

## Safety Data Sheet

## Tetraammine Palladium (II) Hydroxide Solution

1st Version : Jul. 01. 2017

Revised : Feb. 28. 2024

## 1. Product and company information

Product name :	Tetraammine Palladium(II) Hydroxide Solution
Company name :	Toyo Chemical Industrial Co., Ltd.
Address :	2-26-13, Naka-Izumi, Komae-City, Tokyo
Tel :	+81-3-3489-5152
Fax :	+81-3-3488-1706
Emergency contact :	As above
Recommended use of the product and restrictions on use :	Palladium plating

## 2. Hazard identification

## GHS classification of the substance

All items are "Outside scope of classification" or "Cannot classify". The classification of "ammonia aqueous" was used as a quasi-use.

Physicochemical hazards :	Corrosive to metals	Category 1
Health hazards :	Acute toxicity (Oral)	Category 4
	Skin corrosion/irritation	Category 1
	Serious eye damage/eye irritation	Category 1
	Specific target organ toxicity - Single exposure	Category 1 (central nervous system, respiratory organs)
Environmental hazards :	Hazardous to the aquatic environment (Acute)	Category 2

## GHS Label elements

## Pictograms :



## Signal word :

Danger

## Hazard statements :

H290 : May be corrosive to metals  
 H302 : Harmful if swallowed  
 H314 : Causes severe skin burns and eye damage  
 H318 : Causes serious eye damage  
 H370 : Causes damage to organs  
 H401 : Toxic to aquatic life

## Precautionary statement

## Safety measures :

P234 : Keep only in original container.  
 P390 : Absorb spillage to prevent material damage.  
 P260 : Do not breathe dust/fume/gas/mist/vapors/spray.  
 P264 : Wash ... thoroughly after handling.  
 P270 : Do not eat, drink or smoke when using this product.  
 P273 : Avoid release to the environment.

## Emergency measures :

P280 : Wear protective gloves/protective clothing/eye protection/face protection.  
 P301 + P312 : If swallowed : Call a Poison Center / doctor / If you feel unwell.  
 P301 + P330 + P331 : If swallowed : Rinse mouth. Do not induce vomiting.  
 P303 + P361 + P353 : If on skin (or hair) : Take off immediately all contaminated clothing. Rinse skin with water or shower.  
 P302 + P352 : If on skin : wash with plenty of water.  
 P304 + P340 : If inhaled : Remove person to fresh air and keep comfortable for breathing.

P305 + P351 + P338 : If in eyes : Rinse cautiously with water for several minutes.

Remove contact lenses if present and easy to do. Continue rinsing.

P308 + P311 : IF exposed or concerned: Call a Poison Center / doctor /...

P337 + P313 : IF eye irritation persists: Get medical advice/attention.

P310 : Immediately call a Poison Center or doctor / physician.

P363 : Wash contaminated clothing before reuse.

P362 + P364 : Take off contaminated clothing and wash it before reuse.

Storage: P405 : Store locked up.

P406 : Store in corrosive resistant or container with a resistant inner liner.

Disposal: P501 : Dispose of contents/container entrust to a specialized waste disposal company.

Other hazards : No information

### 3. Composition/information on ingredients

Substance or Mixture :		Mixture			
Chemical name	Molecular formula (molecular weight)	CAS No.	Reference numbers in gazetted list in Japan (CSCL)	Reference numbers in gazetted list in Japan (ISHL)	Concentration or concentration range
Tetraammine Palladium (II) Hydroxide	[Pd(NH <sub>3</sub> ) <sub>4</sub> ](OH) <sub>2</sub> (208.56)	68413-68-3	—	—	11 %
Ammonia	NH <sub>3</sub> (17.03)	7664-41-7	1-391	1-391	2 %
Water	H <sub>2</sub> O (18.02)	7732-18-5	—	—	87 %

### 4. First-aid measures

Inhalation :	Remove person to fresh air and keep comfortable for breathing.
Skin contact :	Take off or remove immediately all contaminated clothing. Rinse skin with water or shower. Immediately call a doctor.
Eye contact :	Wash contaminated clothing before reuse. Rinse cautiously with water for several minutes. Remove contact lenses if present and easy to do. Continue rinsing. IF eye irritation persists: Get medical advice/attention.
Ingestion :	Rinse mouth. Do not induce vomiting. Immediately call a doctor.
Protection of people implementing emergency measures :	Wear protective equipment. (See section 8. Exposure controls / personal protection)

### 5. Fire-fighting measures

Suitable extinguishing media :	Foam, Powder, Carbon dioxide gas, Water spray, dry sand
Do not use extinguishing media :	Rod-shaped water discharge
Specific hazards :	This substance is nonflammable and does not burn itself, but can decompose when heated to outbreak harmful gas, so wear protective equipment when firefighting.
Characteristic extinguishing methods:	In case of fire in the surroundings, immediately move the container to a safe place. If it cannot be moved, cool it by sprinkling water around the container and its surroundings. In case of ignition, extinguish with plenty of water. At this time, care should be taken so that the concentrated waste liquid is not discharged into rivers.
Protection of firefighters:	Wear appropriate air-breathing apparatus and chemical protective clothing when extinguishing fires. (See section 8. Exposure controls / personal protection)

**6. Accidental release measures**

Personal precautions, protective equipment and emergency procedures :	Workers must wear appropriate protective equipment (see section 8. Exposure controls / personal protection) and avoid contact with eyes and skin and inhalation. Firefighting should be done upwind and avoid inhalation of harmful gases. Prohibit the entrance except the person concerned.
Environmental precautions :	Avoid discharging into the environment.
Methods and materials for containment and cleaning up :	No information
Preventing secondary accidents :	Prevent inflow to drainage ditches, sewers, cellars, or sealed locations.

**7. Handling and storage**

Handling	
Technical measures :	Take the equipment measures described in "8. Exposure controls/personal protection" and wear protective equipment. Described in "8. Exposure controls/personal protection" perform local exhaust and general ventilation.
Precautions for safe handling :	Obtain instructions for use before use. Do not handle until all safety precautions have been read and understood. Do not eat, drink or smoke when using this product. Wash hands thoroughly after handling. Avoid swallowing. Do not put it in eyes. Avoid discharging into the environment.
Contact evasion :	See "10. Stability and reactivity" section.
Storage	
Safe storage conditions :	Store locked up. Store in a closed container, dry and dark place.
Container and packing materials :	Airtight containers (Polyethylene, Polypropylene, etc.)

**8. Exposure controls/personal protection**

Control concentration :	No information
Tolerable concentration :	25ppm (17mg/m <sup>3</sup> ) as NH <sub>3</sub>
Japan Society for Occupational Health (2021)	
ACGIH (2017)	TLV-TWA 25ppm TLV-STEL 35ppm (as NH <sub>3</sub> )
Equipment measures :	Workplaces storing or handling this material should be equipped with an eyewash facilities and safety shower.
Protective Equipment	
Respiratory protection :	Wear suitable respiratory protection (gas mask (in case of fire: air respirator), dust mask). (Refer to JIS T8151 Particulate respirators, JIS T8152 Gas respirators, JIS T8155 Compressed air open-circuit self-contained breathing apparatus)
Hand protection :	Wear suitable protective gloves. (neoprene gloves, etc.) (Refer to JIS T8116 Chemical protective gloves)
Eye protection :	Wear suitable eye protection (regular glasses, plain glasses with side plates, goggles). (Refer to JIS T8147 Protective Glasses)
Skin and body protection :	Wear suitable protective clothing, and protective boots, etc. (Refer to JIS T8115 Chemical Protective Clothing, JIS T8117 Chemical Protective Boots)

**9. Physical and chemical properties**

Physical state :	Liquid
Color :	Light yellow
Odor :	Weak ammonia odor
Melting point/freezing point :	No information

Boiling point, initial boiling point, and boiling range :	No information
Flammability :	No information
Lower and upper explosion limit / flammability limit :	No information
Flash point :	No information
Auto-ignition temperature :	No information
Decomposition temperature :	No information
pH :	10 ~ 11
Kinematic viscosity :	No information
Solubility :	Mix arbitrarily in water
Partition coefficient: n-octanol / water (log value) :	No information
Vapor pressure :	No information
Density and/or relative density	About 1.06
Relative vapour density :	No information
Particle characteristics	No information

## 10. Stability and reactivity

Reactivity :	No information
Chemical stability :	Stable substance under normal conditions.
Possibility of hazardous reactions :	Reduced to metallic palladium by a strong reducing agent. Harmful gases is released by contact with strong acids and exposure to high temperatures. Contact or mixture with flammable substances may cause heating and ignition due to the catalytic reaction of palladium.
Conditions to avoided :	Heat
Incompatible materials :	Reducing agents, metals, strong acid, and organic substances
Hazardous decomposition products :	Nitrogen oxide

## 11. Toxicological information

Acute toxicity	
Oral :	Based on an LD50 value of 350 mg/kg for rats (SIDS, 2008), this substance was classified in Category 4. (As Ammonium hydroxide)
Dermal :	It has been reported that subcutaneous injection of a water-soluble Pd salt into rats causes necrosis at the administration site when the amount is large, but classification is not possible due to lack of data.
Inhalation : Gases	Classification is not possible due to lack of data.
Inhalation : Vapours	Classification is not possible due to lack of data.
Inhalation : Dusts and mists	Classification is not possible due to lack of data.
Skin corrosios/irritation :	There is a report that in a skin irritation test with rabbits, after application of a 20% aqueous solution of this substance, it was corrosive (SIDS, 2008) and there is a description that it was corrosive to the eyes and skin because of strong alkaline properties (SIDS, 2008). This substance was classified in Category 1 because no data to classify for the sub-category were available. Besides this substance was classified in "C; R34" in EU DSD classification and in "H314 Skin Corr. 1B" in EU CLP classification, respectively. (As Ammonium hydroxi
Serious eye damage/irritation :	There are reports that irritation was observed in a test in which 1 mg of this substance was applied to rabbit eyes (SIDS, 2008), and that in a test in which a 28.5% aqueous solution was applied to rabbit eyes, irreversible corneal injuries such as corneal nebula and opacification and vascularization were observed (HSDB (Access on June 2014)). There are also descriptions that this substance was corrosive to the skin and eyes due to it being a strong alkali (SIDS, 2008) and caused severe irritation of the mucosa (HSDB (Access on June 2014)). Based on the above, this substance was classified in Category 1. (As Ammonium hydroxide)
Respiratory sensitization :	Classification is not possible due to lack of data.

Skin sensitization :	May cause skin allergy, but classification is not possible due to lack of data. Besides, it is reported that in an open epicutaneous test with guinea pigs, after application of a 20% ammonia aqueous solution, it was negative (IUCALID, 2000), but the test method was not the one recommended in the classification guidance, therefore, it was judged that the data were not sufficient to use for classification. (As Ammonium hydroxide)
Germ-cell mutagenicity :	Classification is not possible due to lack of data. No in vivo data were available and available in vitro data were bacterial reverse mutation tests only with negative results (SIDS, 2008). Besides, as for in vivo, a positive result in a micronucleus test by intraperitoneal administration with mice was reported (ATSDR, 2004). However, details were unknown and not adopted for classification. (As Ammonium hydroxide)
Carcinogenicity :	Classification is not possible due to lack of data. No classification for carcinogenicity by any international organization was available. Besides, as for individual information, although it is reported that it was not carcinogenic in a carcinogenicity test with rats administered by drinking water, this information was not sufficient (SIDS, 2008). From the above, this substance was classified as "Classification not possible" due to lack of data. (As Ammonium hydroxide)
Reproductive toxicity :	Classification is not possible due to lack of data.
Specific target organ toxicity (single exposure) :	In humans, this substance was irritating to the respiratory tract and caused severe irritation and pain in the respiratory tract mucosa. Besides, it was severely corrosive to the mouth, throat and stomach by the oral route (HSDB (Access on June 2014)). Although the neurological effects following inhalation or dermal exposure were known and usually limited to blurred vision due to direct contact, more severe exposures, which resulted in elevation of blood ammonia levels, resulted in seizure, coma, diffuse nonspecific encephalopathy, muscle weakness, decreased deep tendon reflexes and loss of consciousness leading to death (ATSDR, 2004). In an epidemiological death case after ingestion of this substance, autopsy showed hemorrhagic esophagus, stomach and duodenum. In a case of ingestion of household ammonia (ammonium hydroxide), there is a report on lesions and edema in the esophagus and acute respiratory disorder (ATSDR, 2004). In a case of a worker who was exposed to a high concentration (10,000 ppm) of this substance which overflowed from a tank, he immediately developed coughing, vomiting, difficulty in breathing and labored breathing and he died 6 hours after the exposure. On autopsy, there is a report of marked inflammation of the respiratory tract and severe denudation of the tracheal epithelium (HSDB (Access on June 2014)). Although only limited data were available in experimental animals, by oral administration to rats, sedation, staggering, abnormal posture, convulsions, tremors, ataxia, prostration, ptosis, exophthalmus, salivation, labored and irregular breathing and diarrhea were reported (no detailed information available). Although there is no description of the minimum dose affected, provided that these effects, observed at around 350 mg/kg, which is the LD50 value, it corresponds to Category 2 (SIDS, 2008). Based on the above, this substance was classified in Category 1 (central nervous system, respiratory organs). (As Ammonium hydroxide)
Specific target organ toxicity (repeated exposure) :	In humans, no report was available regarding chronic exposure. In experimental animals, in a test in which rats and guinea pigs were continuously exposed by inhalation for 90 days, at a concentration of 455 mg/m <sup>3</sup> , dyspnea and nasal irritation were observed, and there were dead animals (SIDS, 2008). Although these findings suggest that the respiratory organs were the target organs, information on testing conditions such as exposure time was unknown, therefore, the data could not be adopted for classification. Since there was no other information on chronic exposure to aqueous ammonia, classification was not possible due to lack of data. Besides, the previous classification was made based on the data listed in List 3 or on those not listed in the current classification guidance. (As Ammonium hydroxide)
Aspiration hazard :	Although there is a description that by oral ingestion of this substance, edema and burning in the upper respiratory tract occurred (HSDB (Access on June 2014)), there were no findings indicative of aspiration hazards, therefore, classification was not possible due to lack of data. (As Ammonium hydroxide)

## 12. Ecological information

Toxicity	
Hazardous to the aquatic environment (acute) :	It was classified in Category 2 due to 96-hour LC50 = 2.81-98.9 mg total NH3/L for crustacea ( <i>Mysidopsis bahia</i> ) (SIDS, 2007). (As Ammonium hydroxide)
Hazardous to the aquatic environment (chronic) :	If chronic toxicity data are used, then it is classified as "Not classified" due to rapid degradability (readily converted to nitrate in an aqueous environment (SIDS, 2007)), and 32-day NOEC = 3.47 mg total NH3/L for crustacea ( <i>Mysidopsis bahia</i> ) (SIDS, 2007). If acute toxicity data are used for a trophic level for which chronic toxicity data are not obtained, then it is classified as "Not classified" due to rapid degradability (readily converted to nitrate in an aqueous environment (SIDS, 2007)), and because no bioaccumulation is estimated: there is elimination mechanism for this substance since it is formed during protein degradation process in vivo. From the above results, it was classified as "Not classified." (As Ammonium hydroxide)
Persistence and degradability :	No information
Bioaccumulative potential :	No information
Mobility in soil :	No information
Hazard to the ozone layer :	The materials concerned are not listed by an affiliated book of Montreal Protocol.

## 13. Disposal precautions:

Residual waste :	Recover palladium using reduction roasting or oxidative precipitation. Do not incinerate in an incinerator or the like without a cleaning device because a gas containing harmful components is generated during incineration (It is desirable to outsource to a specialized company). Outsource to an industrial waste disposal contractor licensed by the prefectural governor, or if a local public entity does the disposal, outsource it there. If outsourcing waste disposal, thoroughly notify the disposal companies of the dangers and harmfulness before outsourcing. Avoid discharging wastewater and washing wastewater containing this substance of directly into rivers, or landfill, or dumping.
Dirty containers and packaging :	Containers should be disposed of properly according to relevant laws and local government standards. When disposing of empty containers, completely remove the contents.

## 14. Transport information

International regulations	
UN No. :	No information
Proper shipping name :	No information
Class :	No information
Sub risk :	No information
Packing group :	No information
Marine pollutant (sea) :	No
Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code :	No
Japanese regulations	
Land regulations information :	Obey poisonous and deleterious substances control act and Fire services act regulations.
Maritime regulations information :	Obey ship safety law regulations.
Aviation regulations information :	Obey the civil aeronautics law.
Special safety measures :	When transporting, avoid direct sunlight, load containers without damage, corrosion, or leakage, and securely prevent collapse of cargo.

## 15. Regulatory information (Japanese law)

Industrial safety and health act :	Dangerous or Harmful Substances Subject to Be Indicated their Names (Article 57 of the act, Article 18 of the Cabinet Order, Appendix Table 9)
	Dangerous or Harmful Substances Whose Names, etc. Should Be Notified (Article 57-2 of the act, Article 18-2 of the Cabinet Order, Appendix Table 9)
	Dangerous or Harmful Substances for which a risk assessment should be conducted (Article 57-3 of the act)
	Ordinance on industrial safety and health Article 594-2 (as Ammonia above)

\*Laws and regulations are examples and do not cover domestic laws and regulations.

## 16. Other information

References, etc. :	GHS classification results database: NITE website GHS model SDS information: JISHA website Ministry of Health, Labor and Welfare website JIS Z7252 : 2019 JIS Z7253 : 2019 Selection Manual for Protective Equipment for Prevention of Skin Damage, etc. (Ministry of Health, Labour and Welfare Feb.2024 )
--------------------	---

### \*Caution:

Although hazard and harmfulness evaluations are based on the data and information available at the current time, they may not be sufficient.

Please handle with care.

Furthermore, the data and evaluations described herein are not in any way guaranteed. The descriptions refer to normal handling.

Regarding special handling, please handle based on the safety measures which are suitable for the intended applications and methods of use.

This SDS is an English translation of a document prepared in Japanese in accordance with JIS Z7253:2019.