

pynamin forte (allethrin)

Review Date: 09/21/2011

CAS #: 231937-89-6

Type	Insecticide / repellent - synthetic pyrethroid
Controls	Flying and crawling insects (wasps, hornets, ants, roaches, mosquitoes, etc.).
Mode of Action	Allethrins are used as a knockdown chemical that is typically used along with another pesticide ingredient. Allethrins cause blocking of the sodium channels at the nerve endings causing hyperactivity, paralysis, or death.

Thurston County Review Summary:

The term "allethrin" is used in this review to include the active ingredients; bioallethrin, esbiol, esbiothrin, and pynamin forte (also known as "d-allethrin"). Allethrins are comprised of eight different stereo-isomers that are present in the active ingredients but in different percentages. The isomer that is considered the most insecticidally active and toxicologically significant is the "d trans". The data in this review is specific to pynamin forte whenever possible, but much of the information found for allethrin compounds is not specific to any of them.

The allethrin "pynamin forte" is used exclusively in insect repelling mats and mosquito coils (or sticks). The mats contain up to 25% pynamin forte and are heated up to disperse the ingredients and repel insects. The coils contain up to 0.3% active ingredient that is released when they are lit to repel insects. Products containing pynamin forte that are mats used for repelling flying insects fail Thurston County's review criteria because the risk to children at expected environmental concentrations is rated high in hazard. Products containing pynamin forte in mosquito coils (or sticks) are rated moderate in hazard for potential exposures to children at expected environmental concentrations. Pynamin forte is also rated high in hazard for bioaccumulation potential and moderate in hazard due to mixed results in mutagenicity testing. Risk of toxicity to pets and wildlife from exposures to pynamin forte from insect repellent products is rated low in hazard.

MOBILITY

Property	Value	Reference	Value Rating
Water Solubility (mg/L)	0.0001	1	Low
Soil Sorption (Kd=mL/g)	Value not found		
Organic Sorption (Koc=mL/g)	1,400	1	Moderate

Mobility Summary:

Allethrins are not soluble in water and are expected to adhere moderately to soil containing organic matter. When pynamin forte is used in mosquito coils and mats, it is released into the air where it will either be degraded by sunlight or get distributed in low concentrations on nearby surfaces. Eventually, when the remaining chemical is washed onto the ground, it will pose a moderate hazard to continue to move with water from that spot.

PERSISTENCE

Property	Value	Reference	Value Rating
Vapor Pressure (mm Hg)	0.0000012	3	Moderate
Biotic or Aerobic Half-life (days)	60	1	Moderate
Abiotic Half-life (days)	Data gap		
Terrestrial Field Test Half-life (days)	Data gap		
Hydrolysis Half-life (days)	Stable at pH 4 to 7	4	High
Anaerobic Half-life (days)	Value not found		
Aquatic Field Test Half-life (days)	Value not found		

Persistence Summary:

Since pynamin forte products are released to the air, the main route of degradation is expected to be by sunlight. When used at night, more chemical will land on surfaces to be degraded later by sunlight or soil microbes. Sunlight will degrade pynamin forte within hours but soil degradation can take up to 60 days to reach half of the applied concentration. The hazard for chemical persistence is rated low in air and moderate on soil.

BIOACCUMULATION

Property	Value	Reference	Value Rating
Bioaccumulation Factor	Value not found		
Bioconcentration Factor	3,281	1	Moderate
Octanol/Water Partition Coefficient	log Kow = 4.96	1	High

Bioaccumulation Summary:

The EPA stated that the physical and chemical properties of allethrin indicate that there is a low potential for bioaccumulation although studies with a structurally similar type I pyrethroid chemical indicates the potential is high. Bioconcentration studies with allethrin compounds indicates that there is some accumulation in fish tissue although the accumulation is moderate. Human metabolism studies show that allethrin are quickly metabolised and eliminated with peak urine concentrations reached within 24 hours, rat studies indicate that half of ingested bioallethrin is eliminated from the body within 48 hours (References 5 and 6). The hazard of bioaccumulation of allethrin compounds is rated moderate.

ACUTE TOXICITY HAZARD - ECOTOXICITY

Test Subject	Value	Reference	Value Rating
Mammalian (LD50)	900 mg/kg	2	Moderate
Avian (LD50)	2030 mg/kg	1	Low
Honey bee or insect (LD50)	3.4 ug/bee	1	Moderate
Annelida -worms (LC50)	Value not found		
Fish (LC50)	0.0094 mg/L	6	High
Crustacean (LC50)	0.021 mg/L	1	High
Mollusk (LC50)	Value not found		
Amphibian (LD50 or LC50)	Value not found		

Acute Toxicity Testing and Ecotoxicity Summary:

Single-dose toxicity testing of pynamin forte indicates that it is low in toxicity to birds, moderate in toxicity to animals, bees, and fish, but very highly toxic to other aquatic organisms.

Pynamin forte is found exclusively in coils, sticks, and mats that are used as insect repellants. Intended uses of these products are not expected to create significant concentrations of pynamin forte outside of the area of use and therefore exposures to non-target organisms is expected to be small and mostly to occur while the products are in use. Residues of pynamin forte on vegetation are expected to be much lower than the level of concern for bees. The risk of toxicity from exposures to pynamin forte to non-target organisms (pets and wildlife) from insecticidal use is rated low in hazard.

ACUTE TOXICITY - Risk Assessment

Subject and Scenario	Route	Dose of Concern	Exposure	Margin of Safety	Reference	Value Rating
Child on patio with 2 insect mats	Inhalation	0.0013 mg/kg/day	0.0007 mg/kg/day	1.8	2	High
Child on patio with 2 mosquito coils	Inhalation	0.0013 mg/kg/day	0.00018 mg/kg/day	7	2	Moderate
Applicator risk is assumed to be low						
Combined routes of exposure are not expected						

Acute Toxicity Risk Assessment Summary:

Intended uses of allethrin insecticides are not expected to cause contamination to surface water or groundwater, therefore drinking water is not considered an exposure risk from allethrin insecticide use. There are currently no food or crop uses of allethrin insecticides. Dermal (skin absorption) toxicity testing with allethrin did not produce toxicity - therefore risk assessments for skin exposures were not required.

Pynamin forte products are used in coils and mats for repelling flies and mosquitoes. Risk from post-application inhalation exposures to pynamin forte was calculated by the EPA for the use of insect repellant mats (2 per patio) and mosquito coils (2 per patio). Inhalation exposures to include infants were evaluated with a dose of concern set at 0.0013 mg/kg/day. The potential exposure to a child was calculated to be more than half of the dose of concern for use of mat repellants which is rated high in hazard. Potential exposures to a child in the area of the mosquito coils was 7 times less than the dose of concern and is rated moderate in hazard.

CHRONIC TOXICITY HAZARDS

Property	Value	Adverse Effect	Reference	Rating
Carcinogenicity	No evidence of carcinogenicity	--	2	Low
Mutagenicity	Value not found	Positive and negative test results	2 and 3	Moderate
Neurotoxicity - (NOAEL)	Data gap	--	2	Moderate
Endocrine Disruption	"no evidence"	--	2	Low
Developmental Toxicity (NOAEL)	Value not found			
Reproductive Toxicity (NOAEL)	Value not found			
Chronic Toxicity (NOAEL)	6 mg/kg/day	Microscopic liver changes	2	Check risk

Chronic Toxicity Hazard Summary:

There are specific developmental neurotoxicity testing data lacking for allethrins so the EPA placed an additional 10x safety factor on the human risk assessments to further protect infants and developing fetuses. The EPA states that pynamin forte is not considered mutagenic although review of studies by the Center for Disease Control (CDC) infers that there are mixed results in mutagenicity testing; some positive and some negative). The mixed results for mutagenicity evaluation is rated moderate in hazard (Reference 3). Cancer testing with pynamin forte did not produce any evidence of carcinogenicity and the EPA stated that in reviewing available toxicity testing of allethrins, there was no evidence of endocrine disruption (Reference 2). The EPA's re-registration document for allethrin products states that developmental and reproductive toxicity was only observed at levels that were at or above concentrations that caused other toxicities (Reference 2). The hazard for developmental or reproductive toxicity is rated moderate when toxicity to the offspring occurs at the same concentration as toxicity to the parent.

CHRONIC TOXICITY - Risk Assessment

Subject and Scenario	Route	Dose of Concern	Exposure	Margin of Safety	Reference	Value Rating
Long-term exposure to pynamin forte not expected						
Long-term exposure to pynamin forte not expected						
Long-term exposure to pynamin forte not expected						
Long-term exposure to pynamin forte not expected						

Chronic Toxicity Risk Assessment Summary:

There were no risk assessments evaluated by the EPA for exposures to pynamin forte for durations longer than 30 days because long-term exposures are not expected from mosquito repellent uses.

Metabolites and Degradation Products:

The metabolites and degradation chemicals of the allethrin compounds could not be found although the EPA stated that the parent compound (allethrins) is the only residue of toxicological significance (Reference 2).

Comments:

Pynamin forte is considered a slight eye irritant (EPA Toxicity Category III), but is not a skin irritant (EPA Toxicity Category IV) and it is not considered a skin sensitizer (Reference 2).

References

1. International Union of Pure & Applied Chemistry. Pesticide Properties Database. allethrin (Ref: FMC 249). Accessed 9/13/11. <http://sitem.herts.ac.uk/aeru/iupac/>
2. USEPA. Prevention, Pesticides and Toxic Substances. Reregistration Eligibility Decision for Allethrins. EPA 738-R-07-001. Revised May 2009.
3. Center for Disease Control, Agency for Toxic Substances and Disease Registry. "Toxicological Profile for Pyrethrins and Pyrethroids". September 2003.
4. USEPA. Office of Pesticide Programs, Environmental Fate and Effects Division. Environmental Fate and Ecological Risk Assessment for the Reregistration of the Allethrins. April 4, 2007.
5. Leng G, Kühn KH, Wieseler B, Idel H. PubMed 107(1-3):109-21. "Metabolism of (S)-bioallethrin and related compounds in humans" June 30, 1999.
6. World Health Organization. International Programme on Chemical Safety. Environmental Health Criteria 87. ALLETHRINS. 1989.