sodium ferric EDTA

Review Date: 03/22/2013
CAS #: 15708-41-5

Type	Molluscicide
Controls	Slugs and snails
Mode of Action	The iron interacts with hemocyanin (a copper-based oxygen transport protein found in molluscs) resulting in suffocation and death.

Thurston County Review Summary:

Sodium ferric EDTA is rated moderate in hazard and pesticides containing it as the sole active ingredient get a conditional rating by Thurston County's pesticide review criteria. Sodium ferric EDTA is rated moderate in hazard for the combined effects of chemical mobility and persistence associated with the compound ethylenediaminetetraacetic acid (EDTA). EDTA is a man-made chemical that is used to bind certain metals and is used in food additives, cosmetics, and many other products including pesticides.

MOBILITY

Property	Value	Reference	Value Rating
Water Solubility (mg/L)	1,000	6	High
Soil Sorption (Kd=mL/g)	Value not found		
Organic Sorption (Koc=mL/g)	Value not found		

Mobility Summary:

EDTA is soluble in water. In acidic environments it is likely to remain bound to iron, although in alkaline environments it is likely to bind with available calcium (Reference 8). EDTA, bound to metal or unbound, is likely to leach into soil with rain or irrigation water (Reference 8). The hazard for mobility is rated high.

PERSISTENCE

Property	Value	Reference	Value Rating
Vapor Pressure (mm Hg)	Value not found		
Biotic or Aerobic Half-life (days)	4 to 18 (EDTA)	8	High
Abiotic Half-life (days)	Negligible (except for photolysis)	8	High
Terrestrial Field Test Half-life (days)	Value not found		
Hydrolysis Half-life (days)	Value not found		
Anaerobic Half-life (days)	"Relatively stable"	4	High
Aquatic Field Test Half-life (days)	8 (EDTA)	8	Low

Persistence Summary:

In the environment the iron in sodium ferric EDTA may get replaced with another metal, but EDTA is not expected to break down appreciably (Reference 8). The persistence of sodium ferric EDTA is rated high because neither the sodium, iron, or EDTA are expected to breakdown to half of the applied concentration within 60 days, although they are likely to dissociate in the presence of another metal with a higher affinity for EDTA.

BIOACCUMULATION

Property	Value	Reference	Value Rating
Bioaccumulation Factor	Value not found		
Bioconcentration Factor	Value not found		
Octanol/Water Partition Coefficient	log Kow = -3.86 (EDTA)	6	Low

Bioaccumulation Summary:

Sodium ferric EDTA is not expected to bioaccumulate and the hazard of bioaccumulation is rated low. EDTA has a very low octanol/water partition coefficient and is not expected to bioaccumulate.

ACUTE WILDLIFE TOXICITY VALUES and Risk Assessment

Test Subject	Value	Reference	Value Rating
Mammalian (LD50)	5,719 mg/kg	1	Low
Avian (LD50)	>2,038 mg/kg	1	Low
Honey bee or insect (LD50)	Value not found		
Annelida -worms (LC50)	72.2 mg/kg	7	Moderate
Fish (LC50)	Value not found		
Crustacean (LC50)	Value not found		
Mollusk (LC50)	Value not found		
Amphibian (LD50 or LC50)	Value not found		

Acute Toxicity Testing and Ecotoxicity Summary:

Risk of toxicity to non-target insects is expected to be minimal because sodium ferric EDTA is selectivly toxic to copper-based blood systems found in snails, slugs, and other mollusks and crustaceans (Reference 1). Vertebrate animals (including fish) have an iron-based blood system that is not known to be affected by sodium ferric EDTA (Reference1). Sodium ferric EDTA is toxic to aquatic invertebrates, but use of slug and snail control products should not result in exposure to aquatic invertebrates. Toxicity to insects is not expected except for "land-living crustaceans" like sowbugs, pillbugs, woodlice and any others that have hemocyanin in their system (Reference 1). The hazard of toxicity to non-target wildlife from exposures to sodium ferric EDTA from use of slug and snail control products is rated low.

ACUTE HUMAN TOXICITY - Risk Assessment

Subject and Scenario	Route	Dose of Concern	Exposure	Margin of Safety	Reference	Value Rating
Risk assessment requirement was waived by EPA						
Risk assessment requirement was waived by EPA						
Risk assessment requirement was waived by EPA						
Risk assessment requirement was waived by EPA						

Acute Toxicity Risk Assessment Summary:

The toxicity related to sodium ferric EDTA is associated with iron in individuals that have a sensitivity to iron or from EDTA removing other essential metals. An allowable daily intake of sodium ferric EDTA as a food additive of 0.8 mg/kg/bw was established by the Joint FAO/WHO Committee in 2000 (Reference 8).

Slug and snail control products are pellets that do not produce a dust, so dermal and inhalation exposures are expected to be minimal. Also, sodium ferric EDTA is low in toxicity to mammals from inhalation and dermal exposures. Risk assessment for short-term exposures were not required by EPA. Risk of toxicity from exposures to sodium ferric EDTA from pesticidal use is rated as low in hazard.

CHRONIC HUMAN TOXICITY HAZARDS

Property	Value	Adverse Effect	Reference	Rating
Carcinogenicity	No reliable data	- -	1	Low
Mutagenicity	Mixed results	- -	1, 2 and 8	Moderate
Neurotoxicity - (NOAEL)	See chronic toxicity summary	- -	4	Low
Endocrine Disruption	See chronic toxicity summary	- -	1	Low
Developmental Toxicity (NOAEL)	See chronic toxicity summary	- -	1 and 3	Low
Reproductive Toxicity (NOAEL)	>2.5 mg/kg bw (EDTA)/day	Disruption of zinc balance	1	Low
Chronic Toxicity (NOAEL)	>2.5 mg/kg bw/day (EDTA)	Disruption of zinc balance	1	See toxicity summary

Chronic Toxicity Hazard Summary:

The EPA stated that there is no reliable data to evaluate carcinogenic potential, although there is no toxicological data that indicate that sodium ferric EDTA or its degradation chemicals (iron and EDTA salt) cause effects in any organs that could potentially result in neoplastic changes (Reference 1). Carcinogenicity hazard is rated low. In an evaluation of endocrine disruption potential, the EPA stated: "Based on the weight of the evidence of available data, no endocrine system-related effects have been identified for Sodium Ferric EDTA and none is expected since it does not share any structural similarity to any known endocrine disruptor" (Reference 1). The hazard of endocrine disruption is rated low. Health Canada stated that there is no indication that ferric sodium EDTA causes damage to the nervous system (Reference 4). The hazard for neurotoxicity is rated low.

Testing with sodium ferric EDTA produced mutagenicity in a L5178Y tk+/tk- mouse lymphoma assay (with and without S9 gene activation) but not in an Ames salmonella assay. The EPA reported that an evaluation of the studies indicated that the results were likely due to sensitivity of the L5178Y cells to very high concentrations of iron (Reference 1). Mutagenicity testing with EDTA demonstrated inhibition of DNA synthesis in mammalian cells, enhanced mutagen-induced abberation frequency caused by other mutagens, DNA damage, unscheduled DNA synthesis, and others (Reference 8). Mixed mutagenicity studies without in vitro positive effects result in a moderate hazard rating for mutagenicity.

Developmental toxicity concerns for sodium ferric EDTA involves the exchange of iron for zinc as the predominant reaction of concern during pregnancy because of the potential to disrupt the zinc balance, and the high sensitivity of the developing embryo to zinc deficiency (Reference 1). At the concentration at 2.5 mg EDTA/kg bw/day, recommended by the FAO/WHO Expert Committed on Food Additives (JECFA, 1974), detrimental effects on zinc balance would not be expected. Exposures to slug baits containing low concentrations of sodium ferric EDTA are expected to much lower than 2.5 mg EDTA kilogram of body weight per day. The hazard of developmental toxicity from the use of slug/snail products containing sodium ferric EDTA as the sole active ingredient is rated low.

CHRONIC HUMAN TOXICITY - Risk Assessment

Subject and Scenario	Route	Dose of Concern	Exposure	Margin of Safety	Reference	Value Rating
Risk assessment requirement was waived by EPA						
Risk assessment requirement was waived by EPA						
Risk assessment requirement was waived by EPA						
Risk assessment requirement was waived by EPA						

Chronic Toxicity Risk Assessment Summary:

Risk assessment for long-term exposures were not required by EPA and are considered to be low in hazard due to lack of a toxicological endpoint. Risk of toxicity from exposures to sodium ferric EDTA from pesticidal use is rated as low in hazard.

Metabolites and Degradation Products:

Sodium ferric EDTA is metabolized in the gastrointestinal tract to form iron and EDTA salt, which are absorbed independently in animals (References 1 and 5).

Comments:

Sodium ferric EDTA is a severe eye irritant (EPA Toxicity Category I), but it is not a skin irritant (EPA Toxicity Category IV) or a skin sensitizer (Reference 1). A later EPA registration document categorized 71.4% sodium ferric EDTA as a mild eye and skin irritant (EPA Toxicity Category III) and not a skin sensitizer (Reference 2).

References

1. USEPA. Biopesticides and Pollution Prevention Division. Biopesticides Registration Action Document. Sodium Ferric Ethylenediaminetetraacetate (PC Code 139114). November 2008.
2. USEPA. Office of Pesticide Program. [EPA-HQ-OPP-2010-0097; FRL-8867-7] Sodium Ferric Ethylenediaminetetraacetate; Exemption From the Requirement of a Tolerance. March 2011.
3. Health Canada. Proposed Registration Decision PRD2010-03 FeHEDTA. 23 February 2010.

4. Health Canada. Registration Decision RD2008-04 Ferric Sodium EDTA. 4 April 2008.
5. Heimbach, J. et al. Safety assessment of iron EDTA [sodium iron (Fe(3+)) ethylenediaminetetraacetic acid]: Summary of Toxicological, Fortification and Exposure Data. Food and Chemical Toxicology. 2000 Jan;38(1):99-111.
6. International Union of Pure & Applied Chemistry. Pesticide Properties Database. Ethylenediamine tetraacetic acid. Data accessed 4/12/2013
7. Clive, et al. Crop Protection Volume 28. "The relative toxicity of metaldehyde and iron phosphate-based molluscicides to earthworms." 2009.
8. USEPA. Office of Prevention, Pesticides, and Toxic Substances. "Ethylenediaminetetraacetic acid (EDTA) and the salts of EDTA: Science Assessment Document for Tolerance Reassessment." January 26, 2004.