

Rotenone

sc-203242

Material Safety Data Sheet



The Power to Question

Hazard Alert Code
Key:

EXTREME

HIGH

MODERATE

LOW

Section 1 - CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

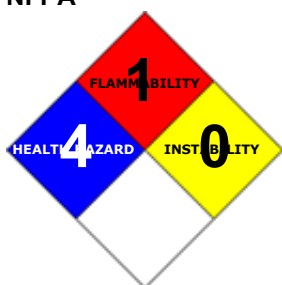
PRODUCT NAME

Rotenone

STATEMENT OF HAZARDOUS NATURE

CONSIDERED A HAZARDOUS SUBSTANCE ACCORDING TO OSHA 29 CFR 1910.1200.

NFPA



SUPPLIER

Company: Santa Cruz Biotechnology, Inc.

Address:

2145 Delaware Ave

Santa Cruz, CA 95060

Telephone: 800.457.3801 or 831.457.3800

Emergency Tel: CHEMWATCH: From within the US and
Canada: 877-715-9305

Emergency Tel: From outside the US and Canada: +800 2436
2255 (1-800-CHEMCALL) or call +613 9573 3112

PRODUCT USE

■ Operators should be trained in procedures for safe use of this material. Rotenone is the principal active insecticidal constituent of derris and lonchocarpus. A selective contact insecticidal with some acaridal properties used as dusts for garden insects, lice and animal ticks. Emulsions are used for the elimination of fish in water-body management. May also be used as a drench to control fire-ants in lawns, gardens and agricultural land. Rotenone is environmentally unstable and decomposes rapidly in light and air.

SYNONYMS

C23-H22-O6, "(1)benzopyrano(3, 4-B)furo(2, 3H)(1)benzopyran-6(6AH)-one, 1, 2, 12, 12A-", "tetrahydro-2-alpha-isopropenyl-8, 9-dimethoxy-", "tetrahydro-2-alpha-isopropenyl-8, 9-dimethoxy-", Barbasco, Canex, "Cenol Garden Rust", "Chem Fish", Chem-Mite, Cube, "Cube Extract", Cube-Pulver, "Cube root", Cubor, "Curex Flea Duster", Dactinol, Deril, Derrin, Derris, "Derris Root", Dri-Kil, ENT-133, Extrax, Fish-Tox, "Green Cross", Warble, Haiari, "Liquid Derris", Mexide, NC-C55210, Nicouline, Noxifire, Noxfish, Paraderil, "Powder and Root", Prenfish, Prentox, "Pro-Nox Fish", Ro-Ko, Ronone, Rotefive, Rotefour, Rotenon, Rotenox, Rotessanol, Rotocide, Synpren, Tubatoxin, Tubotoxin

Section 2 - HAZARDS IDENTIFICATION

CANADIAN WHMIS SYMBOLS



EMERGENCY OVERVIEW

RISK

Toxic if swallowed.

Very toxic by inhalation.

Danger of cumulative effects.

Irritating to eyes, respiratory system and skin.

Very toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.

POTENTIAL HEALTH EFFECTS

ACUTE HEALTH EFFECTS

SWALLOWED

■ Toxic effects may result from the accidental ingestion of the material; animal experiments indicate that ingestion of less than 40 gram may be fatal or may produce serious damage to the health of the individual.

EYE

■ Evidence exists, or practical experience predicts, that the material may cause eye irritation in a substantial number of individuals. Prolonged eye contact may cause inflammation characterized by a temporary redness of the conjunctiva (similar to windburn).

SKIN

■ This material can cause inflammation of the skin on contact in some persons.

■ The material may accentuate any pre-existing dermatitis condition.

■ Skin contact with the material may damage the health of the individual; systemic effects may result following absorption.

■ Entry into the blood-stream, through, for example, cuts, abrasions or lesions, may produce systemic injury with harmful effects. Examine the skin prior to the use of the material and ensure that any external damage is suitably protected.

INHALED

■ Inhalation of dusts, generated by the material, during the course of normal handling, may produce severely toxic effects; these may be fatal.

■ The material can cause respiratory irritation in some persons. The body's response to such irritation can cause further lung damage.

■ Persons with impaired respiratory function, airway diseases and conditions such as emphysema or chronic bronchitis, may incur further disability if excessive concentrations of particulate are inhaled.

CHRONIC HEALTH EFFECTS

■ Repeated or long-term occupational exposure is likely to produce cumulative health effects involving organs or biochemical systems.

Long-term exposure to respiratory irritants may result in disease of the airways involving difficult breathing and related systemic problems.

Long term exposure to high dust concentrations may cause changes in lung function i.e. pneumoconiosis; caused by particles less than 0.5 micron penetrating and remaining in the lung. Prime symptom is breathlessness; lung shadows show on X-ray.

Rotenone is a central nervous poison which produces vomiting, incoordination, muscle tremors, clonic convulsion and respiratory failure in animals receiving intravenous doses. It interferes with specific enzymes in the electron transport chain. Rotenone metabolism in laboratory animals is mediated by NADP-linked hepatic microsomal enzymes with some half-dozen polar metabolites having been tentatively identified; the toxicity of these rotenoids, in mice, is of the same order of magnitude as the parent compound.

Rotenone is essentially (95-97%) eliminated in the faeces. Rat studies indicate that enterohepatic circulation is possible and the route, dose and duration of exposure have no effect on the excretion pattern.

Chronic exposure to rotenone can cause damage to liver and kidneys involving fatty changes.

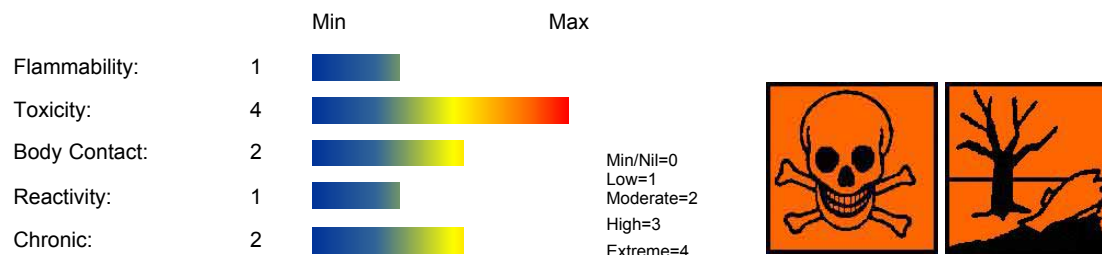
Prolonged or repeated exposure can cause nausea, vomiting, abdominal cramps, poor muscle coordination, seizures, shallow breathing, skin rashes and eye, nose and mouth lesions. [Manufacturer - FDC]

Dogs fed rotenone at 5 mg/kg/day for 1 month show fatty hepatic and renal degeneration. 10 mg/kg is fatal.

Lifetime feeding studies showed parathyroid adenomas in highly dosed male rats and no evidence of carcinogenic activity in female rats and in male and female mice.

Section 3 - COMPOSITION / INFORMATION ON INGREDIENTS

HAZARD RATINGS



NAME	CAS RN	%
rotenone	83-79-4	>98

Section 4 - FIRST AID MEASURES

SWALLOWED

■

- Give a slurry of activated charcoal in water to drink. NEVER GIVE AN UNCONSCIOUS PATIENT WATER TO DRINK.
- At least 3 tablespoons in a glass of water should be given.
- Although induction of vomiting may be recommended (IN CONSCIOUS PERSONS ONLY), such a first aid measure is dissuaded because to the risk of aspiration of stomach contents. (i) It is better to take the patient to a doctor who can decide on the necessity and method of emptying the stomach. (ii) Special circumstances may however exist; these include non-availability of charcoal and the ready availability of the doctor.

NOTE: If vomiting is induced, lean patient forward or place on left side (head-down position, if possible) to maintain open airway and prevent aspiration. NOTE: Wear protective gloves when inducing vomiting.

- REFER FOR MEDICAL ATTENTION WITHOUT DELAY.
- In the mean time, qualified first-aid personnel should treat the patient following observation and employing supportive measures as indicated by the patient's condition.
- If the services of a medical officer or medical doctor are readily available, the patient should be placed in his/her care and a copy of the MSDS should be provided. Further action will be the responsibility of the medical specialist.
- If medical attention is not available on the worksite or surroundings send the patient to a hospital together with a copy of the MSDS.

(ICSC20305/20307).

EYE

- If this product comes in contact with the eyes:
 - Immediately hold eyelids apart and flush the eye continuously with running water.
 - Ensure complete irrigation of the eye by keeping eyelids apart and away from eye and moving the eyelids by occasionally lifting the upper and lower lids.
 - Continue flushing until advised to stop by the Poisons Information Center or a doctor, or for at least 15 minutes.
 - Transport to hospital or doctor without delay.
 - Removal of contact lenses after an eye injury should only be undertaken by skilled personnel.

SKIN

- If skin contact occurs:
 - Immediately remove all contaminated clothing, including footwear
 - Flush skin and hair with running water (and soap if available).
 - Seek medical attention in event of irritation.

INHALED

- - If fumes or combustion products are inhaled remove from contaminated area.
 - Lay patient down. Keep warm and rested.
 - Prostheses such as false teeth, which may block airway, should be removed, where possible, prior to initiating first aid procedures.
 - Apply artificial respiration if not breathing, preferably with a demand valve resuscitator, bag-valve mask device, or pocket mask as trained. Perform CPR if necessary.
 - Transport to hospital, or doctor, without delay.

NOTES TO PHYSICIAN

- Treat symptomatically.
- 1. The decision to empty the stomach is largely dependent on other constituents found in the preparation. Hydrocarbons (e.g. kerosene) prevent emesis induction. Otherwise Ipecac Syrup or a slurry of activated charcoal may be administered.
- 2. If the amount ingested is estimated to contain a lethal or near-lethal dose of rotenone (see "Acute Health Effects") or any other ingredient in the mixture, cautious gastric lavage may be performed, even though the product may be largely composed of hydrocarbons. Further, it may be advisable to premedicate the patient with diazepam or a barbiturate drug.
- 3. Administer a saline cathartic e.g., 15-30 gm sodium sulfate in water and perhaps a slurry of activated charcoal. Avoid all oils and fats, which promote the intestinal absorption of rotenone.
- 4. Symptomatic and supportive treatment with oxygen, artificial ventilation, barbiturates and parental fluids.
- 5. Based on the experimental studies in laboratory animals, a trial with large parental doses of menadione (vitamin K3) appears to be warranted. Use the water-soluble menadione sodium bisulfite (10 or more mg. i.v. or i.m.) or menadiol sodium diphosphate (75 mg i.v.).
- 6. Administer glucose intravenously to correct hypoglycaemia.
- 7. Wash skin with liberal quantities of water.
- 8. Treat pulmonary complications in the same way as those arising from the aspiration of kerosene or the inhalation of nitrogen oxides.
- 9. Because severe hypoglycaemia has been reported in some test animals, a blood sugar test is desirable.

[Gosselin: Clinical Toxicology of Commercial Products.]

Section 5 - FIRE FIGHTING MEASURES

Vapour Pressure (mmHG):	Negligible
Upper Explosive Limit (%):	Not available
Specific Gravity (water=1):	Not available
Lower Explosive Limit (%):	Not available

EXTINGUISHING MEDIA

- - Foam.
 - Dry chemical powder.
 - BCF (where regulations permit).
 - Carbon dioxide.
 - Water spray or fog - Large fires only.

FIRE FIGHTING

- - Alert Emergency Responders and tell them location and nature of hazard.
 - Wear full body protective clothing with breathing apparatus.
 - Prevent, by any means available, spillage from entering drains or water course.
 - Use fire fighting procedures suitable for surrounding area.
 - DO NOT approach containers suspected to be hot.
 - Cool fire exposed containers with water spray from a protected location.
 - If safe to do so, remove containers from path of fire.
 - Equipment should be thoroughly decontaminated after use.

GENERAL FIRE HAZARDS/HAZARDOUS COMBUSTIBLE PRODUCTS

- - Combustible solid which burns but propagates flame with difficulty.

- Avoid generating dust, particularly clouds of dust in a confined or unventilated space as dusts may form an explosive mixture with air, and any source of ignition, i.e. flame or spark, will cause fire or explosion. Dust clouds generated by the fine grinding of the solid are a particular hazard; accumulations of fine dust may burn rapidly and fiercely if ignited.
- Dry dust can be charged electrostatically by turbulence, pneumatic transport, pouring, in exhaust ducts and during transport.
- Build-up of electrostatic charge may be prevented by bonding and grounding.
- Powder handling equipment such as dust collectors, dryers and mills may require additional protection measures such as explosion venting.

Combustion products include: carbon monoxide (CO), carbon dioxide (CO₂), other pyrolysis products typical of burning organic material.

May emit poisonous fumes.

FIRE INCOMPATIBILITY

■ Avoid contamination with oxidizing agents i.e. nitrates, oxidizing acids, chlorine bleaches, pool chlorine etc. as ignition may result.

PERSONAL PROTECTION

Glasses:

Safety Glasses.

Chemical goggles.

Gloves:

Respirator:

Particulate

Section 6 - ACCIDENTAL RELEASE MEASURES

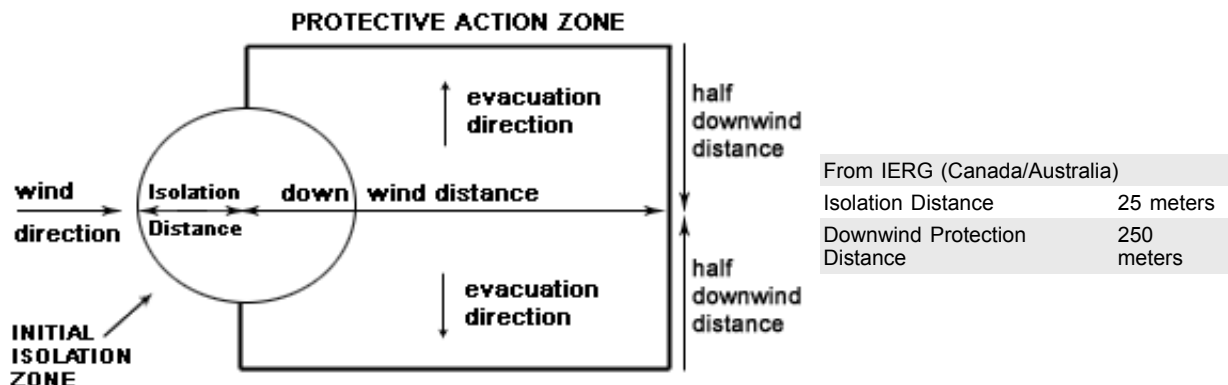
MINOR SPILLS

-
- Clean up waste regularly and abnormal spills immediately.
- Avoid breathing dust and contact with skin and eyes.
- Wear protective clothing, gloves, safety glasses and dust respirator.
- Use dry clean up procedures and avoid generating dust.
- Vacuum up or sweep up. NOTE: Vacuum cleaner must be fitted with an exhaust micro filter (HEPA type) (consider explosion-proof machines designed to be grounded during storage and use).
- Dampen with water to prevent dusting before sweeping.
- Place in suitable containers for disposal.

MAJOR SPILLS

-
- Clear area of personnel and move upwind.
- Alert Emergency Responders and tell them location and nature of hazard.
- Wear full body protective clothing with breathing apparatus.
- Prevent, by any means available, spillage from entering drains or water course.
- Stop leak if safe to do so.
- Contain spill with sand, earth or vermiculite.
- Collect recoverable product into labeled containers for recycling.
- Neutralize/decontaminate residue.
- Collect solid residues and seal in labeled drums for disposal.
- Wash area and prevent runoff into drains.
- After clean up operations, decontaminate and launder all protective clothing and equipment before storing and re-using.
- If contamination of drains or waterways occurs, advise emergency services.

PROTECTIVE ACTIONS FOR SPILL



FOOTNOTES

1 PROTECTIVE ACTION ZONE is defined as the area in which people are at risk of harmful exposure. This zone assumes that random changes in wind direction confines the vapour plume to an area within 30 degrees on either side of the predominant wind direction, resulting in a crosswind protective action distance equal to the downwind protective action distance.

2 PROTECTIVE ACTIONS should be initiated to the extent possible, beginning with those closest to the spill and working away from the site in the downwind direction. Within the protective action zone a level of vapour concentration may exist resulting in nearly all unprotected persons becoming incapacitated and unable to take protective action and/or incurring serious or irreversible health effects.

3 INITIAL ISOLATION ZONE is determined as an area, including upwind of the incident, within which a high probability of localised wind reversal may expose nearly all persons without appropriate protection to life-threatening concentrations of the material.

4 SMALL SPILLS involve a leaking package of 200 litres (55 US gallons) or less, such as a drum (jerrican or box with inner containers). Larger packages leaking less than 200 litres and compressed gas leaking from a small cylinder are also considered "small spills". LARGE SPILLS involve many small leaking packages or a leaking package of greater than 200 litres, such as a cargo tank, portable tank or a "one-tonne" compressed gas cylinder.

ACUTE EXPOSURE GUIDELINE LEVELS (AEGL) (in ppm)

AEGL 1: The airborne concentration of a substance above which it is predicted that the general population, including susceptible individuals, could experience notable discomfort, irritation, or certain asymptomatic nonsensory effects. However, the effects are not disabling and are transient and reversible upon cessation of exposure.

AEGL 2: The airborne concentration of a substance above which it is predicted that the general population, including susceptible individuals, could experience irreversible or other serious, long-lasting adverse health effects or an impaired ability to escape.

AEGL 3: The airborne concentration of a substance above which it is predicted that the general population, including susceptible individuals, could experience life-threatening health effects or death.

Section 7 - HANDLING AND STORAGE

PROCEDURE FOR HANDLING

-
- Avoid all personal contact, including inhalation.
- Wear protective clothing when risk of exposure occurs.
- Use in a well-ventilated area.
- Prevent concentration in hollows and sumps.
- DO NOT enter confined spaces until atmosphere has been checked.
- DO NOT allow material to contact humans, exposed food or food utensils.
- Avoid contact with incompatible materials.
- When handling, DO NOT eat, drink or smoke.
- Keep containers securely sealed when not in use.
- Avoid physical damage to containers.
- Always wash hands with soap and water after handling.
- Work clothes should be laundered separately.
- Launder contaminated clothing before re-use.
- Use good occupational work practice.
- Observe manufacturer's storing and handling recommendations.
- Atmosphere should be regularly checked against established exposure standards to ensure safe working conditions are maintained.

Empty containers may contain residual dust which has the potential to accumulate following settling. Such dusts may explode in the presence of an appropriate ignition source.

- Do NOT cut, drill, grind or weld such containers
- In addition ensure such activity is not performed near full, partially empty or empty containers without appropriate workplace safety authorisation or permit.

RECOMMENDED STORAGE METHODS

-
- Lined metal can, Lined metal pail/drum
- Plastic pail
- Polyliner drum
- Packing as recommended by manufacturer.
- Check all containers are clearly labeled and free from leaks.

For low viscosity materials

- Drums and jerricans must be of the non-removable head type.
- Where a can is to be used as an inner package, the can must have a screwed enclosure.

For materials with a viscosity of at least 2680 cSt. (23 deg. C) and solids (between 15 C deg. and 40 deg C.):

- Removable head packaging;
- Cans with friction closures and
- low pressure tubes and cartridges may be used.

- Where combination packages are used, and the inner packages are of glass, there must be sufficient inert cushioning material in contact with inner and outer packages * . - In addition, where inner packagings are glass and contain liquids of packing group I and II there must be sufficient inert absorbent to absorb any spillage *. - * unless the outer packaging is a close fitting molded plastic box and the substances are not incompatible with the plastic.

STORAGE REQUIREMENTS

-
- Store in original containers.
- Keep containers securely sealed.
- Store in a cool, dry, well-ventilated area.
- Store away from incompatible materials and foodstuff containers.
- Protect containers against physical damage and check regularly for leaks.
- Observe manufacturer's storing and handling recommendations.

SAFE STORAGE WITH OTHER CLASSIFIED CHEMICALS



X

X

+

X

X

+

X: Must not be stored together

O: May be stored together with specific preventions

+: May be stored together

Section 8 - EXPOSURE CONTROLS / PERSONAL PROTECTION

EXPOSURE CONTROLS

Source	Material	TWA ppm	TWA mg/m ³	STEL ppm	STEL mg/m ³	Peak ppm	Peak mg/m ³	TWA F/CC	Notes
Canada - British Columbia Occupational Exposure Limits	rotenone (Rotenone (commercial))		5						
Canada - Ontario Occupational Exposure Limits	rotenone (Rotenone (commercial))		5						
US - Minnesota Permissible Exposure Limits (PELs)	rotenone (Rotenone)		5						
US ACGIH Threshold Limit Values (TLV)	rotenone (Rotenone (commercial))		5						TLV Basis: upper respiratory tract irritation; central nervous system impairment; eye irritation
US NIOSH Recommended Exposure Limits (RELs)	rotenone (Rotenone)		5						
Canada - Alberta Occupational Exposure Limits	rotenone (Rotenone (commercial))		5						
US - California Permissible Exposure Limits for Chemical Contaminants	rotenone (Rotenone, commercial)		5						
US - Tennessee Occupational Exposure Limits - Limits For Air Contaminants	rotenone (Rotenone)		5						
US - Vermont Permissible Exposure Limits Table Z-1-A Transitional Limits for Air Contaminants	rotenone (Rotenone)		5						
US - Vermont Permissible Exposure Limits Table Z-1-A Final Rule Limits for Air Contaminants	rotenone (Rotenone)		5						
US - Idaho - Limits for Air Contaminants	rotenone (Rotenone - Rouge)		5						
US - Idaho - Limits for Air Contaminants	rotenone (Rotenone - Total dust)		15						
US - Idaho - Limits for Air Contaminants	rotenone (Rotenone - Respirable fraction)		5						
US - Hawaii Air Contaminant Limits	rotenone (Rotenone (commercial))		5		10				
US - Alaska Limits for Air Contaminants	rotenone (Rotenone)		5						
US - Michigan Exposure Limits for Air Contaminants	rotenone (Rotenone)		5						
Canada - Yukon Permissible Concentrations for Airborne Contaminant Substances	rotenone (Rotenone (commercial))	-	5	-	10				
US - Washington Permissible exposure limits of air contaminants	rotenone (Rotenone)		5		10				
Canada - Saskatchewan Occupational Health and Safety Regulations - Contamination Limits	rotenone (Rotenone (commercial))		5		10				
US - Oregon Permissible Exposure Limits (Z1)	rotenone (Rotenone)		5						
US - Wyoming Toxic and Hazardous Substances Table Z1 Limits for Air	rotenone (Rotenone)		5						

Contaminants	(rotenone)			
Canada - Quebec Permissible Exposure Values for Airborne Contaminants (English)	rotenone (Rotenone)	5		
US OSHA Permissible Exposure Levels (PELs) - Table Z1	rotenone (Rotenone)	5		
Canada - Northwest Territories Occupational Exposure Limits (English)	rotenone (Rotenone (commercial))	5	10	
Canada - Nova Scotia Occupational Exposure Limits	rotenone (Rotenone (commercial))	5		TLV Basis: upper respiratory tract irritation; central nervous system impairment; eye irritation
Canada - Prince Edward Island Occupational Exposure Limits	rotenone (Rotenone (commercial))	5		TLV Basis: upper respiratory tract irritation; central nervous system impairment; eye irritation

EMERGENCY EXPOSURE LIMITS

Material	Revised IDLH Value (mg/m3)	Revised IDLH Value (ppm)
rotenone	2,500	

MATERIAL DATA

ROTENONE:

Rotenone, inhibits aerobic respiration, effects the nervous system and produces convulsions in animals. Human inhalation reportedly produces rhinitis with temporary, but complete loss of smell. Poisoning results in numbness of the oral mucosa, nausea, vomiting, abdominal pain, muscle tremor, incoordination, clonic convulsions, and stupor. Ocular and dermal irritation occur following exposure to dusts. Given that exposure at the TLV for 8 hours results in a total daily intake of 0.7 mg/kg/day, the occupational dose is far less than those levels reported to cause systemic effects.

PERSONAL PROTECTION



Consult your EHS staff for recommendations

EYE

- Safety glasses with side shields.
- Chemical goggles.
- Contact lenses pose a special hazard; soft lenses may absorb irritants and all lenses concentrate them. DO NOT wear contact lenses.

HANDS/FEET

- Wear chemical protective gloves, eg. PVC.

Wear safety footwear or safety gumboots, eg. Rubber.

Suitability and durability of glove type is dependent on usage. Important factors in the selection of gloves include: such as:

- frequency and duration of contact,
- chemical resistance of glove material,
- glove thickness and
- dexterity

Select gloves tested to a relevant standard (e.g. Europe EN 374, US F739).

- When prolonged or frequently repeated contact may occur, a glove with a protection class of 5 or higher (breakthrough time greater than 240 minutes according to EN 374) is recommended.
- When only brief contact is expected, a glove with a protection class of 3 or higher (breakthrough time greater than 60 minutes according to EN 374) is recommended.
- Contaminated gloves should be replaced.

Gloves must only be worn on clean hands. After using gloves, hands should be washed and dried thoroughly. Application of a non-perfumed moisturiser is recommended.

OTHER

-
- Overalls.
- Eyewash unit.
- Barrier cream.
- Skin cleansing cream.
-
- Respirators may be necessary when engineering and administrative controls do not adequately prevent exposures.
- The decision to use respiratory protection should be based on professional judgment that takes into account toxicity information, exposure measurement data, and frequency and likelihood of the worker's exposure - ensure users are not subject to high thermal loads which may result in heat stress or distress due to personal protective equipment (powered,

- positive flow, full face apparatus may be an option).
- Published occupational exposure limits, where they exist, will assist in determining the adequacy of the selected respiratory. These may be government mandated or vendor recommended.
- Certified respirators will be useful for protecting workers from inhalation of particulates when properly selected and fit tested as part of a complete respiratory protection program.
- Use approved positive flow mask if significant quantities of dust becomes airborne.
- Try to avoid creating dust conditions.

RESPIRATOR

Protection Factor	Half-Face Respirator	Full-Face Respirator	Powered Air Respirator
10 x PEL	P1	-	PAPR-P1
	Air-line*	-	-
50 x PEL	Air-line**	P2	PAPR-P2
100 x PEL	-	P3	-
		Air-line*	-
100+ x PEL	-	Air-line**	PAPR-P3

* - Negative pressure demand ** - Continuous flow

Explanation of Respirator Codes:

Class 1 low to medium absorption capacity filters.

Class 2 medium absorption capacity filters.

Class 3 high absorption capacity filters.

PAPR Powered Air Purifying Respirator (positive pressure) cartridge.

Type A for use against certain organic gases and vapors.

Type AX for use against low boiling point organic compounds (less than 65°C).

Type B for use against certain inorganic gases and other acid gases and vapors.

Type E for use against sulfur dioxide and other acid gases and vapors.

Type K for use against ammonia and organic ammonia derivatives

Class P1 intended for use against mechanically generated particulates of sizes most commonly encountered in industry, e.g. asbestos, silica.

Class P2 intended for use against both mechanically and thermally generated particulates, e.g. metal fume.

Class P3 intended for use against all particulates containing highly toxic materials, e.g. beryllium.

The local concentration of material, quantity and conditions of use determine the type of personal protective equipment required.

Use appropriate NIOSH-certified respirator based on informed professional judgement. In conditions where no reasonable estimate of exposure can be made, assume the exposure is in a concentration IDLH and use NIOSH-certified full face pressure demand SCBA with a minimum service life of 30 minutes, or a combination full facepiece pressure demand SAR with auxiliary self-contained air supply. Respirators provided only for escape from IDLH atmospheres shall be NIOSH-certified for escape from the atmosphere in which they will be used.

ENGINEERING CONTROLS

- Local exhaust ventilation is required where solids are handled as powders or crystals; even when particulates are relatively large, a certain proportion will be powdered by mutual friction.
- Exhaust ventilation should be designed to prevent accumulation and recirculation of particulates in the workplace.
- If in spite of local exhaust an adverse concentration of the substance in air could occur, respiratory protection should be considered. Such protection might consist of:
 - particle dust respirators, if necessary, combined with an absorption cartridge;
 - filter respirators with absorption cartridge or canister of the right type;
 - fresh-air hoods or masks
- Build-up of electrostatic charge on the dust particle, may be prevented by bonding and grounding.
- Powder handling equipment such as dust collectors, dryers and mills may require additional protection measures such as explosion venting.

Air contaminants generated in the workplace possess varying "escape" velocities which, in turn, determine the "capture velocities" of fresh circulating air required to efficiently remove the contaminant.

Type of Contaminant:	Air Speed:
direct spray, spray painting in shallow booths, drum filling, conveyer loading, crusher dusts, gas discharge (active generation into zone of rapid air motion)	1-2.5 m/s (200-500 f/min.)
grinding, abrasive blasting, tumbling, high speed wheel generated dusts (released at high initial velocity into zone of very high rapid air motion).	2.5-10 m/s (500-2000 f/min.)

Within each range the appropriate value depends on:

Lower end of the range	Upper end of the range
1: Room air currents minimal or favorable to capture	1: Disturbing room air currents
2: Contaminants of low toxicity or of nuisance value only	2: Contaminants of high toxicity
3: Intermittent, low production.	3: High production, heavy use
4: Large hood or large air mass in motion	4: Small hood-local control only

Simple theory shows that air velocity falls rapidly with distance away from the opening of a simple extraction pipe. Velocity generally decreases with the square of distance from the extraction point (in simple cases). Therefore the air speed at the extraction point should be adjusted, accordingly, after reference to distance from the contaminating source. The air velocity at the extraction fan, for example, should be a minimum of 4-10 m/s (800-2000 f/min) for extraction of crusher dusts generated 2 meters distant from the extraction point. Other mechanical considerations, producing performance deficits within the extraction apparatus, make it essential that theoretical air velocities are multiplied by factors of 10 or more when extraction systems are installed or used.

PHYSICAL PROPERTIES

Solid.
Does not mix with water.

State	Divided solid	Molecular Weight	394.45
Melting Range (°F)	329- 330.8	Viscosity	Not Applicable
Boiling Range (°F)	410- 428 (5 mm)	Solubility in water (g/L)	Immiscible
Flash Point (°F)	Not available	pH (1% solution)	Not applicable
Decomposition Temp (°F)	Not Available	pH (as supplied)	Not applicable
Autoignition Temp (°F)	Not available	Vapour Pressure (mmHG)	Negligible
Upper Explosive Limit (%)	Not available	Specific Gravity (water=1)	Not available
Lower Explosive Limit (%)	Not available	Relative Vapor Density (air=1)	Not applicable
Volatile Component (%vol)	Negligible	Evaporation Rate	Not applicable

APPEARANCE

Colourless to brownish crystals or white to brownish-white, odourless, tasteless crystalline powder; does not mix with water. Soluble in alcohol (1:300), chloroform (1:3), and ether (1:200). Colourless solutions in organic solvents oxidise upon exposure and become yellow, orange and then deep red and may deposit crystals of dehydrorotenone and rotenonone.

Section 10 - CHEMICAL STABILITY

CONDITIONS CONTRIBUTING TO INSTABILITY

-
- Presence of elevated temperatures.
- Presence of incompatible materials.
- Product is considered stable.
- Hazardous polymerization will not occur.

STORAGE INCOMPATIBILITY

- Avoid reaction with oxidizing agents.

For incompatible materials - refer to Section 7 - Handling and Storage.

Section 11 - TOXICOLOGICAL INFORMATION

rotenone

TOXICITY AND IRRITATION

- unless otherwise specified data extracted from RTECS - Register of Toxic Effects of Chemical Substances.
 - Asthma-like symptoms may continue for months or even years after exposure to the material ceases. This may be due to a non-allergenic condition known as reactive airways dysfunction syndrome (RADS) which can occur following exposure to high levels of highly irritating compound. Key criteria for the diagnosis of RADS include the absence of preceding respiratory disease, in a non-atopic individual, with abrupt onset of persistent asthma-like symptoms within minutes to hours of a documented exposure to the irritant. A reversible airflow pattern, on spirometry, with the presence of moderate to severe bronchial hyperreactivity on methacholine challenge testing and the lack of minimal lymphocytic inflammation, without eosinophilia, have also been included in the criteria for diagnosis of RADS. RADS (or asthma) following an irritating inhalation is an infrequent disorder with rates related to the concentration of and duration of exposure to the irritating substance. Industrial bronchitis, on the other hand, is a disorder that occurs as result of exposure due to high concentrations of irritating substance (often particulate in nature) and is completely reversible after exposure ceases. The disorder is characterised by dyspnea, cough and mucus production.
- The material may be irritating to the eye, with prolonged contact causing inflammation. Repeated or prolonged exposure to irritants may produce conjunctivitis.
- Equivocal carcinogen by RTECS criteria
- Reproductive effector in rats.
- (10% technical in dimethyl phthalate suspension)
- Growth retardation and vomiting were the observable results of chronic exposures involving rats and dogs. Rats fed diets 2.5 to 50 mg/kg for two years developed no pathological changes that could be attributed to rotenone. The lowest dose administered, 2.5 mg/kg, inhibited growth.
- Dogs fed low to moderate doses of rotenone for 28 days experienced vomiting and excessive salivation, but no negative weight gain. Dogs fed rotenone for six months at low doses had reduced food consumption and therefore reduced weight gain. At necropsy, the most frequent lesions were bleeding patches in the small intestine.
- Reproductive Effects
- Pregnant rats fed small amounts of the insecticide (10 mg/kg) through day 15 of gestation, experienced decreases in live births and increases in fetal resorption. Some of the mothers died due to rotenone poisoning also. The 2.5 mg/kg dose produced no observable maternal toxicity or adverse effect on fetal development. While low doses of the pesticide were sufficient to cause adverse effects in the pregnant rats, there is not enough information to draw any connection to the potential for reproductive risks to humans.
- Teratogenic Effects
- Pregnant rats fed small amounts (5 mg/kg) produced a significant number of young with skeletal deformities. The effects was not observed at the 10 mg/kg level, so the data do not provide convincing evidence of teratogenicity .
- Mutagenic Effects
- The results from a number of tests for mutagenicity make any conclusion about mutagenic risks to humans difficult to draw. The compound was determined to be non-mutagenic to bacteria and yeast and in treated mice and rats. However, it was shown to cause mutations in some cultured mouse cells.
- Carcinogenic Effects
- Young mice given small amounts of rotenone (1 mg/kg) until they were four weeks old and then fed 3 mg/kg for 18 months more months did not show a significant increase in tumors. Rat studies which showed an increased evidence of mammary

tumor at 1.7 mg/kg for 42 days could not be duplicated in later studies on rats and hamsters. Male rats showed equivocal evidence of carcinogenic activity in a two- year feeding study done by the National Cancer Institute . These males had increased evidence of parathyroid gland tumors. However, female rats and all mice showed no evidence of cancer.

CARCINOGEN

Non-arsenical insecticides (occupational exposures in spraying and application of)	International Agency for Research on Cancer (IARC) - Agents Reviewed by the IARC Monographs	Group	2A
Rotenone (commercial)	US ACGIH Threshold Limit Values (TLV) - Carcinogens	Carcinogen Category	A4

Section 12 - ECOLOGICAL INFORMATION

Refer to data for ingredients, which follows:

ROTENONE:

■ Fish LC50 (96hr.) (mg/l):	0.47- 5.8 (
■ Fish LC50 (96hr.) (mg/l):	0.0165- 0.3
■ Daphnia magna EC50 (48hr.) (mg/l):	0.1

- Very toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.
- Do NOT allow product to come in contact with surface waters or to intertidal areas below the mean high water mark. Do not contaminate water when cleaning equipment or disposing of equipment wash-waters.

Wastes resulting from use of the product must be disposed of on site or at approved waste sites.

- DO NOT discharge into sewer or waterways.

- The material is classified as an ecotoxin* because the Fish LC50 (96 hours) is less than or equal to 0.1 mg/l

* Classification of Substances as Ecotoxic (Dangerous to the Environment)

Appendix 8, Table 1

Compiler's Guide for the Preparation of International Chemical Safety Cards: 1993 Commission of the European Communities.

Half-life (hr) H2O surface water: 23.6-247.2

Toxicity Fish: LC50(96)305ug/L

Rotenone is slightly toxic to wildfowl. The LD50 values for rotenone in mallards and pheasants is (greater than) 2,000 mg/kg and 1,680 mg/kg respectively. Some of the signs of intoxication in birds include muscle incoordination, feathers fluffed or held tightly to the body, wings drooped and the neck pulled in. Remission of signs of intoxication take about a week. It appears that birds are more sensitive to ground derris root than to pure rotenone.

Since rotenone is used as a fish toxin (piscicide), it follows that it is very highly toxic to fish. Rainbow trout had a 96-hour LC50 of 23 micrograms/l (ppb) and channel catfish had 2.6 micrograms/l (ppb) .

Aquatic invertebrates have a wide range of sensitivity to rotenone with 96 hr LC50 values ranging from 0.002 to 100 mg/l (ppm). The compound is not toxic to bees. However, it is toxic to bees when used in combination with pyrethrum.

ENVIRONMENTAL FATE

Rotenone breaks down readily by exposure to sunlight. Nearly all of the toxicity of the compound is lost in five to six days of spring sunlight or two to three days of summer sunlight.

Rotenone is a highly active but short-lived photosensitizer. This means that an organism consuming the compound develops a strong sensitivity to the sun for a short time. A number of photodecomposition products are formed when bean leaves are exposed to light. It is also sensitive to heat with, much of the rotenone quickly lost at high temperatures.

Rotenone is rapidly broken down in soil and in water. The half-life in both of these environments is between one and three days. Because of its short half-life and because it does not readily leach from soil, it is not expected to be a groundwater pollutant.

Ecotoxicity

Ingredient rotenone	Persistence: Water/Soil HIGH	Persistence: Air	Bioaccumulation LOW	Mobility LOW
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Section 13 - DISPOSAL CONSIDERATIONS

Disposal Instructions

All waste must be handled in accordance with local, state and federal regulations.

! Puncture containers to prevent re-use and bury at an authorized landfill.

Legislation addressing waste disposal requirements may differ by country, state and/ or territory. Each user must refer to laws operating in their area. In some areas, certain wastes must be tracked.

A Hierarchy of Controls seems to be common - the user should investigate:

- Reduction
- Reuse
- Recycling
- Disposal (if all else fails)

This material may be recycled if unused, or if it has not been contaminated so as to make it unsuitable for its intended use. Shelf life considerations should also be applied in making decisions of this type. Note that properties of a material may change in use, and recycling or reuse may not always be appropriate.

DO NOT allow wash water from cleaning equipment to enter drains. Collect all wash water for treatment before disposal.

- Recycle wherever possible.
- Consult manufacturer for recycling options or consult Waste Management Authority for disposal if no suitable treatment or disposal facility can be identified.
- Dispose of by: Burial in a licensed land-fill or Incineration in a licensed apparatus (after admixture with suitable combustible material)
- Decontaminate empty containers. Observe all label safeguards until containers are cleaned and destroyed.

Section 14 - TRANSPORTATION INFORMATION



DOT:

Symbols:	None	Hazard class or Division:	6.1
Identification Numbers:	UN2588	PG:	III
Label Codes:	6.1	Special provisions:	IB8, IP3, T1, TP33
Packaging: Exceptions:	153	Packaging: Non-bulk:	213
Packaging: Exceptions:	153	Quantity limitations: Passenger aircraft/rail:	100 kg
Quantity Limitations: Cargo aircraft only:	200 kg	Vessel stowage: Location:	A
Vessel stowage: Other:	40	S.M.P.:	YES

Hazardous materials descriptions and proper shipping names:

Pesticides, solid, toxic, n.o.s.

Air Transport IATA:

ICAO/IATA Class:	6.1	ICAO/IATA Subrisk:	None
UN/ID Number:	2588	Packing Group:	III
Special provisions:	A3		

Shipping Name: PESTICIDE, SOLID, TOXIC, N.O.S. *(CONTAINS ROTENONE)

Maritime Transport IMDG:

IMDG Class:	6.1	IMDG Subrisk:	None
UN Number:	2588	Packing Group:	III
EMS Number:	F-A,S-A	Special provisions:	61 223 274 944

Limited Quantities: 5 kg

Shipping Name: PESTICIDE, SOLID, TOXIC, N.O.S.(contains rotenone)

Section 15 - REGULATORY INFORMATION

rotenone (CAS: 83-79-4,12679-58-2) is found on the following regulatory lists;

"Canada - Alberta Occupational Exposure Limits","Canada - British Columbia Occupational Exposure Limits","Canada - Northwest Territories Occupational Exposure Limits (English)","Canada - Nova Scotia Occupational Exposure Limits","Canada - Ontario Occupational Exposure Limits","Canada - Prince Edward Island Occupational Exposure Limits","Canada - Quebec Permissible Exposure Values for Airborne Contaminants (English)","Canada - Saskatchewan Occupational Health and Safety Regulations - Contamination Limits","Canada - Yukon Permissible Concentrations for Airborne Contaminant Substances","Canada Domestic Substances List (DSL)","US - Alaska Limits for Air Contaminants","US - California Occupational Safety and Health Regulations (CAL/OSHA) - Hazardous Substances List","US - California Permissible Exposure Limits for Chemical Contaminants","US - Connecticut Hazardous Air Pollutants","US - Hawaii Air Contaminant Limits","US - Idaho - Limits for Air Contaminants","US - Massachusetts Oil & Hazardous Material List","US - Michigan Exposure Limits for Air Contaminants","US - Minnesota Hazardous Substance List","US - Minnesota Permissible Exposure Limits (PELs)","US - New Jersey Right to Know Hazardous Substances","US - Oregon Permissible Exposure Limits (Z1)","US - Pennsylvania - Hazardous Substance List","US - Rhode Island Hazardous Substance List","US - Tennessee Occupational Exposure Limits - Limits For Air Contaminants","US - Vermont Permissible Exposure Limits Table Z-1-A Final Rule Limits for Air Contaminants","US - Vermont Permissible Exposure Limits Table Z-1-A Transitional Limits for Air Contaminants","US - Washington Permissible exposure limits of air contaminants","US - Wyoming Toxic and Hazardous Substances Table Z1 Limits for Air Contaminants","US ACGIH Threshold Limit Values (TLV)","US ACGIH Threshold Limit Values (TLV) - Carcinogens","US DOE Temporary Emergency Exposure Limits (TEELs)","US NFPA 499 Combustible Dusts","US NIOSH Recommended Exposure Limits (RELs)","US OSHA Permissible Exposure Levels (PELs) - Table Z1"

Section 16 - OTHER INFORMATION

LIMITED EVIDENCE

- Skin contact may produce health damage*.

* (limited evidence).

Ingredients with multiple CAS Nos

Ingredient Name	CAS
rotenone	83-79-4, 12679-58-2

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- Classification of the mixture and its individual components has drawn on official and authoritative sources as well as

independent review by the Chemwatch Classification committee using available literature references.
A list of reference resources used to assist the committee may be found at:
www.chemwatch.net/references.

■ The (M)SDS is a Hazard Communication tool and should be used to assist in the Risk Assessment. Many factors determine whether the reported Hazards are Risks in the workplace or other settings. Risks may be determined by reference to Exposures Scenarios. Scale of use, frequency of use and current or available engineering controls must be considered.

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