

d-phenothrin (sumithrin)

Review Date: 04/22/2013

CAS #: 26002-80-2

Type	Non-systemic pyrethroid insecticide that works on contact or from ingestion.
Controls	Controls ants, aphids, bed bugs, bees, beetles, borers, cockroaches, caterpillars, centipedes, fleas, flies, gnats, hornets, grain insects, lice, moths, mites, mosquitoes, rust, scab, worms, and yellow jackets (Reference 1).
Mode of Action	Pyrethroids alter nerve function by modifying normal biochemistry and physiology of nerve membrane sodium channels resulting in paralysis and death (Reference 1).

Thurston County Review Summary:

D-phenothrin is rated high in hazard and pesticides containing it as an active ingredient fail Thurston County's pesticide review criteria. D-phenothrin is rated high in hazard because reproductive toxicity was observed without maternal toxicity and due to the level of risk of toxicity from specific product uses. A summary of risks associated with specific uses is discussed in the acute human toxicity risk assessment section.

MOBILITY

Property	Value	Reference	Value Rating
Water Solubility (mg/L)	<0.01	1	Low
Soil Sorption (Kd=mL/g)	Value not found		
Organic Sorption (Koc=mL/g)	141,000	2	Low

Mobility Summary:

D-phenothrin is not soluble in water and adheres strongly to soil. When d-phenothrin is on the ground, it is expected to bind to soil and not leach into the ground and get into groundwater. When products are applied to the ground or to vegetation, d-phenothrin is not expected to leave the site of application with rain or irrigation water except when there is soil erosion. The hazard for chemical mobility is rated low.

PERSISTENCE

Property	Value	Reference	Value Rating
Vapor Pressure (mm Hg)	0.0000001	1	High
Biotic or Aerobic Half-life (days)	18 - 25	2	Moderate
Abiotic Half-life (days)	6.5 (aqueous photolysis)	2	Low
Terrestrial Field Test Half-life (days)	Value not found		
Hydrolysis Half-life (days)	"Nearly stable"	2	High
Anaerobic Half-life (days)	173	2	High
Aquatic Field Test Half-life (days)	36	2	Moderate

Persistence Summary:

D-phenothrin will not dissipate into the air after application and degrades slowly in sediment or soil with little oxygen. The main route of chemical dissipation and degradation are from sunlight (when in water) and from soil microbes. It is likely to take between one week and two months for d-phenothrin to degrade to half of the applied concentration and is rated moderate in chemical persistence.

BIOACCUMULATION

Property	Value	Reference	Value Rating
Bioaccumulation Factor	Value not found		
Bioconcentration Factor	592 (edible) 4,000 (non-edible)	2	Moderate
Octanol/Water Partition Coefficient	log Kow = 6	1	High

Bioaccumulation Summary:

When fish were put into water containing d-phenothrin it accumulated in the fish tissue up to 4,000 times in the inedible portions and up to 592 times in the edible portions. When the fish were moved to clean water 50% of the chemical was eliminated (depurated) from the fish within 2 to 4 days. So, although there was a moderate amount of accumulation, it was rapidly removed from the fish. The potential for bioaccumulation is rated moderate.

ACUTE WILDLIFE TOXICITY VALUES and Risk Assessment

Test Subject	Value	Reference	Value Rating
Mammalian (LD50)	>5,000 ppm	2	Low
Avian (LD50)	>2,510 ppm	2	Low
Honey bee or insect (LD50)	"Highly toxic"	2 and 3	Highly toxic
Annelida -worms (LC50)	Value not found		
Fish (LC50)	16-18 ug/L	2	Very highly toxic
Crustacean (LC50)	4.4 ug/L	2	Very highly toxic
Mollusk (LC50)	Value not provided	2	"Very highly toxic"
Amphibian (LD50 or LC50)	Value not found		

Acute Toxicity Testing and Ecotoxicity Summary:

Single-dose toxicity testing indicates that d-phenothrin is low in toxicity to birds and animals but highly toxic to bees and very highly toxic to fish and other aquatic organisms (Reference 2). Cats and kittens may be more susceptible to the neurotoxic effects of phenothrin. Products containing it are not recommended for use on cats and kittens (Reference 1).

The EPA evaluated the potential risk to aquatic organisms from adult mosquito control applications. The level of concern was exceeded for aquatic invertebrates in estuarine/marine environments from potential short-term and long-term exposures. Risk to fish was not evaluated due to lack of toxicological data (Reference 2). Risk to birds and animals from mosquito abatement applications is considered low by the EPA, although they noted that reproductive effects to birds could not be evaluate based on lack of data (Reference 2). The EPA believes that bees and beneficial insects are likely to be adversely affected by direct exposure to d-phenothrin.

For large-scale broadcast aerial applications for mosquito control around wetlands the hazard to non-target beneficial insects and aquatic organisms is rated high. For residential uses that do not involve applications to wetlands the risk to non-target wildlife and aquatic organisms is low. Use of any insecticide product will create risk to non-target beneficial insects.

ACUTE HUMAN TOXICITY - Risk Assessment

Subject and Scenario	Route	Dose of Concern	Exposure	Margin of Safety	Reference	Value Rating
Child indoors with aerosol space spray	Inhalation	0.027 mg/kg	0.008 mg/kg	3.3	1	Moderate
Adult spraying aerosol can	Inhalation	0.027 mg/kg	0.001 mg/kg	26	1	Low
Toddler playing on treated lawn	Incidental ingestion	0.05 mg/kg/day	0.0015 mg/kg/day	34	1	Low
Child playing with pet after spot-on treatment	Incidental ingestion	0.1 mg/kg/day BMDL	0.2 mg/kg/day	2	1	High

Acute Toxicity Risk Assessment Summary:

Application methods of d-phenothrin products include Ready-to-Use (RTU) spray containers, crack and crevice, spot treatment, fogger, automatic sprayer, aerosol can, foam applicator, and ground or aerial ultra low volume (ULV) spray for mosquito control. Risks from potential exposures vary greatly due to the application method, amount of product used, location and size of use area, etc.

Contact with skin is not expected to result in much absorption of d-phenothrin (about 2% or less). In toxicity tests, exposures to the skin did not produce toxicity at exposure levels expected from pesticidal uses (Reference 1). Risk assessments for inhalation and incidental ingestion were evaluated by the EPA for indoor and outdoor uses. Potential exposures to indoor or outdoor applicators of Ready-To-Use aerosol sprays are rated low in hazard, although a child breathing in an indoor aerosol space spray may have an exposure that is rated moderate in hazard (between 10% and 50% of the EPA's level of concern). Other child exposures that are rated moderate in hazard include potential oral exposures from contact with surfaces following use of indoor foggers and potential oral exposures following an application with carpet powders (even after vacuuming). Potential exposures to toddlers, children, or adults contacting treated lawns are rated low in hazard.

CHRONIC HUMAN TOXICITY HAZARDS

Property	Value	Adverse Effect	Reference	Rating
Carcinogenicity	Not likely to be carcinogenic to humans	Not likely to be carcinogenic to humans	1	Low
Mutagenicity	Evaluation not found	--	--	Data gap
Neurotoxicity - (NOAEL)	30 mg/kg/day	Spina bifida	1	Check risk
Endocrine Disruption	Not specifically listed as a disruptor	--	4	Low
Developmental Toxicity (NOAEL)	30 mg/kg/day	Spina bifida	1	Check risk
Reproductive Toxicity (NOAEL)	59 mg/kg/day	Decreased pup weight	1	High
Chronic Toxicity (NOAEL)	26.8 mg/kg/day	Liver toxicity +	1	Check risk

Chronic Toxicity Hazard Summary:

Neurodevelopmental toxicity was observed in developing rabbits in the form of spina bifida, although it was not indicated whether it was with or without maternal toxicity. Reproductive toxicity was observed in pups at doses much lower than maternally toxic doses. Due to reproductive toxicity without maternal toxicity, the EPA used an additional safety factor in their risk assessment for the protection of infants (Reference 1). Reproductive toxicity without maternal toxicity is rated high in hazard by Thurston County's pesticide review criteria. A mutagenicity potential evaluation could not be located. D-phenothrin is not likely to be carcinogenic.

CHRONIC HUMAN TOXICITY - Risk Assessment

Subject and Scenario	Route	Dose of Concern	Exposure	Margin of Safety	Reference	Value Rating
Occupational applicator within greenhouse	Inhalation	0.027 mg/kg/day	>0.0135 mg/kg/day	<2	1	High
child near truck broadcast spray for mosquitoes	Inhalation	0.027 mg/kg/day	<0.00027 mg/kg/day	>100	1	Low
Child near aerial broadcast spray for mosquitoes	Inhalation	0.027 mg/kg/day	<0.000027 mg/kg/day	>1,000	1	Low

Chronic Toxicity Risk Assessment Summary:

Using a 1,000 times safety factor for the protection of infants, all potential exposures from mosquito abatement programs (broadcast applications made with ultra low volume sprayers on a plane or truck) are rated low in hazard.

The worst-case exposure to an occupational applicator is calculated to be from the use of a high-pressure hand wand sprayer for an application to a greenhouse (assuming spraying of 1,000 gallons per day at the maximum application rate). These applications could result in an exposure that is rated high in hazard (even with the use of a PF-5 respirator).

Metabolites and Degradation Products:

D-phenothrin degrades to the chemicals; CHOPH (3-phenoxybenzyl (1R,3R)-2,2-dimethyl-3-formyl-cyclopropane-carboxylate), Keto-PHN (3-phenoxybenzyl 2,2-dimethyl-3-(2-methyl-1-oxo-prop-2-enyl) cyclopropanecarboxylate), COOH-PH (3-phenoxybenzyl (1R, 3R)-2,2-dimethyl-3-carboxy-cyclopropane-carboxylate), Pbacid (3-phenoxybenzoic acid), 4'-OH-Pbacid [3-(4-hydroxyphenoxy) benzoic acid] and Pbalc (3-phenoxybenzyl alcohol) Reference 2. Of these chemicals, Keto-PHN is considered a possible concern by the EPA but it is only formed through aqueous photolysis (Reference 2).

Comments:

D-phenothrin is an eye irritant (EPA Toxicity Category III) but is not considered a skin irritant or sensitizer (Reference 1).

References

1. USEPA. Office of Prevention, Pesticides and Toxic Substances. Reregistration Eligibility Decision for d-Phenothrin. September 2008.
2. USEPA. Office of Prevention, Pesticides and Toxic Substances. Preliminary Environmental Fate and Effects Assessment Science Chapter for the Reregistration Eligibility Decision of D-Phenothrin (SUMITHRIN)®. 3/5/2008.
3. International Union of Pure & Applied Chemistry. Pesticide Properties Database. Phenothrin (Ref: OMS 1809). Date accessed 4/22/2013.
4. Scorecard - The Pollution Information Site. Health Effects / Endocrine Toxicants (Accessed 4/22/2012). <http://scorecard.goodguide.com/health-effects>.