SAFETY DATA SHEET

Updated on 26/09/2024

1. Material Identification

Product Name : Carbendazim
Catalog Number : io-1919
CAS Number : 10605-21-7
Identified uses : Laboratory chemicals, manufacture of chemical compounds
Company : Ionz

>> R&D Use only

2. Hazards Identification

GHS Classification:

Flammable liquid (category 2)
Acute toxicity, oral (Category 3)
Acute toxicity, dermal (Category 3)
Acute toxicity, inhalation (Category 3)
Specific target organ toxicity, single exposure (Category 1)

Note

>> Pictograms displayed are for 99.7% (702 of 704) of reports that indicate hazard statements. This chemical does not meet GHS hazard criteria for 0.3% (2 of 704) of reports.

Pictogram(s)

GHS Hazard Statements

>> H317 (23.6%): May cause an allergic skin reaction [Warning Sensitization, Skin]

>> H340 (99.6%): May cause genetic defects [Danger Germ cell mutagenicity]

>> H360 (78.3%): May damage fertility or the unborn child [Danger Reproductive toxicity]

>> H360FD (21.3%): May damage fertility; May damage the unborn child [Danger Reproductive toxicity]

>> H400 (98.2%): Very toxic to aquatic life [Warning Hazardous to the aquatic environment, acute hazard]

>> H410 (99.7%): Very toxic to aquatic life with long lasting effects [Warning Hazardous to the aquatic environment, long-term hazard]

Precautionary Statement Codes

>> P203, P261, P272, P273, P280, P302+P352, P318, P321, P333+P317, P362+P364, P391, P405, and P501

Health Hazards:

>> ACUTE/CHRONIC HAZARDS: When heated to decomposition this compound emits toxic fumes of NOx. (NTP, 1992)

>> Literature sources indicate that this chemical is probably nonflammable. (NTP, 1992)

>> Gives off irritating or toxic fumes (or gases) in a fire.

3. Composition/Information On Ingredients

Chemical name : Carbendazim
CAS Number : 10605-21-7
Molecular Formula : C9H9N3O2
Molecular Weight : 191.1900 g/mol

4. First Aid Measures

First Aid:

>> EYES: First check the victim for contact lenses and remove if present. Flush victim's eyes with water or normal saline solution for 20 to 30 minutes while simultaneously calling a hospital or poison control center. Do not put any ointments, oils, or medication in the victim's eyes without specific instructions from a physician. If symptoms (such as redness or irritation) develop, immediately transport the victim to a hospital.

>> SKIN: IMMEDIATELY flood affected skin with water while removing and isolating all contaminated clothing. Gently wash all affected skin areas thoroughly with soap and water. If symptoms such as redness or irritation develop, IMMEDIATELY call a physician and be prepared to transport the victim to a hospital for treatment.

>> INHALATION: IMMEDIATELY leave the contaminated area; take deep breaths of fresh air. If symptoms (such as wheezing, coughing, shortness of breath, or burning in the mouth, throat, or chest) develop, call a physician and be prepared to transport the victim to a hospital. Provide proper respiratory protection to rescuers entering an unknown atmosphere. Whenever possible, Self-Contained Breathing Apparatus (SCBA) should be used; if not available, use a level of protection greater than or equal to that advised under Protective Clothing.

>> INGESTION: DO NOT INDUCE VOMITING. If the victim is conscious and not convulsing, give 1 or 2 glasses of water to dilute the chemical and IMMEDIATELY call a hospital or poison control center. Be prepared to transport the victim to a hospital if advised by a physician. If the victim is convulsing or unconscious, do not give anything by mouth, ensure that the victim's airway is open and lay the victim on his/her side with the head lower than the body. DO NOT INDUCE VOMITING. IMMEDIATELY transport the victim to a hospital. (NTP, 1992)

First Aid Measures

Inhalation First Aid

>> Fresh air, rest.

Skin First Aid

>> Remove contaminated clothes. Rinse and then wash skin with water and soap.

Eye First Aid

>> First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then refer for medical attention.

Ingestion First Aid

>> Rinse mouth. Rest.

5. Fire Fighting Measures

>> Fires involving this material can be controlled with a dry chemical, carbon dioxide or Halon extinguisher. (NTP, 1992)

>> Use water spray, powder.

6. Accidental Release Measures

Isolation and Evacuation:

Isolation and evacuation measures to take when a large amount of this chemical is accidentally released in an emergency.

>> Excerpt from ERG Guide 171 [Substances (Low to Moderate Hazard)]:

>> IMMEDIATE PRECAUTIONARY MEASURE: Isolate spill or leak area in all directions for at least 50 meters (150 feet) for liquids and at least 25 meters (75 feet) for solids.

>> SPILL: Increase the immediate precautionary measure distance, in the downwind direction, as necessary.

>> FIRE: If tank, rail tank car or highway tank is involved in a fire, ISOLATE for 800 meters (1/2 mile) in all directions; also, consider initial evacuation for 800 meters (1/2 mile) in all directions. (ERG, 2024)

Spillage Disposal:

Methods for containment and safety measures to protect workers dealing with a spillage of this chemical.

>> Do NOT let this chemical enter the environment. Sweep spilled substance into covered containers. If appropriate, moisten first to prevent dusting. Carefully collect remainder. Then store and dispose of according to local regulations.

7. Handling And Storage

Safe Storage:

>> Separated from bases and food and feedstuffs.

Storage Conditions:

>> Keep container tightly closed in a dry and well-ventilated place.

8. Exposure Control/ Personal Protection

MAK (Maximale Arbeitsplatz Konzentration)

>> (inhalable fraction): 10 mg/m

Inhalation Risk:

>> Evaporation at 20 °C is negligible; a harmful concentration of airborne particles can, however, be reached quickly on spraying or when dispersed, especially if powdered.

Effects of Long Term Exposure:

>> Animal tests show that this substance possibly causes toxicity to human reproduction or development.

Exposure Prevention

>> PREVENT DISPERSION OF DUST! AVOID EXPOSURE OF (PREGNANT) WOMEN! AVOID EXPOSURE OF ADOLESCENTS AND CHILDREN!

Inhalation Prevention

>> Avoid inhalation of dust and mist.

Skin Prevention

>> Protective gloves.

Eye Prevention

>> Wear safety spectacles.

Ingestion Prevention

>> Do not eat, drink, or smoke during work. Wash hands before eating.

Exposure Control and Personal Protection

Maximum Allowable Concentration (MAK)

>> 10.0 [mg/m3], inhalable fraction[German Research Foundation (DFG)]

9. Physical And Chemical Properties

Molecular Weight:

>> 191.19

Exact Mass:

>> 191.069476538

Physical Description:

>> Carbendazim appears as light gray or beige powder. (NTP, 1992)

>> COLOURLESS CRYSTALS OR GREY-TO-WHITE POWDER.

Color/Form:

>> White powder

Odor:

>> Odorless /Technical/

Melting Point:

>> 576 to 585 °F (decomposes) (NTP, 1992)

Solubility:

>> less than 1 mg/mL at 70 °F (NTP, 1992)

>> Solubility in water, g/100ml at 24 °C: 0.0008

Density:

>> 1.45 at 68 °F (NTP, 1992) - Denser than water; will sink

>> 0.27 g/cm^3

Vapor Pressure:

>> less than 0.000000075 mmHg at 68 °F ; <0.001 mmHg at 257 °F (NTP, 1992)

>> Vapor pressure at 20 °C: negligible

LogP:

>> log Kow = 1.52

>> 1.49

Stability/Shelf Life:

>> Stable under recommended storage conditions.

Decomposition:

>> Decomposes at 300 °C.

>> 302-307 °C

Ionization Efficiency:

The ratio of the number of ions formed to the number of electrons or photons used in an ionization process.

Ionization mode

>> Positive

logIE

>> 3.46

pH

>> 2.7

Instrument

>> Agilent XCT

Ion source

>> Electrospray ionization

Additive

>> formic acid (5.3nM)

Organic modifier

>> MeCN (80%)

Reference

>> DOI:10.1038/s41598-020-62573-z

Dissociation Constants:

>> pKa = 4.29

Collision Cross Section:

Collision cross section (CCS) represents the effective area for the interaction between an individual ion and the neutral gas through which it is traveling (e.g., in ion mobility spectrometry (IMS) experiments). It quantifies the probability of a collision taking place between two or more particles.

>> 134.94 Å² [M+H]+ [CCS Type: TW]

10. Stability And Reactivity

>> Insoluble in water. This compound slowly decomposes in alkaline solution. (NTP, 1992).

11. Toxicological Information

Toxicity Summary:

>> IDENTIFICATION AND USE: Carbendazim is a white powder. it is a systemic leaf and soil fungicide, absorbed through the roots and green tissues. HUMAN EXPOSURE AND TOXICITY: Six human chromosomes were investigated in pairs (1 and 8, 11 and 18, and X and 17). Abnormalities were classified as chromosome loss (including centromeric positive micronuclei), chromosome gain, non-disjunction, or polyploidy. ANIMAL STUDIES: Previous studies indicate that carbendazim may interfere with mitosis and thus may disrupt or inhibit microtubule function resulting in apoptosis. Carbendazim even at low dose exhibited toxicity, affected the liver and also caused specific changes in hematological and biochemical parameters in the rat. Male rats (6 per dose level) were gavaged with 200, 3400 and 5000 mg/kg 5 days/wk for 2 wk. Two out of the 6 rats died at the dose level of 3400 mg/kg per day. At all dose levels, gross and microscopic evidence of adverse effects on the testes and reduction or absence of sperm in the epididymides was seen. The testes were small and discolored, with tubular degeneration and evidence of aspermatogenesis. At the dose level of 3400 mg/kg per day, there were also morphological changes in the duodenum (edema and focal necrosis), bone marrow (reduction in the blood forming elements) and liver (decrease in the large globular shaped vacuoles). Groups of 1 yr old beagles (4 males, 4 females) were admin carbendazim in the diet for 3 months at dietary levels of 0, 100, 500 and 2500 mg/kg. Females at the mid dose level showed a trend toward incr cholesterol levels at 1, 2 and 3 months compared with the pre-test and control values. High dose females also had elevated cholesterol levels. Organ to body weight changes were observed in the case of the thymus of low and mid dose males and the prostate of mid dose males. Groups of pregnant rats were administered carbendazim by gavage on days 6-15 of gestation at dose levels up to 80 mg/kg/day. Groups of pregnant rabbits were similarly administered up to 160 mg/kg/day on days 6-18 of gestation. In the rats, dead and resorbed fetuses accounted for 29% of conceptions in controls, 48% at 20 mg/kg, 64% at 40 mg/kg, and 73% at 80 mg/kg. In rabbits, no dead or resorbed fetuses were seen in controls whereas 15-33% were found in carbendazim-treated rabbits. There were no differences among rats or rabbits in mean weight of live fetuses, and there were no malformations. Carbendazim induced chromosome aberrations in spermatids with a high incidence of aneuploidy. Carbendazim induced micronuclei in mouse bone marrow cells. 2,3-diaminophenazine (DAP) and 2-amino-3-hydroxyphenazine (AHP) were detected in mutagenic carbendazim samples. Carbendazim samples containing DAP or AHP at levels as low as 5 or 10 ppm, respectively, were positive in the Salmonella/Ames test with activation when tested at 5000 ug/plate. Purified carbendazim was not mutagenic. ECOTOXICITY STUDIES: Amazonian fish appeared to be slightly less sensitive for carbendazim than temperate fish with LC50 values ranging between 1648 and 4238 ug/L, and Amazonian invertebrates were found to be significantly more resistant than their temperate counterparts, with LC50 values higher than 16000 ug/L. In plants, carbendazim causes methylation or demethylation of certain genes and changes the expression of these genes.

EPA Human Health Benchmarks for Pesticides:

This section provides the EPA human health benchmarks non-enforceable drinking water levels related to adverse health effects from drinking water exposure to contaminants that have no drinking water standards or health advisories.

Chemical Substance

>> Carbendazim (MBC)

Acute or One Day PAD (RfD) [mg/kg/day]

>> 0.14

Acute or One Day HHBPs [ppb]

>> 930

Acute HHBP Sensitive Lifestage/Population

>> Children

Chronic or One Day PAD (RfD) [mg/kg/day]

>> 0.14

Chronic or One Day HHBPs [ppb]

>> 830

Chronic HHBP Sensitive Lifestage/Population

>> General Population

Cancer Quantification c (Q1) Values (CSF) [mg/kg/day]

>> 0.00239

Carcinogenic HHBP (E-6 to E-4) [ppb]

>> 12.4-1240

Reference (PDF)

>> Human Health Benchmarks for Pesticides - 2021 Update

USGS Health-Based Screening Levels for Evaluating Water-Quality:

This section provides the USGS Health-Based Screening Levels for Evaluating Water-Quality data.

Chemical

>> Carbendazim

USGS Parameter Code

>> 68548

Chronic Noncancer HHBP (Human Health Benchmarks for Pesticides)[µg/L]

>> 830

Carcinogenic HHBP [µg/L]

>> 12.4-1240

Benchmark Remarks

>> Synonym MBC; degradate of thiophanate-methyl

Reference

>> Smith, C.D. and Nowell, L.H., 2024. Health-Based Screening Levels for evaluating water-quality data (3rd ed.). DOI:10.5066/F71C1TWP

Evidence for Carcinogenicity:

Evidence that this chemical does or may cause cancer. The information here is collected from various sources by the Hazardous Substances Data Bank (HSDB).

>> Cancer Classification: Group C Possible Human Carcinogen

Carcinogen Classification:

This section provides the International Agency for Research on Cancer (IARC) Carcinogenic Classification and related monograph links. In the IARC Carcinogenic classification, chemicals are categorized into four groups: Group 1 (carcinogenic to humans), Group 2A (probably carcinogenic to humans), Group 2B (possibly carcinogenic to humans), and Group 3 (not classifiable as to its carcinogenicity to humans).

>> No indication of carcinogenicity to humans (not listed by IARC).

Health Effects:

>> Carbendazim is a suspected endocrine disruptor. It is also a developmental toxin. Animals exposed to carbendazim in the womb to have serious deformities such as lack of eyes and hydrocephalus (water on the brain). Carbendazim can

disrupt the development of sperm and damage testicular development in adult rats.

Exposure Routes:

>> The substance can be absorbed into the body by inhalation of its aerosol.

>> Inhalation (L793) ; oral (L793); dermal (L793)

Eye Exposure

>> Redness.

>> Skin redness and skin irritation. Fetuses exposed to high levels may exhibit microphthalmia (small eyes) or anaphthalmia (no eyes).

Adverse Effects:

An adverse effect is an undesired harmful effect resulting from a medical treatment or other intervention.

>> Occupational hepatotoxin - Secondary hepatotoxins: the potential for toxic effect in the occupational setting is based on cases of poisoning by human ingestion or animal experimentation.

>> Reproductive Toxin - A chemical that is toxic to the reproductive system, including defects in the progeny and injury to male or female reproductive function. Reproductive toxicity includes developmental effects. See Guidelines for Reproductive Toxicity Risk Assessment.

Toxicity Data:

>> Acute oral LD50 for rats is >15000 mg/kg and >2500 mg/kg for dogs

Minimum Risk Level:

The minimal risk level (MRL) is an estimate of the amount of a chemical a person can eat, drink, or breathe each day without a detectable risk to health

>> The MRLs for fresh produce in the European Union are now between 0.1 and 0.7 mg/kg

Treatment:

Treatment when exposed to toxin

>> For acute exposures and first aid: EYES: irrigate opened eyes for several minutes under running water. INGESTION: do not induce vomiting. Rinse mouth with water (never give anything by mouth to an unconscious person). Seek immediate medical advice. SKIN: should be treated immediately by rinsing the affected parts in cold running water for at least 15 minutes, followed by thorough washing with soap and water. If necessary, the person should shower and change contaminated clothing and shoes, and then must seek medical attention. INHALATION: supply fresh air. If required provide artificial respiration.

Interactions:

>> ... The present work studied the effect of licorice aqueous extract on carbendazim-induced testicular toxicity in albino rats. Administration of carbendazim induced significant decrease in testis weight, diameter, and germinal epithelial height of the seminiferous tubules. Histological results revealed degeneration of seminiferous tubules, loss of spermatogenic cells, and apoptosis. Moreover, carbendazim caused elevation of testicular malondialdehyde (MDA), marker of lipid peroxidation, and reduced the activity of the antioxidant enzymes, superoxide dismutase (SOD) and catalase (CAT). Coadministration of licorice extract with carbendazim improved the histomorphological and histopathological changes observed in animals treated with carbendazim. In addition, licorice treatment leads to a significant decrease in the level of MDA and increase in the activities of SOD and CAT. According to the present results, it is concluded that licorice aqueous extract can improve the testicular toxicity of carbendazim and this effect may be attributed to antioxidant properties of one or more of its constituents.

Antidote and Emergency Treatment:

>> Immediate first aid: Ensure that adequate decontamination has been carried out. If patient is not breathing, start artificial respiration, preferably with a demand-valve resuscitator, bag-valve-mask device or pocket mask, as trained. Perform CPR if necessary. Immediately flush contaminated eyes with gently flowing water. Do not induce vomiting. If vomiting occurs, lean patient forward or place on left side (head-down position, if possible) to maintain an open airway and prevent aspiration. Keep patient quiet and maintain normal body temperature. Obtain medical attention.

Human Toxicity Excerpts:

>> /HUMAN EXPOSURE STUDIES/ Moderately toxic by skin contact. Mildly toxic by ingestion.

Non-Human Toxicity Excerpts:

>> /LABORATORY ANIMALS: Acute Exposure/ ... In the present study, low dose intracellular effect of carbendazim was investigated employing 5, 10, 25 and 50 mM of the compound administered to male rats intradermally. Blood and liver of each animal was collected 6 hrs later to analyze serum and tissue enzyme activities, tissue lipid peroxidation and hematological and biochemical parameters. The experimental results of low dosage carbendazim use indicated

augmentation of investigated parameters. However, the higher dosage of carbendazim use resulted in renormalization of investigated parameters to control levels or to values below control, providing a U-shaped hormesis type dose-response profile. Histopathological sections revealed portal vein congestion, mononuclear cell infiltration and hydropic degeneration of the liver tissue. These results indicated that carbendazim even at low dose exhibited toxicity, affected the liver and also caused specific changes in hematological and biochemical parameters in the rat.

Non-Human Toxicity Values:

>> LD50 Rat oral (in sesame oil) >15,000 mg/kg

12. Ecological Information

ICSC Environmental Data:

>> The substance is very toxic to aquatic organisms. This substance does enter the environment under normal use. Great care, however, should be taken to avoid any additional release, for example through inappropriate disposal.

Animal Concentrations:

Concentrations of this compound in animals.

>> There is considerable and ongoing debate as to the harm inflicted on bees by exposure to agricultural pesticides. In part, the lack of consensus reflects a shortage of information on field-realistic levels of exposure. Here, we quantify concentrations of neonicotinoid insecticides and fungicides in the pollen of oilseed rape, and in pollen of wildflowers growing near arable fields. We then compare this to concentrations of these pesticides found in pollen collected by honey bees and in pollen and adult bees sampled from bumble bee colonies placed on arable farms. We also compared this with levels found in bumble bee colonies placed in urban areas. Pollen of oilseed rape was heavily contaminated with a broad range of pesticides, as was the pollen of wildflowers growing nearby. Consequently, pollen collected by both bee species also contained a wide range of pesticides, notably including the fungicides carbendazim, boscalid, flusilazole, metconazole, tebuconazole and trifloxystrobin and the neonicotinoids thiamethoxam, thiacloprid and imidacloprid. In bumble bees, the fungicides carbendazim, boscalid, tebuconazole, flusilazole and metconazole were present at concentrations up to 73 ng/g. It is notable that pollen collected by bumble bees in rural areas contained high levels of the neonicotinoids thiamethoxam (mean 18 ng/g) and thiacloprid (mean 2.9 ng/g), along with a range of fungicides, some of which are known to act synergistically with neonicotinoids. Pesticide exposure of bumble bee colonies in urban areas was much lower than in rural areas. Understanding the effects of simultaneous exposure of bees to complex mixtures of pesticides remains a major challenge.

Average Daily Intake:

The average amount of the compound taken into the body through eating, drinking, or breathing.

>> The estimated dermal and inhalation exposure to workers applying pesticides to flower crops in greenhouses in Colombia were 20 and 0.03 mg/day, respectively; 10% of the dermal exposure was expected to be adsorbed through the skin resulting in 2 mg/day absorbed(1).

13. Disposal Considerations

Spillage Disposal

>> Do NOT let this chemical enter the environment. Sweep spilled substance into covered containers. If appropriate, moisten first to prevent dusting. Carefully collect remainder. Then store and dispose of according to local regulations.

Disposal Methods

>> Generators of waste (equal to or greater than 100 kg/mo) containing this contaminant, EPA hazardous waste number U372, must conform with USEPA regulations in storage, transportation, treatment and disposal of waste.

>> Product: Offer surplus and non-recyclable solutions to a licensed disposal company. Contact a licensed professional waste disposal service to dispose of this material. Dissolve or mix the material with a combustible solvent and burn in a chemical incinerator equipped with an afterburner and scrubber; Contaminated packaging: Dispose of as unused product.

>> Do NOT let this chemical enter the environment. Sweep spilled substance into covered containers. If appropriate, moisten first to prevent dusting. Carefully collect remainder. Then store and dispose of according to local regulations.

14. Transport Information

DOT

Carbendazim

Reportable Quantity of 10 lb or 4

IATA

Carbendazim

,

15. Regulatory Information

Regulatory Information

The Australian Inventory of Industrial Chemicals

>> Chemical: Carbamic acid, 1H-benzimidazol-2-yl-, methyl ester

REACH Registered Substance

>> Status: Active Update: 04-03-2019 https://echa.europa.eu/registration-dossier/-/registered-dossier/27856

New Zealand EPA Inventory of Chemical Status

>> Carbendazim: HSNO Approval: HSR003016 Approved with controls

16. Other Information

Toxic Combustion Products:

Toxic products (e.g., gases and vapors) produced from the combustion of this chemical.

>> Special hazards arising from the substance or mixture: Carbon oxides, nitrogen oxides (NOx).

Other Safety Information

Chemical Assessment

>> IMAP assessments - Carbamic acid, 1H-benzimidazol-2-yl-, methyl ester: Human health tier II assessment

>> Evaluation - Carbamic acid, 1H-benzimidazol-2-yl-, methyl ester (carbendazim)

"The information provided is believed to be accurate but is not comprehensive and should be used as a reference. It reflects our current knowledge and is intended for safety guidance related to the product. This document does not constitute a warranty of the product's properties. Ionz is not responsible for any damages resulting from handling or contact with the product incorrectly."