

Prepared: October 1, 1992
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Material Safety Data Sheet

1. IDENTIFICATION OF SUBSTANCE / PREPARATION AND COMPANY / UNDERTAKING

Product Name: Anhydrous Hydrogen Chloride

Company Name: Tsurumi Soda Co., Ltd.

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Prepared by: Sales Department,
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Usage and restriction: Manufacturing process for semiconductor wafers,
and manufacture of pharmaceuticals, pesticides, and
other chemicals

Reference number: G-A-17

2. HAZARD IDENTIFICATION

GHS CLASSIFICATION

PHYSICAL HAZARDS

Flammable gas:	Not classified
Oxidizing gas:	Not classified
Gas under pressure / Liquefied gas:	

HEALTH HAZARDS

Acute Toxicity (oral):	Category 3
Acute Toxicity (dermal):	Not classified

Acute Toxicity (inhalation, gas):	Category 3
Acute Toxicity (inhalation, mist):	Category 2
Skin Corrosion / Skin Irritation:	Category 1A
Serious Eye Damage / Eye Irritation:	Category 1
Respiratory Sensitizer:	Category 1
Skin Sensitizer:	Not classified
Carcinogenicity:	Not classified
Target Organ / Systemic Toxicity (single exposure):	Category 1 (Respiratory system)
Target Organ / Systemic Toxicity (repeated exposure):	Category 1 (Respiratory system, and teeth)

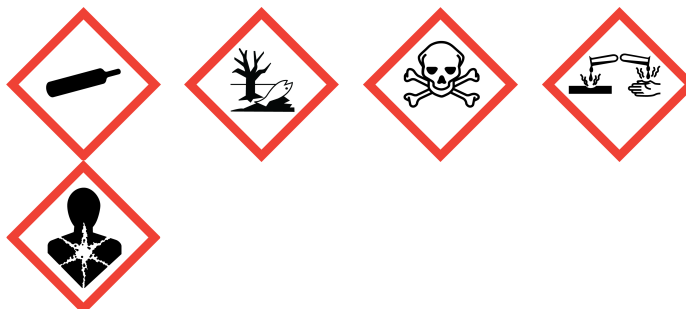
ENVIRONMENTAL HAZARDS

Acute Aquatic Toxicity:	Category 1
Chronic Aquatic Toxicity:	Not classified

For other GHS classification elements than the above, the product is classified as “Not applicable for classification” or “Classification not possible.”

GHS LABELLING ELEMENTS

Pictograms or Symbols:



Signal words: Danger

Hazard statements:

- Contains gas under pressure; may explode if heated.
- Harmful if swallowed.
- Fatal if inhaled.
- Toxic if inhaled.
- Causes severe skin burns and eye damage.
- Causes serious eye damage.
- May cause allergy or asthma symptoms or breathing difficulties if inhaled.

- Causes damage to respiratory system.
- May cause damage to respiratory system and teeth through prolonged or repeated exposure.
- Very toxic to aquatic life.

Precautionary Statements

- Prevention:
- Do not eat, drink or smoke when using this product.
 - Wash hands thoroughly after handling.
 - Use only outdoors or in a well-ventilated area.
 - Do not breathe gas.
 - Do not breathe mist, vapors, or spray.
 - Wear protective gloves, protective clothing, eye protection, and face protection.
 - In case of inadequate ventilation, wear suitable respiratory protection equipment.
 - Avoid release to the environment.

- Response:
- If on skin (or hair), remove or take off immediately all contaminated clothing. Rinse skin with running water / shower.
 - Wash contaminated clothing before reuse.
 - If inhaled, remove the victim to fresh air and keep at rest in a position comfortable for breathing.
 - If experiencing respiratory symptoms, call a poison center or doctor / physician.
 - If in eyes, rinse cautiously with water for several minutes (at least 15 min.). Remove contact lenses if present and easy to do – continue rinsing.
 - If swallowed, rinse mouth. Do not induce vomiting.
 - If on skin, in eyes, swallowed, or inhaled, immediately call a poison center or doctor / physician.
 - Get medical advice / attention if you feel unwell.
 - Recover the leakage.

- Storage:
- Protect from sunlight. Do not expose to temperatures exceeding 40°C.
 - Store in a well ventilated place.
 - Store locked up.

- Disposal:
- To dispose of contents / containers, commission a professional waste treatment agent authorized by prefectural governor.

3. COMPOSITION, INFORMATION ON INGREDIENT

Nature: Straight product

Chemical Name: Hydrogen chloride

Chemical formula: HCl

CAS Number: 7647-01-0

Content: $\geq 99.7\%$

Reference No. Used in Japan: (1)-215

(This reference number is given by the Law Concerning Examination and Regulation of Manufacture, etc. of Chemical Substances, Japan.)

Impurities and stabilizing agents contributing to GHS Classification:

No data available

Industrial Safety and Health Act, Japan:

Dangerous or harmful substances subject to be notified their names, etc. (Appended Table 9, Article 18-2, Enforcement Ordinance of the Industrial Safety and Health Act; Article 57-2 of the above act):

Hydrogen chloride
(Ordinance No. 98)
(99.7%)

Poisonous and Deleterious Substances Control Act, Japan:

Deleterious substance (Appended Table 2, Article 2 of the above act):

Hydrogen chloride

4. FIRST AID MEASURES

If inhaled:

- Remove the victim to fresh air and keep at rest in a position comfortable for breathing.
- Immediately call a poison center or doctor / physician.

If on skin:

- Immediately remove / take off all contaminated clothing.
- Rinse skin with running water / shower.
- Immediately call a poison center or doctor / physician.
- Wash contaminated clothing before reuse.

If in eyes:

- Rinse cautiously with water for several minutes (at least 15 minutes). Remove contact lenses if

present and easy to do – continue rinsing.

- Immediately call a poison center or doctor / physician.

If swallowed:

- Rinse mouth. Do not induce vomiting.
- If conscious, make the victim drink plenty of water.
- Immediately call a poison center or doctor / physician.

Expected acute and delayed symptoms:

- Inhalation of a large quantity results in fatal pulmonary edema.

Most important symptoms or effects:

- Contact with eyes or skin causes inflammation. Irritation to membrane of throat, nose, etc. leads to a cough.

5. FIRE-FIGHTING MEASURES

Suitable extinguishing media:

- Large-scale fire: Coarse-spray of water, water spray, and foam
Small-scale fire: Dry chemical, and carbon dioxide

Fire-specific hazards:

- Not combustible.
- Due to nearby fire, irritative, corrosive, and/or toxic gases may be generated.
- Containers may explode in the heat of fire.
- A bursting container may become airborne.

Fire-fighting method:

- If possible without risk, remove containers from fire area.
- Even after extinction of fire, keep containers sufficiently cool with plenty of water.
- Fight fire from maximum distance, using unmanned hose holders or monitor nozzles.
- Only experts are allowed to handle damaged containers.
- Do not put any water in the container.

Protection for fire-brigades:

- Wear a self-contained breathing apparatus, heat resistant protective clothes, etc.

6. ACCIDENTAL RELEASE MEASURES

Personal precautions

Protection equipment and emergency measures:

- Avoid contact with and entry into the leakage
- Immediately create and isolate a hazardous area, ensuring adequate distances in all directions.
- Prevent unauthorized entry into the hazardous area.
- Keep out of low places, and stay upwind.
- If necessary, place a wet towel and the like over the nose and mouth for temporary respiratory protection.
- In case of leakage in a closed area, ventilate before entry.
- Personnel engaged in cleanup must wear suitable protective equipment (refer to Section 8. EXPOSURE CONTROLS / PERSONAL PROTECTION), and avoid contact with skin and eyes, and inhalation.
- In case of leakage without fire, wear airtight, impermeable protective clothes.
- Keep the hazardous area off-limits until the hazardous gas goes away.

Environmental protection

Recovery and neutralization:

- Avoid release to the environment.
- In case of small leakage, thoroughly absorb a leaked gas with water. Do not spray water onto leaking containers.
- In case a large amount of gas is blowing out, absorb the gas with water spray provided from a distance.

Containment, cleanup, and equipment:

- Stop leak if possible without risk.
- If possible, turn the leaking container so that a gas, not a liquid, blows out.
- After recovery, wash out the contaminated area thoroughly with water.

Preventive measures against secondary disaster:

- Protect drainages, sewers, and basements from entry of leakage.

- Immediately give warning to people in residential / industrial area to evacuate from the hazardous area.

7. HANDLING AND STORAGE

Handling:

Technical Measures:

- Perform the engineering measures written in Section 8. EXPOSURE CONTROLS / PERSONAL PROTECTION, and wear personal protective equipment.

Local / general ventilation:

- Conduct local / general ventilation written in Section 8. EXPOSURE CONTROLS / PERSONAL PROTECTION.

Precautions for safe handling:

- Read and understand the contents of safety precautions before handling.
- Handle containers carefully to prevent mechanical shock, overturn, etc.
- Containers must be carefully mounted or dismounted to prevent leakage.
- Use dry conduits and pipes.
- After use, close the valve tightly, and attach the mouth ring and the protective cap.
- Fatal if inhaled.
- Corrosive to materials if leaked.
- Causes inflammation if on skin or mucous membrane.
- Do not eat or smoke during handling.
- Wash hands thoroughly after handling.
- Conduct local exhaust ventilation to keep atmospheric levels below the permissible exposure limit.
- Do not breathe gas, vapor, or mist.
- Use only outdoors or in areas well ventilated.
- Avoid release to the environment.

Prevention of contact:

- Refer to Section 10. STABILITY AND REACTIVITY.

Storage

Technical Measures:

- Promptly return unused containers to the

dealer of high pressure gases.

- Materials to avoid:
- Refer to Section 10. STABILITY AND REACTIVITY.
- Storage conditions:
- Store containers in a warehouse with roof at $\leq 40^{\circ}\text{C}$ protecting from direct sunlight and flames.
 - Store locked up.
- Packaging materials:
- Use containers which meet the requirements specified by Poisonous and Deleterious Substances Control Act, Japan, High Pressure Gas Safety Act, Japan, and United Nations' regulations for transport.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

- Engineering measures:
- Provide eye-wash stations and emergency showers close to storage and handling areas.
 - In order to keep the atmospheric levels below the recommended control level or permissible level, use closed processes and local exhaust ventilation.

- Control exposure level:
- Not determined.

Permissible level:

Jpn. Soc. for Occupat. Hlth. (2006): OEL 5 ppm (7.5 mg/m^3)

ACGIH (2007): STEL 2 ppm (Ceiling value)

Personal protective equipment

Respiratory protection: Wear a self-contained breathing apparatus, a gas mask for acidic gases, or an airline respirator.

Hand protection: Wear rubber-made or chemical-resistant gloves.

Eye protection: Wear protective glasses or goggles.

Skin and body protection: Wear rubber-lined protective clothes, and rubber boots.

Hygienic measures: Wash hands thoroughly after handling.

9. PHYSICAL AND CHEMICAL PROPERTIES

Physical state

Form:	Liquefied gas
Color:	Colorless, clear
Odor:	Irritative odor

Physical properties

pH (acidity):	Acidic (water solution)
Melting point / Freezing point:	-114.2°C
Boiling point (BP) / Initial BP:	-85.03°C
Flammability:	Not applicable
Vapor pressure:	4.22 MPa (20°C)
Solubility:	Soluble in water
P _{o/w} :	No data available
Spontaneous ignition temp.:	Not applicable
Decomposition temperature:	Not applicable
Density (gas):	1.639 g/L (0°C, 1 atm)
Specific gravity (gas):	1.268 (0°C, air = 1)
Evaporation rate (butyl acetate = 1):	Not applicable
Flammability (solid, gas):	Nonflammable / noncombustible gas
Viscosity (gas):	1.56 x 10 ⁻⁵ Pa·s (20°C)
Critical temperature:	51.4°C
Critical pressure:	8.26 MPa

10. STABILITY AND REACTIVITY

Stability:

- Reacts with alkali metals to form chloride film on the metal surface though the reaction is not so active.

Possibility of hazardous reactions:

- Although hydrogen chloride itself is not explosive, hydrogen resulting from reaction with metals may form an explosive mixture with air.
- Although hydrogen chloride is not corrosive

under dry conditions, it is extremely hygroscopic, and easily absorbs moisture to form hydrochloric acid, which is corrosive to metals.

- Conditions to avoid:
- High temperature, moisture, and sunlight
- Incompatible materials:
- Oxidizers and organic peroxides. Contact with them generates heat to cause a fire.
- Hazardous decomposition products:
- Hydrogen (a flammable gas)
- Others:
- Hydrogen chloride is poorly conductive. However, a hydrochloric acid solution in which some other substance has dissolved is highly conductive.

11. TOXICOLOGICAL INFORMATION

Acute toxicity

Oral LD₅₀: 238–277 mg/kg, and 700 mg/kg in rats (SIDS, 2002)

Dermal LD₅₀: >5,010 mg/kg in rabbits (SIDS, 2002). This value led to the GHS classification of “Not classified.”

Inhalation LC₅₀:

- For gas, 4.2, 4.7, or 283 mg/L/60 min. (SIDS, 2002). The lowest LC₅₀ value of 4.2 mg/L/60 min. was converted to 1,411 ppm/4 hrs. Based on this converted value, the product was classified as “Category 3.”
- For mist, 1.68 mg/L/1 hr. (SIDS, 2002). This value was converted to 0.42 mg/L/4 hrs. Based on this converted value, the product was classified as “Category 2.”

Skin corrosion / irritation:

In a rabbit skin irritation study with 1- to 4-hour exposure, skin corrosion was induced depending on exposure concentrations employed (SIDS, 2002); 5- to 30-min. dermal exposure in mice or rats resulted in skin irritation and ulcer with skin discoloration (SIDS, 2002); and dermal exposure in humans resulted in mild to severe irritation, ulcer and/or chemical burn (SIDS, 2002). Based on the above information, this product is considered to be corrosive and is classified as “Category 1A.”

Serious eye damage / irritation:

- Classified as “Category 1” due to positive skin corrosiveness.
- All the available eye damage / irritation data relate to the exposure to hydrochloric acid, water solutions of the product. Studies with rabbits and other species resulted in severe eye irritation, damage, or corrosion (SIDS, 2002). In humans, persistent eye damage and possible sight loss were reported (SIDS, 2002).

Respiratory sensitizer: Classified as “Category 1,” since the special committee of Japanese Society of Occupational and Environmental Allergy lists up the product as an occupational allergenic chemical sensitizer. Human exposure to a cleaner containing hydrogen chloride caused bronchial spasm, and even one year after the exposure, slight stimulation given to this case induced asthma-like symptoms (ACGIH, 2003).

Skin sensitizer: Maximization test in guinea pigs and ear swelling test in mice revealed negative sensitizing activity (SIDS, 2002). Moreover, none of the 15 humans, who received induction treatment 10–14 days prior to challenge treatment, showed positive reactions (SIDS, 2002). Based on these observations, the product was classified as “Not classified.”

Germ cell mutagenicity:

With an exception of positive mutagenic activities obtained from sex-linked recessive lethal test in *Drosophila melanogaster*, all the available *in vivo* studies revealed negative activity. Positive mutagenic activities obtained from a few *in vitro* mutagenicity studies were considered to be an insufficient evidence for the mutagenesis in human germ cells. The product, therefore, was classified as “Classification not possible.”

Carcinogenicity:

Classified as Group 3 by IARC (1992), and as A4 by ACGIH (2003). The product, therefore, was classified as “Not classified.” Incidentally, carcinogenicity studies in rats and mice did not reveal evidences of carcinogenicity (SIDS, 2002), and epidemiological surveys in humans resulted mostly in negative relations between carcinogenesis and exposure to hydrogen chloride (IARC, 54,

1992; PATTY, 5th, 2001).

Reproductive toxicity: All the studies in rats or mice, which were treated during gestation, showed no adverse effects on development of the offspring. However, effects of pre-gestation treatment on sexual functions and fertility are unknown. The product, therefore, was classified as “Classification not possible.”

Target organ / systemic toxicity (single exposure):

Respiratory exposure in humans was reported to reveal symptoms of breathing difficulty, laryngitis, bronchitis, bronchoconstriction, and pneumonia; moreover, edema, inflammation, and necrosis of upper respiratory tracts, and pulmonary edema were reported (DFGOT, vol. 6, 1994; PATTY, 5th, 2001; IARC, 54, 1992; ACGIH, 2003). In animal experiments, morphological damages in lungs and bronchi were observed, e.g., bronchitis with necrosis of mucous membrane, pulmonary edema, hemorrhage, and thrombi. Such toxicological effects were in a range of the guidance values for Category 1 (ACGIH, 2003; SIDS, 2002). Based on the above human and animal data, the product was classified as “Category 1 (respiratory system).”

Target organ / systemic toxicity (repeated exposure):

Repeated exposure in humans was reported to cause dental erosional damage in more than one literature (SIDS, 2002; EHC, 21, 1982; DFGOT, vol. 6, 1994; PATTY, 5th, 2001); moreover, increased incidence of chronic bronchitis (DFGOT, vol. 6, 1994). Based on the above data, the product was classified as “Category 1 (teeth, and respiratory system).”

Aspiration hazard: Classified as “Not applicable for classification” because the product is gaseous.

12. ECOLOGICAL INFORMATION

Aquatic environmental hazard

Acute aquatic toxicity: As crustacean (*Daphnia magna*) toxicity, EC₅₀ (48 hrs.) of 0.492 mg/L is reported (SIDS, 2005). Based on this value and other data, the product was classified as “Category 1.”

Chronic aquatic toxicity:

Aquatic toxicity is considered to be derived from strong acidity of aquatic solutions of the product. However, under actual conditions, aquatic toxicity is reduced by natural buffering functions in environmental water. Therefore, the product was classified as “Not classified.”

Ecotoxicity:

No data available

13. DISPOSAL CONSIDERATION

Waste from residues:

- Dispose of a high pressure gas in line with the provisions of General High Pressure Gas Safety Regulations, High Pressure Gas Safety Act, Japan.
- Before disposal, detoxification, stabilization, and neutralization must be carried out as much as possible to lower hazard levels.
- Dispose of according to applicable laws and regulations as well as standards of local authorities.
- For waste treatment, commission waste treatment agents authorized by prefectural governors, or if practical, local authorities.
- Waste treatment agents or the like must be informed well about dangers and hazards of the wastes at the time of commission.

Contaminated containers and packages:

- Contaminated containers must be cleaned for recycling, or disposed of appropriately according to applicable laws and regulations as well as standards of local authorities.
- In case of disposing of empty containers, remove all the residues inside before disposal.
- When disposing of containers of high pressure gas, commission the manufacturer or professional agents to collect them.

14. TRANSPORT INFORMATION

International transport

UN Classification:

Class 2.3

UN Number: 1050
UN proper shipping name: HYDROGEN CHLORIDE, ANHYDROUS
Packing group: 2
Marine pollutant: Applicable
Maritime regulations: Comply with the regulations of IMO.
Aviation regulation: Forbidden.

Domestic transport, i.e. Transport in Japan

UN Classification: Class 2.3
UN Number: 1050
UN proper shipping name: For labeling, use proper Japanese translation of "HYDROGEN CHLORIDE, ANHYDROUS."
Packing group: 2
Marine pollutant: Applicable
Marine transport: Comply with the provisions of Ship Safety Act, Japan.
Air transport: Forbidden.
Land transport: Comply with the provisions of 1) High Pressure Gas Safety Act, Japan, and 2) Poisonous and Deleterious Substances Control Act, Japan.

Specific safety measures and conditions for transport:

- Prior to loading, ensure that containers do not suffer from damage, corrosion, or leak.
- Load carefully to prevent containers from falling, overturning or being damaged.
- Fix the loaded containers to prevent overturning, shock, and friction during transportation.
- Protect from flames, heat, and direct sunlight.
- When a traffic accident occurs during transportation, inform the event immediately to the public health department, the police station, and the fire department, and contact the manufacturer, the consignor, etc. to seek directions.
- Do not transport in the same loading space with food and animal feed.
- Keep containers apart from steel materials.
- Do not place a heavy cargo on containers of the product.
- Vehicle-operators must carry the transport emergency card during transportation.

Emergency Response Guide: • Guide 157

15. REGULATORY INFORMATION

1) Industrial Safety and Health Act, Japan:

Specific chemical substance of Class 3 (No. 6, Clause 1, Article 2, Ordinance on Prevention of Hazards Due to Specific Chemical Substances)

Dangerous or harmful substances subject to be notified their names, etc. (Appended Table 9, Article 18-2, Enforcement Ordinance of the Industrial Safety and Health Act; Article 57-2 of the above act)

Corrosive liquid (Article 326, Ordinance on Industrial Safety and Health) (Hydrochloric acid)

2) Poisonous and Deleterious Substances Control Act, Japan:

Deleterious substance (Appended Table 2, Article 2 of the above act)

3) Air Pollution Control Act, Japan:

Specific substance (Article 10, Enforcement Ordinance of Air Pollution Control Act; Clause 1, Article 17 of the above act) (No. 9: Hydrogen chloride)

Substance subject to emission control (hazardous substance) (Article 1, Enforcement Ordinance of Air Pollution Control Act; No. 3, Clause 1, Article 2 of the above act) (No. 2: Chlorine and hydrogen chloride)

4) Ship Safety Act, Japan:

High pressure gas (Appended Table 1, Announcement on Dangerous Substances; Article 3, Regulations for the Carriage and Storage of Dangerous Goods in Ship)

(UN No. 1050, Hydrogen chloride, anhydrous)

Corrosive substance (Appended Table 1, Announcement on Dangerous Substances; Article 3, Regulations for the Carriage and Storage of Dangerous Goods in Ship)

(UN No. 1789, Hydrochloric acid)

5) Civil Aeronautics Act, Japan:

Transport-forbidden substance (Article 194, Enforcement Regulations of Civil Aeronautics Act) (UN No. 1050: Hydrogen chloride, anhydrous)

Corrosive substance (Appended Table 1, Announcement on

Dangerous Substances; Article 194, Enforcement Regulations of Civil Aeronautics Act) (UN No. 1789, Hydrochloric acid)

- 6) High Pressure Gas Safety Act, Japan:
Liquefied gas (Item 2, Article 2 of the above act)

Poisonous gas (Item 2, Article 2, Security Regulation for General High-Pressure Gas) (other gases)
(Gas with permissible level of ≤ 200 ppm)
- 7) Labor Standards Act, Japan:
Chemical substance causing occupational diseases to be compensated (No. 4-1, Appended Table 1-2, Announcement of the Ministry of Labor, No. 36, 1978; Article 35, Enforcement Regulations of the Labor Standards Act; Clause 2, Article 75 of the above act)
- 8) Fire Service Act, Japan:
Substances whose storage etc. require reporting (Appended Table 2, No. 6, Item 10, Article 1, Hazardous Materials Control Order; Article 9-3 of the above act)
- 9) Act on Prevention of Marine Pollution and Maritime Disaster, Japan:
Substance hazardous for marine environment (Substance of Class Z, Appended Table 1, Article 1-2, Enforcement Ordinance of the Act on Prevention of Marine Pollution and Maritime Disaster)

Based on the acute aquatic toxicity of Category 1, this product falls under "Marine pollutants" in case of transport in packaged form.
- 10) Act on Port Regulations, Japan:
Dangerous substance / Corrosive substance (Item "b," Appended Table 2, Ministerial Announcement No. 547, 1979; Article 12, Enforcement Regulations of the Act on Port Regulations; Paragraph 2, Article 21 of the above act)

Dangerous substance / High pressure gas (Item "a," Appended Table 2, Ministerial Announcement No. 547, 1979; Article 12, Enforcement Regulations of the Act on Port Regulations; Paragraph 2, Article 21 of the above act)
- 11) Road Act, Japan:
Traffic-restricting substance (Appended Table 2-3: Hydrochloric acid; Announcement of Japan Highway Public Corporation; Article 19-13, Enforcement Ordinance of the Road Act)
- 12) Narcotics and Psychotropics Control Act, Japan:
Raw material for narcotics and psychotropics (Article 4, Government

Ordinance No. 238, August 1, 1990; No. 9, Appended Table 4 of the above act) (No. 3: Hydrochloric acid)
(Substance containing hydrogen chloride at >10% [Appended Table 3, Enforcement Ordinance of the Narcotics and Psychotropics Control Act; No. 10, Appended Table 4 of the above act])

16. OTHER INFORMATION

- References:
- 1) RTECS, 2002
 - 2) Yakumu Kohosha, Standards-related Notifications on Poisonous and Deleterious Substances (in Japanese), 1991
 - 3) Japan Soda Industry Association, Safety and Health Handbook (in Japanese), 2006
 - 4) Japan Chemical Database Ltd., ezCRIC™, 2008

Others: Values written in this document, e.g. contents, physical and chemical properties, etc. do not warrant the product quality. Dangers and hazards of the product were evaluated based on data and information currently available to us. However, not all the data were used for the evaluation. Therefore, users are requested to handle the product with sufficient care.

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