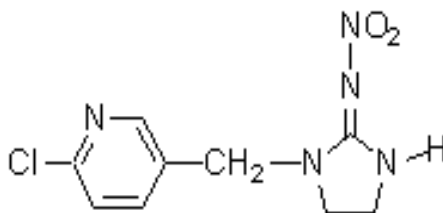


Imidacloprid



Chemical name: Imidacloprid

Other names: *N*-[1-[(6-Chloro-3-pyridyl)methyl]-4,5-dihydroimidazol-2-yl]nitramide
1[(6-chloro-3-pyridinyl)methyl]-*N*-nitro-2-imidazolidinimine)

Compound: C₉H₁₀ClN₅O₂

CAS Number: 138261-41-3

Pesticide type: insecticide

Characteristics

Imidacloprid is a neonicotinoid, a neuro-active insecticide modeled after nicotine. It was patented in 1986 and first registered in the US in 1994. It is sold under trade names Kohinor, Admire, Gaucho, Merit, Hachikusan, Premise, Winner. The chemical works by interfering with the transmission of stimuli in the insect nervous system. It causes a blockage in a type of neuronal pathway that is more abundant in insects than in warm-blooded animals. This blockage leads to the accumulation of acetylcholine, resulting in the insect's paralysis, and eventually death. It is effective on contact and via stomach action.

Use

It is marketed as pest control, seed treatment, an insecticide spray, termite control, flea control or household cocroach control. Most widespread uses are turf pest control, grape growing, lettuce growing, uses on rice, grains, potatoes, vegetables, sugar beets, fruit, cotton, hops, citrus, coffee, soybeans, sugarcane. Target insect is sucking insect, beetles, termites, locusts and fleas.

By killing parasitic wasps that control grub larvae, it sets the stage for repeated, more extensive grub infestations which is counter-productive.

In 2006, Imidacloprid was detected in a range of fresh and processed fruits and vegetables. It was present in over 80% of all bananas tested, 76% of cauliflower, and 72% of spinach. All levels bellow US EPA tolerance levels.

Possible hazards and regulation

In France, its use (as Gaucho) has become controversial due to a possible link to derangement of behavior in domesticated honeybees (colony collapse disorder, a mysterious condition that causes sudden death of whole populations). It was finally banned for use as a crop pesticide there in 1999 after a third of French honeybees died. Bayer, the manufacturer, maintained that it is safe for bees if correctly applied. Germany baned seed treatment related to neonicotinoids in May 2008, due to negative effects upon bee colonies. Germany also called for this family of pesticides to be banned across Europe while their role in killing honeybees were investigated. This is followed by a call for a ban from beekeeping associations and environmental organisations across Europe. It is also banned in Italy and Slovenia. Similar concerns were raised in Canada, where beekeepers have experienced high colony losses of 50-80% since 1999.

Potential ground water contaminant. Not listed for endocrine, reproductive or developmental toxicity.

WHO II moderately toxic

US EPA class II or III requiring a “warning” or “caution” label

Toxicity

Studies on rats show that the thyroid is the organ most affected. Thyroid lesions occurred in rats at 16,9 mg/kg/day. It is notable for its relatively low toxicity to most animals other than insects due to its specificity acting on the nicotinic acetylcholine receptor, which is found more often in insect nervous system than that of other animals.

In the body, 96% of the chemical is eliminated within 48 hours. It has been reported to degrade into toxic, persistent, 2-chloropyridine.

Toxicity to humans

Signs of toxicity may include the following: fatigue, twitching, cramps, weakness leading to asphyxia. A person who orally ingested acute overdoses experienced emesis, drowsiness and disorientation. A 69-year-old woman ingested a formulated product containing 9,6% imidacloprid, she suffered severe cardiac toxicity and death 12 hours after the exposure. A 24-year-old man who accidentally inhaled a pesticide containing 17,8% imidacloprid was disoriented, agitated, incoherent, sweating and breathless following the exposure.

ADI 0,06 mg/kg/day

Acute toxicity limits

The oral LD50 in rats is 450 mg/kg, in mice 131 mg/kg.

24-hour dermal LD50 in rats is greater than 5000 mg/kg.

It is not irritating to eyes or skin in rabbits and guinea pigs.

Chronic toxicity:

In rats during a 2-year feeding study, no observable effect was seen at 100ppm, at 300ppm females showed decreased body weight gain and males showed decreased thyroid lesions. In a one year feeding study in dogs, no observable effect was seen at 1250ppm.

Adverse effects include increased cholesterol levels in the blood, and some stress to the liver. Liver damage disappears after exposure ends, but abnormalities in the blood are not entirely reversible.

NOAEL established at 14 mg/kg/day for rats.

Reproductive effects:

Studies in rats – no observable effect at 100ppm and decreased pup weight at 250ppm. When it was fed to pregnant rabbits, there was an increase in the number of miscarriages and an increase in the number of offspring with abnormal skeletons. ¹

Ecological effects

Toxic to upland game birds. The LD50 is 152 mg/kg for bobwhite quail and 31 mg/kg in Japanese quail. It was observed that birds learned to avoid imidacloprid treated seeds after experiencing transitory gastrointestinal distress and ataxia. It caused abnormal behaviour, lack of coordination, lack of responsiveness and an inability to fly. Its use has also been linked to eggshell thinning in birds, reduced egg production and reduced hatching success at exposures of 234 ppm in food. ²

It is moderately toxic to fish. The 96hour LC50 is 211 mg/l for rainbow trout and 280 mg/l for carp. May be very toxic to aquatic invertebrates. Highly toxic to bees. Acutely toxic to earthworms with an LD50 of between 2 and 4ppm in soil. Extremely low doses of 0,2ppm and 0,5ppm have been shown to cause deformed sperm and DNA damage. Imidacloprid can also reduce blue-green algal communities.

Carcinogenicity

Imidacloprid is rated as an „unlikely“ carcinogen by the EPA (group E). BUT inert ingredients of

the imidacloprid product „Merit“ have been reported to include naphthalene and crystalline silica, both proven cancer causing agents.³

Mutagenity

Negative in 21 out of 23 tests, may be weakly mutagenic. It did test positive for causing changes in chromosomes in human lymphocytes, as well as testing positive for genotoxicity in Chinese hamster.

Bioaccumulation: imidacloprid does not bioaccumulate

Mobility: moderately mobile

Persistence and degradability in environment

The chemical breaks down to inorganic molecules by both photolysis and microbial action. Photolysis in water results in a half-life of 1,4-10 days, while microbial action results in a half-life of 30-150 days in water and 106-193 days in soil. In soil it has moderate to very high persistence. Generally not a high risk of groundwater contamination. However there is a potential for the compound to move through sensitive soil types including porous, gravelly, or cobbly soils, depending on irrigation practices. Compared with 11 other popular pesticides, Imidacloprid moved more quickly through soil than any of the other pesticides tested. Apart from this, breakdown is very complex and slow, and some degradation products are more toxic than the parent compound.

Limits

Canadian Water Quality Guidelines for the Protection of Aquatic Life:

fresh water guidelines 0,23 µg/L, salt water guidelines 0,65 µg/L

Vyhláška 381/2007 (mg/kg): hops 2, corn 0,05, poppy seed 0,05, other food of plant origin 0,01

Hazard Symbol : T toxic

N dangerous for the environment

Risk Phrases :

R22 Harmful if swallowed

R25 Toxic if swallowed

R52 Harmful to aquatic organisms

Safety Phrases :

S22 Do not breathe dust

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

References:

¹ US EPA Office of Prevention, Pesticides and Toxic Substances. 1993. Imidacloprid.

² US EPA. Office of Pesticide Programs. 1994. Pesticide fact sheet: Imidacloprid. Washington, D.C., Mar. 18.

³ International Agency for Research on Cancer. 1997. Silica.

<http://193.51.164.11/htdocs/Monographs/Vol68/SILICA.htm>

Links

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

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

<http://www.guardian.co.uk/environment/2008/may/23/wildlife.endangeredspecies>

http://www.efsa.europa.eu/en/scdocs/doc/praper_concl_sr148_imidacloprid_summary_en_web.pdf
<http://www.flora.org/healthyottawa/merit-pesticide-insecticide-grub.htm>
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<http://npic.orst.edu/factsheets/imidacloprid.pdf>
<http://www.beyondpesticides.org/info services/pesticidesandyou/Fall08/Imidacloprid.pdf>



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