United States
Environmental Protection
Agency

Office of Pesticides and Toxic Substances
Office of Pesticide Programs (H7508C)
Washington, DC 20460

540/FS-89-040

EPA

Pesticide Fact Sheet

Name of Chemical: ROTENONE

Reason for Issuance: Registration Standard

Date Issued: October 7, 1988

Fact Sheet Number: 198

1. DESCRIPTION OF CHEMICAL

Common name: Rotenone (and associated resins)

Chemical Name: (2R, 6aS, 12aS)-1,2,6,6a,12,12a-hexahydro-2-isopropenyl-8,9-dimethoxychromeno[3,4-b] furo[2,3-h]chromen-6-one.

Other Chemical nomenclature:

(R)-1,2-dihydro-8,9-dimethoxy-2-(1-methylethenyl)[1]benzopyrano[3,4-b] furo[2,3-h][1]benzopyran-6,12-dione (9th Collective Index); 1,2,12,12a alpha-tetrahydro-2a-isopropenyl-8,9-dimethoxy[1] benzopyranol[3,4-b]furo[2,3-h][1]benzopyran-6 (6aH)-one (8th Collective Index); 1,2,12,12a-tetrahydro-8,9-dimethoxy-2-(1-methylethenyl)-[2R-(2a,6a,alpha, 12a alpha)]-(1)benzopyrano (3,4-b)furo(2,3-h)-(1)benzopyran-6 (6aH)-one.

Other Names: aker- root; Chem Fish; Derris; derris root; Nicouline; Rotacide; Protex; Tubatoxin; and tuba-root; ENT-133; Barbasco; Cube; Haiari; Nekos; and Timbo.

Chemical Abstracts Service (CAS) Number: 83-79-4

EPA Pesticide Chemical Code (Shaughnessy Number): 71003 - rotenone; 71004 - cube' resins other than rotenone; 71001 - derris resins.

Year of Initial Registration: 1947

Pesticide Type: Botanical

Producers: Penick-Bio UCLAF Corporation and Prentiss Drug and Chemical Company

2. USE PATTERNS AND FORMULATION

Registered Uses:

Terrestrial Food Crops: Rotenone is registered for foliar preharvest application to vegetables, berries, tree fruit, nuts, forage crops, and sugarcane.

In addition to foliar applications, delayed dormant applications are made to deciduous tree fruit.

Soil applications may be made to vegetable crops, berries and tree nuts.

Terrestrial Nonfood Crop: Ornamentals, turf, shade trees, and tobacco.

Greenhouse Food Crop: Vegetables.

Greenhouse Nonfood: Ornamentals.

Aquatic Non-Food Crop: Fish.

Domesticated Pets and Their Man-made Premises: Cats and Dogs.

Livestock: Cattle (Beef and Dairy), Goats, Horses, Sheep, and Swine.

Household: Flying and crawling insects.

Commercial and Industrial Uses: Flying and crawling insects.

Methods of Application: Dusts, sprays, dips, and pumping liquid formulations into bodies of water.

Annual Usage: 50,000 to 120,000 lb

Predominant Usage: Aquatic (piscicide); agriculture (potatoes, tomatoes, pears, apples); livestock, pets, and household

Formulations: The following formulations are registered 0.4-5% dusts; up to 5% wettable powders (WP); up to 0.55 lb/gal emulsifiable concentrate (EC); up to 1.25% soluble concentrate/liquid (SC/L); up to 5%; wettable powder/dust (WP/D) up to 2.5%;emulsifiable concentrate (EC); up to 1.5%; soluble concentrate/lquid (SC/L); ready-to-use (RTU) at 0.1%or less; and up to 0.1% pressurized liquid (PrL).

3. SCIENCE FINDINGS

Chemical/Physical Characteristics of Rotenone (purity 99.5% or unspecified) and its associated resins:

Empirical Formula: $C_{23}H_{22}O_6$

Molecular Weight: 394.4

Color: colorless (rotenone, purity 99.5%)

Physical State: Crystalline solid

Specific Gravity: 1.27 at 20° °C

Melting Point: 165-166 °C

Solubility: Water 0.00002 g/100 ml at 20 °C; Ethyl alcohol 0.2 g/100 ml at 20 °C; Carbon tetrachloride 0.6 g/100 ml at 20°C; Amyl acetate 1.6 g/100 ml at 20°C; Xylene 3.4 g/100 ml at 20 °C; Ethylene dichloride 33.0 g/100 ml at 20 °C; Chloroform 47.2 g/100 ml at 20 °C; Acetone 6.6 g/100 ml at 20 °C; Benzene 8.0 g/100 ml at 20 °C; Chlorobenzene 13.5 g/100 ml at 20°C.

Stability: Decomposes rapidly in organic solvents exposed to light and air.

Toxicology Characteristics

- Acute oral LD (rat): LD_{50} = 39.5 +/- 2.21 mg/kg for female rats and 102 +/- 12.6 mg/kg for male rats.
- 6 Month Feeding (dog): NOEL = 0.4 mg/kg/day; LEL = 2 mg/kg/day; levels tested 0, 0.4, 2, and 10 mg/kg/day.

- 2 Year Feeding (rat): NOEL = 7.5 ppm; LEL = 37.5 ppm; levels tested 0, 7.5, 37.5, and 75 ppm.
- 2 Year Oncogenicity (rat): Negative for oncogenic effects.
- 2 Year Oncogenicity (mouse): Negative for oncogenic effects at doses below the MTD.
- Teratology (rat and mouse): No fetal effects at rates below NOEL for adults.
- Reproduction Toxicity (rat): Reproductive NOEL = 37.5 ppm; Maternal Toxicity NOEL = 7.5 ppm; levels tested 0, 7.5, 37.5, and 75 ppm. No reproductive effects were noted.
- Gene Mutation: Rotenone did not induce gene mutations in bacteria or yeast, but it increased the frequency of gene mutations in mouse lymphoma cells in vitro without metabolic activation. No mutations were induced in mice in vivo by rotenone. No chromosomal effects were observed in rats or mice treated with rotenone, and yeast treated with rotenone did not show increased mitotic recombination or mitotic gene conversion.

Physiological and Biochemical Characteristics

Mechanism of pesticidal action: Rotenone is an inhibitor of oxidative phosphorylation.

Environmental Characteristics

Rotenone is rapidly degraded in soil and water with a half-life of 1-3 days for both aerobic aquatic and anaerobic aquatic soils.

Ecological Characteristics:

- Avian Acute Oral LC_{50}

Mallard	2200mg/kg
Pheasant	1680mg/kg

° Fish Acute LC_{50}

Rainbow Trout	22.5 ppb
Channel Catfish	2.6-2.8 ppb
Bluegill	22.5 ppb

° Aquatic Invertebrate EC_{50}

Daphnia magna (Water fleas) 2.1 ug/l
(21 Day EC_{50})

TOLERANCES

Currently, use of rotenone or derris or cube' roots on growing crops is exempt from the requirement of tolerences, and neither tolerances nor exemptions exist for rotenone residues in animal commodities.

4. SUMMARY OF REGULATORY POSITION

Rotenone is not being referred to Special Review because none of criteria for special review were met.

Cranberry and piscicide uses are classified for restricted use. Users must consult their State Fish and Game Agency before applying rotenone products. Because of significant data gaps on the effects of rotenone in upland game birds, waterfowl, estuarine and marine organisms, a statement is required on all end-use products giving directions for use for killing fish. The statement requires mandatory consultation with state or federal fish and wildlife agencies and will minimize effects on non-target organisms.

The Agency is concerned about residues and metabolites of rotenone and associated resins in/on plants and animals. Data on the metabolism and nature of rotenone residues are needed to reevaluate the tolerance exemption.

Water treated with rotenone must not be used as potable water or for irrigation of crops. A restriction against use of rotenone within one half mile of potable water or irrigation intakes must be included on labels of products intended for use in cranberry bogs and for control of fish. This statement will be an interim precaution until data on residues in water are available.

5. SUMMARY OF MAJOR DATA GAPS

Toxicology: Acute dermal toxicity, primary eye and skin irritation studies, dermal sensitization study, histological examination of the low and mid dose groups in the rat chronic feeding study.

Environmental Fate: Hydrolysis, photodegradation in water and on soil, aerobic soil and aquatic metabolism, leaching, terrestrial and aquatic field dissipation, confined rotational crop study, and irrigated crop accumulation.

Environmental Safety: Effects on upland game birds, waterfowl, and estuarine and marine organisms.

Residue Chemistry: Plant, livestock, and fish metabolism; method validation, residue data for each registered commodity and their processed products; food handling establishment residue data, and all product chemistry data.

6. LABELING REQUIREMENTS

Products containing rotenone intended for terrestrial (food and non-food) and domestic outdoor uses must include the following statement on the label:
"This pesticide is toxic to fish. Do not apply directly to water or wetlands (swamps, bogs, marshes, potholes). Runoff and drift from treated areas may be hazardous to aquatic organisms in adjacent sites. Do not contaminate untreated water when disposing of equipment washwater."

Products containing rotenone intended for use in cranberry bogs must include the following statement on the label:
This pesticide is toxic to fish. Runoff and drift from treated areas may be hazarddous to aquatic organisns in adjacent sites. Do not contaminate untreated water when disposing of equipment washwaters.

Products containing rotenone intended for use to kill fish fish must include the following statement on the label:
"This pesticide is toxic to fish. Fishkills are expected at recomended rates. Consult your State Fish and Game Agency before applying this product to public waters to determine if a permit is needed for such an application. Do not contaminate untreated water when disposing of equipment washwaters.

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DISCLAIMER: The information presented in this Chemical Information Fact Sheet is a summary only and may not be used to fulf data requirements for pesticide registration and reregistration.

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