Developed and designed by Thanal Conservation Action Information and Trading Network Private Limited

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HIGHLY HAZARDOUS PESTICIDES

QUINALPHOS

(Insecticide/Acaricide)

It is a non-systemic, broad-spectrum insecticide used to control sucking and chewing insects such as aphids and beetles on vegetable crops. It is used for foliar and seed treatments, indoor and outdoor insect control, home gardening and for control of fleas on pets. It is acutely toxic and can induce cytotoxic, carcinogenic, and reproductive toxic effects in animals. It has no specific antidote.

IUPAC Name- diethoxy-quinoxalin-2-yloxy-sulfanylidene-λ5-phosphane

CAS NO: 13593-03-8

Substance Group-

Organophosphate Insecticide

Trade names – Ekalux (Syngenta), Goldlux (Crop Chemicals), Quinguard (Gharda), Deviquin (Devidayal), Buonos (Bayer), Carpo-25 (MFL), Vazara -25 (Cheminova), Krush (Neobio)

Classification-

WHO - Class Ib (Highly hazardous)

USEPA- Moderately Toxic

EU- Acute toxicity (3-H301 & 4-H312), aquatic toxicity - very toxic to aquatic life (acute 1-H400) with long lasting effects (Chronic1-H410)

Banned Countries- It is banned in 32 countries including Bangladesh, Brazil, Indonesia and Malaysia

Mode of Action: Quinalphos causes inactive inhibition of the choline esterase enzyme and causes nervous system degeneration

General properties

Quinalphos is a Pure white odourless crystal

It is a broad-spectrum contact insecticide and a stomach poison

It is a non-systemic organophosphate

It is highly soluble in water and organic solvents

Formulations: 5 (Quinalphos 01.50 % DP, Quinalphos 05 % Granules, Quinalphos 20 % AF, Quinalphos 25 % EC, and Quinalphos 25 % Gel)

GHS Hazard Statements

GHS Signal word: DANGER

H302: Harmful if swallowed (Acute toxicity, oral)

H312: Harmful in contact with skin (Acute toxicity, dermal)

H400: Very toxic to aquatic life (Hazardous to the aquatic environment, acute hazard)

H410: Very toxic to aquatic life with long-lasting effects (Hazardous to the aquatic environment, long-term hazard)

Exposure Route: Exposure by inhalation and ingestion

Residues- The maximum residue limit proposed by the European Commission for Quinalphos in fruits (Fresh and frozen) and nuts is 0.01 mg/kg and 0.05 mg/kg for spices (applicable from 30/12/2015)

Quinalphos was found in spice samples above MRL (<1), collected at vellayani centre, Kerala Agricultural University in the Annual project report of All India Network Project on Pesticide Residues, Indian Agricultural Research Institute 2018-19.

Quinalphos residues were detected from water samples taken from River Nile.

The Maximum Residue Limit (MRL) prescribed for Quinalphos according to Food safety and standards (Contaminants, toxins, and residues) Regulations, 2011 is given in mg/kg.

Rice	-0.01
Bengal gram	-0.05
Cotton seed oil	-0.05
Tea	-0.01
Fish	-0.01
Cauliflower	-0.1
Soybean	-0.05

Regulatory status:

International regulation: It is not approved by U.K COPR regulation and EU regulation (1107/2009)

It Is a PAN bad actor chemical and included in PAN HHP list

National regulation: Quinalphos is toxic-labelled yellow colour

Quinalphos is recommended for multiple crops for which MRL values and ADI (Adult dietary intake) are not set

It is recommended for 25 crops nationally- Chilli, Paddy, Sorghum, okra, Coton, Tomato, Tea, Pigeon Pea, Ground nut, Wheat, Black gram, Bengal gram, French bean, Red gram, Soy bean, Jute, Mustardm Sesamum, Cauliflower, Apple, Banana, Citrus, Pomegranate, Cardamom and Safflower against insect pests like Leaf weevil, Earhead midge, Wooly Aphid, Leaf Webber, Aphids, Jassids, Thrips, Whiteflies, Green leaf hopper, Leaf roller/folder, shoot borer, Pod borer, etc.

It is a deemed to be registered pesticide

Quinalphos was included among 66 pesticides reviewed under the Chairmanship of Dr Anupam Verma in 2013.

361st Special Meeting of Registration Committee held on 22nd December, 2015, considered these recommendations, and decided that, 'The Certificate of Registration of Quinalphos and its formulation deemed to be invalid w.e.f. from Ist January 2018 if studies as recommended by the Expert Committee if not submitted by December, 2017'

Quinalphos was included among 27 pesticides considered for ban in 2020.

It has a production volume of 2454 metric ton units in 2022 and a volume consumption of 412.6 metric ton units in India in the year 2021

Health Hazards

Acute toxicity: Quinalphos is toxic via ingestion and dermal absorption (GHS). It has moderate acute toxicity

Poisoning symptoms include excessive salivation, sweating, rhinorrhoea and tearing, muscle twitching, weakness, tremor, incoordination, headache, dizziness, nausea, vomiting, abdominal cramps, diarrhoea; respiratory depression, tightness in the chest, wheezing, productive cough, fluid in lungs; Pin-point pupils, sometimes with blurred or dark vision; Severe cases: seizures, incontinence, respiratory depression, loss of consciousness, and cholinesterase inhibition (EPA recognition and Management of poisons)

Chronic toxicity: Quinalphos inhibits acetylcholinesterase (a neurotransmitter) activity, in insects as well as in other animals including birds, amphibians, and mammals, causing a range of abnormalities in respiratory, reproductive, nervous, hepatic, and renal functioning. They can readily cross the placenta and act upon nervous system of a developing baby and cause various nerve-related disorders and maldevelopment (Gurpreet Kaur Sidhu et al, 2019)

Carcinogenicity: Not classifiable as a human carcinogen.

A study indicated that quinalphos caused damage and degeneration of the testicular tissues due to free-radical-mediated lipid peroxidation at low doses in albino rats. (Debnath. D et al, 2000)

Reproductive Toxicity: Potent reproductive toxicant (GHS)

Quinalphos decreases fertility in adult male rats by affecting the pituitary gonadotrophins (Sarkar. R et al,2000)

Abortions and still-births seen in grape-garden workers on organophosphate application, including Quinalphos in India (Rita et al., 1987)

A study showed that persistent effects of quinalphos in brain development could lead to

neurological dysfunction in later life stages (Gupta. A et al,1999)

Genotoxicity: Quinalphos has also been attributed to induce chromosome breaks/ fragments in mice and human lymphocytes (Rupa DS et al,1991)

Quinalphos is capable of inducing micronuclei and chromosomal aberrations in the bone marrow cells of mice. A significant increase in abnormal sperms was observed in treated mice (Mishra. V et al,2015)

Neurotoxicity: Potent Neurotoxin (GHS)

In a survey of the health effects in pesticide operatives, immediate effects; severe giddiness and nervous dysfunction were observed in 52 out of 260 cotton-field workers after spraying quinalphos (D. S. Rupa, P. P. Reddy and O. S. Reddi, unpublished data, 1990)

A study evidenced neurotoxic potential of quinalphos by inhibition of the AChE activity in the tissues of the fish, C. carpio at sublethal concentrations (Chebbi, S. G et al, 2009)

Degenerated dorsal olfactory area, formation of blood streaks, degenerated septal area, degenerated ventral area, degeneration of neurons, were observed in the brain of the fish *Anabas testudineus* and *Oreochromis mossambicus* exposed to sub-lethal concentration of quinalphos toxicity. Quinalphos exposures also induced discrete pathological changes in the liver tissues of the fishes (Kunhiraman, D. P, 2022)

Endocrine disruption: Suspected endocrine disruptor (Pesticide info)

Quinalphos treatment enhanced serum hormone concentrations of LH and FSH in a dose-dependent manner in mice (Sarkar. R et al,2000)

The secondary metabolite of quinalphos, 2-hydroxyquinoxaline, is mostly responsible for estrogenic/ antiandrogenic actions in animals. (Behrends. A et al, 2007)

Poisoning Data

Quinalphos was responsible for 9 deaths and 78 admissions to hospital in 2002, Warangal poisoning

Antidote- Pralidoxime and atropine sulphate are the antidotes recommended, which are common antidotes available for organophosphate treatment.

Environmental fate and effects:
Quinalphos has high acute toxicity for most non-target organisms.
It has slight mobility in in soils with low leachability

The metabolites, 2-hydroxy quinoxaline and quinalphos oxon were found to be more toxic than quinalphos and had longer persistence

Persistence of quinalphos is reported as 40 days and 125 days with half-life in black soil and red sandy soil found as 13 and 15 days forming the above metabolite

It has slight mobility in soils with low leachability

Quinalphos inhibited 30% DHA in the soil after 15 days of application (Mayanglambam et al, 2005)

Ecotoxicity
Mammals- High acute toxicity

Birds- High acute toxicity

Earthworms- Moderate acute toxicity

Honeybees- High acute toxicity

Fish - High acute toxicity

Aquatic invertebrates- High acute toxicity

Alternate pest management

Sustainable ecological solutions to replace chemical Pesticides include the use of biopesticides and numerous cultural, mechanical and biological solutions to pest control, as well as natural sprays that can be used depending on the pest and the situation that relies on the utilization of agroecological practices.

Notes on HHPs

Highly Hazardous pesticides or HHPs are a group of pesticides, that can pose serious risks to humans and cause irreversible damage to the environment. They are listed in international conventions and are banned in many countries. The handling and use of these HHPs are beyond the safety level of PPE as stated by SAICM. HHPs upon exposure enter the body through food, inhalation, or dermal contact. These pesticides cause lethal effects, especially when exposed for the long term. It includes acute toxicity (Headache, Nausea, Vomiting etc) to Chronic hazards (Gene mutations, Cancer, Reproductive dysfunction etc). Farmers, applicators, and their families are mostly exposed to pesticides. The increased closeness of residents to farming areas worsens the situation and their exposure can occur under deplorable conditions, such as handling, storing, mixing, loading, spraying, disposing, and washing pesticide containers or pesticide-soaked clothes.

Women are the most affected by the ill effects of HHP use, as they have a higher proportion of hormone-sensitive tissues, fats, and primary reproductive tasks. HHPs can cause birth defects, miscarriage, early onset of puberty, sexual maturation, infertility, and abortions in female children. Children are exposed to the HHP-contaminated environment as they consume more air, water and food per unit of body weight. They have a higher metabolism and their immunity and developing functions are compromised at a young age.

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