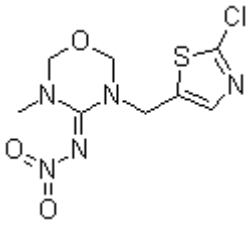
Thiamethoxam



Chemical name: thiamethoxam
Other names:
3-[(2-chloro-5-thiazolyl)methyl]tetrahydro-5-methyl-*N*-nitro-4*H*-1,3,5-oxadiazin-4-imine
3-(2-chloro-1,3-thiazol-5-ylmethyl)-5-methyl-1,3,5-oxadiazinan-4-ylidene(nitro)amine
hiamethoxam, Thiamethoxan, Thiomethoxain, Thiomethoxiam, tiametoxame
Compound: $C_8H_{10}ClN_5O_3S$
CAS Number: 153719-23-4
Pesticide type: fungicide, insecticide

Characteristics

Thiamethoxam is a second generation neonicotinoid insecticide, possessing some unique chemical properties. It was discovered in the course of an optimisation program on neonicotinoids started in 1985. It was introduced in 1997 in New Zealand, then approved to use in almost all european countries and also registered in the USA and Australia. The compound can be synthesised in only a few steps and high yield from easily accessible starting materials. It interferes with a specific receptor site in the insect´s nervous system. Once insect come into contact with thiamethoxam, feeding is irreversibly stopped and insect damage halts.

Use

Insecticide with contact, stomach and systemic activity. Used for control of aphids, whitefly, thrips, ricehoppers, ricebugs, mealybugs, white grubs, Colorado potato beetle, flea beetles, wireworms and ground beetles. Major target crops are leafy and fruity vegetables, potatoes, rice, cotton, citrus, tobacco and soya beans, cereals, sugar beet, peas, sunflowers etc. Most common tradenames include Actara and Cruiser. A strong preventative effect on some virus transmissions has been demonstrated as well. It is also used as a wood preservative, to control termites. It is commonly used for modern integrated pest management programmes in many cropping systems.

Possible hazards and regulation

Thiamethoxam has not been rated as a hazardous chemical in general. According to Commission Directive 93/31/EEC there is no inhalation hazard, no classification required for sensitiser.
WHO toxicity class III slightly hazardous.

Toxicity

Toxicity to humans

Results of various studies have concluded that there is reasonable certainty that no harm will result to infants and children from exposure to thiamethoxam residues.
Unlikely to pose a hazard to humans exposed to this chemical at the low concentrations found in the environment or during its use as an insecticide.

Acute toxicity limits

Low acute toxicity to rodents. Oral acute LD50 for rats about 1563 mg/kg. The rat dermal LD50 is > 2,000 mg/kg and the rat inhalation LC50 is > 3.72 milligrams per liter (mg/L) air.

Chronic toxicity:
Studies were carried out in rats, dogs and mice. The NOAEL was 1,74 mg/kg/day in male rats. This is not relevant for human risk assessment. The NOAEL in dogs was 8,23 mg/kg/day. No dermal irriatation observed in a 28-day dose dermal study in rats.

Reproductive effects:
In rabbits, thiamethoxam caused decreased body weights (bwt), decreased food consumption and premature death of two females administered 150 mg/kg/day during gestation. This maternal toxicity was accompanied by reduced fetal bwts and an increase in the incidence of minor skeletal anomalies or variations. In rats, thiamethoxam caused decreased bwts, decreased food consumption and hypoactivity at 200 and 750 mg/kg/day. Reduced fetal bwts and an increase in the incidence of minor skeletal anomalies and variations were observed only at 750 mg/kg/day. There was no indication of developmental toxicity at 200 mg/kg/day. (NOAEL) in rabbits for maternal toxicity was 15 mg/kg/day.

Ecological effects
PAN Groud Water contaminant – potential

Practically non-toxic to fish, invertebrates and birds. Highly toxic to bees. Acute oral LD50 for birds: bobwhite quail 1552 mg/kg, mallard ducks 576 mg/kg. Fish LC50 for rainbow trout 100. Bees LD50 0,024 mg/bee, worms LC50 1000 mg/kg soil – earthworms are the most sensitive group.

There is a very slight risk that some aquatic insects could be harmed by runoff from thiamethoxam treated fields, if a large precipitation event occurs shortly after the material is applied.

Carcinogenity
Not a likely carcinogen, no carcinogenic response in rats, but significant increase in liver cancer in mice.
USEPA (United States Environmental Protection Agency) classified thiametoxam as „likely to be carcinogenic to humans“ at one point, but later (2008) changed this statement to „not likely to be carcinogenic to humans“

Mutagenity: no evidence
Bioaccumulation: no bioaccumulation
Mobility: medium mobility in soil

Persistence and degradability in environment
Quickly and completely absorbed by animals, rapidly distributed in the body and rapidly eliminated. Soil DT50 is 51 days. Binds weakly to soil and thus has potential to leach. In addition, metabolite CGA322704, formed in soil as major metabolite, is toxic to eartwhorms and very stable in soil. Stable in water under acid conditions, hydrolysed under alkaline conditions. Aqueous photolysis occurs rapidly. The substance is not volatile.

Limits
Food: Canada MRL: 0,08 ppm potatoe chips, 0,05ppm potatoes
EPA: soybean, hulls 2,0ppm, grain frations of soybean 0,08ppm
Vyhláška č. 381/2007 Sb.(mg/kg): potatoes 0,1, cereals 0,05, tomatoes 0,2, meat 0,01, milk 0,02
Water: USA: 50 microgram/liter

ADI – 0,026 mg/kg/day

Hazard Symbol : N – dangerous to the environment

Xn - harmful

Risk Phrases :
R22 harmful if swallowed
R50/53 Very toxic to aquatic organisms/may cause long-term adverse effects in the aquatic environment

Safety Phrases :
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 in the environment

Links
http://www.pesticideinfo.org/Detail_Chemical.jsp?Rec_Id=PC36879
http://www.chinese-pesticide.com/insecticides/thiamethoxam.htm
http://ecb.jrc.ec.europa.eu/documents/Biocides/ANNEX_I/ASSESSMENT_REPORTS/AnnexI_AR_153719-23-4_PT08_en.pdf
http://toxsci.oxfordjournals.org/cgi/content/abstract/86/1/48
http://www.epa.gov/fedrgstr/EPA-PEST/2008/April/Day-18/p8398.htm
http://sitem.herts.ac.uk/aeru/iupac/Reports/631.htm

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