United States
Environmental Protection
Agency

Office of Pesticides and Toxic Substances
Office of Pesticide Programs (TS-766C)
Washington, DC 20460

EPA Pesticide Fact Sheet

Name of Chemical: AVERMECTIN
Reason for Issuance: New Chemical Registration
Date Issued: April 18, 1986
Fact Sheet Number: 89

1. DESCRIPTION OF CHEMICAL

Generic Name: Avermectin B_1 [A mixture of avermectins containing $\geq$ 80% avermectin B_1a (5-O-dimethyl-avermectin A_1a) and $\leq$ 20% avermectin B_1b (5-O-demethyl-25-de(1-methylpropyl)-25-(1-methylethyl)avermectin A_1a)]

Common Name: None assigned.

Trade Name: Affirm™

EPA Shaughnessy Code: 0122804

Chemical Abstracts Service (CAS) Numbers: 65195-55-3 and 65195-56-4

Year of Initial Registration: 1986

Pesticide Type: Insecticide

Chemical Family: Avermectins (macrocylic lactones isolated from soil organism Streptomyces avermitilis).

U.S. Producers: Merck Sharp & Dohme Research Laboratories

2. USE PATTERNS AND FORMULATIONS

Application Sites: Turf, lawns and other non-crop wide outdoor areas.

Type of Formulations: 0.011% insecticide bait.

Method of Application: Bait broadcast (ground or air application) and individual mound to mound treatment.

Application Rates: 50 mg active ingredient (A.I.) per acre (1 pound of product per acre).

Usual Carriers: Pregelled defatted corn grit carrier.

Limitations: Do not use in pastures, rangeland, or croplands.

3. SCIENCE FINDINGS

Summary Science Statement:

Technical avermectin exhibits high mammalian acute toxicity. It is not considered to be mutagenic nor teratogenic and does not sensitize skin. It is not readily absorbed by mammals and the majority of the residue is excreted in the feces. The results of the acute toxicity on the bait formulation indicates that it is of low toxicity. Chronic feeding and oncogenicity studies and a three-generation reproduction study are currently in progress and will be required in support of food/feed crop uses.

Sufficient data are available to characterize avermectin from an environmental fate and ecological stand point. Avermectin is extremely toxic to fish and aquatic invertebrates and highly toxic to birds. However, because of its low use rate and rapid rate of photolysis no adverse acute or chronic effects to aquatic, estuarine or endangered species are expected. The degradation products are less toxic than the parent and tend to become less toxic as they continue to degrade. Avermectin undergoes rapid photolysis, is readily degraded by soil microorganisms and, due to its binding properties and low water solubility, is expected to exhibit little or no potential for leaching.

A tolerance assessment is not needed because the registered use pattern is for non-crop/non-food use. There are no data gaps.

A. Chemical Characteristics:

Physical State: Crystalline powder.

Color: Yellowish-white.

Odor: Odorless.

Melting Point: 155 - 157°C.

Vapor Pressure: Being tested, expected to be extremely low.

Density: 1.16 $\pm$ 0.05 at 21°C.

Solubility: Insoluble in water ($\leq$ 5 ug/ml), readily soluble in organic solvents.

pH: NA. The avermectin molecule has neither acidic nor basic functional groups.

Octanol/Water Partition Coefficient: 9.9×10^3

B. Toxicological Characteristics:

Technical Avermectin

Acute Oral: 1.52 mg/kg. Toxicity Category I.

Acute Dermal: LD_{50} >380 mg/kg. Toxicity Category II.

21-day Dermal: Noel is 125 mg/kg/day

Dermal Sensitization: Negative for skin sensitization.

Acute Inhalation: 1.62 mg/l. Toxicity Category II.

Teratogenicity: Three teratology studies (rat, rabbit, and mouse) have been evaluated to determine the teratogenic potential of avermectin. Teratogenic effects were negative for the rat up to 1.6 mg/kg/day and for the rabbit up to 2.0 mg/kg/day. Avermectin was positive in the mouse at 0.4 mg/kg/day and the NOEL for these effects was 0.2 mg/kg/day. However, the margin of safety between the NOEL and exposure to applicators and persons upon reentry is estimated to be greater than 10,000.

Mutagenicity: Adequate studies are available to demonstrate that avermectin is not a mutagen. Avermectin was not mutagenic in the Ames assay and in vivo bone marrow cytogenetics. In rat hepatocytes, Avermectin caused an induction of single strand DNA breaks in vitro. No effect was observed when this same assay was carried out in hepatoocytes from rats dosed in vivo at the LD_{50} (10.6 mg/kg). In the mammalian cell mutagenic assay, Avermectin was not mutagenic for V-79 cells.

Metabolism (rats): The metabolic T 1/2 in rats is 1.2 days. Avermectin does not bioaccumulate in rats.

Affirm Fire Ant Formulation

Oral LD_{50} in rats: LD_{50} > 5.0 gm/kg. Toxicity Category III.

Dermal LD_{50} in rats: LD_{50} > 2.0 gm/kg. Toxicity Category III.

Acute inhalation LC_{50}: Not required due to large particle size and low vapor pressure of technical.

Primary eye irritation: Toxicity Category III.

Primary skin irritation: No irritation. Toxicity Category III.

C. Physiological and Biological Characteristics:

Folier absorption: not absorbed.

Translocation: not translocated.

Mechanism of Pesticide Action: Avermectin is γ-aminobutyric acid (GABA) agonist, and thus acts in arthropods by inhibiting nervous signal transmission at the neuromuscular juncture causing paralysis. No effect on any cholinergic nervous systems have been demonstrated.

D. Environmental Characteristics:

Avermectin is not expected to hydrolyze in the environment. It photodegrades rapidly in water and soil with half-lives less than 1 day. Soil metabolism studies conducted in darkness indicate degradation does occur with a half-life of 2 weeks to 2 months under aerobic conditions. Anaerobic degradation is slower. It is not expected to accumulate in fish. Avermectin's solubility in water is determined to be 7.8 ppb. The field dissipation study indicates that avermectin, when applied in the bait formulation directly to the soil, dissipates with a half life of about a week but may persist longer if the bait is shaded. Avermectin and its degradates do not leach into the soil. There are no concerns at this time in regard to ground water contamination. Due to low application rates, it is unlikely that there would be any significant exposure to humans and nontarget organisms.

E. Ecological Characteristics:

Avian Oral: Bobwhite quail - LD_{50} > 2000 mg/kg.

Bobwhite quail - LC_{50} = 3102 ppm.

Avian Dietary: Mallard duck - LC_{50} = 383 ppm.

Freshwater Fish: Bluegill - LC_{50} = 9.6 ppb.

Rainbow trout - LC_{50} = 3.2 ppb.

Acute Freshwater Invertebrate: Daphnia - LC_{50} = 0.22 ppb.

Acute Estuarine Invertebrate: Shrimp, mysid - LC_{50} = 0.2 ppb.

Estuarine Fish: Fathead minnow - LC_{50} = 15 ppb.

Oyster Embryo Larvae: LC_{50} = 430 ppb.

4. SUMMARY OF REGULATORY POSITION AND RATIONALE

The Agency has determined that it should allow the registration of avermectin for non-crop, wide area general outdoor use for control of the imported fire ant. Adequate studies are available to assess the acute toxicological effects of avermectin to humans. Since the proposed use is a non-food/feed use a tolerance assessment is not necessary. No reentry interval is necessary. Available data are sufficient to characterize the environmental fate of avermectin. Although technical avermectin is highly toxic to fish, birds, and invertebrates, the 50 mg/acre rate plus rapid degradation should minimize this potential hazard. The effectiveness of the bait formulation has been extensively tested by USDA and also by the registrant under an EPA-approved experimental use permit from 1982-1985. None of the criteria for unreasonable adverse effects listed in section 162.11(a) of Title 40 of the U.S. Code of Federal Regulations have been met or exceeded for this use.

5. SUMMARY OF MAJOR DATA GAPS

There are no data gaps for the present use pattern.

6. CONTACT PERSON AT EPA

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