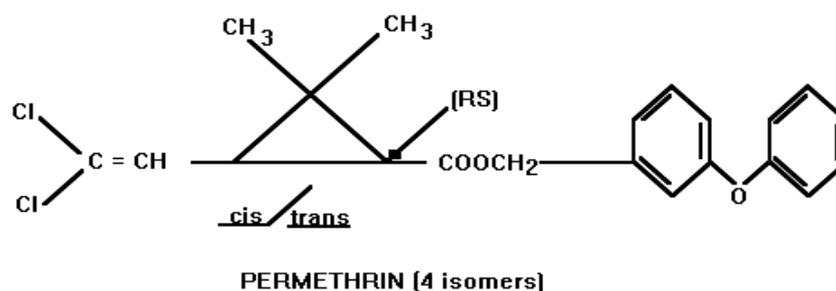


Permethrin



Chemical name: Permethrin

Other names:

(3-Phenoxyphenyl)methyl cis,trans-(+)-3-(2,2-dichloroethenyl)-2,2-dimethylcyclopropanecarboxylate

3-Phenoxybenzyl 3-(2,2-dichlorovinyl)-2,2-dimethylcyclopropanecarboxylate

Ambush, Anomethrin N, Atroban, Chinetrin, Coopex, Corsair, Cyclopropanecarboxylic acid, Ecsumin, Ectiban, Efmethrin, Eksmin, Exmin, Matadan, Perigen, Permasect, Permethrin total, permethrine, Permetrin, Permetrina, Perthrine, Talcord

Compound: C₂₁H₂₀Cl₂O₃

CAS Number: 51877-74-8 (trans-isomer), 52645-53-1 (mixed isomers), 54774-45-7 (cis-isomer)

Pesticide type: insecticide, acaricide

Characteristics

Odorless, colorless crystalline solid or a viscous liquid that is pale brown. Insecticide belonging to the synthetic pyrethroid family, first marketed in 1973. Originally registered for use by the US EPA in 1979 and it was re-registered in 2006. It kills insects by strongly exciting their nervous systems. It makes the nervous system hypersensitive so the nerves send a train of impulses instead of just a single one. Similar mode of action to that of DDT.

Use

Widely used on cotton (about 60% of all permethrin used), wheat, corn, nut, mushroom, potato, alfalfa and other crops. Used to kill pest insects, livestock parasites, in forestry, public health programs including head lice control, in timber treatment, as a personal protective measure (cloth impregnant notably used for US military uniforms and mosquito nets), in pet collars. It is also used in tropical areas to prevent mosquito-borne disease such as dengue fever and malaria. In addition over 100 million applications are made annually around US homes.

Many insects have developed resistance to permethrin, mainly cockroaches, head lice and tobacco budworm. Besides its use is controversial because, as a broad-spectrum chemical, it kills indiscriminately.

Possible hazards and regulation

As with all neurotoxins, symptoms of poisoning include irritability to sound or touch, abnormal facial sensation, numbness, tremors, incoordination, elevated body temperature, increased aggressive behaviour, paralysis, hyperactivity. These symptoms persist up to three days. Products containing permethrin can be irritating to both eyes and skin (toxicity category III low toxicity). It can cause tearing, swelling and blurred vision. Ingestion of permethrin reduces the ability of immune system cells to recognize and respond to foreign proteins meaning the immune system is exquisitely sensitive.

Suspected endocrine disruptor.

It has been restricted by the US government, however this restriction is outdated now. All products

for agricultural uses are Restricted Use Pesticides.
EPA toxicity category III low toxicity.
WHO II moderately hazardous.

Toxicity

In mammals, permethrin has complex effects on the nervous system. It also inhibits a variety of nervous system enzymes: ATPase and acetylcholinesterase. It also inhibits respiration. It does not present notable genotoxicity or immunotoxicity in humans and farm animals.

Toxicity to humans

Tests suggest that permethrin is more acutely toxic to children than to adults. It has been found in streams and rivers in the USA and it is also routinely found on produce, particularly spinach, tomatoes, celery, lettuce and peaches. In 1996 it was the 13th most commonly detected pesticide and found in 12% of samples of baby food tested.

There is a concern about its synergic effects, being combined with another chemical. A possible cause of the health problems reported by 30 000 veterans from the Persian Gulf War is exposure to a combination of permethrin, the anti-nerve gas drug pyridostigmine bromide and the insect repellent DEET. Residues of permethrin were also found in African women breast milk together with DDT.

Recent studies also linked permethrin exposure to Parkinson's disease.

EPA determined a Population Adjusted Dose of 0,25 mg/kg/day for both acute and chronic dietary exposures to permethrin.

ADI 0,05 mg/kg/day

Acute toxicity limits

LD50 for rats 430 mg/kg – 4000 mg/kg. It is almost 5 times more acutely toxic to 8-day-old rats than it is to adult rats.

LD50 for mice range from 540 to 2690 mg/kg. Factors contributing to all these variabilities include age, sex, carrier and isomer ratio.

LD50 in rabbits is over 2000 mg/kg.

Chronic toxicity

Effects on the liver are most serious. Also enlarges adrenal glands and increases kidney weights (rabbit and rat studies).

Dogs fed daily doses at 0, 5, 50 or 500 mg/kg body weight for 96 days showed transient signs including tremors. The NOAEL is 50 mg/kg/day.

Mice fed 28 – 1400 mg/kg/day for 28 days and no mice died. NOAEL at 140 mg/kg/day.

Rats in a 2-year feeding study given 100 mg/kg and showed no signs of toxicity.

Ecotoxicity

In general, mammals are less susceptible to permethrin compared to insects because their sodium channels are less sensitive and recover more rapidly. Acutely toxic to honey bees (lethal dose is 0,008 micrograms/bee) and other beneficial insects, fish (LC50 is less than 1 ppm, small fish being less tolerant to permethrin than large fish and it is more toxic in cold water than in warm water, for example it is very highly toxic to lobster, the LC50 less than 1ppb), aquatic insects (also causing rapid depletion of bottom fauna), crayfish (LC50 around 0,4 – 1,2 ppb) and shrimp. Permethrin causes deformities and other developmental problems in tadpoles and effects brain function in tadpoles and reduces the number of oxygen-carrying cells in the blood of birds and decreases immune responses. LD50 for chicken, mallard ducks and Japanese quail are 3000, 9800 and 13 500 mg/kg. According to a study it caused 99% mortality to all 13 species of beneficial arthropods tested.

Highly toxic to cats. Many cats die after being given flea treatments intended for dogs.

Reproductive effects

Affects both male and female reproductive systems. It has caused embryo loss in pregnant rabbits and rats. Also reduction in fetal rat weights and a greater occurrence of additional ribs has been reported.

In a study with women, no evidence that exposure affected the outcome of their pregnancies found, thus it is unlikely to cause reproductive effects in humans under normal circumstances.

Carcinogenity

Classified as a carcinogen by the EPA, because it causes lung tumors in female mice and liver tumors in mice of both sexes. IARC carcinogens III unclassifiable.

A lifetime cancer study involving mice resulted in slightly elevated numbers of benign hepatic tumors.

Mutagenity: was mutagenic in three tests with human cell cultures, one with hamster cells and one with fruit fly larvae, but usually reported to have no mutagenic activity

Bioaccumulation: bioconcentrates in fish – in bluefish the factor is 715 times the concentrations in water and in catfish this is even more, 703 times.

Mobility: not very mobile in a wide range of soil types

Persistence and degradability in the environment

Permethrin binds tightly to soil and is broken down primarily by microorganisms. Half-life in soil is between 17 and 43 days. It persists longer in tree needles and bark, up to 363 days. In water, the majority binds tightly to the sediment. Half-life is about 19-27 hours, however adsorbed to sediments can persist more than a year. It is not likely to contaminate groundwater due to its low water solubility and strong adsorption to soil. In air it has the potential to drift and is not expected to volatilize. Permethrin may persist in fatty tissues, with half-lives of 4-5 days in brain and body fat.

Limits

Oral exposure:

The Agency for Toxic Substances and Disease Registry determined Minimum Risk Levels of 0,3 mg/kg/day.

Water:

WHO water quality criteria – concentration when toxic effects may occur 0,3 µg/l

Canadian Water Quality Guidelines – fresh water 0,004 µg/l, salt water 0,001 µg/l

Food:

Codex Alimentarius – broccoli 2ppm, cabbage 5ppm, cereal grains 2ppm, eggs 0,1ppm, olives 1ppm, potato 0,05ppm, tea 20ppm, spinach 2ppm

Vyhláška 381/2007 Sb. - tea 0,1 mg/kg, hops 0,1 mg/kg, other food 0,05 mg/kg, meat 0,5 mg/kg

Hazard Symbol : Xn harmful
N dangerous for the environment

Risk Phrases

R20/22 Harmful by inhalation and in contact with skin

R43 May cause sensitisation by skin contact

R50/53 Very toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment

Safety Phrases

S20/21 When using do not eat, drink or smoke

S46 If swallowed, seek medical advice immediately and show this container or label

S60 This material and its container must be disposed of as hazardous waste

S61 Avoid release to the environment. Refer to special instructions/safety data sheet

Links

<http://www.safe2use.com/poisons-pesticides/pesticides/permethrin/cox-report/cox.htm>

http://www.pesticideinfo.org/Detail_Chemical.jsp?Rec_Id=PC35397

<http://en.wikipedia.org/wiki/Permethrin>

<http://npic.orst.edu/factsheets/Permtech.pdf>

<http://extoxnet.orst.edu/pips/permethr.htm>

http://www.epa.gov/oppsrrd1/REDS/factsheets/permethrin_fs.htm

<http://www.mindfully.org/Pesticide/Permethrin.htm>

http://www.up3project.org/documents/Permethrin_PRA_Overview.pdf



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