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|----------------|---|
| Type | Biochemical insecticide |
| Controls | Flies, flea larvae, mosquitoes, beetles, moths, etc. |
| Mode of Action | Insect growth regulator - inhibits development of larvae. |

Thurston County Review Summary:

Methoprene products are formulated in liquids, aerosol sprays, foggers, shampoos, animal collars, granulars, pellets, tablets, etc. The risk to non-target organisms is based on the product type and application area (high for water applications of slow-release products and low for all other applications), therefore, the rating is "conditional".

MOBILITY

| Property | Value | Reference | Value Rating |
|-----------------------------|--------------------|-----------|--------------|
| Water Solubility (mg/L) | 1.9 | 1 | Low |
| Soil Sorption (Kd=mL/g) | Value not found | | |
| Organic Sorption (Koc=mL/g) | 23,000 (estimated) | 6 | Low |

Mobility Summary:

Methoprene is not very soluble in water and is expected to adhere strongly to organic soil (clay, sediment, etc.). The hazard for methoprene to move off the application area with rain or irrigation water is rated low.

PERSISTENCE

| Property | Value | Reference | Value Rating |
|---|------------------------------|-----------|--------------|
| Vapor Pressure (mm Hg) | 0.000024 | 2 | Moderate |
| Biotic or Aerobic Half-life (days) | < 7 | 1 | Low |
| Photolysis Half-life (days) | <1 (photodegradation in air) | 6 | Low |
| Terrestrial Field Test Half-life (days) | 10 | 2 | Moderate |
| Hydrolysis Half-life (days) | Not expected to hydrolyze | 1 and 2 | High |
| Anaerobic Half-life (days) | 10 - 14 | 1 | Moderate |
| Aquatic Field Test Half-life (days) | <3 | 1 | Low |

Persistence Summary:

The formula type and location of the application greatly influence the persistence of methoprene (Reference 6). Solid products are intended to keep methoprene from dissipating or being degraded too quickly; products used indoors or on animals are also not expected to degrade at the rates determined from environmental conditions. Therefore, the rating of persistence is most reflective of liquid or dissolved solid products used outdoors.

Methoprene degrades up to 90% in water or water saturated soil within 3 days (Reference 1). On soil and in aquatic settings methoprene is likely to take about a week to degrade to half of the applied concentration. The hazard of chemical persistence is rated low, although pelletized or other slow release solid products are expected to be high in hazard for persistence.

BIOACCUMULATION

| Property | Value | Reference | Value Rating |
|-------------------------------------|---------------------------|-----------|--------------|
| Bioaccumulation Factor | Value not found | | |
| Bioconcentration Factor | 457 (degradates) to 3,400 | 1 and 2 | Moderate |
| Octanol/Water Partition Coefficient | log Kow = 5 | 2 | High |

Bioaccumulation Summary:

Methoprene and its metabolites are rapidly degraded in animals and incorporated into natural body constituents, however, these chemicals are not of toxicological concern (Reference 1). In fish, methoprene metabolites accumulated up to 950 times the water concentration but within 14 days nearly 95% was eliminated when the fish were moved to clean water (Reference 1). So, although there is potential for metabolites of methoprene to be retained in fish or animal tissue, the hazard associated with methoprene bioaccumulation is rated low.

ACUTE WILDLIFE TOXICITY VALUES and Risk Assessment

| Test Subject | Value | Reference | Toxicity Rating |
|----------------------------|-----------------|-----------|-----------------|
| Mammalian (LD50) | >10,000 mg/kg | 1 | Low |
| Avian (LD50) | >2,000 mg/kg | 1 | Low |
| Honey bee or insect (LD50) | <2 ug/bee | 2 | High |
| Annelida -worms (LC50) | Value not found | | |
| Fish (LC50) | 0.76 mg/L | 2 | High |
| Crustacean (LC50) | 0.09 mg/L | 1 | Very high |
| Mollusk (LC50) | Value not found | | |
| Amphibian (LD50 or LC50) | Value not found | | |

Acute Toxicity Testing and Ecotoxicity Summary:

Single-dose toxicity testing indicates that methoprene is low in toxicity to animals and birds, and highly toxic to insects, fish, and other aquatic organisms.

Methoprene applied throughout a watershed along with malathion, resmethrin, and sumethrin for mosquito control resulted in a large decline of seasonal lobsters (Reference 3). Subsequent studies indicate that methoprene at concentrations as low as 1 part per billion (1 ppb) is toxic to stage II lobster larvae and may have contributed to the lobster deaths (Reference 3). The EPA later determined that long-term exposures to estuarine invertebrates may be a concern from use of briquette-style slow release products (Reference 1). Other aquatic formulated products do not pose a risk of concern to the EPA (Reference 1). The hazard to non-target aquatic invertebrates is rated high for direct aquatic applications of slow release products, but low in hazard for all other applications. Overall, the risk is rated conditional due to the risk being based on application type and location.

ACUTE HUMAN TOXICITY - Risk Assessment

| Subject and Scenario | Route | Dose of Concern | Exposure | Margin of Safety | Reference | Risk Rating |
|---|-------|-----------------|----------|------------------|-----------|-------------|
| Applicator exposures were not evaluated | | | | | | |
| Post-application exposures were not evaluated | | | | | | |
| Post-application exposures were not evaluated | | | | | | |
| Combined exposures were not evaluated | | | | | | |

Acute Toxicity Risk Assessment Summary:

Due to the low dermal and inhalation toxicity of methoprene, the EPA did not require a risk assessment for potential short-term or long-term occupational exposures (Reference 1).

CHRONIC HUMAN TOXICITY HAZARDS

| Property | Value | Adverse Effect | Reference | Rating |
|--------------------------------|-----------------------------|---|-----------|------------|
| Carcinogenicity | No evidence of oncogenicity | Does not induce tumor formation | 1 | Low |
| Mutagenicity | Value not found | Not mutagenic | 1 | Low |
| Neurotoxicity - (NOAEL) | Value not provided | No evidence of neurotoxicity | 1 | Low |
| Endocrine Disruption | Value not provided | Affected testosterone metabolism in crustaceans | 3 and 4 | N/A |
| Developmental Toxicity (NOAEL) | 600 mg/kg/day | No developmental toxicity | 1 | Low |
| Reproductive Toxicity (NOAEL) | 2500 ppm | No evidence of reproductive toxicity | 1 | Low |
| Chronic Toxicity (NOAEL) | 37.5 mg/kg/day | Liver pigmentation | 1 | Check risk |

Chronic Toxicity Hazard Summary:

Toxicity testing with methoprene indicates that it is not carcinogenic or mutagenic and does not cause reproductive or developmental toxicity (Reference 1). Methoprene is considered a juvenile insect hormone agonist which can disrupt events under endocrine control in aquatic crustaceans (References 3 and 4).

CHRONIC HUMAN TOXICITY - Risk Assessment

| Subject and Scenario | Route | Dose of Concern | Exposure | Margin of Safety | Reference | Risk Rating |
|---|-------|-----------------|----------|------------------|-----------|-------------|
| Applicator exposures were not evaluated | | | | | | |
| Post-application exposures were not evaluated | | | | | | |
| Post-application exposures were not evaluated | | | | | | |
| Combined exposures were not evaluated | | | | | | |

Chronic Toxicity Risk Assessment Summary:

Long-term exposures to methoprene are not expected from insecticide uses and so the EPA did not require a risk assessment for methoprene product registration (Reference 1).

Metabolites and Degradation Products:

In a metabolism test with chickens, carbon dioxide is the main metabolite of methoprene (Reference 5). In mammals the major metabolites included: 7-methoxycitronellic acid, 11-methoxy-3,7,11-trimethyl-2,4-dodecadienoic acid, and 11-hydroxy-3,7,11-trimethyl-2,4-dodecadienoic acid (Reference 5).

Comments:

Methoprene is not considered an eye or skin irritant (EPA Toxicity Category IV) and is not a human skin sensitizer (Reference 1).

References

- USEPA. Office of Pesticide Programs. Reregistration Eligibility Decision Document, Isopropyl (2E, 4E) -11-Methoxy-3, 7, 11-Trimethyl-2, 4-Dodecadienoate (Referred to as Methoprene), List A, Case 0030. March 1991.
- International Union of Pure & Applied Chemistry. Pesticide Properties Database. Methoprene (Ref: OMS 1697). Date accessed 11/8/2013.
- Walker AN, Bush P, Puritz J, Wilson T, Chang ES, Miller T, Holloway K, Horst MN. Department of Pathology, School of Medicine, Mercer University, Macon, Georgia. Bioaccumulation and Metabolic Effects of the Endocrine Disruptor Methoprene in the Lobster, Homarus americanus. January 2005.
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