

Titanium(IV) isopropoxide

sc-253704



The Power is Question

Material Safety Data Sheet

Hazard Alert Code
Key:

EXTREME

HIGH

MODERATE

LOW

Section 1 - CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

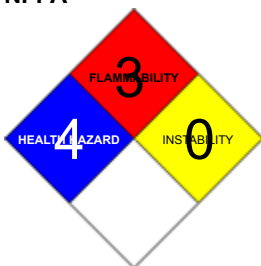
PRODUCT NAME

Titanium(IV) isopropoxide

STATEMENT OF HAZARDOUS NATURE

CONSIDERED A HAZARDOUS SUBSTANCE ACCORDING TO OSHA 29 CFR 1910.1200.

NFPA



SUPPLIER

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EMERGENCY

ChemWatch
Within the US & Canada: 877-715-9305
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(1-800-CHEMCALL) or call +613 9573 3112

SYNONYMS

C12-H28-O4-Ti, C3-H8-O.1/4Ti, Ti[OCH(CH3)2]4, "isopropyl orthotitanate", "isopropyl titanate (IV)", tetraisopropoxytitanium, "tetraisopropoxide titanium", "tetraisopropyl orthotitanate", "tetraisopropyl titanate", "tetra isopropyl titanate", "titanium(4+) isopropoxide", "titanium isopropylate", "titanium tetraisopropoxide", "titanium tetraisopropylate", "titanium tetra-n-propoxide"

Section 2 - HAZARDS IDENTIFICATION

CHEMWATCH HAZARD RATINGS

	Min	Max
Flammability	2	
Toxicity	2	
Body Contact	2	
Reactivity	1	

Min/Nil=0
Low=1
Moderate=2
High=3
Extreme=4



**CANADIAN WHMIS SYMBOLS****EMERGENCY OVERVIEW****RISK**

Harmful by inhalation.

Irritating to eyes, respiratory system and skin.

Flammable.

POTENTIAL HEALTH EFFECTS**ACUTE HEALTH EFFECTS****SWALLOWED**

- Accidental ingestion of the material may be damaging to the health of the individual.
- Dusts of titanium and titanium compounds are thought to exhibit little or no toxic effects.
- Following ingestion, a single exposure to isopropyl alcohol produced lethargy and non-specific effects such as weight loss and irritation.

Ingestion of near-lethal doses of isopropanol produces histopathological changes of the stomach, lungs and kidneys, incoordination, lethargy, gastrointestinal tract irritation, and inactivity or anaesthesia.

EYE

- This material may produce eye irritation in some persons and produce eye damage 24 hours or more after instillation.

Moderate inflammation may be expected with redness; conjunctivitis may occur with prolonged exposure.

- Isopropanol vapour may cause mild eye irritation at 400 ppm.

Splashes may cause severe eye irritation, possible corneal burns and eye damage.

SKIN

- The material may cause mild but significant inflammation of the skin either following direct contact or after a delay of some time.

Repeated exposure can cause contact dermatitis which is characterized by redness, swelling and blistering.

- Open cuts, abraded or irritated skin should not be exposed to this material.
- 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.

- Most liquid alcohols appear to act as primary skin irritants in humans.

Significant percutaneous absorption occurs in rabbits but not apparently in man.

INHALED

- Inhalation of aerosols (mists, fumes), generated by the material during the course of normal handling, may be harmful.

- The material can cause respiratory irritation in some persons.

The body's response to such irritation can cause further lung damage.

- Inhalation of vapours may cause drowsiness and dizziness.

This may be accompanied by narcosis, reduced alertness, loss of reflexes, lack of coordination and vertigo.

- Inhalation hazard is increased at higher temperatures.

- The odour of isopropanol may give some warning of exposure, but odour fatigue may occur.

Inhalation of isopropanol may produce irritation of the nose and throat with sneezing, sore throat and runny nose.

- Acute effects from inhalation of high vapor concentrations may be chest and nasal irritation with coughing, sneezing, headache and even nausea.

CHRONIC HEALTH EFFECTS

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

Limited evidence suggests that repeated or long-term occupational exposure may produce cumulative health

effects involving organs or biochemical systems.

Long term or repeated ingestion exposure of isopropanol may produce incoordination, lethargy and reduced weight gain.

Repeated inhalation exposure to isopropanol may produce narcosis, incoordination and liver degeneration. Animal data show developmental effects only at exposure levels that produce toxic effects in the adult animals. Isopropanol does not cause genetic damage in bacterial or mammalian cell cultures or in animals.

There are inconclusive reports of human sensitisation from skin contact with isopropanol. Chronic alcoholics are more tolerant of systemic isopropanol than are persons who do not consume alcohol; alcoholics have survived as much as 500 ml. of 70% isopropanol.

Continued voluntary drinking of a 2.5% aqueous solution through two successive generations of rats produced no reproductive effects.

NOTE Commercial isopropanol does not contain "isopropyl oil". An excess incidence of sinus and laryngeal cancers in isopropanol production workers has been shown to be caused by the byproduct "isopropyl oil". Changes in the production processes now ensure that no byproduct is formed. Production changes include use of dilute sulfuric acid at higher temperatures.

Long term exposure to titanium and several of its compounds produces lung scarring and chronic bronchitis. Breathing is impaired and cardiac changes with right heart enlargements occur.

Section 3 - COMPOSITION / INFORMATION ON INGREDIENTS

NAME	CAS RN	%
titanium(IV) isopropoxide	546-68-9	>99
decomposes in water or moist air to produce		
isopropanol	67-63-0	
titanic acid	20338-08-3	

Section 4 - FIRST AID MEASURES

SWALLOWED

- If swallowed do NOT induce vomiting.
- If vomiting occurs, lean patient forward or place on left side (head-down position, if possible) to maintain open airway and prevent aspiration.

EYE

If this product comes in contact with the eyes

- Wash out immediately with fresh 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.

SKIN

If skin contact occurs

- Immediately remove all contaminated clothing, including footwear
- Flush skin and hair with running water (and soap if available).

INHALED

- If fumes or combustion products are inhaled remove from contaminated area.
- Lay patient down. Keep warm and rested.

NOTES TO PHYSICIAN

- For acute or short term repeated exposures to isopropanol
- Rapid onset respiratory depression and hypotension indicates serious ingestions that require careful cardiac and respiratory monitoring together with immediate intravenous access.
- Rapid absorption precludes the usefulness of emesis or lavage 2 hours post-ingestion. Activated charcoal and cathartics are not clinically useful. Ipecac is most useful when given 30 mins. post-ingestion.

Section 5 - FIRE FIGHTING MEASURES

Vapour Pressure (mmHG)	Not available
Upper Explosive Limit (%)	Not available
Specific Gravity (water=1)	0.95 @ 25 C
Lower Explosive Limit (%)	Not available

EXTINGUISHING MEDIA

- Alcohol stable foam.
- Dry chemical powder.

FIRE FIGHTING

- Alert Emergency Responders and tell them location and nature of hazard.
- May be violently or explosively reactive.

When any large container (including road and rail tankers) is involved in a fire, consider evacuation by 800 metres in all directions.

GENERAL FIRE HAZARDS/HAZARDOUS COMBUSTIBLE PRODUCTS

- Liquid and vapor are flammable.
- Moderate fire hazard when exposed to heat or flame.

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

FIRE INCOMPATIBILITY

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

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Section 6 - ACCIDENTAL RELEASE MEASURES

MINOR SPILLS

- Remove all ignition sources.
- Clean up all spills immediately.

Slippery when spilt.

MAJOR SPILLS

Slippery when spilt.

- Clear area of personnel and move upwind.
- Alert Emergency Responders and tell them location and nature of hazard.

Section 7 - HANDLING AND STORAGE

PROCEDURE FOR HANDLING

- Containers, even those that have been emptied, may contain explosive vapours.
- Do NOT cut, drill, grind, weld or perform similar operations on or near containers.
- Avoid all personal contact, including inhalation.
- Wear protective clothing when risk of overexposure occurs.
- DO NOT allow clothing wet with material to stay in contact with skin

RECOMMENDED STORAGE METHODS

Packing as supplied by manufacturer. Plastic containers may only be used if approved for flammable liquid.

- For low viscosity materials (i) Drums and jerricans must be of the non-removable head type. (ii) 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)

STORAGE REQUIREMENTS

- Store in original containers in approved flammable liquid storage area.
- DO NOT store in pits, depressions, basements or areas where vapors may be trapped.
- Material is hygroscopic, i.e. absorbs moisture from the air. Keep containers well sealed in storage.

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 - Ontario Occupational Exposure Limits	titanium(IV) isopropoxide (Particles (Insoluble or Poorly Soluble) Not Otherwise)		10 (I)						
Canada - British Columbia Occupational Exposure Limits	titanium(IV) isopropoxide (Particles (Insoluble or Poorly Soluble) Not Otherwise Classified (PNOC))		10 (N)						
Canada - Ontario Occupational Exposure Limits	titanium(IV) isopropoxide (Specified (PNOS) / Particules (insolubles ou peu solubles) non précisées par ailleurs)		3 (R)						
US - Tennessee Occupational Exposure Limits - Limits For Air Contaminants	titanium(IV) isopropoxide (Particulates not otherwise regulated Respirable)		5						

	fraction)					
US - California Permissible Exposure Limits for Chemical Contaminants	titanium(IV) isopropoxide (Particulates not otherwise regulated Respirable fraction)	5				(n)
US - Oregon Permissible Exposure Limits (Z-1)	titanium(IV) isopropoxide (Particulates not otherwise regulated (PNOR) (f) Total Dust)	-	10			Bold print identifies substances for which the Oregon Permissible Exposure Limits (PELs) are different than the federal Limits. PNOR means “particles not otherwise regulated.”
US - Michigan Exposure Limits for Air Contaminants	titanium(IV) isopropoxide (Particulates not otherwise regulated, Respirable dust)	5				
US - Oregon Permissible Exposure Limits (Z-1)	titanium(IV) isopropoxide (Particulates not otherwise regulated (PNOR) (f) Respirable Fraction)	-	5			Bold print identifies substances for which the Oregon Permissible Exposure Limits (PELs) are different than the federal Limits. PNOR means “particles not otherwise regulated.”
US - Wyoming Toxic and Hazardous Substances Table Z1 Limits for Air Contaminants	titanium(IV) isopropoxide (Particulates not otherwise regulated (PNOR)(f)- Respirable fraction)	5				
Canada - Prince Edward Island Occupational Exposure Limits	titanium(IV) isopropoxide (Particles (Insoluble or Poorly Soluble) [NOS] Inhalable particles)	10				See Appendix B current TLV/BEI Book
Canada - Alberta Occupational Exposure Limits	isopropanol (2-Propanol (Isopropyl alcohol, isopropanol))	200	492	400	984	

Canada - British Columbia Occupational Exposure Limits	isopropanol (Isopropanol (Isopropyl alcohol) Revised 2003)	200	400			
US - Minnesota Permissible Exposure Limits (PELs)	isopropanol (Isopropyl alcohol)	400	980	500	1225	
US ACGIH Threshold Limit Values (TLV)	isopropanol (2-Propanol)	200	400			TLV Basis eye & upper respiratory tract irritation; central nervous system impairment
US NIOSH Recommended Exposure Limits (RELs)	isopropanol (Isopropyl alcohol)	400	980	500	1225	
US - Tennessee Occupational Exposure Limits - Limits For Air Contaminants	isopropanol (Isopropyl alcohol)	400	980	500	1225	
US - Vermont Permissible Exposure Limits Table Z-1-A Transitional Limits for Air Contaminants	isopropanol (Isopropyl alcohol)	400	980			
US - Vermont Permissible Exposure Limits Table Z-1-A Final Rule Limits for Air Contaminants	isopropanol (Isopropyl alcohol)	400	980	500	1225	
US - California Permissible Exposure Limits for Chemical Contaminants	isopropanol (Isopropyl alcohol)	400	980	500	1225	
US - Idaho - Limits for Air Contaminants	isopropanol (Isopropyl alcohol)	400	980			
US - Hawaii Air Contaminant Limits	isopropanol (Isopropyl alcohol)	400	980	500	1,225	
US - Alaska Limits for Air Contaminants	isopropanol (Isopropyl alcohol)	400	980	500	1225	
US - Michigan Exposure Limits for Air Contaminants	isopropanol (Isopropyl alcohol)	400	980	500	1225	

Canada - Yukon Permissible Concentrations for Airborne Contaminant Substances	isopropanol (Isopropyl alcohol - Skin)	400	980	500	1,225	
US - Washington Permissible exposure limits of air contaminants	isopropanol (Isopropyl alcohol)	400		500		
Canada - Saskatchewan Occupational Health and Safety Regulations - Contamination Limits	isopropanol (Isopropyl alcohol)	200		400		
US - Oregon Permissible Exposure Limits (Z-1)	isopropanol (Isopropyl alcohol)	400	980			
US - Wyoming Toxic and Hazardous Substances Table Z1 Limits for Air Contaminants	isopropanol (Isopropyl alcohol)	400	980			
Canada - Quebec Permissible Exposure Values for Airborne Contaminants (English)	isopropanol (Isopropyl alcohol)	400	985	500	1230	
US OSHA Permissible Exposure Levels (PELs) - Table Z1	isopropanol (Isopropyl alcohol)	400	980			
Canada - Northwest Territories Occupational Exposure Limits (English)	isopropanol (Isopropyl alcohol - Skin)	400	983	500	1228	
Canada - Nova Scotia Occupational Exposure Limits	isopropanol (2-Propanol)	200		400		TLV Basis eye & upper respiratory tract irritation; central nervous system impairment
Canada - Prince Edward Island Occupational Exposure Limits	isopropanol (2-Propanol)	200		400		TLV Basis eye & upper respiratory tract irritation; central nervous system impairment

US OSHA Permissible Exposure Levels (PELs) - Table Z3	titanic acid (Inert or Nuisance Dust (d) Respirable fraction)	5	
US OSHA Permissible Exposure Levels (PELs) - Table Z3	titanic acid (Inert or Nuisance Dust (d) Total dust)	15	
US - Oregon Permissible Exposure Limits (Z-3)	titanic acid (Inert or Nuisance Dust(d) Respirable fraction)	5	Oregon Permissible Exposure Limits (PELs) are different than the federal limits.
US - Oregon Permissible Exposure Limits (Z-3)	titanic acid (Inert or Nuisance Dust (d) Total dust)	10	Oregon Permissible Exposure Limits (PELs) are different than the federal limits.

PERSONAL PROTECTION



RESPIRATOR

•Type A Filter of sufficient capacity. (AS/NZS 1716 & 1715, EN 1432000 & 1492001, ANSI Z88 or national equivalent)

EYE

- Safety glasses with side shields.
- Chemical goggles.

HANDS/FEET

Wear chemical protective gloves, eg. PVC.

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

- 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, AS/NZS 2161.1 or national equivalent).

- 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, AS/NZS 2161.10.1 or national equivalent) 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, AS/NZS 2161.10.1 or national equivalent) 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.

- Neoprene gloves

OTHER

- Overalls.
- PVC Apron.
- Some plastic personal protective equipment (PPE) (e.g. gloves, aprons, overshoes) are not recommended as

they may produce static electricity.

- For large scale or continuous use wear tight-weave non-static clothing (no metallic fasteners, cuffs or pockets), non sparking safety footwear.

ENGINEERING CONTROLS

For flammable liquids and flammable gases, local exhaust ventilation or a process enclosure ventilation system may be required. Ventilation equipment should be explosion-resistant.

Section 9 - PHYSICAL AND CHEMICAL PROPERTIES

PHYSICAL PROPERTIES

Liquid.

State	Liquid	Molecular Weight	284.22
Melting Range (°F)	68	Viscosity	Not available
Boiling Range (°F)	428	Solubility in water (g/L)	Reacts
Flash Point (°F)	73	pH (1% solution)	Not applicable
Decomposition Temp (°F)	Not available	pH (as supplied)	Not applicable
Autoignition Temp (°F)	Not available	Vapour Pressure (mmHG)	Not available
Upper Explosive Limit (%)	Not available	Specific Gravity (water=1)	0.95 @ 25 C
Lower Explosive Limit (%)	Not available	Relative Vapor Density (air=1)	>1
Volatile Component (%vol)	< 1	Evaporation Rate	Not available

APPEARANCE

■ Material is hygroscopic, absorbs moisture from surrounding air. Liquid, fumes in air; decomposes rapidly by water/ moist air, forming isopropanol, with possible decrease in flash point, increase in hazard. Soluble in anhydrous ethanol, ether, benzene, chloroform.

log Kow -0.16- 0.28 Chronic aquatic toxicity has also been shown to be of low concern, based on 16- to 21-day NOEC values of 141 to 30 mg/L, respectively, for a freshwater invertebrate. Bioconcentration of IPA in aquatic organisms is not expected to occur based on a measured log octanol/water partition coefficient (log Kow) of 0.05, a calculated bioconcentration factor of 1 for a freshwater fish, and the unlikelihood of constant, long-term exposures.

Material	Value
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Section 10 - CHEMICAL STABILITY

CONDITIONS CONTRIBUTING TO INSTABILITY

- Presence of incompatible materials.
- Product is considered stable.

STORAGE INCOMPATIBILITY

‡ Avoid storage with strong acids, acid chlorides, acid anhydrides, oxidizing agents.

- NOTE May develop pressure in containers; open carefully. Vent periodically.

Segregate from alcohol, water.

Titanium propoxide/ titanium isopropoxide

- reacts with water / steam to produce flammable vapours
- reacts violently with strong oxidisers
- is incompatible with sulfuric acid, nitric acid, caustics, aliphatic amines, isocyanates, boranes

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

Section 11 - TOXICOLOGICAL INFORMATION

titanium(IV) isopropoxide

TOXICITY AND IRRITATION

unless otherwise specified data extracted from RTECS - Register of Toxic Effects of Chemical Substances.

The material may cause skin irritation after prolonged or repeated exposure and may produce on contact skin redness, swelling, the production of vesicles, scaling and thickening of the skin.

TITANIUM(IV) ISOPROPOXIDE

TOXICITY	IRRITATION
Oral (rat) LD50 7460 mg/kg	Skin (rabbit) 500 mg/24h - Mild
Dermal (rabbit) LD50 >16000 mg/kg	Eye (rabbit) 20 mg/24h - Moderate
Inhalation (rat) LC50 7.78 mg/L./4h *	Eye human SEVERE ** = DUPONT

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 produce moderate eye irritation leading to inflammation. Repeated or prolonged exposure to irritants may produce conjunctivitis.

TOXICITY	IRRITATION
ISOPROPANOL	
Oral (human) LDLo 3570 mg/kg	Skin (rabbit) 500 mg - Mild
Oral (human) TDLo 223 mg/kg	Eye (rabbit) 10 mg - Moderate
Oral (man) TDLo 14432 mg/kg	Eye (rabbit) 100mg/24hr-Moderate
Oral (rat) LD50 5045 mg/kg	Eye (rabbit) 100 mg - SEVERE
Dermal (rabbit) LD50 12800 mg/kg	
Oral (Human) TDLo 14432 mg/kg	
Oral (Human) LD 5272 mg/kg	
Oral (Human) LD 3570 mg/kg	
Intraperitoneal (Rat) LD50 2735 mg/kg	
Intravenous (Rat) LD50 1088 mg/kg	
Oral (Mouse) LD50 3600 mg/kg	
Intraperitoneal (Mouse) LD50 4477 mg/kg	
Intravenous (Mouse) LD50 1509 mg/kg	
Oral (Dog) LD 1537 mg/kg	
Intravenous (Dog) LD 1024 mg/kg	
Intravenous (Cat) LD 1963 mg/kg	
Oral (Rabbit) LD50 6410 mg/kg	
Intraperitoneal (Rabbit) LD50 667 mg/kg	
Intravenous (Rabbit) LD50 1184 mg/kg	

Intraperitoneal (Guinea pig) LD50 2560 mg/kg

Inhalation (Mouse) LC50 53000 mg/m³/4h

Oral (Rat) LD50 5000 mg/kg

Intraperitoneal (Rat) TDLo 800 mg/kg

Inhalation (Rat) LC50 72600 mg/m³/4h

Oral (Human) TDLo 286 mg/kg

Inhalation (Human) TCLo 35 ppm/4h

Inhalation (Human) TCLo 150 ppm/2h

For isopropanol (IPA)

Acute toxicity Isopropanol has a low order of acute toxicity. It is irritating to the eyes, but not to the skin. Very high vapor concentrations are irritating to the eyes, nose, and throat, and prolonged exposure may produce central nervous system depression and narcosis. Human volunteers reported that exposure to 400 ppm isopropanol vapors for 3 to 5 min. caused mild irritation of the eyes, nose and throat.

Although isopropanol produced little irritation when tested on the skin of human volunteers, there have been reports of isolated cases of dermal irritation and/or sensitization. The use of isopropanol as a sponge treatment for the control of fever has resulted in cases of intoxication, probably the result of both dermal absorption and inhalation. There have been a number of cases of poisoning reported due to the intentional ingestion of isopropanol, particularly among alcoholics or suicide victims. These ingestions typically result in a comatose condition. Pulmonary difficulty, nausea, vomiting, and headache accompanied by various degrees of central nervous system depression are typical. In the absence of shock, recovery usually occurred.

Repeat dose studies The systemic (non-cancer) toxicity of repeated exposure to isopropanol has been evaluated in rats and mice by the inhalation and oral routes. The only adverse effects-in addition to clinical signs identified from these studies were to the kidney.

Reproductive toxicity A recent two-generation reproductive study characterised the reproductive hazard for isopropanol associated with oral gavage exposure. This study found that the only reproductive parameter apparently affected by isopropanol exposure was a statistically significant decrease in male mating index of the F1 males. It is possible that the change in this reproductive parameter was treatment related and significant, although the mechanism of this effect could not be discerned from the results of the study. However, the lack of a significant effect of the female mating index in either generation, the absence of any adverse effect on litter size, and the lack of histopathological findings of the testes of the high-dose males suggest that the observed reduction in male mating index may not be biologically meaningful.

Developmental toxicity The developmental toxicity of isopropanol has been characterized in rat and rabbit developmental toxicity studies. These studies indicate that isopropanol is not a selective developmental hazard. Isopropanol produced developmental toxicity in rats, but not in rabbits. In the rat, the developmental toxicity occurred only at maternally toxic doses and consisted of decreased foetal body weights, but no teratogenicity

Genotoxicity All genotoxicity assays reported for isopropanol have been negative

Carcinogenicity rodent inhalation studies were conducted to evaluate isopropanol for cancer potential. The only tumor rate increase seen was for interstitial (Leydig) cell tumors in the male rats. Interstitial cell tumors of the testis is typically the most frequently observed spontaneous tumor in aged male Fischer 344 rats. These studies demonstrate that isopropanol does not exhibit carcinogenic potential relevant to humans. Furthermore, there was no evidence from this study to indicate the development of carcinomas of the testes in the male rat, nor has isopropanol been found to be genotoxic. Thus, the testicular tumors seen in the isopropanol exposed male rats are considered of no significance in terms of human cancer risk assessment.

The substance is classified by IARC as Group 3

NOT classifiable as to its carcinogenicity to humans.

Evidence of carcinogenicity may be inadequate or limited in animal testing.

TITANIC ACID

No significant acute toxicological data identified in literature search.

CARCINOGEN

Isopropyl alcohol	International Agency for Research on Cancer (IARC) - Agents Reviewed by the IARC Monographs	Group	3
2-Propanol	US ACGIH Threshold Limit Values (TLV) - Carcinogens	Carcinogen Category	A4
isopropanol	US - Rhode Island Hazardous Substance List	IARC	
ISOPROPYL ALCOHOL (STRONG-ACID PROCESS)	US Environmental Defense Scorecard Suspected Carcinogens	Reference(s)	IARC
TWAPPM~	US - Maine Chemicals of High Concern List	Carcinogen	A4
VPVB_(VERY~	US - Maine Chemicals of High Concern List	Carcinogen	CA Prop 65; IARC; NTP 11th ROC

Section 12 - ECOLOGICAL INFORMATION

This material and its container must be disposed of as hazardous waste.

Section 13 - DISPOSAL CONSIDERATIONS

US EPA Waste Number & Descriptions

A. General Product Information

Ignitability characteristic: use EPA hazardous waste number D001 (waste code I)

Disposal Instructions

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

‡ 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. If it has been contaminated, it may be possible to reclaim the product by filtration, distillation or some other means. 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.

Section 14 - TRANSPORTATION INFORMATION

DOT:

Symbols:	None	Hazard class or Division:	3
Identification Numbers:	UN2413	PG:	III
Label Codes:	3	Special provisions:	B1, IB3, T4, TP1
Packaging: Exceptions:	150	Packaging: Non-bulk:	203

Packaging: Exceptions:	150	Quantity limitations: Passenger aircraft/rail:	60 L
Quantity Limitations: Cargo aircraft only:	220 L	Vessel stowage: Location:	A
Vessel stowage: Other:	None		
Hazardous materials descriptions and proper shipping names: Tetrapropylorthotitanate			
Air Transport IATA:			
ICAO/IATA Class:	3	UN/ID Number:	2413
Packing Group:	III	Special provisions:	None
		Cargo Only	
		Packing Instructions:	366
Maximum Qty/Pack:	220 L	Passenger and Cargo	
Passenger and Cargo		Packing Instructions:	Y344
Maximum Qty/Pack:	60 L	Passenger and Cargo Limited Quantity	
Passenger and Cargo Limited Quantity		Packing Instructions:	355
Maximum Qty/Pack:	10 L		
Shipping Name: TETRAPROPYL ORTHOTITANATE			
Maritime Transport IMDG:			
IMDG Class:	3	IMDG Subrisk:	None
UN Number:	2413	Packing Group:	III
EMS Number:	F-E,S-D	Special provisions:	None
Limited Quantities:	5 L		
Shipping Name: TETRAPROPYL ORTHOTITANATE			

Section 15 - REGULATORY INFORMATION

titanium(IV) isopropoxide (CAS: 546-68-9) is found on the following regulatory lists;

"International Council of Chemical Associations (ICCA) - High Production Volume List", "US DOE Temporary Emergency Exposure Limits (TEELs)", "US EPA High Production Volume Chemical List", "US FDA Indirect Food Additives: Adhesives and Components of Coatings - Substances for Use Only as Components of Adhesives - Adhesives", "US Toxic Substances Control Act (TSCA) - Chemical Substance Inventory"

Regulations for ingredients

isopropanol (CAS: 67-63-0) is found on the following regulatory lists;

"Canada - Alberta Ambient Air Quality Objectives", "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 - Prince Edward Island Occupational Exposure Limits", "Canada - Prince Edward Island Occupational Exposure Limits - Carcinogens", "Canada - Quebec Permissible Exposure Values for Airborne Contaminants (English)", "Canada - Saskatchewan Industrial Hazardous Substances", "Canada - Saskatchewan Occupational Health and Safety Regulations - Contamination Limits", "Canada - Yukon Permissible Concentrations for Airborne Contaminant Substances", "Canada Ingredient Disclosure List (SOR/88-64)", "Canada National Pollutant Release Inventory (NPRI)", "Canada Toxicological Index Service - Workplace Hazardous Materials Information System - WHMIS (English)", "GESAMP/EHS Composite List - GESAMP Hazard Profiles", "IMO IBC Code Chapter 18: List of products to which the Code does not apply", "IMO MARPOL 73/78 (Annex II) - List of Other Liquid Substances", "IMO Provisional Categorization of Liquid Substances - List 2: Pollutant only mixtures containing at least 99% by weight of components already assessed by IMO", "International Agency for Research on Cancer (IARC) - Agents Reviewed by the IARC Monographs", "International Fragrance Association (IFRA) Survey: Transparency List", "US - Alaska Limits for Air Contaminants", "US - California Air Toxics ""Hot Spots"" List (Assembly Bill 2588) Substances for which emissions

must be quantified","US - California Occupational Safety and Health Regulations (CAL/OSHA) - Hazardous Substances List","US - California OEHHA/ARB - Acute Reference Exposure Levels and Target Organs (RELS)","US - California OEHHA/ARB - Chronic Reference Exposure Levels and Target Organs (CRELS)","US - California Permissible Exposure Limits for Chemical Contaminants","US - California Toxic Air Contaminant List Category II","US - Connecticut - Regulations Concerning the Designation of Controlled Drugs - Volatile substances","US - Connecticut Hazardous Air Pollutants","US - Hawaii Air Contaminant Limits","US - Idaho - Limits for Air Contaminants","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 (Z-1)","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 DOT Coast Guard Bulk Hazardous Materials - List of Flammable and Combustible Bulk Liquid Cargoes","US EPA High Production Volume Program Chemical List","US EPA Master Testing List - Index I Chemicals Listed","US EPA Master Testing List - Index II Chemicals Removed","US EPCRA Section 313 Chemical List","US FDA Indirect Food Additives: Adhesives and Components of Coatings - Substances for Use Only as Components of Adhesives - Adhesives","US Food Additive Database","US List of Lists - Consolidated List of Chemicals Subject to EPCRA, CERCLA and Section 112(r) of the Clean Air Act","US NFPA 30B Manufacture and Storage of Aerosol Products - Chemical Heat of Combustion","US NIOSH Recommended Exposure Limits (RELS)","US OSHA Permissible Exposure Levels (PELs) - Table Z1","US Postal Service (USPS) Hazardous Materials Table: Postal Service Mailability Guide","US Spacecraft Maximum Allowable Concentrations (SMACs) for Airborne Contaminants","US Toxic Substances Control Act (TSCA) - Chemical Substance Inventory","US TSCA Section 4/12 (b) - Sunset Date/Status","US TSCA Section 8 (d) - Health and Safety Data Reporting"

titanic acid (CAS: 20338-08-3) is found on the following regulatory lists;

"Canada Domestic Substances List (DSL)","US Toxic Substances Control Act (TSCA) - Chemical Substance Inventory"

Section 16 - OTHER INFORMATION

LIMITED EVIDENCE

- Ingestion may produce health damage*.
- Cumulative effects may result following exposure*.
- Vapours potentially cause drowsiness and dizziness*.

* (limited evidence).

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- Classification of the preparation 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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