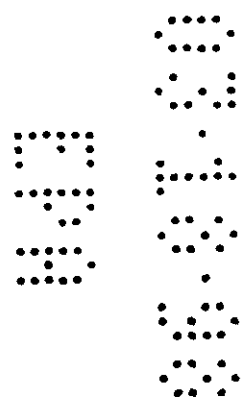
By using this product, user or buyer accepts the following conditions, warranty, disclaimer of warranties and limitations of liability.

**CONDITIONS:** The directions for use of this product are believed to be adequate and should be followed carefully. However, because of extreme weather and soil conditions, manner of use and other factors beyond AgrEvo USA Company's control, it is impossible for AgrEvo USA Company to eliminate all risk associated with the use of this product. As a result, crop injury or ineffectiveness is always possible. All such risks shall be assumed by the user or buyer.

**DISCLAIMER OF WARRANTIES:** THERE ARE NO WARRANTIES, EXPRESS OR IMPLIED, OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE OR OTHERWISE, WHICH EXTEND BEYOND THE STATEMENTS MADE ON THIS LABEL. No agent of AgrEvo USA Company is authorized to make any warranties beyond those contained herein or to modify the warranties contained herein. AgrEvo USA Company disclaims any liability whatsoever for incidental or consequential damages, including, but not limited to, liability arising out of breach of contract, express or implied warranty (including warranties of merchantability and fitness for a particular purpose, tort), negligence, strict liability or otherwise.

**LIMITATIONS OF LIABILITY:** THE EXCLUSIVE REMEDY OF THE USER OR THE BUYER FOR ANY AND ALL LOSSES, INJURIES OR DAMAGES RESULTING FROM THE USE OR HANDLING OF THIS PRODUCT, WHETHER IN CONTRACT, WARRANTY, TORT, NEGLIGENCE, STRICT LIABILITY OR OTHERWISE, SHALL NOT EXCEED THE PURCHASE PRICE PAID, OR AT AGREVO USA COMPANY'S ELECTION, THE REPLACEMENT OF PRODUCT.

AgrEvo® USA Company, 1996





**AgrEvo™**

A company of Hoechst and NOR-AM

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# Technical Bulletin

## THIODAN TECHNICAL

### GENERAL INFORMATION

Thiodan Technical is the technical grade product for the active ingredient endosulfan, an insecticidal compound. The chemical is a sulfurous acid ester of a chlorinated cyclic diol and is chemically classified in class 602 of halogenated hydrocarbons (EEC Directive 76/907). Endosulfan is a stomach and contact poison effective against a wide variety of biting and sucking insects and mites. It is used primarily on food crops like fruits including grapes, vegetables, tree nuts, tea, cotton and other row crops.

**Chemical Name:** IUPAC:

6,7,8,9,10,10-hexachloro-1,5,5a,6,9,9a-hexahydro-6,9-methano-2,4,3-benzo-dioxathiepin-3-oxide

CA:

6,9-methano-2,4,3-benzodioxathiepin -6,7,8,9,10,10-hexachloro-1,5,5a,6,9,9a-hexahydro-3-oxide

**CAS Number:** 115-29-7

**EEC** 204-079-9

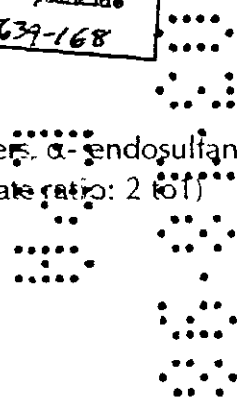
**CIPAC** 89

**Molecular Formula**  $C_9H_6Cl_6O_3S$

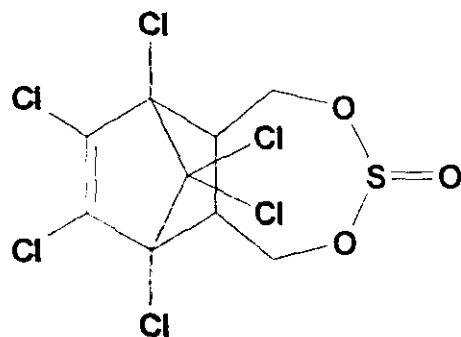
**Molecular Mass:** 406.9

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**Molecular Composition:** as a mixture of the two isomers,  $\alpha$ -endosulfan and  $\beta$ -endosulfan (approximate ratio: 2 to 1)



**Structural Formula**



The minimum content of the pure active ingredient in the technical grade is 965 g/kg.

**PHYSICAL AND CHEMICAL PROPERTIES OF ENDOSULFAN**

**Vapour Pressure**

endosulfan (mixture of  $\alpha$  +  $\beta$  - endosulfan):

1.7 x 10<sup>-5</sup> hPa (1.3 x 10<sup>-5</sup> Torr) at 25°C

$\alpha$ - endosulfan

1.9 x 10<sup>-5</sup> hPa (1.5 x 10<sup>-5</sup> Torr) at 25°C

$\beta$ - endosulfan

9.2 x 10<sup>-7</sup> hPa (6.9 x 10<sup>-7</sup> Torr) at 25°C

The vapour pressure is considered to be moderate and therefore endosulfan may be assumed to be semi-volatile.

**Volatility (Henry's law constant)**

$\alpha$ - isomer:

1.48 Pa x m<sup>3</sup> x mol<sup>-1</sup> at 24 °C

$\beta$ - isomer

0.07 Pa x m<sup>3</sup> x mol<sup>-1</sup> at 24 °C

**Solubility in water, including effect of pH (4 to 10) on solubility <sup>(1)</sup>**

$\alpha$ - endosulfan

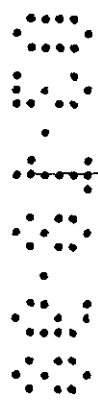
0.33 mg/l (pH 5, 22 °C)

$\beta$ - endosulfan

0.32 mg/l (pH 5, 22 °C)

Due to the molecular structure of endosulfan, there is no reason to expect that its water solubility is dependent on the pH-value, since the

(1) Since endosulfan is rapidly hydrolysed under neutral and basic conditions, the water solubility and the partition coefficient can only be determined under acid conditions.





substance cannot dissociate and possesses neither acid protons nor an appreciable number of basic centres.

The low water solubility of endosulfan and its metabolites is the reason for its high adsorption to organic particles in agricultural soils and sediment ( $K_{oc} \alpha + \beta$  endosulfan and endosulfan-sulfate approx. 5700 - 21300).

**Partition coefficient n-octanol/water, including effect of pH (4 to 10)**  
(1)

22°C	Ph	Concentration range	P <sub>ow</sub>
α-endosulfan	5.1	0.31 μmol/l - 0.37 μmol/l	55500
β-endosulfan	5.1	0.16 μmol/l - 0.34 μmol/l	61400

Based on these data, the compound might be expected to accumulate in fatty tissue. Nevertheless, numerous fish accumulation studies and residue analyses of different organs in long-term toxicological studies in rat and mice clearly demonstrated that the compound is rapidly eliminated (half-lives in fish 2-4 days) and that no accumulation takes place in the fatty tissue of rats and mice.

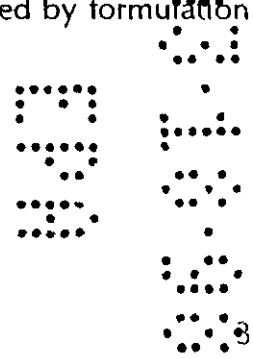
**Direct Phototransformation in Water**

Sterile aqueous solutions of <sup>14</sup>C-α + β - endosulfan (0.24 mg/l) buffered to pH 5 were placed in a sterile, closed photoreactor. The solutions were irradiated at 25 °C with filtered light to remove UV below 290 nm for up to 120 h of continuous exposure. The material balance based on zero-value recovery ranged from 72.8% to 106.2%, means 91 - 100% for the separate studies. Both <sup>14</sup>C-α + β - endosulfan were found to be photolytically stable under such aqueous environment.

**Quantum Yield of Direct Photodegradation**

Since radioactively labelled <sup>14</sup>C-α + β - endosulfan appeared to be photochemically stable it was not possible to calculate a quantum yield.

However, under conditions of agricultural practice photolytical degradation in water might be considerably accelerated by formulation adjuvants and neutral photosensitisers.



### Dissociation Constant

Due to the molecular structure of endosulfan, the substance cannot dissociate and possesses neither acid protons nor an appreciable number of basic centres.

### Hydrolysis Rate

#### α- Endosulfan

pH	Temperature (°C)	DT <sub>50</sub> (days)
5	25	> 200
7	25	19
9	25	0.26

#### β- Endosulfan

pH	Temperature (°C)	DT <sub>50</sub> (days)
5	25	> 200
7	25	10.7
9	25	0.17

Endosulfan is sensitive to alkalis and moisture and subject to slow to moderate hydrolysis to the diol and to sulphur dioxide.

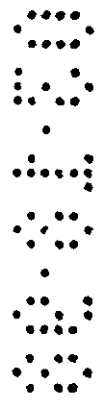
### Stability and Photochemical Degradation in Air, Identity of Breakdown Product(s)

Irradiation experiments in the gas phase have clearly shown that photodegradation of α + β - endosulfan and endosulfan sulfate can occur under natural conditions. The substances were converted to photoproducts and simple inorganic compounds (e.g. CO<sub>2</sub>, CO or HCl).

Despite the results presented above, reactions of photolytic degradation (possibly indirect photolysis via reaction with photogenerated hydroxyl radicals) were observed in the gaseous phase with the following half lives (under laboratory conditions).

Substance	t 1/2 (in hours)
α - endosulfan	6.4
β - endosulfan	2.4
Endosulfan - sulfate	3.7

The photo-oxidative degradation in air was estimated in a reaction with photogenerated hydroxyl radicals according to the increment method of



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Atkinson. Assuming a globally averaged concentration of 500 000 OH radicals per cm<sup>3</sup>, the degradation half-life of endosulfan amounted to 8.5 days. Since the OH concentration depends on the solar intensity, the degradation half-life is expected to be shorter the Mediterranean climate (Southern Europe). Attempts to determine experimentally the atmospheric degradation half-life of endosulfan were performed, but failed due to its too low volatility.

The flammability, explosive and oxidising properties indicate no hazard during manufacturing, storage, transport or use.

March 1998

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