

# [1,1'- Bis(diphenylphosphino)ferrocene]dichloropalladium(II)

sc-224880



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

[1,1'-Bis(diphenylphosphino)ferrocene]dichloropalladium(II)

### STATEMENT OF HAZARDOUS NATURE

CONSIDERED A HAZARDOUS SUBSTANCE ACCORDING TO OSHA 29 CFR 1910.1200.

### NFPA



### SUPPLIER

Santa Cruz Biotechnology, Inc.  
2145 Delaware Avenue  
Santa Cruz, California 95060  
800.457.3801 or 831.457.3800

### EMERGENCY:

ChemWatch

Within the US & Canada: 877-715-9305

Outside the US & Canada: +800 2436 2255

(1-800-CHEMCALL) or call +613 9573 3112

### SYNONYMS

C34-H28-Cl2-Fe-P2-Pd, "[1, 1' -bis(diphenylphosphino)ferrocene]palladium (II) chloride complex with", "dichloromethane (1:1)", "1, 1' -ferrocenebis(diphenylphosphine)palladium (II) chloride", "methylene chloride complex (1:1)", "1, 1' -ferrocenediyl-bis(diphenylphosphine)palladium chloride complex (1:1)"

## Section 2 - HAZARDS IDENTIFICATION

### CHEMWATCH HAZARD RATINGS

	Min	Max
Flammability:	1	
Toxicity:	2	
Body Contact:	2	
Reactivity:	1	
Chronic:	2	

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



### CANADIAN WHMIS SYMBOLS



## EMERGENCY OVERVIEW

### RISK

Limited evidence of a carcinogenic effect.  
Harmful by inhalation, in contact with skin and if swallowed.  
Irritating to eyes, respiratory system and skin.

### POTENTIAL HEALTH EFFECTS

#### ACUTE HEALTH EFFECTS

#### SWALLOWED

- Accidental ingestion of the material may be harmful; animal experiments indicate that ingestion of less than 150 gram may be fatal or may produce serious damage to the health of the individual.
- Colloidal palladium is reported to increase body temperature, producediscoloration and tissue death at the site of injection, decreasebody-weight and cause some destruction of blood cells.
- The platinoids and their compounds as a group are generally poorly absorbed from the gastrointestinal tract and absorption by other parenteral routes, excluding the intravenous (i.v.).

#### EYE

- This material can cause eye irritation and damage in some persons.

#### SKIN

- Skin contact with the material may be harmful; systemic effects may resultfollowing absorption.
- This material can cause inflammation of the skin oncontact in some persons.
- The material may accentuate any pre-existing dermatitis condition.
- 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.

#### INHALED

- Inhalation of dusts, generated by the material, during the course of normalhandling, may be harmful.
- 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

- Long-term exposure to respiratory irritants may result in disease of the airways involving difficult breathing and related systemic problems. There has been concern that this material can cause cancer or mutations, but there is not enough data to make an assessment. Limited evidence suggests that repeated or long-term occupational exposure may produce cumulative health effects involving organs or biochemical systems. There is limited evidence that, skin contact with this product is more likely to cause a sensitization reaction in some persons compared to the general population. 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. Subcutaneous injection of 3 ml of cyclopentadiene into rabbits was a narcotising dose producing fatal convulsions. Signs and symptoms during narcosis included primary motor unrest and a decreased intermittent respiration rate prior to death. The liquid produced marked local irritation, exudates in the pleural and peritoneal cavities and hyperaemia of the kidneys. Lethal subchronic doses (332 ppm dicyclopentadiene for 10 days) produced convulsions, haemorrhage of the lungs and intestines of rats and haemorrhage of the thymus of female rats. Kidney damage was seen in rats exposed at 35 ppm for 7 hrs/day for 85 days. Some lung involvement was seen as chronic pneumonia and bronchiectasis. The no-ill effect was determined to be below 19.7 ppm. Effects of chronic exposure to dicyclopentadiene may include damage to liver, kidneys and lungs. Repeated inhalation exposures by rats produced mild injury to both liver and kidney (centrilobular, cloudy swelling of liver cells and cloudy vacuolisation of renal tubular epithelium) at 500 ppm 7 hours/day, 53 days. There is a weak association between palladium chloride and tumor productionon the basis of a single study. Chronic excessive intake of iron have been associated with damage to the liver and pancreas. People with a genetic disposition to poor control over iron are at an increased risk.

## Section 3 - COMPOSITION / INFORMATION ON INGREDIENTS

NAME	CAS RN	%
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## Section 4 - FIRST AID MEASURES

### SWALLOWED

· IF SWALLOWED, REFER FOR MEDICAL ATTENTION, WHERE POSSIBLE, WITHOUT DELAY. · Where Medical attention is not immediately available or where the patient is more than 15 minutes from a hospital or unless instructed otherwise:

### 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

■ Treat symptomatically.

For acute or short term repeated exposures to iron and its derivatives:

· Always treat symptoms rather than history.

· In general, however, toxic doses exceed 20mg/kg of ingested material (as elemental iron) with lethal doses exceeding 180 mg/kg.

## 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.

### FIRE FIGHTING

· Alert Emergency Responders and tell them location and nature of hazard.

· Wear breathing apparatus plus protective gloves.

### 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.

Combustion products include: carbon monoxide (CO), carbon dioxide (CO<sub>2</sub>), hydrogen chloride, phosgene, phosphorus oxides (PO<sub>x</sub>), other pyrolysis products typical of burning organic material.

May emit poisonous fumes.

May emit corrosive 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:

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**

- Moderate hazard.
- CAUTION: Advise personnel in area.
- Alert Emergency Responders and tell them location and nature of hazard.

**Section 7 - HANDLING AND STORAGE**

**PROCEDURE FOR HANDLING**

- Avoid all personal contact, including inhalation.
  - Wear protective clothing when risk of exposure occurs.
- 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**

- Polyethylene or polypropylene container.
- Check all containers are clearly labelled and free from leaks.

**STORAGE REQUIREMENTS**

- Store in original containers.
- Keep containers securely sealed.

**Section 8 - EXPOSURE CONTROLS / PERSONAL PROTECTION**

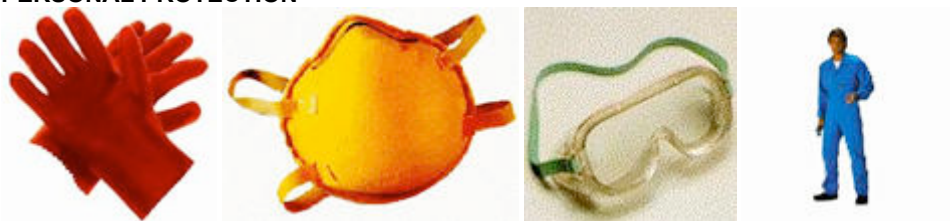
**EXPOSURE CONTROLS**

Source	Material	TWA ppm	TWA mg/m <sup>3</sup>	STEL ppm	STEL mg/m <sup>3</sup>	Peak ppm	Peak mg/m <sup>3</sup>	TWA F/CC	Notes
US - California Permissible Exposure Limits for Chemical Contaminants	[bis(diphenylphosphino)ferrocene]PdCl <sub>2</sub> / dichloromethane (Particulates not otherwise regulated Respirable fraction)		5						(n)
US - Tennessee Occupational Limits For Air Contaminants	[bis(diphenylphosphino)ferrocene]PdCl <sub>2</sub> / dichloromethane (Particulates not otherwise regulated Respirable fraction)		5						
US - Wyoming Toxic and Hazardous Substances Table Z1 Limits for Air Contaminants	[bis(diphenylphosphino)ferrocene]PdCl <sub>2</sub> / dichloromethane (Particulates not otherwise regulated (PNOR)(f)-Respirable fraction)		5						
US - Michigan Exposure Limits for Air Contaminants	[bis(diphenylphosphino)ferrocene]PdCl <sub>2</sub> / dichloromethane (Particulates not otherwise regulated, Respirable dust)		5						
Canada - Prince Edward Island Occupational Exposure	[bis(diphenylphosphino)ferrocene]PdCl <sub>2</sub> / dichloromethane (Particles (Insoluble or Poorly Soluble) [NOS] Inhalable particles)		10						See Appendix B current TLV/BEI Book

## Limits

### ENDOELTABLE

#### PERSONAL PROTECTION



#### RESPIRATOR

Particulate

Consult your EHS staff for recommendations

#### EYE

- Safety glasses with side shields.
- Chemical goggles.

#### HANDS/FEET

■ NOTE: The material may produce skin sensitization in predisposed individuals. Care must be taken, when removing gloves and other protective equipment, to avoid all possible skin contact.

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.

Experience indicates that the following polymers are suitable as glove materials for protection against undissolved, dry solids, where abrasive particles are not present.

- polychloroprene
- nitrile rubber
- butyl rubber
- fluorocautchouc
- polyvinyl chloride

Gloves should be examined for wear and/ or degradation constantly.

#### OTHER

- Overalls.
- P.V.C. apron.
- Barrier cream.
- Skin cleansing cream.
- Eye wash unit.

#### 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.

## Section 9 - PHYSICAL AND CHEMICAL PROPERTIES

#### PHYSICAL PROPERTIES

Solid.

Does not mix with water.

State	Divided solid	Molecular Weight	731.70
Melting Range (°F)	527- 536	Viscosity	Not available
Boiling Range (°F)	Not available	Solubility in water (g/L)	Partly miscible
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)	>1
Volatile Component (%vol)	Negligible	Evaporation Rate	Not applicable

## APPEARANCE

Red powder; does not mix well water.

## Section 10 - CHEMICAL STABILITY

### CONDITIONS CONTRIBUTING TO INSTABILITY

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

### STORAGE INCOMPATIBILITY

#### ■ The 18-Electron rule:

Organometallic complexes exhibit a wide range of stabilities and reactivities; some reaction may produce unstable compounds.

The 18-electron rule is a rule of thumb used primarily in transition metal chemistry for characterising and predicting the stability of metal complexes. Valence shells of a transition metal can accommodate 18 electrons: 2 in each of the five d orbitals (10 in total); 2 in each of the three p orbitals (6 in total); and 2 in the s orbital. In practice, of course, these orbitals cannot directly accept electrons, otherwise one would encounter ions such as Fe<sup>10-</sup> and Pt<sup>8-</sup>. However, combination of these atomic orbitals with ligand orbitals gives rise to nine molecular orbitals which are either metal-ligand bonding or non-bonding. (There are also some higher energy anti-bonding orbitals). The complete filling of these nine lowest energy orbitals with electrons, whether those electrons originate from the metal or from any ligands, is the basis of the 18-electron rule. When the metal has 18 electrons, it has then achieved the same electron configuration as the noble gas at the end of the period.

Many metal complexes do not satisfy the 18-electron rule. It is, however, especially useful for organometallic complexes of the Cr, Mn, Fe, and Co triads. The ligands in a complex play an important role in determining whether or not it obeys the 18-electron rule.

- Metallocenes (metal alkyls) are compounds consisting of two cyclopentadienyl anions (Cp) bound to a metal center in the oxidation state II. These species are also called bis(cyclopentadienyl)metal complexes. According to the IUPAC definition, a metallocene contains a transition metal and two cyclopentadienyl ligands coordinated in a sandwich structure, i. e., the two cyclopentadienyl anions are co-planar with equal bond lengths and strengths. In contrast to the more strict definition proposed by IUPAC, which requires a d-block metal and a sandwich structure, the term metallocene and thus the denotation -ocene, is applied in the chemical literature also to non-transition metal compounds, such as Cp<sub>2</sub>Ba, or structures where the aromatic rings are not co-planar, such as found in manganocene or titanocene dichloride

- A notable feature of some metallocenes is their high thermal stability. Charge-neutral metallocenes are soluble in common organic solvents and can generally be purified by vacuum sublimation.

- The chemical reactivity of the metallocenes varies widely with the metal and the substituents on the rings. Except for 18-electron metallocenes (metal= Fe, Ru, Os, Co, Rh, Ir) all transition metal and main-group metallocenes display some sensitivity to oxygen. Air stability varies from several minutes (Mg) to seconds (Ba). Such reactivity can be moderated, sometimes dramatically, by blocking physical access to the metal centre with sterically bulky groups.

- Many metal alkyl compounds are highly reactive with catalytic properties. Most non-18 electron metallocenes are pyrophoric (will ignite spontaneously upon contact with oxygen in air). Many are also water reactive and may ignite spontaneously on contact with water.

- Due to their catalytic nature many metal alkyls must be stored or transported in specially designed containers to prevent hazardous decomposition. Under most circumstances, metal alkyl solutions with a metal alkyl concentration below the so-called non-pyrophoric limit (NPL) will not ignite immediately when exposed to air.

- Several platinum compounds, including trimethylplatinum derivatives are explosively unstable.

- Some compounds of the other platinum group metals are also of limited stability.

Avoid reaction with oxidizing agents.

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

## Section 11 - TOXICOLOGICAL INFORMATION

[bis(diphenylphosphino)ferrocene]PdCl<sub>2</sub>/ dichloromethane

### TOXICITY AND IRRITATION

#### [BIS(DIPHENYLPHOSPHINO)FERROCENE]PDCL<sub>2</sub>/ DICHLOROMETHANE:

■ 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.  
No significant acute toxicological data identified in literature search.

## Section 12 - ECOLOGICAL INFORMATION

No data

## 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.

## Section 14 - TRANSPORTATION INFORMATION

NOT REGULATED FOR TRANSPORT OF DANGEROUS GOODS: DOT, IATA, IMDG

## Section 15 - REGULATORY INFORMATION

**[bis(diphenylphosphino)ferrocene]PdCl<sub>2</sub>/ dichloromethane (CAS: 72287-26-4) is found on the following regulatory lists;**

"US - California Air Toxics ""Hot Spots"" List (Assembly Bill 2588) Substances for which emissions must be quantified"

## Section 16 - OTHER INFORMATION

*Reasonable care has been taken in the preparation of this information, but the author makes no warranty of merchantability or any other warranty, expressed or implied, with respect to this information. The author makes no representations and assumes no liability for any direct, incidental or consequential damages resulting from its use. For additional technical information please call our toxicology department on +800 CHEMCALL.*

■ 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](http://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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