

SAFETY DATA SHEET
According to OSHA Hazcom Standard 29 CFR 1910.1200
Nitric oxide 180 µmol/mol and 2 others mix / Nitrogen

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1. IDENTIFICATION

A. Product name

- Nitric oxide 180 µmol/mol and 2 others mix / Nitrogen

B. Recommended use and restriction on use

- General use : Not available
- Restriction on use : Not available

C. Manufacturer / Supplier / Distributor information

○ **Manufacturer information**

- Company name : RIGAS Co.,Ltd
- Address : 46,Munpyeongseo-ro 17 beon-gil, Daedeok-gu,Daejeon, KOREA
- Emergency telephone number : 82-42-934-6900

○ **Supplier/Distributor information**

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2. HAZARD IDENTIFICATION

A. GHS Classification

- Gases under pressure : Compressed gas

B. GHS label elements

○ **Hazard symbols**



○ **Signal words**

- Warning

○ **Hazard statements**

- H280 Compressed gas ; Contains gas under pressure; may explode if heated

○ **Precautionary statements**

1) Prevention

- Not applicable

2) Response

- Not applicable

3) Storage

- P410+P403 Protect from sunlight. Store in a well-ventilated place.

4) Disposal

- Not applicable

C. Other hazards which do not result in classification

- Not available

3. COMPOSITION/INFORMATION ON INGREDIENTS

Chemical Name	Trade names and Synonyms	CAS No.	Content(%)
Nitrogen	Nitrogen, Elemental ; Diazyne ; Dinitrogen ; Diatomic nitrogen ;	7727-37-9	Balance
Carbon monoxide	Carbonic oxide ; Carbon monoxide, compressed gas	630-08-0	0.0225
Nitric oxide	Nitrogen oxide (NO) ; Nitric oxide trimer ; Nitrogen(II) oxide ; Nitrosyl radical ; Nitric oxide ;	10102-43-9	0.018
Sulfur dioxide	Sulfur dioxide, liquid ; Sulfur oxide (SO ₂) ; Sulfur superoxide ; Sulfurous acid anhydride ; Sulfurous oxide ;	7446-09-5	0.0081

4. FIRST AID MEASURES

A. Eye contact

- Do not rub your eyes.
- Immediately flush eyes with plenty of water for at least 15 minutes and call a doctor/physician.

B. Skin contact

- Flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes.
- Wash contaminated clothing thoroughly before re-using.

C. Inhalation contact

- Take specific treatment if needed.
- When exposed to large amounts of steam and mist, move to fresh air.

D. Ingestion contact

- Please be advised by doctor whether induction of vomit is demanded or not.
- Rinse your mouth with water immediately.

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

- Not available

F. Notes to physician

- Notify medical personnel of contaminated situations and have them take appropriate protective measures.

5. FIREFIGHTING MEASURES

A. Suitable (Unsuitable) extinguishing media

- Avoid use of water jet for extinguishing
- Dry chemical, carbon dioxide, regular foam extinguishing agent, spray

B. Specific hazards arising from the chemical

- Compressed gas ; Contains gas under pressure; may explode if heated

C. Special protective actions for firefighters

- Avoid inhalation of materials or combustion by-products.
- Cool containers with water until well after fire is out.
- Do not approach the tank surrounded by fire until it is extinguished.
- In case of conflagration, use automatic fire sprinkler. Major fire may require withdrawal, allowing the object itself to burn.
- Keep unauthorized personnel out.

6. ACCIDENTAL RELEASE MEASURES

A. Personal precautions, protective equipment and emergency procedures

- Do not touch spilled material. Stop leak if you can do it without risk.
- Handle the damaged containers or spilled material after wearing appropriate protective equipment
- Move container to safe area from the leak area.
- Must work against the wind, let the upwind people to evacuate.
- Remove all sources of ignition.

B. Environmental precautions

- If large amounts have been spilled, inform the relevant authorities.
- Prevent runoff and contact with waterways, drains or sewers.

C. Methods and materials for containment and cleaning up

- Appropriate container for disposal of spilled material collected.
- Disposal of waste shall be in compliance with the Wastes Control Act
- Large spill : Stay upwind and keep out of low areas. Dike for later disposal.
- Notify the central and local government if the emission reach the standard threshold.

7. HANDLING AND STORAGE

A. Precautions for safe handling

- Avoid contact with incompatible materials.
- Avoid direct physical contact.
- Comply with all applicable laws and regulations for handling
- Dealing only with a well-ventilated place.
- Do not handle until all safety precautions have been read and understood.

B. Conditions for safe storage, including any incompatibilities

- Avoid direct sunlight.
- Check regularly for leaks.
- Do not apply any physical shock to container.
- Do not apply direct heat.
- Do not use damaged containers.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

A. Exposure limits

- o **ACGIH TLV**
 - [Nitrogen] : Asphyxia
 - [Carbon monoxide] : TWA, 25 ppm (29 mg/m³)
 - [Nitric oxide] : TWA, 25 ppm (31 mg/m³)
 - [Sulfur dioxide] : STEL 0.25 ppm (0.65 mg/m³)
- o **OSHA PEL**
 - [Carbon monoxide] : 55
 - [Nitric oxide] : 30
 - [Sulfur dioxide] : 13

B. Engineering controls

- Business owner is recommended to maintain below recommended exposure limits for the working place with general exhaust of gas/vapour/mist/fume.

C. Individual protection measures, such as personal protective equipment

- o **Respiratory protection**
 - Consider warning properties before use.
 - Respiratory protection is ranked in order from minimum to maximum.
- o **Eye protection**
 - Provide an emergency eye wash station and quick drench shower in the immediate work area.
 - Wear primary eye protection such as splash resistant safety goggles with a secondary protection face shield.
- o **Hand protection**
 - Wear appropriate chemical resistant glove.
- o **Skin protection**
 - Wear appropriate chemical resistant protective clothing.
- o **Others**
 - Not available

9. PHYSICAL AND CHEMICAL PROPERTIES

A. Appearance	N₂
- Appearance	gas
- Color	Colorless
B. Odor	odorless
C. Odor threshold	Not available
D. pH	Not available

E. Melting point/Freezing point	-210 °C
F. Initial Boiling Point/Boiling Ranges	-196 °C
G. Flash point	Not available
H. Evaporation rate	Not available
I. Flammability(solid, gas)	Not available
J. Upper/Lower Flammability or explosive limits	Not available
K. Vapour pressure	1 atm (77.347 deg K)
L. Solubility	(1.18E+004mg/L(25°C))
M. Vapour density	0.97 ((air = 1))
N. Specific gravity	0.808 (kg / l at the boiling point of the liquid)
O. Partition coefficient of n-octanol/water	0.67
P. Autoignition temperature	Not available
Q. Decomposition temperature	Not available
R. Viscosity	Not available
S. Molecular weight	28

A. Appearance	CO (Carbon monoxide)
- Appearance	gas
- Color	Colorless
B. Odor	odorless
C. Odor threshold	Not available
D. pH	Not available
E. Melting point/Freezing point	-205 °C
F. Initial Boiling Point/Boiling Ranges	-191 °C
G. Flash point	Not available
H. Evaporation rate	Not available
I. Flammability(solid, gas)	Flammable gas
J. Upper/Lower Flammability or explosive limits	74.2 / 12.5 %
K. Vapour pressure	760 mmHg (-191°C)
L. Solubility	2.3 g/100ml (20°C)
M. Vapour density	0.97 (air=1)
N. Specific gravity	Not available
O. Partition coefficient of n-octanol/water	1.78 (estimated)
P. Autoignition temperature	605 °C
Q. Decomposition temperature	Not available
R. Viscosity	Not available
S. Molecular weight	28.01

A. Appearance	SO2
- Appearance	Gas
- Color	Not available
B. Odor	Pungent odor
C. Odor threshold	0.1-3.0 ppm
D. pH	Not available
E. Melting point/Freezing point	-75.5 °C
F. Initial Boiling Point/Boiling Ranges	-10 °C
G. Flash point	Not available
H. Evaporation rate	(> 1 (butyl acetate = 1))
I. Flammability(solid, gas)	Non-combustible
J. Upper/Lower Flammability or explosive limits	Not available
K. Vapour pressure	330 kPa (20 °C)
L. Solubility	8.5 g/100 ml (25 °C)
M. Vapour density	2.25 (air = 1)
N. Specific gravity	2.811 (Water = 1)
O. Partition coefficient of n-octanol/water	Not available
P. Autoignition temperature	Not available
Q. Decomposition temperature	Not available
R. Viscosity	0.0124 cP (gas: 18 °C (liquid: 0.368 cP (0 °C)))

S. Molecular weight	64.1
A. Appearance	NO
- Appearance	Gas
- Color	Colorless
B. Odor	Sweet odor
C. Odor threshold	Not available
D. pH	Not available
E. Melting point/Freezing point	-163.6 °C
F. Initial Boiling Point/Boiling Ranges	-151.8 °C
G. Flash point	Not available
H. Evaporation rate	Not available
I. Flammability(solid, gas)	Not available
J. Upper/Lower Flammability or explosive limits	Not available
K. Vapour pressure	45600 mm Hg (-94.8 °C)
L. Solubility	(7.4 ml/100 ml, 0 °C)
M. Vapour density	1.04 (air = 1)
N. Specific gravity	1.27 (-150.2 °C (liquid))
O. Partition coefficient of n-octanol/water	Not available
P. Autoignition temperature	Not available
Q. Decomposition temperature	Not available
R. Viscosity	0.0188 cP (25 °C, 101.325 kPa (gas))
S. Molecular weight	Not available

10. STABILITY AND REACTIVITY

A. Chemical Stability

- high-pressure gas; May explode when heated.

B. Possibility of hazardous reactions

- Contact with other combustible material may cause fire.

C. Conditions to avoid

- Avoid : Accumulation of electrostatic charges, Heating, Flames and hot surfaces
- Avoid contact with incompatible materials and condition.
- Avoid contact with heat, sparks, flame or other ignition sources.

D. Incompatible materials

- Not available

E. Hazardous decomposition products

- May emit flammable vapour if involved in fire.

11. TOXICOLOGICAL INFORMATION

A. Information on the likely routes of exposure

- o **Respiratory tracts**
 - Not available
- o **Oral**
 - Not available
- o **Eye/Skin**
 - Not available

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

- o **Acute toxicity**
 - * **Oral**
 - Product (ATEmix) : Not available
 - Not available
 - * **Dermal**
 - Product (ATEmix) : Not available

- Not available
- * **Inhalation**
 - Product (ATEmix) : Not available
 - [Carbon monoxide] : Gas LC50 1300 ppm 4 hr Rat (OECD TG 403)
 - [Nitric oxide] : Gas LC50 100~500 ppm 4 hr (NIER)
 - [Sulfur dioxide] : Gas LC50 1000 ppm 4 hr Mouse
- **Skin corrosion/irritation**
 - Not available
- **Serious eye damage/irritation**
 - Not available
- **Respiratory sensitization**
 - Not available
- **Skin sensitization**
 - Not available
- **Carcinogenicity**
 - * **IARC**
 - [Sulfur dioxide] : Group 3
 - * **OSHA**
 - Not available
 - * **ACGIH**
 - [Sulfur dioxide] : A4
 - * **NTP**
 - Not available
 - * **EU CLP**
 - Not available
- **Germ cell mutagenicity**
 - Not available
- **Reproductive toxicity**
 - Not available
- **STOT-single exposure**
 - Not available
- **STOT-repeated exposure**
 - Not available
- **Aspiration hazard**
 - Not available

12. ECOLOGICAL INFORMATION

A. Ecotoxicity

- **Fish**
 - [Carbon monoxide] : LC50 672.6 mg/L 96 hr (Estimate) (ECHA)
- **Crustaceans**
 - [Carbon monoxide] : LC50 307.5 mg/L 48 hr (Estimate) (ECHA)
- **Algae**
 - [Carbon monoxide] : EC50 124.4 mg/L 96 hr (Estimate) (ECHA)

B. Persistence and degradability

- **Persistence**
 - [Nitrogen] : log Kow 0.67 (NLM/HSDB)
 - [Carbon monoxide] : log Kow 1.78 (Estimate)
- **Degradability**
 - Not available

C. Bioaccumulative potential

- **Bioaccumulative potential**
 - Not available
- **Biodegradation**
 - Not available

D. Mobility in soil

- Not available

E. Other adverse effects

- Not available

13. DISPOSAL CONSIDERATIONS**A. Disposal methods**

- It shall be treated by incineration
- Oil water separation technology shall be applied as pre-waste treatment if it is applicable
- Stabilization and minimization treatment by incineration or similar method can be applied, if more than two kinds of designated wastes are in mixture state and it is impractical to separate them

B. Special precautions for disposal

- Anyone with business license number who generates industrial wastes shall treat the waste by him/herself or by entrusting to the legal entities who treat the wastes, recycle the wastes of others or install and operate the waste treatment facilities according to the Wastes Control Act
- Dispose of waste in accordance with all applicable laws and regulations.

14. TRANSPORT INFORMATION**A. UN No. (IMDG)**

- 1956

B. Proper shipping name

- COMPRESSED GAS, N.O.S.

C. Hazard Class

- 2.2

D. IMDG CODE/IATA DGR Packing group

- Not applicable

E. Marine pollutant

- Not applicable

F. Special precautions for user related to transport or transportation measures

- Local transport follows in accordance with Dangerous goods Safety Management Law.
- Package and transport follow in accordance with Department of Transportation (DOT) and other regulatory agency requirements.
- EmS FIRE SCHEDULE : F-C (Non-flammable gases)
- EmS SPILLAGE SCHEDULE : S-V (Gases (non-flammable, non-toxic))

15. REGULATORY INFORMATION**A. National and/or international regulatory information**

- o **POPs Management Law**
 - [Nitrogen] : Not applicable
 - [Carbon monoxide] : Not applicable
 - [Nitric oxide] : Not applicable
 - [Sulfur dioxide] : Not applicable
- o **Information of EU Classification**
 - * **Classification**
 - [Carbon monoxide] : H220,H280,H331,H360,H372
 - [Sulfur dioxide] : H280,H314,H331
- o **U.S. Federal regulations**
 - * **OSHA PROCESS SAFETY (29CFR1910.119)**
 - [Nitric oxide] : 113.39975 kg 250 lb
 - [Sulfur dioxide] : 453.599 kg 1000 lb
 - * **CERCLA Section 103 (40CFR302.4)**
 - [Nitric oxide] : 4.53599 kg 10 lb

- * **EPCRA Section 302 (40CFR355.30)**
 - [Nitric oxide] : 45.3599 kg 100 lb
 - [Sulfur dioxide] : 226.7995 kg 500 lb
- * **EPCRA Section 304 (40CFR355.40)**
 - [Nitric oxide] : 4.53599 kg 10 lb
 - [Sulfur dioxide] : 226.7995 kg 500 lb
- * **EPCRA Section 313 (40CFR372.65)**
 - Not applicable
- o **Rotterdam Convention listed ingredients**
 - Not applicable
- o **Stockholm Convention listed ingredients**
 - Not applicable
- o **Montreal Protocol listed ingredients**
 - Not applicable

16. OTHER INFORMATION

A. Reference

- The information contained herein is believed to be accurate. It is provided independently of any sale of the product for purpose of hazard communication. It is not intended to constitute performance information concerning the product. No express warranty, or implied warranty of merchantability or fitness for a particular purpose is made with respect to the product or the information contained herein.
- This Safety Data Sheet was compiled with data and information from the following sources: KOSHA, NITE, ESIS, NLM, SIDS, IPCS

B. Issue date

- 2022-08-30

C. Revision number and Last date revised

- 3 times, 2020-01-16

D. Other

- This SDS is prepared according to the Globally Harmonized System (GHS).