

E X T O X I C O L O G Y

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.

Pesticide
Information
Profile

Cypermethrin

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TRADE OR OTHER NAMES

Some trade names include Ammo, Arrivo, Barricade, Basathrin, CCN52, Cymbush, Cymperator, Cynoff, Cypercopal, Cyperguard 25EC, Cyperhard Tech, Cyperkill, Cypermar, Demon, Flectron, Fligene CI, Folcord, Kafil, NRDC 149, Polytrin, PP383, Ripcord, Siperin, Stockade and Super.

REGULATORY STATUS

Some or all products containing cypermethrin may be classified as Restricted Use Pesticides (RUP) by the EPA ([1](#)) because of cypermethrin's toxicity to fish ([9](#)). Restricted Use Pesticides may be purchased and used only by certified applicators. Pesticides containing cypermethrin must bear the signal word "Danger" or "Caution" on the product label, depending on the content of the particular formulation ([1](#)).

INTRODUCTION

Cypermethrin is a synthetic pyrethroid insecticide used to control many pests, including moth pests of cotton, fruit and vegetable crops ([1](#)). It is also used for crack, crevice and spot treatment for control of insect pests in stores, warehouses, industrial buildings, houses, apartment buildings, greenhouses, laboratories and on ships, railcars, buses, trucks and aircraft. It may also be used in non-food areas in schools, nursing homes, hospitals, restaurants, hotels, and in food processing plants and as a barrier treatment insect repellent for horses ([9](#)). Cypermethrin is available in emulsifiable concentrate, ULV, and wettable powder formulations ([1](#)). Technical cypermethrin is a mixture of eight different isomers, each of which may have its own chemical and biological properties.

TOXICOLOGICAL EFFECTS

ACUTE TOXICITY

Cypermethrin is a moderately toxic material by dermal absorption or ingestion (1, 3). It may cause irritation to the skin and eyes. Symptoms of dermal exposure include numbness, tingling, itching, burning sensation, loss of bladder control, incoordination, seizures and possible death (3). Pyrethroids may adversely effect the central nervous system (3). Human volunteers given dermal doses of 130 ug/cm² on the earlobe experienced local tingling and burning sensations (2). One man died after eating a meal cooked in a 10% cypermethrin concentrate that was mistakenly used for cooking oil. Shortly after the meal, the victim experienced nausea, prolonged vomiting, stomach pains, and diarrhea which progressed to convulsions, unconsciousness and coma. Other family members exhibited milder symptoms and survived after hospital treatment (2). Rats fed high doses of 37.5 mg/kg of the cis-isomer of cypermethrin for 5 weeks exhibited severe motor incoordination, while 20-30% of rats fed 85 mg/kg died 4 to 17 days after treatment began (2). Cypermethrin is not a skin or eye irritant, but it may cause allergic skin reactions (9).

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 cypermethrin in rats is 250 mg/kg (in corn oil) or 4,123 mg/kg (in water) (1). EPA reports an oral LD50 of 187 to 326 mg/kg in male rats and 150 to 500 mg/kg in female rats (9). The oral LD50 also varies from 367 to 2,000 mg/kg in female rats, and from 82 to 779 mg/kg in mice, depending on the ratio of cis/trans-isomers present (2). This wide variation in toxicity may reflect different mixtures of isomers in the materials tested. The oral LD50 reported in rabbits is 3,000 mg/kg (3). The dermal LD50 in rats is 1,600 mg/kg (3), and in rabbits is > 2,000 mg/kg (1) or > 4,800 mg/kg (2).

CHRONIC TOXICITY

Long-term exposure to cypermethrin may cause liver changes. Pathological changes in the cortex of the thymus, liver, adrenal glands, lungs and skin were observed in rabbits repeatedly fed cypermethrin (3).

Reproductive Effects

No adverse effects on reproduction were observed in a 3-generation study with rats given doses of 37.5 mg/kg, the highest dose tested (9).

Teratogenic Effects

FAO has reported that cypermethrin is not teratogenic (2). No birth defects were observed in the offspring of rats given doses as high as 70 mg/kg/day nor in the offspring of rabbits given doses as high as 30 mg/kg/day (9).

Mutagenic Effects

FAO has reported that cypermethrin is not mutagenic, but tests with very high doses on mice caused a temporary increase in the number of bone marrow cells with micronuclei. Other tests for mutagenic effects in human, bacterial and hamster cell cultures and in live mice have been negative (2).

Carcinogenic Effects

EPA has classified cypermethrin as a weak possible human carcinogen because there is some evidence that it caused benign lung tumors in only one sex and one species (female mice) tested, and then only at the highest dose tested (1,600 ppm). No tumors occurred in rats given doses of up to 75 mg/kg (9).

Organ Toxicity

Pyrethroids may cause adverse effects on the central nervous system. Long-term feeding studies have caused increased liver and kidney weights and adverse changes to liver tissues in test animals (3).

Fate in Humans and Animals

In humans, urinary excretion of cypermethrin metabolites was complete 48 hours after the last of 5 daily doses of 1.5 mg (2). Studies in rats have shown that cypermethrin is rapidly metabolized by hydroxylation and cleavage, with over 99% being eliminated within hours. The remaining 1% becomes sequestered in body fat. This portion is eliminated slowly, with a half-life of 18 days for the cis-isomer and 3.4 days for the trans-isomer (2, 4).

ECOLOGICAL EFFECTS

Effects on Birds

Cypermethrin is practically non-toxic to birds. Its acute oral LD50 in mallard ducks is > 4,640 mg/kg (9). The dietary LC50 for mallards and bobwhite quail is > 20,000 ppm (9). No adverse reproductive effects occurred in mallards or bobwhite quail given 50 ppm, the highest dose tested (9).

Effects on Aquatic Organisms

Cypermethrin is extremely toxic to fish and aquatic invertebrates. The 96-hour LC50 for cypermethrin in rainbow trout is 0.82 ppb, and in bluegill sunfish is 1.78 ppb. Its acute LC50 for *Daphnia magna*, a small freshwater crustacean, is 0.2 ppb. The bioconcentration factor for cypermethrin in rainbow trout was 1200 times in a flow through study (9).

Cypermethrin is metabolized and eliminated significantly more slowly by rainbow trout than by mammals or birds (11), which may explain this compound's higher toxicity in fish than in other organisms.

The pyrethroid insecticides are extremely toxic to fish with 96-hour LC50 values generally below 10 ug/l. Corresponding LD50 values in mammals and birds are in the range of several hundred to several thousand mg/kg. Fish sensitivity to the pyrethroids may be explained by their relatively slow metabolism and elimination of these compounds. The half-lives for elimination of several pyrethroids by trout are all greater than 48 hours, while elimination half-lives for birds and mammals range from 6 to 12 hours (15).

Generally, the lethality of pyrethroids to fish increases with increasing octanol/water partition coefficients (16).

Effects on Other Animals (Nontarget species)

Cypermethrin is highly toxic to bees (8, 9).

ENVIRONMENTAL FATE

Breakdown of Chemical in Soil and Groundwater

Cypermethrin is not soluble in water and has a strong tendency to adsorb to soil particles. It is therefore unlikely to cause groundwater contamination (5, 9).

On soils, cypermethrin photodegrades rapidly with a half-life of 8 to 16 days. Its major photodegradation products are DCVA, 3-phenoxybenzaldehyde, and 3-phenoxybenzoic acid. Cypermethrin is also subject to microbial degradation under aerobic conditions (9).

Under laboratory conditions, cypermethrin degrades more rapidly on sandy clay and sandy loam soils than on clay soils and more rapidly in soils low in organic material

(9). In aerobic conditions, its soil half-life is 2 to 8 weeks. Cypermethrin is more persistent under anaerobic conditions (9).

Its soil half-life is 63 days (5) or, under field conditions, 4 to 12 days (9). When applied to a sandy soil under laboratory conditions, its half-life was 2.5 weeks and declined to 6% of the amount applied within 48 weeks (6). When applied to soil at 125 g of active ingredient per ha, residues of cypermethrin were detectable 15 days later, but were not detectable 30 days after the application (7).

Breakdown of Chemical in Surface Water

In neutral or acid aqueous solution, cypermethrin hydrolyzes slowly, with hydrolysis being more rapid at pH 9. Slow photodegradation occurred in a sterile solution exposed to sunlight (< 10% in 32 days). Under normal environmental temperatures and pH, cypermethrin is stable to hydrolysis with a half-life of > 50 days and to photodegradation with a half-life of > 100 days (9).

When applied to open water at 125 g of active ingredient per ha, the concentration of cypermethrin in the water dropped by 95% within 24 hours (7). This rapid loss was probably due to adsorption of cypermethrin to sediment and suspended soil particles (10). The remaining residues persisted for 30 days when measurements were ceased (7).

In pond waters and in laboratory degradation studies, pyrethroid concentrations decrease rapidly due to sorption to sediment, suspended particles and plants. Microbial and photodegradation also occur.

Breakdown of Chemical in Vegetation

When a 4.5 ml/100 l solution of Cymbush 250 EC was applied to strawberry plants until run-off, 40% of the applied cypermethrin remained after 1 day, 12% remained after 3 days, and 0.5% remained after 7 days, with a light rain occurring on day 3 (12).

When cypermethrin was applied to wheat at 28 g of active ingredient/ ha, residues on the wheat were 4 ppm immediately after spraying and declined to 0.2 ppm 27 days later. No cypermethrin was detected in the grain. Similar residue loss patterns have been observed on treated lettuce and celery crops. In another study with cypermethrin applied to wheat at 0.25 to 1.5 kg/ha, its half-life was 4.8 days (13).

PHYSICAL PROPERTIES AND GUIDELINES

Pure isomers of cypermethrin form colorless crystals. When mixed isomers are present, cypermethrin is a viscous semi-solid (1) or a viscous, yellow liquid (2). Cypermethrin is light stable (2).

Workers handling products containing cypermethrin should wear protective clothing as directed on the product label.

Cypermethrin may pose a slight fire hazard if exposed to heat or flame. It may burn, but does not readily ignite. Avoid contact with strong oxidizers, excessive heat, sparks and open flame. Thermal decomposition may release toxic fumes of hydrogen cyanide, chlorine, and oxides of nitrogen and carbon (3).

Exposure Guidelines:

No occupational exposure limits have been established for cypermethrin by OSHA, NIOSH or ACGIH (3).

ADI: 0.01 mg/kg/day based on a dog study with a NOEL of 1.0 mg/kg/day and a 100 fold safety margin (9).

MPI: 0.60 mg/kg/day for a 60 kg person (9).

Physical Properties:

CAS #: 52315-07-8

Chemical Name: (R,S)-alpha-Cyano-3-phenoxybenzyl-2,2-dimethyl (1R, 1S)-cis,trans-3-(2,2-dichlorovinyl) cyclopropane-carboxylate

Chemical Class/Use: Synthetic pyrethroid insecticide

Density: 1.12 gm/ml at 22 degrees C (2); 1.249 g/cm³ at 20 degrees C (9).

H₂O solubility: insoluble in water (1); 9 ug/liter (2)

Solubility in other solvents: soluble in methanol, acetone, xylene, methylene dichloride (1)

Melting point: 60-80 degrees C (pure isomers) (1, 2); 177 degrees F (81 degrees C)(3).

Boiling point: 170-195 degrees C (9)

Flashpoint: > 572 degrees F (> 300 degrees C) (3)

Vapor pressure: 4 x 10⁻⁸ mm Hg at 70 degrees C (2); 1.3 x 10⁻³ mm Hg at 20 degrees C (3); 8 x 10⁻⁴ mm Hg at 80 degrees C and 1 x 10⁻⁷ mm Hg at 20 degrees C (9).

Koc: 160,000 gm/ml (5)

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