RIGAS 리가스
Research Institute of Gas Analytical Science

MATERIAL SAFETY DATA SHEET

NO,SO2,CO in N2

Date of issue: 2016-04-11 **Revision date: 2016-01-18** **Version: 2.0**

1. IDENTIFICATION

A. Product name

- NO,SO2,CO in N2

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 : 142,Munpyeongdong-ro 48 beon-gil, Daedeok-gu,Daejeon, KOREA
- Dept. : Customer Service Dept.
- Telephone number : 82-42-934-6900
- Emergency telephone number : 82-42-934-6900
- Fax number : 82-42-935-8814
- E-mail address : master@rigas.co,kr

○ **Supplier/Distributer information**

- Company name : RIGAS Co.,Ltd
- Address : 142,Munpyeongdong-ro 48 beon-gil, Daedeok-gu,Daejeon, KOREA
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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 : (NFPA Classification)

○ **NFPA grade (0 ~ 4 level)**

- Health : 0, Flammability : 0, Reactivity : 0

3. COMPOSITION/INFORMATION ON INGREDIENTS

Chemical Name	Trade names and Synonyms	CAS No.	Content(%)
Nitrogen	Nitrogen, Elemental	7727-37-9	Balace
Nitric oxide	Nitrogen oxide (NO)	10102-43-9	0.5
Carbon monoxide	Carbonic oxide	630-08-0	0.2
Sulfur dioxide	Sulfur dioxide, liquid	7446-09-5	0.5

4. FIRST AID MEASURES

A. Eye contact

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

B. Skin contact

- Flush skin with plenty of wter for at least 15 minutes while removing contaminated clothing and shoes.
- Laundering enough contaminated clothing before reuse.

C. Inhalation contact

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

D. Ingestion contact

- About whether I should induce vomiting Take the advice of a doctor.
- 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

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

B. Specific hazards arising from the chemical

- high-pressure gas; May explode when heated.

C. Special protective actions for firefighters

- Cool containers with water until well after fire is out.
- Withdraw immediately in case of rising sound from venting safety devices or discoloration of tank.
- Notify your local firestation and inform the location of the fire and characteristics hazard.
- Using a unattended and water devices in case of large fire and leave alone to burn if you do not imperative.
- Avoid inhalation of materials or combustion by-products.

- Keep containers cool with water spray.

6. ACCIDENTAL RELEASE MEASURES

A. Personal precautions, protective equipment and emergency procedures

- Wear proper personal protective apparatus as indicated in Section 8 and avoid skin contact and inhalation.
- Must work against the wind, let the upwind people to evacuate.
- Remove all sources of ignition.

B. Environmental precautions

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

C. Methods and materials for containment and cleaning up

- Large spill : Stay upwind and keep out of low areas. Dike for later disposal.
- Notification to central government, local government. When emissions at least of the standard amount
- Dispose of waste in accordance with local regulation.
- Appropriate container for disposal of spilled material collected.

7. HANDLING AND STORAGE

A. Precautions for safe handling

- Wash thoroughly after handling.
- Since emptied containers retain product residue(vapor, liquid, solid) follow all MSDS and label warnings even after container is emptied.
- Get the manual before use.
- Operators should wear antistatic footwear and clothing.

B. Conditions for safe storage, including any incompatibilities

- Do not use damaged containers.
- Do not apply direct heat.
- Save applicable laws and regulations.
- Do not apply any physical shock to container.
- Avoid direct sunlight.
- Store in well ventilated area.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

A. Exposure limits

○ **ACGIH TLV**

- [Carbon monoxide] : TWA 25 ppm
- [Sulfur dioxide] : TWA 2 ppm
- [Nitric oxide] : TWA 25 ppm

B. Engineering controls

- A system of local and/or general exhaust is recommended to keep employee exposures above the Exposure Limits. Local exhaust ventilation is generally preferred because it can control the emissions of the contaminant at its source, preventing dispersion of it into the general work area. The use of local exhaust ventilation is recommended to control emissions near the source.

C. Personal protective equipment

○ **Respiratory protection**

- Under conditions of frequent use or heavy exposure, Respiratory protection may be needed.
- Respiratory protection is ranked in order from minimum to maximum.
- Consider warning properties before use.

○ **Eye protection**

- Wear primary eye protection such as splash resistant safety goggles with a secondary protection face shield.
- Provide an emergency eye wash station and quick drench shower in the immediate work area.

○ **Hand protection**

- Wear appropriate chemical resistant glove.

○ **Skin protection**

- Wear appropriate chemical resistant protective clothing.

○ **Others**

- Not available

9. PHYSICAL AND CHEMICAL PROPERTIES

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 ℃
F. Initial Boiling Point/Boiling Ranges	-151.8 ℃
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 ㎜ Hg (-94.8 ℃)
L. Solubility	(7.4 ml/100 ml, 0 ℃)
M. Vapour density	1.04 (air = 1)
N. Specific gravity	1.27 (-150.2 ℃ (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 ℃, 101.325 kPa (gas))
S. Molecular weight	Not available

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 ℃
F. Initial Boiling Point/Boiling Ranges	-10 ℃
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 ㎪ (20 ℃)
L. Solubility	8.5 g/100 ㎖ (25 ℃)
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 ℃ (liquid: 0.368 cP (0 ℃)))
S. Molecular weight	64.1

A. Appearance	**CO**
- Appearance	gas
- Color	Colorless
B. Odor	odorless
C. Odor threshold	Not available

D. pH	Not available
E. Melting point/Freezing point	-205 ℃
F. Initial Boiling Point/Boiling Ranges	-191 ℃
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 ㎜Hg (-191℃)
L. Solubility	2.3 g/100㎖ (20℃)
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 ℃
Q. Decomposition temperature	Not available
R. Viscosity	Not available
S. Molecular weight	28.01

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 ℃
F. Initial Boiling Point/Boiling Ranges	-196 ℃
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℃))
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

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 contact with incompatible materials and condition.
- Avoid : Accumulation of electrostatic charges, Heating, Flames and hot surfaces
- 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

○ **(Respiratory tracts)**
- Not available

○ **(Oral)**
- Not available

○ **(Eye·Skin)**
- Not available

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

○ **Acute toxicity**

*** Oral**
- Not available

*** Dermal**
- Not available

*** Inhalation**
- [Carbon monoxide] : gas LC50 1805 ppm 4 hr Rat
- [Sulfur dioxide] : LC50 2520 ppm 1 hr Rat (White Rat)
- [Nitric oxide] : gas LC50 870 ppm 4 hr Rat

○ **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**
- Not available

○ **Crustaceans**
- Not available

○ **Algae**

- Not available

B. Persistence and degradability

○ **Persistence**

- [Nitrogen] : log Kow 0.67
- [Nitric oxide] : log Kow not available
- [Carbon monoxide] : log Kow 1.78 (Estimates)

○ **Degradability**

- Not available

C. Bioaccumulative potential

○ **Bioaccumulative potential**

- Not available

○ **Biodegration**

- Not available

D. Mobility in soil

- Not available

E. Other adverse effects

- Not available

13. DISPOSAL CONSIDERATIONS

A. Disposal methods

- Since more than two kinds of designaed waste is mixed, it is difficult to treat seperatly, then can be reduction or stabilization by incineration or similar process.
- If water separation is possible, pre-process with Water separation process.
- Dispose by incineration.

B. Special precautions for disposal

- The user of this product must disposal by oneself or entrust to waste disposer or person who other’s waste recycle and dispose, person who establish and operate waste disposal facilities.
- 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 Packing group

- Not available

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

○ **POPs Management Law**

- Not applicable

○ **Information of EU Classification**

*** Classification**

- [Carbon monoxide] : F+; R12 Repr. Cat. 1; R61 T; R23-48/23
- [Sulfur dioxide] : T; R23 C; R34

*** Risk Phrases**

- [Carbon monoxide] : R61, R12, R23, R48/23
- [Sulfur dioxide] : R23, R34

*** Safety Phrase**

- [Carbon monoxide] : S53, S45
- [Sulfur dioxide] : S1/2, S9, S26, S36/37/39, S45

○ **U.S. Federal regulations**

*** OSHA PROCESS SAFETY (29CFR1910.119)**

- [Sulfur dioxide] : 453.599 kg 1000 lb
- [Nitric oxide] : 113.39975 kg 250 lb

*** CERCLA Section 103 (40CFR302.4)**

- [Nitric oxide] : 4.53599 kg 10 lb

*** EPCRA Section 302 (40CFR355.30)**

- [Sulfur dioxide] : 226.7995 kg 500 lb
- [Nitric oxide] : 45.3599 kg 100 lb

*** EPCRA Section 304 (40CFR355.40)**

- [Sulfur dioxide] : 226.7995 kg 500 lb
- [Nitric oxide] : 4.53599 kg 10 lb

*** EPCRA Section 313 (40CFR372.65)**

- Not applicable

○ **Rotterdam Convention listed ingredients**

- Not applicable

○ **Stockholm Convention listed ingredients**

- Not applicable

○ **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

- 2014-02-11

C. Revision number and Last date revised

- 2 times, 2016-01-18

D. Other

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