

SAFETY DATA SHEET

Version 8.8
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Product Number Millipore - 233155

1. PRODUCT AND COMPANY IDENTIFICATION

Product name : Cleland's Reagent

Product Number 233155

Brand : Millipore
Recommended use of the chemical and restrictions on use : **Identified uses**
Reagent for analysis Reagent for development and research

Company : 씨그마알드리치코리아(유)
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금요일 (공휴일 제외)

2. HAZARDS IDENTIFICATION

GHS Classification

Acute toxicity (Oral) : Category 4

Skin corrosion/irritation : Category 1B

Serious eye damage/eye irritation : Category 1

Long-term (chronic) aquatic hazard : Category 3

GHS label elements

Hazard pictograms :



Signal word : Danger

Hazard statements : H302 Harmful if swallowed.
H314 Causes severe skin burns and eye damage.
H318 Causes serious eye damage.
H412 Harmful to aquatic life with long lasting effects.

Precautionary statements : **Prevention:**
P260 Do not breathe dust.
P264 Wash skin thoroughly after handling.
P270 Do not eat, drink or smoke when using this product.
P273 Avoid release to the environment.
P280 Wear protective gloves/ protective clothing/ eye protection/ face protection.

Response:
P301 + P330 + P331 + P310 IF SWALLOWED: Rinse mouth. Do NOT induce vomiting. Immediately call a POISON CENTER/ doctor.
P303 + P361 + P353 IF ON SKIN (or hair): Take off immediately all contaminated clothing. Rinse skin with water.
P304 + P340 + P310 IF INHALED: Remove person to fresh air and keep comfortable for breathing. Immediately call a POISON CENTER/ doctor.
P305 + P351 + P338 + P310 IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Immediately call a POISON CENTER/ doctor.
P363 Wash contaminated clothing before reuse.

Storage:

P405 Store locked up.

Disposal:

P501 Dispose of contents/ container according to waste-related laws

Other hazards which do not result in classification

No data available

3. COMPOSITION/INFORMATION ON INGREDIENTS

Substance / Mixture : Substance
CAS-No. : 3483-12-3

Components

Chemical name	CAS-No.	Concentration (% w/w)
(R*,R*)-1,4-Dimercapto-2,3-butanediol	3483-12-3	>= 95 - <= 100

4. FIRST AID MEASURES

General advice : First aiders need to protect themselves.
Show this safety data sheet to the doctor in attendance.

In case of eye contact : After eye contact: rinse out with plenty of water.
Immediately call in ophthalmologist.
Remove contact lenses.

In case of skin contact : In case of skin contact: Take off immediately all contaminated clothing. Rinse skin with water/ shower.
Call a physician immediately.

If inhaled : After inhalation: fresh air. Call in physician.

If swallowed : After swallowing: make victim drink water (two glasses at most), avoid vomiting (risk of perforation).
Call a physician immediately.
Do not attempt to neutralise.

Most important symptoms and effects, both acute and delayed : The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

Protection of first-aiders : For personal protection see section 8.

Notes to physician : No data available

5. FIREFIGHTING MEASURES**Suitable and unsuitable extinguishing media**

Suitable extinguishing media : Water
Foam
Carbon dioxide (CO₂)
Dry powder

Unsuitable extinguishing media : For this substance/mixture no limitations of extinguishing agents are given.

Specific hazards during fire fighting : Combustible.

Fire may cause evolution of:

Sulphur oxides

Development of hazardous combustion gases or vapours possible in the event of fire.

Hazardous combustion products : Carbon oxides

Sulphur oxides

Specific extinguishing methods : Suppress (knock down) gases/vapours/mists with a water spray jet.
Prevent fire extinguishing water from contaminating surface water or the ground water system.

Special protective equipment for fire-fighters : Stay in danger area only with self-contained breathing apparatus. Prevent skin contact by keeping a safe distance or by wearing suitable protective clothing.

6. ACCIDENTAL RELEASE MEASURES

Personal precautions, protective equipment and emergency procedures : Advice for non-emergency personnel:
Avoid inhalation of dusts.
Avoid substance contact.
Ensure adequate ventilation.
Evacuate the danger area, observe emergency procedures, consult an expert.
Advice for emergency responders:
For personal protection see section 8.

Environmental precautions : Do not let product enter drains.

Methods and materials for containment and cleaning up : Cover drains. Collect, bind, and pump off spills. Observe possible material restrictions (see sections 7 and 10). Take up dry. Dispose of properly. Clean up affected area. Avoid generation of dusts.

7. HANDLING AND STORAGE

For precautions see section 2.2.

Further information on storage conditions : Protected from light.

Tightly closed.
Dry.

Storage class : 8A, Combustible, corrosive hazardous materials

Recommended storage temperature : Recommended storage temperature see product label.

Further information on storage stability : Recommended storage temperature see product label.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Ingredients with workplace control parameters

Contains no substances with occupational exposure limit values.

Engineering measures : No data available

Personal protective equipment

Among the following personal protective equipment, the PPEs which require safety certification need to be certified by KOSHA.

Respiratory protection : required when dusts are generated.

Our recommendations on filtering respiratory protection are based on the following standards: DIN EN 143, DIN 14387 and other accompanying standards relating to the used respiratory protection system.

Recommended Filter type: : Filter type P2

The entrepreneur has to ensure that maintenance, cleaning and testing of respiratory protective devices are carried out according to the instructions of the producer. These measures have to be properly documented.

Eye protection	: Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU). Tightly fitting safety goggles
Hand protection	
Material	: Nitrile rubber
Break through time	: 480 min
Glove thickness	: 0.11 mm
Protective index	: Full contact
Manufacturer	: KCL 741 Dermatril® L
Material	: Nitrile rubber
Break through time	: 480 min
Glove thickness	: 0.11 mm
Protective index	: Splash contact
Manufacturer	: KCL 741 Dermatril® L
Remarks	: This recommendation applies only to the product stated in the safety data sheet, supplied by us and for the designated use. When dissolving in or mixing with other substances and under conditions deviating from those stated in EN 16523-1 please contact the supplier of CE-approved gloves (e.g. KCL GmbH, D-36124 Eichenzell, Internet: www.kcl.de).
Skin and body protection	: protective clothing
Hygiene measures	: Immediately change contaminated clothing. Apply preventive skin protection. Wash hands and face after working with substance.

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance	: powder
Colour	: white
Odour	: unpleasant
Odour Threshold	: No data available
pH	: No data available
Melting point/ range	: 42.44 °C (1,000.7 hPa) Method: OECD Test Guideline 102

	GLP: yes
Boiling point/boiling range	: 270 - 272 °C (1,013 hPa) Method: OECD Test Guideline 103 GLP: yes
Flash point	: Not applicable
Evaporation rate	: No data available
Burning rate	: No data available
Upper explosion limit / Upper flammability limit	: No data available
Lower explosion limit / Lower flammability limit	: No data available
Vapour pressure	: < 0.1 hPa (25 °C) Method: OECD Test Guideline 104 GLP: yes
Bulk density	: ca. 300 kg/m ³
Water solubility	: No data available
Relative vapour density	: No data available
Relative density	: No data available
Density	: 1.377 g/cm ³ (20 °C) Method: OECD Test Guideline 109 GLP: yes
Partition coefficient: n- octanol/water	: No data available
Autoignition temperature	: No data available
Decomposition tempera- ture	: No data available
Viscosity, dynamic	: No data available
Viscosity, kinematic	: No data available
Flow time	: No data available
Explosive properties	: Not classified as explosive.
Oxidizing properties	: none
Molecular weight	: 154.25 g/mol

Particle characteristics
Particle size : No data available

10. STABILITY AND REACTIVITY

Chemical stability and possibility of hazardous reactions : Reactivity:
The following applies in general to flammable organic substances and mixtures: in correspondingly fine distribution, when whirled up a dust explosion potential may generally be assumed.
Chemical stability:
The product is chemically stable under standard ambient conditions (room temperature) .
Possibility of hazardous reactions:
Violent reactions possible with:
Possibility of hazardous reactions:
bases
Strong oxidizing agents

Conditions to avoid : no information available

Incompatible materials : Strong oxidizing agents

Hazardous decomposition products : In the event of fire: see section 5

11. TOXICOLOGICAL INFORMATION

Information on likely routes of exposure

No data available

Delayed and immediate effects and also chronic effects from short and long term exposure

Acute toxicity

LD50 Oral - Rat - female - 300 - 2,000 mg/kg

Inhalation: No data available

Dermal: No data available

Skin corrosion/irritation

Skin - human skin - Skin irritation - 1 h - OECD Test Guideline 439

Serious eye damage/eye irritation

Remarks: Causes serious eye damage.

Respiratory or skin sensitization

Local lymph node assay (LLNA) - Mouse - negative - OECD Test Guideline 429

Carcinogenicity

IARC: No component of this product present at levels greater than or equal to 0.1% is identified as probable, possible or confirmed human carcinogen by IARC.

Germ cell mutagenicity

Genotoxicity in vitro
Test Type: Ames test
Test system: S. typhimurium
Metabolic activation: with and without metabolic activation
Method: OECD Test Guideline 471
Result: negative

Reproductive toxicity

No data available

Specific target organ toxicity - single exposure

No data available

Specific target organ toxicity - repeated exposure

No data available

Aspiration hazard

No data available

Signs and Symptoms of Exposure

Nausea, Headache, Vomiting, Central nervous system depression, To the best of our knowledge, the chemical, physical, and toxicological properties have not been thoroughly investigated.

Numerical measures of toxicity

No data available

Additional Information

No data available

12. ECOLOGICAL INFORMATION

Ecotoxicity

Components:

(R*,R*)-1,4-Dimercapto-2,3-butanediol:

Toxicity to fish	: LC50 (Danio rerio (zebra fish)): > 24.3 mg/l Exposure time: 96 h Test Type: semi-static test Method: OECD Test Guideline 203 Remarks: (ECHA)
Toxicity to daphnia and other aquatic invertebrates	: EC50 (Daphnia magna (Water flea)): 34.8 mg/l End point: Immobilization Exposure time: 48 h Test Type: static test Analytical monitoring: yes Method: OECD Test Guideline 202 GLP: yes
Toxicity to algae/aquatic plants	: ErC50 (Pseudokirchneriella subcapitata): 24.3 mg/l Exposure time: 72 h Test Type: static test

Analytical monitoring: yes
Method: OECD Test Guideline 201
GLP: yes

Persistence and degradability

Components:

(R*,R*)-1,4-Dimercapto-2,3-butanediol:

Biodegradability : aerobic
Inoculum: activated sludge, non-adapted
Concentration: 64.3 mg/l
Result: Not readily biodegradable.
Biodegradation: 50 %
Exposure time: 43 d
Method: OECD Test Guideline 301B
GLP: yes
Remarks: The 10 day time window criterion is not fulfilled.

Bioaccumulative potential

Components:

(R*,R*)-1,4-Dimercapto-2,3-butanediol:

Bioaccumulation : Remarks: No data available

Mobility in soil

Components:

(R*,R*)-1,4-Dimercapto-2,3-butanediol:

Stability in soil : Remarks: No data available

Other adverse effects

Components:

(R*,R*)-1,4-Dimercapto-2,3-butanediol:

Additional ecological in-formation : No data available

Endocrine disrupting properties

No data available

13. DISPOSAL CONSIDERATIONS

Disposal methods

Waste from residues : Waste material must be disposed of in accordance with the national and local regulations. Leave chemicals in original containers. No mixing with other

waste. Handle uncleaned containers like the product itself.

Disposal precautions

Dispose of contents and container according to wastes control act.

14. TRANSPORT INFORMATION

International Regulations

IATA-DGR

UN/ID No.	: UN 3335
Proper shipping name	: Aviation regulated solid, n.o.s. ((R*,R*)-1,4-Dimercapto-2,3-butanediol)
Class	: 9
Packing group	: III
Labels	: Class 9 - Miscellaneous dangerous substances and articles
Packing instruction (cargo aircraft)	: 956
Packing instruction (passenger aircraft)	: 956

IMDG-Code

Not regulated as a dangerous good	
UN number	: Not applicable
Proper shipping name	: Not applicable
Class	: Not applicable
Subsidiary risk	: Not applicable
Packing group	: Not applicable
Labels	: Not applicable
EmS Code	: Not applicable
Marine pollutant	: no

Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code

Not applicable for product as supplied.

National Regulations

Refer to section 15 for specific national regulation.

Special precautions for user

The transport classification(s) provided herein are for informational purposes only, and solely based upon the properties of the unpackaged material as it is described within this Safety Data Sheet. Transportation classifications may vary by mode of transportation, package sizes, and variations in regional or country regulations.

15. REGULATORY INFORMATION

National regulatory information

Regulation under the Occupational Safety and Health Act

Harmful Substances Prohibited from Manufacturing

Not applicable

Harmful Substances Required Permission for Manufacture

Not applicable

Harmful Agents to be kept below Occupational Exposure Limits

Not applicable

Harmful Agents Required to be kept below Permission Levels

Not applicable

Hazardous substances requiring management

Not applicable

Special Management Materials

Not applicable

Controlled Substances Subject to Environment Monitoring

Not applicable

Controlled Substances Subject to Health Examination

Not applicable

Hazardous Substances Subject to Process Safety Management (PSM) Reporting Obligation

Not applicable

K-OSHA Hazardous Substances (Occupational Safety and Health Regulations, Table 1)

Category
Corrosive substances

K-OSHA Hazardous Substances (Occupational Safety and Health Regulations, Table 9)

Category	Manufacturing or handling quantity
Corrosive substances	300 kilogram

Regulation under the Chemicals Control Act

Chemicals of Acute and Chronic Hazard to Human Health and the Environment

Substances Acutely hazardous to humans

Not applicable

Substances Chronically hazardous to humans

Not applicable

Substances Hazardous to the environment

Not applicable

Accident Precaution Chemicals

Not applicable

Toxic Release Inventory

Not applicable

Act on Registration and Evaluation of Chemical Substances (K-REACH)**Restricted Chemicals**

Not applicable

Prohibited Chemicals

Not applicable

Substances subject to intensive control (ARECs)

Not applicable

Substances with Unconfirmed Hazards

Not applicable

Dangerous Substances Safety Management Act

Not Applicable to Dangerous Materials

Wastes Control Act

Industrial general wastes

Follow article 13 of the act to dispose the product waste

Other requirements in domestic and other countries

16. OTHER INFORMATION**Further information**

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Revision number and date

Number of Revision : 8.8

Revision Date : 2026.07.07

Other information : The information is believed to be correct but is not exhaustive and will be used solely as a guideline, which is based on current knowledge of the chemical substance or mixture and is applicable to appropriate safety precautions for the product. It does not represent any guarantee of the properties of the product. Sigma-Aldrich Corporation and its Affiliates shall not be held liable for any damage resulting from handling or from contact with the above product. See www.sigma-aldrich.com and/or the reverse side of invoice or packing slip for additional terms and conditions of sale.
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only.

Date format : yyyy/mm/dd

Full text of other abbreviations

AIIC - Australian Inventory of Industrial Chemicals; ANTT - National Agency for Transport by Land of Brazil; ASTM - American Society for the Testing of Materials; bw - Body weight; CMR - Carcinogen, Mutagen or Reproductive Toxicant; DIN - Standard of the German Institute for Standardisation; DSL - Domestic Substances List (Canada); ECx - Concentration associated with x% response; ELx - Loading rate associated with x% response; EmS - Emergency Schedule; ENCS - Existing and New Chemical Substances (Japan); ErCx - Concentration associated with x% growth rate response; ERG - Emergency Response Guide; GHS - Globally Harmonised System; GLP - Good Laboratory Practice; IARC - International Agency for Research on Cancer; IATA - International Air Transport Association; IBC - International Code for the Construction and Equipment of Ships carrying Dangerous Chemicals in Bulk; IC50 - Half maximal inhibitory concentration; ICAO - International Civil Aviation Organization; IECSC - Inventory of Existing Chemical Substances in China; IMDG - International Maritime Dangerous Goods; IMO - International Maritime Organisation; ISHL - Industrial Safety and Health Law (Japan); ISO - International Organisation for Standardisation; KECI - Korea Existing Chemicals Inventory; LC50 - Lethal Concentration to 50 % of a test population; LD50 - Lethal Dose to 50% of a test population (Median Lethal Dose); MARPOL - International Convention for the Prevention of Pollution from Ships; MERCOSUR - The Agreement for the Facilitation of the Transport of Dangerous Goods; n.o.s. - Not Otherwise Specified; Nch - Chilean Norm; NO(A)EC - No Observed (Adverse) Effect Concentration; NO(A)EL - No Observed (Adverse) Effect Level; NOELR - No Observable Effect Loading Rate; NOM - Official Mexican Norm; NTP - National Toxicology Program; NZIoC - New Zealand Inventory of Chemicals; OECD - Organisation for Economic Co-operation and Development; OPPTS - Office of Chemical Safety and Pollution Prevention; PBT - Persistent, Bioaccumulative and Toxic substance; PICCS - Philippines Inventory of Chemicals and Chemical Substances; (Q)SAR - (Quantitative) Structure Activity Relationship; REACH - Regulation (EC) No 1907/2006 of the European Parliament and of the Council concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals; SADT - Self-Accelerating Decomposition Temperature; SDS - Safety Data Sheet; TCSI - Taiwan Chemical Substance Inventory; TDG - Transportation of Dangerous Goods; TECI - Thailand Existing Chemicals Inventory; TSCA - Toxic Substances Control Act (United States); UN - United Nations; UNRTDG - United Nations Recommendations on the Transport of Dangerous Goods; vPvB - Very Persistent and Very Bioaccumulative; WHMIS - Workplace Hazardous Materials Information System

KR / EN