



Material Safety Data Sheet

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1,3-Butadiene

1. Chemical Product & Company identification

- A. Product Name : **1,3-Butadiene**
- B. Intended Use : Production of BR, SBR and rubber
Restriction in use : Do not use for purposes other than those recommended
- C. Manufacturer/Supplier :

1) Manufacturer :

Hanwha TotalEnergies Petrochemicals Co.,Ltd			
103, Dokgot2-Ro, Daesan-Eup, Seosan-Si, Chungnam, 31900, Korea			
T e l e p h o n e	82-41-660-6415	F a x	82-41-660-6637

2) Supplier : (Product information: 041-660-6180)

Hanwha TotalEnergies Petrochemicals Co.,Ltd			
17~20F Hanwha Finance Plaza, 92, Sejong-daero, Jung-gu, Seoul 04525, Korea			
T e l e p h o n e	82-2-3415-9363	F a x	82-2-3415-9370

3) Competitive person:

Departments	Safety & Health Planning Team		
T e l e p h o n e	82-41-660-6390,6382	F a x	82-41-660-6348

2. Hazard Identification

- A. Hazard Category :
- 1) Physicochemical Hazards
 - Flammable liquid : Category 1
 - High-pressure gas : liquid gas
 - 2) Health Hazards :
 - Carcinogenicity : Category 1A
 - Germ cell mutagenicity : Category 1B
 - Specific target organ toxicity(Single exposure) : Category 3 (Respiratory tract irritation)
 - Specific target organ toxicity(Repeated exposure) : Category 2
 - 3) Environmental Hazards : Not Classified

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B. Precautionary Statement(s) & Warning Label

1) Symbol :



2) Signal Word : Danger

3) Hazard Statement(s) :

H220 Extremely flammable gas.

H280 Contains gas under pressure; may explode if heated.

H335 May cause respiratory irritation.

H340 May cause genetic defects.

H350 May cause cancer.

H373 May cause drowsiness and dizziness.

4) Precautionary Statement(s) :

■ Prevention

P201 Obtain special instructions before use.

P202 Do not handle until all safety precautions have been read and understood.

P210 Keep away from heat/sparks/open flames/hot surfaces. No smoking.

P260 Do not breathe dust/fume/gas/mist/vapours/spray.

P261 Avoid breathing dust/fume/gas/mist/vapours/spray.

P271 Use only outdoors or in a well-ventilated area.

P280 Wear protective gloves/protective clothing/eye protection/face protection.

■ Response

P304+P340 IF INHALED: Remove person to fresh air and keep comfortable for breathing.

P308+P313 If exposed or concerned: Get medical advice/attention.

P312 Call a POISON CENTER or doctor/physician if you feel unwell.

P314 Get medical advice/attention if you feel unwell.

P377 Leaking gas fire: Do not extinguish, unless leak can be stopped safely.

P381 Eliminate all ignition sources if safe to do so.

■ Storage

P403 Store in a dry place.

P403+P233 Store in a well-ventilated place. Keep Container tightly closed.

P405 Store locked up.

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



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■ Disposal

P501 Dispose of contents/container in accordance with local/regional/national/international regulation

C. Other hazards

NFPA ratings: Health=2, Flammability=4, Instability=0, Special=--

3. Composition / Information on ingredients

Chemical Name	Other Name	CAS No. or EU No.	(%)
Butadiene	1,3-Butadiene	106-99-0 (EU No.203-450-8)	100%

4. First Aid Measures

A. Eye Contact :

- Flush thoroughly with running water at least 15minutes.
- Get medical advice/attention.

B. Skin Contact :

- Flush immediately with water
- Call a poison center or doctor/physician you feel unwell.
- Remove and isolate contaminated clothing and shoes.
- In case of burns, immediately cool affected skin for as long as possible with cold water. Do not remove clothing if adhering to skin.
- In case of worn statues, keep warm and conduct a variety of topical therapy.
- In case of contact with liquid gas, make the affected area with lukewarm water.
- Contact with gas or liquefied gas may cause burns, severe injury and/or frostbite.

C. Inhalation :

- Move to a place with a fresh air.
- If exposed or concerned: Get medical advice/attention.
- If exposed to excessive levels of dusts or fumes, remove to fresh air and get medical attention if cough or other symptoms develop.
- Give artificial respiration if victim is not breathing.
- Administer oxygen if breathing is difficult.



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D. Ingestion :

- If concerns contact and exposure, get medical advice/attention.

E. Likely Acute or Delayed Symptoms/Effects :

1) Inhalation

- Short term exposure : respiratory tract irritation, nausea, vomiting, blurred vision, headache, fatigue, unconsciousness
- Long term exposure : respiratory tract irritation, nausea, vomiting, blurred vision, headache, fatigue, unconsciousness

2) Skin contact

- Short term exposure : irritation, frostbite
- Long term exposure : irritation, frostbite

3) Eye contact

- Short term exposure : irritation, redness, excess tearing, freezing
- Long term exposure : irritation, redness, excess tearing, freezing

4) Ingestion

- Short term exposure : Not available
- Long term exposure : Not available

F. Emergency measure / Notes to physician :

- Notify medical personnel of contaminated situations and have them take appropriate protective measures.
- If exposed or concerned, get medical attention/advice.

5. Fire Fighting Measures

A. Extinguishing media :

1) Suitable extinguishing media

: Use alcohol foam, carbon dioxide, water spray, dry sand

2) Unsuitable extinguishing media : Not available

3) Unusual fire(big fire) : Do use extinguishing media with water spray.

B. Unusual fire & Explosion hazard :

1) Hazardous combustion product : Carbon oxides (carbon monoxide, carbon dioxide)

2) Fire & Explosion hazard :

- Extremely flammable gas
- Contains gas under pressure; may explode if heated.
- May decompose at high temperatures into forming toxic gases.



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- May violently polymerize and result in fire and explosion.
- Containers may explode when heated.
- May form explosive mixtures with air.
- Will be easily ignited by heat, sparks or flames.
- Vapors may travel to source of ignition and flash back.
- Silane will ignite spontaneously in air.
- Some may be irritating if inhaled at high concentrations.
- Vapors may cause dizziness or asphyxiation without warning.

C. Special fire fighting procedure / protection of firefighters :

- Leaking gas fire: Do not extinguish, unless leak can be stopped safely.
- Eliminate all ignition sources if safe to do so.
- Rescuers should put on appropriate protective gear
- Evacuate area and fight fire from a safe distance.
- Vapors from liquefied gas are initially heavier than air and spread along ground.
- Ruptured cylinders may rocket.
- Stop leak if you can do it without risk.
- Move containers from fire area if you can do it without risk.
- Fire involving Tanks: Do not direct water at source of leak or safety devices; icing may occur.
- Fire involving Tanks: Fight fire from maximum distance or use unmanned hose holders or monitor nozzles.
- Fire involving Tanks: Withdraw immediately in case of rising sound from venting safety devices or discoloration of tank.
- Fire involving Tanks: Always stay away from tanks engulfed in fire.
- Fire involving Tanks: For massive fire, use unmanned hose holders or monitor nozzles; if this is impossible, withdraw from area and let fire burn.

6. Accidental Release Measures

A. Personal precautions :

- Inform the discharge information to the central government and local governments to drain over reference amount.
- Avoid breathing dust/fume/gas/mist/vapours/spray.
- The very fine particles may cause a fire or explosion, eliminate all ignition sources.
- Clean up spills immediately, observing precautions in Protective Equipment section.
- Keep unnecessary and unprotected personnel from entering.
- If possible, turn leaking containers so that gas escapes rather than liquid.
- Isolate area until gas has dispersed.



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- Do not touch or walk through spilled material.
- Do not direct water at spill or source of leak.
- Eliminate all ignition sources.
- Use water spray to reduce vapors or divert vapor cloud drift. Avoid allowing water runoff to contact spilled material.
- All equipment used when handling the product must be grounded.
- Stop leak if you can do it without risk.

B. Environmental precautions :

- Prevent entry into waterways, sewers, basements or confined areas.

C. Spill cleanup methods :

- Dike and collect water used to fight fire.
- Absorb spills with inert material (e.g., dry sand or earth), then place in a chemical waste container.
- Absorb the liquid and scrub the area with detergent and water.

7. Handling and Storage

A. Handling :

- Keep away from putting pressure, cut, weld, braze, solder, drill, grind or expose such containers to heat, flame, sparks, static electricity, or other sources of ignition.
- Do not handle until all safety precautions have been read and understood.
- Avoid breathing dust/fume/gas/mist/vapours/spray.
- Use only outdoors or in a well-ventilated area.
- Follow all MSDS/label precautions even after container is emptied because they may retain product residues.
- Loosen closure cautiously before opening.

B. Storage :

- Keep container tightly closed.
- Protect from sunlight. Store in a well-ventilated place.
- Keep away from incompatible materials
- Empty drums should be completely drained, properly bunged, and promptly returned to a drum reconditioner, or properly disposed of.
- Containers can build up pressure if exposed to heat (fire).
- Storage regulations of the United States : U.S. OSHA29 CFR 1910.101. Grounding required.



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8. Exposure Controls / Personal Protection

A. Exposure limit value :

- 1) ACGIH :
 - TLV-TWA : 2 ppm
- 2) OSHA :
 - TWA : 1 ppm
 - STEL : 5 ppm
- 3) NIOSH :
 - 2000 ppm IDLH(10%LEL)
- 4) Biological exposure index : Not available
- 5) EU regulation :
 - Bulgaria : TWA = 50mg/m³, STEL = 100mg/m³
 - Belgium : TWA = 2ppm (4.5mg/m³)
 - Denmark : TWA = 10ppm (22mg/m³)
- 6) Other
 - Australia : TWA = 10ppm (22mg/m³)
 - Bahrain : TWA = 50ppm (73mg/m³)
 - Brazil : TWA = 780ppm (12.5mg/m³)

B. Engineering control :

- Use process enclosures, local exhaust ventilation, or other engineering controls to control airborne levels below recommended exposure limits
- If user operations generate dust, fume, or mist, use ventilation to keep exposure to airborne contaminants below the recommended exposure limit.
- Please make sure that the appropriate exposure limits.

C. Personal protective equipment

- 1) Respiratory protection :
 - Wear NIOSH or European Standard EN 149 approved full or half face piece (with goggles) respiratory protective equipment when necessary
- 2) Eye protection
 - Wear enclosed safety goggles to protect from gaseous state organic material causing eye irritation or other disorder.
 - An eye wash unit and safety shower station should be available nearby work place.
 - Do not wear contact lenses.



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3) Hand protection

- Wear appropriate protective gloves by considering physical and chemical properties of chemicals.(Butyl rubber gloves are recommended)

4) Skin / Body protection

- Wear appropriate protective gloves by considering physical and chemical properties of chemicals

9. Physical and Chemical Properties

- A. Appearance(physical state, color etc.) : colorless gas
- B. Odor : characteristic odor
- C. Odor Threshold : Not available
- D. pH : Not available
- E. Melting point/Freezing point : -109°C
- F. Boiling point/range : -4°C
- G. Flash point : -76°C
- H. Evaporation rate : >25 (Butyl acetate=1)
- I. Flammability (solid, liquid): Flammable
- J. Flammability Limit (lower/upper) : 1.1% ~ 16.3%
- K. Vapor pressure : 1870mmHg(21 $^{\circ}\text{C}$), 2110mmHg(25 $^{\circ}\text{C}$)
- L. Solubility in water : 0.0735g/100ml (20 $^{\circ}\text{C}$)
- M. Vapor density(Air=1) : 1.9
- N. Specific gravity : 0.6
- O. Partition Coefficient(n-Octanol/water) : 1.99
- P. Auto-ignition temperature : 414 $^{\circ}\text{C}$
- Q. Thermal decomposition : Not available
- R. Viscosity : 0.00754cP(25 $^{\circ}\text{C}$)
- S. Molecular weight : 54.09

10. Stability and Reactivity

A. Chemical Stability and Possibility of hazardous reactions:

- It can be polymerized.
- Avoid heat, storage and use in contact with light or above room temperature.
- Closed containers may rupture violently.

B. Conditions to avoid :

- Containers can build up pressure if exposed to heat (fire).



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- The cylinder exposed fire can be a combustible gas discharge.

D. Incompatible material :

- Metal carbides, Metallic salts, flammable material, Metals, Oxidizing agents, halogen, Metal oxides, heat, blaze, flame or other ignition source.

E. Hazardous decomposition products :

- Hydrocarbon compounds, Carbon oxides(carbon monoxide, carbon dioxide)
- Irritation, corrosion, toxic gas

11. Toxicological Information

A. Route of exposure

- 1) Inhalation : Not available.
- 2) Ingestion : Not available
- 3) Skin/Eye contact : Not available

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

- 1) Acute toxicity : Not classified
 - Oral : Not available
 - Dermal : Not available
 - Inhalation : Rat, LD₅₀ (4hr) = 285 mg/l
- 2) Skin corrosion/irritation : Not available
- 3) Serious eye damage/irritation : Not classified
 - 1,3-Butadiene is non-irritant to the rabbit eyes.
- 4) Respiratory sensitization : Not available
- 5) Skin sensitization : Not available
- 6) Carcinogenicity : Category 1A
 - NTP : K
 - IARC(GROUP) : 1
 - ACGIH : A2
 - EC : 1A
- 7) Germ cell mutagenicity : Category 1B
 - *in vitro* : Bacterial reverse mutation assay(OECD TG 471), Mammalian Chromosome Aberration Test(OECD TG 473): with/without metabolic activation: Positive
 - *in vivo* : Dominant lethal assay(OECD TG 478), micronucleus Test on red blood cell in mammal(OECD TG 474): Positive
- 8) Reproductive toxicity : Not classified
 - In toxicity test to reproduction with rats, clinical observations indicative of



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chromodacryorrhea, chromorhinorrhea, and salivation were observed in F0 males and females at 6000 ppm. There were no treatment-related effects on body weight parameters in F0 females at any dose levels or F0 males at 300ppm but treatment-related decreases in body weights and body weight gains were observed in F0 males at 1500 and 6000 ppm. (NOEC=2,212 mg/m³) (EU Method B.31, GLP)

9) STOT-single exposure : Category 3(Respiratory tract irritation)

- Eye, nasal passages, larynx and lung irritation accompanied with coughing to human was shown.

10) STOT-repeated exposure : Category 2

- A 2-year inhalation study was conducted in Sprague-Dawley rats with 1,3-butadiene.

Some toxic effects (increased heart weight and kidney nephrosis) were seen at 8,000 ppm (17,701 mg/m³) (NOAEC=1,000 ppm)

11) Aspiration hazard : Not available

12. Ecological Information

A. Ecotoxicity :

- Acute toxicity : Not available
- Chronic toxicity : Not available

1) Fishes : Not available

2) Crustacea : Not available

3) Seaweeds : Not available

B. Persistence and Degradability :

1) Persistence : low persistency (Log Kow is less than 3 estimated) (Log Kow = 1.99)
(Estimated)

2) Degradability : Not available

C. Bioaccumulation potential :

1) Biodegradation : As not well-biodegraded, it is expected to have accumulation potential in living organisms (Biodegradability = 53.3 (%)) (Estimated)

2) Bioaccumulation : Bioaccumulation is expected to be low according to the BCF < 500 (BCF = 9.55) (Estimated)

D. Mobility in soil : Not available

E. Hazardous to the ozone layer : Not classified

F. Other adverse effects : Not available



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13. Disposal Consideration

A. Disposal method :

- Waste must be disposed of in accordance with federal, state and local environmental control regulations.

B. Dispose in accordance with all applicable regulations.

- Consider the required attention in accordance with waste treatment management regulation.

14. Transportation Information

A. UN classification : UN1010

B. Proper shipping name : Butadienes, stabilized or Butadienes and Hydrocarbon mixture, stabilized, containing more than 40% butadienes

C. Class/division : 2.1

D. Packing group : Not applicable

E. Marine pollutant : Not applicable

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

- FIRE SCHEDULE : F-D
- SPILLAGE SCHEDULE : S-U

15. Regulatory Information

A. Additional national and/or international regulatory information

Information of EU Classification(EC 1272/2008) :

• EC 1272/288(CLP) Classification:

- Flam. Gas 1, Press Gas, Carc. 1A, Muta. 1 B

• Risk Phrases:

- H220, H280, H335, H340, H350, H373

• Safety Phrase:

- P201, P202, P210, P260, P261, P271, P280, P304+P340, P308+P313, P312, P314, P377, P381, P403, P403+P233, P405, P410+P403, P501

U.S. Federal regulations:

- OSHA PROCESS SAFETY (29CFR1910.119): Not available

- CERCLA Section 103 (40CFR302.4): 4.53599 kg 10 lb

- EPCRA Section 302 (40CFR355.30): Not regulated

- EPCRA Section 304 (40CFR355.40): Not regulated

- EPCRA Section 313 (40CFR372.65): Applicable

Rotterdam Convention listed ingredients: Not regulated

Stockholm Convention listed ingredients: Not regulated

Montreal Protocol listed ingredients: Not regulated



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16. Other Information

A. Key literature reference and sources for data:

IARC Monographs on the Evaluation of Carcinogenic Risks to Humans:

<http://monographs.iarc.fr>

NIOSH (The National Institute for Occupational Safety and Health)

ACGIH (American Conference of Governmental Industrial Hygienists)

ECHA; <http://echa.europa.eu/registration-dossier/-/registered-dossier/15859>

OECD SIDS; <http://webnet.oecd.org/Hpv/UI/SIDS>

TOMES-LOLI®; <http://www.rightanswerknowledge.com/loginRA.asp> ○ National Emergency

Management Agency-Korea dangerous material inventory management system;

<http://www.nema.go.kr/hazmat/main/main.jsp>

Waste Control Act enforcement regulation attached [1]

National chemicals information systems; <http://ncis.nier.go.kr>

B. Key to abbreviations and acronyms

ACGIH – American Conference of Governmental Industrial Hygienists

ECHA – The European Chemicals Agency

OECD – The Organisation for Economic Co-operation and Development

CERCLA – Comprehensive Environmental Response, Compensation, and Liability Act

IARC – International Agency for Research on Cancer

NIOSH – National Institute for Occupational Safety and Health

OSHA – Occupational Safety and Health Administration

NTP – National Toxicology Program

TSCA – Toxic Substances Control Act

NFPA – National Fire Protection Association

LC₅₀ – The concentration of a material expected to kill 50% of an animal test group.

LD₅₀ – The dose of a material expected to kill 50% of an animal test group.

EC₅₀ – median effective concentration


STEL – Short Term Exposure Limit

TWA – Time weight Average

TLV – Threshold Limit Value (recommended by ACGIH)

C. Preparation date: 09. 29. 2009

D. Revision number and date:

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<p>○ Version: 6th</p> <p>○ Revision data: 2022.04.01</p> <p> – Rev.6 : Change company name and logo</p> <p>E. This information relates to the specific material designated and may not be valid for such material used in combination with any other materials or in any process. Such information is to the best of our knowledge and belief, accurate and reliable as of the date compiled. However, no representation, warranty or guarantee is made as to its accuracy, reliability or completeness. It is the user's responsibility to satisfy himself as to the suitability and completeness of such information for his own particular use. We do not accept liability for any loss or damage that may occur from the use of this information nor do we offer warranty against patent infringement.</p>			