

MSDS(MATERIAL SAFETY DATA SHEET)

SECTION 1. PRODUCT AND COMPANY INFORMATION

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| COMPANY NAME : TAEYANG INDUSTRIAL CO., LTD. | TEL : 041) 621-9810 FAX : 041) 621-9822, 9827 |
| ADDRESS : 485-5 Upseong-dong , Cheonan, Choongnam, Korea | D.O.T SHIPMENT NAME : Gas(Butane) Cartridge |
| PRODUCT AND BRAND NAME : MSR 110g | CLASS 2.1, FLAMMABLE GAS : UN1075 |
| CREATION DATE : APR. 23. 2012 | REVISION DATE : |

SECTION 2. COMPOSITION & INGREDIENTS DATA

| Chemical Ingredients Name | Trade Term/Synonym | Cas No. | Approximate Weight % |
|---------------------------|-----------------------------------|----------|----------------------|
| Propane | n-propane, propylhydride | 74-98-6 | 24.87wt% |
| Iso-Butane | 2-methylpropane, trimethylmethane | 75-28-5 | 71.97wt% |
| N-Butane | butane, liquefied petroleum gas | 106-97-8 | 3.16wt% |

SECTION 3. HAZARD INFORMATION

CERCLA Index (0~3) : health=1, fire=3, reactivity=0, durability=0

NFPA Index (0~4) : health=1, fire=4, reactivity=0

■ Emergency overview

- Colorless and odorless but may affect central nervous system
- Occasionally smells like rotten garlic
- If inhaled, it may cause anoxia symptoms
- Flammable gas and may cause a fire
- Need to be separated from the ignition source
- Shall not be contacted with eye, skin, and clothes
- Avoid gas inhalation
- Used under proper ventilation
- Closed well with a container's cap
- Physical hazard : Flammable gas, and it may cause a spark and explode if exposed to heat

■ Potential health effects

o Inhalation

- Short term exposure : Irritation, nausea, vomiting, difficulty in breathing, headache, drowsiness, symptoms of drunkenness, tingling, suffocation, coma
- Long term exposure : No data on adverse effects

o Skin contact

- Short term exposure : May cause blister, frostbite or paralysis
- Long term exposure : No data on adverse effects.

o Eye contact

- Short term exposure : May cause Frostbite or vision problem
- Long term exposure : No data

o Ingestion

- Short term exposure : May cause frostbite
- Long term exposure : No data

■ Cancerogenic status

- o Industry safety and health law : Not specified
- o Occupational Safety and Health Administration (OSHA) : Not specified
- o National Toxicology Program (NTP) : Not specified
- o International Agency For Research on Cancer (IARC) : Not specified

SECTION 4. FIRST AID MEASURES

■ Inhalation

- Move from the exposed areas immediately.
- Artificial respiration if needed
- Secure the airway, maintain blood pressure, and inhale oxygen if possible
- Keep a patient in a warm and comfortable condition
- Treat appropriately depending on the symptoms
- Take a proper medical action

■ Skin contact

- Thoroughly wash off with soft detergent and much water (15~20 minutes)
- If there are symptoms such as frostbite and freezing, take the following process
- Warm the affected part with warm water of 107F(41.7℃)
- Gently wrap the affected part in blanket
- Take an immediate medical action

■ Eye contact

- Wash eyes immediately with much water or saline solution until no chemicals remain
- Take an immediate medical action

■ Ingestion

- Treat properly based on the symptoms
- Take an immediate medical action

■ Information on doctor

- Antidote : No specific antidote exists (General or supportive therapy may be done based on the symptoms)

SECTION 5. MEASURES FOR EXPLOSION & FIRE

■ Explosion & fire hazard

- May burst or explode if exposed to heat or spark
- Heavier than the air, and there is a possibility of ignition and backfire
- Container may explode by heat or fire
- Mixture of gas & air may explode
- Low electrical conduction may cause static electricity, and ignited by a spark

■ Fire extinguisher - Powder fire extinguisher, carbondioxide (Use water or fog in case of a blaze)

■ Extinguishing a fire

- If not dangerous, remove from a fire area
- After putting out a fire, sprinkle a cooling water in the side of the container which is exposed by heat
- Escape from the end of tank
- Use a fire hose or monitor nozzle if a blaze occurs in the stored area, and leave it burned if difficult
- Immediately remove if the size of blaze grows bigger or the tank is discolored by heat
- Leave it burned and isolate by more than 1 mile if we cannot stop the spills from gas tank, and tank lorry
- Extinguish it if the gas spills can be stopped
- Use much water in a form of fog from a long distance
- Don't inhale the smoke from the burning materials with one's back against the wind
- Keep away outside a 5-mile radius (1/3 mile) if fire is out of control or the container is exposed to a flame

■ Harmful combustion product

Pyrolysis product may include a harmful carbon oxidized substance

SECTION 6. MEASURES FOR LEAKAGE ACCIDENT

■ Occupational leakage

- Avoid heat, flame, spark and other source of ignition
- Do not touch a spilled material
- Do it if you can stop a spilled material with safety
- Sprinkle water in order to reduce vapor
- Isolate the area until the gas disperses
- Prohibit smoke, flame or fire at the dangerous area
- No entry to unauthorized persons, and isolate the dangerous and restricted area
- Ventilate the closed place before entering

SECTION 7. HANDLING AND STORAGE MEASURES

- Store and handle in accordance with the regulations of a central government and local autonomous entity
 - Store based on 29CFR 1910.106
- o Ground(Earth) connection
- Store the materials with low electric conductivity in the container which meets ground connection standards according to NFPA77-1983
 - Recommend a practical training against static electricity
 - Please isolate and store the materials separated from other materials which shall not be put together at the same time

SECTION 8. EXPOSURE PREVENTION & PROTECTIVE DEVICE

- Exposure standard (TWA)
Industry safety & health law

Propane :

- 1000ppm(1800mg/m³) OSHA TWA
- 2500ppm ACGIH TWA
- 1000ppm(1800mg/m³) NIOSH recommendation TWA 10hours
- 1800mg/m³ (1000mL/m³) DFG MAK (Peak limit assortment grade -, deviation factor 2)

N-Butane :

- TWA : 800ppm, 1900mg/m³
- STEL : -

- 800ppm(1900mg/m³) OSHA TWA (JUN. 30,1993, Invalid by 58 FR 35338)
- 800ppm ACGIH TWA
- 800ppm(1900mg/m³) NIOSH recommendation TWA 10hours
- 2400mg/m³ (1000mL/m³) DFG MAK (Peak limit assortment grade - II , deviation factor 4)

ISO-Butane :

- 800ppm(1900mg/m³) ACGIH TWA
- 800ppm(1900mg/m³) NIOSH recommendation TWA 10hours
- 2400mg/m³ (1000mL/m³) DFG MAK (Peak limit assortment grade - II , deviation factor 4)

LPG : Liquified Petroleum Gas

- 1000ppm(1800mg/m³) OSHA TWA
- 1000ppm ACGIH TWA
- 1000ppm(1800mg/m³) NIOSH recommendation TWA 10hours

■ Ventilation

- Set up a partial ventilation or general diluted ventilation equipment.
- Install explosion-screening facilities for the relevant ventilation equipment if there is a possibility of explosion for the material

■ Eye protection

- For the gas, eye protection not required, but recommended.
- For the liquid, spray or dust protective goggles are needed to avoid a direct contact with foreign materials
- Contact lense shall not be used

■ Emergency eye washing

- Employer shall install a washing equipment and shower stall near the work place because possibly employee's eye can be exposed to foreign materials

■ Protection clothes

- For gas, protective clothing is not necessary
- In case of possible contact with liquid, employee must wear proper protection clothes and equipment in order to prevent a skin from freezing

■ Protection gloves

- Wear insulated gloves and gloves against the cold

■ Respirator

- Below respirator and maximum use concentration is recommended by NIOSH guide or allowance standard report about chemical hazard established by America Health and Human Services Department
- Specifically-selected respirator shall be based on pollutant density in a work place, and does not exceed the operation limit of respirator, and finally approved by NIOSH and NSHA at the same time

LPG (Liquified Petroleum Gas)

o 10,000ppm : Air-supply respirator, self-support respirator

o 19,000ppm : Respirator operated by continuous flow form

Whole self-support respirator

Whole air-supply respirator

Whole air-supply respirator operated continuously by oil pressure

o Shelter : Shelter-type self-support respirator

o If there is a urgent danger to life or health,

- Operated by inhalation & ventilation resistance or positive pressurization as all of the self-support respirators
- Inhalation & ventilation resistance supportively equipped with self-support respirator operated by inhalation & ventilation resistance or positive pressurization
- Whole air-supply respirator operated by positive pressurization

SECTION 9. PHYSICAL AND CHEMICAL DATA

| Component | N-Butane | Iso-Butane | Propane |
|-------------------------------------|---------------------------|-------------------|--------------------------|
| Physical condition*1 | liquid & vapor | liquid & vapor | liquid & vapor |
| Color | colorless | colorless | colorless |
| Smell*2 | odorless | odorless | odorless |
| Time to smell | no way to know | no way to know | no way to know |
| PH | not applicable | not applicable | not applicable |
| Melting point | -138.3°C | -160°C | -187.7°C |
| Boiling point | -0.5°C | -11.5°C | -42.1°C |
| Flashing point | -73.3°C | -88.0°C | -104.4°C |
| Evaporation rate | 100% | 100% | 100% |
| Flammability | no way to know | no way to know | no way to know |
| Explosion limit concentration | Upper 8.4 vol% | Upper 8.4 vol% | Upper 9.5 vol% |
| | Lower 1.9 vol% | Lower 1.8 vol% | Lower 2.2 vol% |
| Vapor pressure | 0.214MPa @21.1°C | 0.304MPa @20°C | 0.75MPa @20°C |
| Vapor density | 2.1(air=1) | 2.595(air=1) | 1.55(air=1) |
| Specific gravity | 0.549(H2O=1)@20°C | 0.549(H2O=1)@20°C | 0.501(H2O=1)@20°C |
| Solubility | 3.25ml/100ml(20°C, water) | no way to know | 0.007g/100ml(20°C,water) |
| Partition factor N-octanol/water | 2.89 as log POW | 2.8 as log POW | 2.36 as log POW |
| Ignition point | 287°C | 460°C | 466.1°C |
| Decomposition temperature | no way to know | no way to know | no way to know |

* Component has no smell, but a little odorant is added

SECTION 10. STABILITY AND REACTIVITY

■ Reactivity

- Stable at a normal temperature and pressure

■ Condition to be avoided

- Avoid a contact with heat, flame, spark and other sources of ignition

- Vapor has a explosiveness
- Do not contact with a skin
- May cause frostbite
- Because of a pressure, containers may be burst if exposed to heat, and thus could move to a long distance

■ Material to be avoided

- Strong oxidizer : Hazard of fire, explosion
- Nitric acid, chlorine dioxide : Material to be avoided
- Carbonyl nickel & acid : Explode at 20~40℃

■ Dangerous decomposition product

- Pyrolysis product may contain poisonous carbon oxidized substance

■ Polymerization reaction

- No data at a normal temperature and pressure

SECTION 11. TOXICOLOGICAL DATA

■ Toxicological data

Propane :

- LA50 : 6960mg/kg, inhalation – rat

Iso-Butane :

- LC50 : 57pph/15min , inhalation – rat

N-Butane :

- LC50 : 658mg/m³/45min , inhalation – rat
- LC50 : 680mg/m³/2hours , inhalation – mouse

■ Carcinogenicity

Industry safety & health law : No data

■ Acute toxicity level

No toxicity by inhalation (little toxicity by ingestion)

■ Effect on target organs

Simple asphyxiant, and central nervous system suppressant

■ Additional data

Stimulant like epinephrine may cause ventricular fibrillation

■ Effect on health

o Inhalation : Asphyxiant/anesthetic

- Acute exposure

It may cause headache, dullness, difficulty in breathing, drowsiness, and losing consciousness

If exposed under 1% concentration for 10 minutes, it may cause drowsiness or dizziness

High concentration may cause suffocation, difficulty in breathing, nausea, vomiting, coma, spasm, and paralysis

19,000ppm concentration may cause immediate danger to life or health

- Chronic exposure : No data

o Skin contact

- Acute exposure : Contact with liquid may cause frostbite, ache, and water blister
- Chronic exposure : May cause symptoms the same as acute exposure

o Eye contact

- Acute exposure : Contact with liquid may cause frostbite, ache, and eyesight loss
- Chronic exposure : May cause symptoms the same as acute exposure

o Ingestion

- Acute exposure : Gas ingestion is not likely to occur, but if you swallow the liquid, it may cause frostbite on the lips, mouth, and membrane
- Chronic exposure : No data

SECTION 12. ENVIRONMENTAL EFFECT

- o Environmental effect index (0~4) : No data
- o Acute water system toxicity : No data
- o Resolvability : No data
- o BCF : No data
- o Log water/octanium distribution index : No data

SECTION 13. DIRECTIONS FOR DISPOSAL

- Comply with a central government and local autonomous entity regulations
- Disposal shall be executed by a standard of 40CFR 262 applied for hazardous waste generator
- EPA hazardous waste No. D001

SECTION 14. INFORMATION FOR TRANSPORTATION

- o UN harmfulness grade classification : 2.1
- o UN packing group : -
- o UN DOT harmfulness grade classification (40CFR 172.101) : Flammable gas
- o UN DOT indication standard (40CFR 172.101 & Subpart) : Flammable gas
- o UN DOT shipping name & ID number (40CFR 172.101) :
 - Propane : LPG, UN1075
 - Iso-Butane : Iso-Butane, UN1999
 - N-Butane : N-Butane or N-Butane mixture UN1011
- o UN DOT packing standard (40CFR 172.101)
- o UN DOT restriction quantity (40CFR 172.101)
 - Passenger plane or train : Prohibited
 - Cargo plane : 150kg

SECTION 15. DETAILS ON LEGISLATION

■ Korea

- o Industry safety & health law : Allowable concentration
- o Control law of hazardous chemical materials : -
- o Fire Services Act : -

■ USA

- o TSCA : Stipulated
- o CERCLA clauses 103(40CFR 302.4) : Not stipulated
- o SARA clauses 302(40CFR 355.30) : Not stipulated
- o SARA clauses 304(40CFR 355.400) : Not stipulated
- o SARA clauses 313(40CFR 372.62) : Not stipulated
- o OSHA process safety management (29CFR 1910.119) : Not stipulated
- o California clause 65 (drinking water disposal regulation) : Not stipulated
- o SARA harmfulness category : SARA WP311/312 clause (40CFR 370.21)
 - Acute harmfulness : Exist
 - Chronic harmfulness : Not exist
 - Fire hazard : Exist
 - Reaction hazard : Not exist
 - Sudden eruption hazard : Exist

SECTION 16. DIRECTIONS FOR PRODUCT

■ **Precautions in handling and storage**

- Do not expose to heat and store at below 40℃ in an airy place
- Please pay attention in order to avoid a cut on the finger by groove
- In case the product drops on the ground, be careful about deformation of nozzle and gas leakage
- After use, please separate the product in order to avoid an explosion by radiant heat
- keep out of reach of children.
- Do not put such things as iron plate, stone plate, aluminum foil, which have much radiant heat, above the product covers
- Use in an airy place since a use in the airtight place may cause explosion and suffocation
- Do not spray or inhale to human body and avoid an impact on the product

* Please read and follow the directions on the product label

SECTION 17. OTHER REFERENCES

■ Data source : GS Caltex Corporation, Korea Petro Chemical Ind. Co., Ltd., Korea Occupational Safety & Health Agency

* The above information is correct as far as we know.

The company has no responsibility for injuries or damages caused by an inappropriate use