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	CARBON DIOXIDE	

1. IDENTIFICATION OF THE SUBSTANCE / PREPARATION AND OF THE COMPANY

Product name	>9% Ethylene Oxide ≤ 87% / Carbon Dioxide
Chemical formula	$C_2H_4O + CO_2$
CAS Number	8070-50-6
UN Number	1041
Uses	Medical sterilization: chemical intermediate
Synonyms	Carbon dioxide and Ethylene oxide mixture; Ethylene oxide and carbon dioxide mixture, with more than 9% but not more than 87% ethylene oxide; Ethylene oxide and carbon dioxide mixture, with more than 9% but not more than 87% ethylene oxide
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2. HAZARDS IDENTIFICATION

2.1 GHS classification

Hazards Identification

GHS02 – Extremely flammable gas	H220 / category 1
GHS04 – Gas under pressure: may explode if heated	H280 / liquefied gas
GHS06 – Toxic by inhalation	H331 / category 3
GHS08 – Irritating to eyes, respiratory system and skin	H335 / category 3
GHS08 – May cause cancer	H350 / category 1B
GHS08 – May cause inheritable genetic defects	H340 / category 1B



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GHS classification

Hazard pictograms / symbols



2.2 Classified as dangerous according to the criteria of Regulation EC No 1272/2008

Hazard Statement for physical hazards

H220 Extremely flammable gas.
H230 Chemically unstable gas (may react explosively even in the absence of air)
H280 Liquefied gas (may contain gas under pressure)

Hazard Statements for Health Hazards

H302 Harmful if swallowed.
H315 Causes skin irritation.
H319 Causes serious eye irritation.
H331 Toxic if inhaled.
H335 May cause respiration irritation.
H340 May cause genetic defects.
H350 May cause cancer.
H372 Causes damage to the nervous system and to blood forming organs through prolonged or repeated exposure by inhalation.

Prevention

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

Response

P377 Leaking gas fire: Do not extinguish, unless leak can be stopped safely.
P304 + P340 IF INHALED: Remove to fresh air and keep at rest in a position comfortable for breathing.
P308 + P313 IF exposed or concerned: Get medical advice/ attention.
P332 + P337 + P313 If skin or eye irritation occurs: Get medical advice/ attention.
P333 + P313 If skin irritation or rash occurs: Get medical advice/attention.

Storage

P405 Store locked up.
P410 + P403 Protect from sunlight. Store in well-ventilated place



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Other hazards

Carbon dioxide component is under high pressure but is generally non-toxic. Ethylene oxide is liquified gas at room temperature. Ethylene oxide is highly flammable even in this mixture with carbon dioxide. Beside hazard due to compressed gas of carbon dioxide, other hazards are due to ethylene oxide, which is highly flammable and generally toxic.

3. COMPOSITION / INFORMATION ON INGREDIENTS

Substance/Preparation

Compressed gases mixture with varying percent composition from 9% to 87% ethylene oxide.

CAS Number: 8070-50-6

UN Number: 1041

Components/Impurities

Contains a mixture of liquified ethylene oxide and compressed carbon dioxide gas. Chemical toxicities are mainly due to ethylene oxide while carbon dioxide is generally non-toxic.

CAS Number	EC Number (from EINECS)	Name	%(Weight)
75-21-8	200-849-9	Ethylene oxide	9 - 87
124-38-9	200-696-9	Carbon Dioxide	91 - 13

4. FIRST AID MEASURES

General Information

Take appropriate steps to avoid fire, explosion and inhalation hazards.

Remove contaminated soaked clothing immediately

Adhere to personal protective measures when giving first aid.

Seek medical treatment immediately.

Inhalation

Remove the casualty into fresh air and keep him immobile.

In the event of pulmonary irritation treat initially with corticoid spray, e.g. Ventolair or Pulmicort- metered-dose aerosol (Ventolair and Pulmicort are registered trademarks).

Seek medical treatment immediately.

In case of respiratory standstill give artificial respiration by respiratory bag (Ambu bag) or respirator.

Send for a doctor.

Skin / eye contact

In case of frostbite spray with lukewarm (not hot) water for at least 15 minutes. Do not remove clothing frozen to the skin. Thaw it with lukewarm water. Apply a sterile dressing. Obtain medical assistance. Seek medical treatment immediately.



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In case of contact with skin wash off immediately and for a long time (at least 15 minutes) with plenty of water.
In case of eye contact, rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
Call for a doctor immediately.

Ingestion


Ingestion is not considered a potential route of exposure.

5. FIRE FIGHTING MEASURES

Specific Hazards	Exposure to fire may cause containers to rupture/explode
Hazard combustion products	Incomplete combustion may form carbon monoxide
Suitable extinguishing media	All known extinguishers can be used
Unsuitable extinguishing	Full water jet (MUST NOT be used for safety reason)
Specific Methods	If possible. Stop flow of product Continue water spray from protected position until container stays cool. Move away from the container and cool down with water from a Spontaneous / explosive re-ignition may occur. Extinguish any other fire.
Protective equipment	Use self-contained breathing apparatus Use chemically protective clothing.

6. ACCIDENTAL RELEASE MEASURES

Personal precautions	Evacuate area Use self –contained breathing apparatus and chemically protective clothing Eliminate ignition sources Wear self –contained breathing apparatus when entering area. Ensure adequate air ventilation
Environmental precautions	Try to stop release Prevent from entering sewers, and water systems as ethylene oxide is very soluble in water. Reduce vapor with fog or fine water spray.
Clean up methods	Ventilated area Keep area evacuated and free from ignition sources until any spilled liquid has

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evaporated.
 Hose down area with water.
 Wash contaminated equipment or sites of leaks with large quantities of water.

7. HANDLING AND STORAGE

Handling

Use ONLY in thoroughly ventilated areas.
 Ensure equipment is adequately earthed to prevent any spark from static discharge.
 Protect cylinder from any physical damage. Do not drop, drag, roll or slide cylinder.
 Do not let any water to be introduced into container with EtO.
 Purge dry air into container and gas-flow system before introducing gas.

Use only specified equipment to handle this product with specified safe pressure and temperature.
 Refer to supplier's handling instructions.
 Contact gas supplier if in doubt.

Storage

Secure cylinders to the correct positioning.
 Keep in dry well-ventilated area.
 The gas cylinders must be adequately earth during storage.
 Segregate from oxidant gases and other oxidizing agents

Keep containers tightly closed and dry.

Storage condition: -

- In a cool, dry and well-ventilated area
- Away from direct sunlight. Protect from the heat (storage temperature ≤ 50°C)
- Away from any source of ignition (including static discharge)

8. EXPOSURE CONTROL / PERSONAL PROTECTION


Exposure Limit value

Ethylene Oxide:

OSHA Time Weighted Average exposure limit (TWA): 1 ppm
 OSHA Short Term Exposure Limit (STEL): 5 ppm

Carbon Dioxide:

OSHA Time Weighted Average exposure limit (TWA): 5,000 ppm
 OSHA Short Term Exposure Limit (STEL): 30,000 ppm

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Engineering measure

Provide adequate general and local exhaust ventilation to maintain concentrations below exposure and flammable limits.


Personal protective equipment

Respiratory protection may not be required unless in case of leakage, use self-contained breathing apparatus.
 Use appropriate gloves and protective clothing for hand and skin protection.
 Use safety glasses or ventilated goggle for eye protection.
 A safety shower and eyewash station should be readily available.
 For body and skin protection, wear coveralls, boots and/or other chemical resistant protective clothing.

9. PHYSICAL AND CHEMICAL PROPERTIES

Physical and chemical properties of the mixture as a product are not available. However, physical and chemical properties of each component are provided here as a guide.

Physical state at 20°C	High pressure liquefied gases mixture
Colour	Colourless gas mixture
Odour	CO ₂ : Odourless EtO : sweet, ether-like smell
Flammability	EtO is extremely flammable and mixture with CO ₂ is also flammable
Melting Point	CO ₂ : -75.5 °C (sublimation point) EtO: -112 °C
Boiling Point	CO ₂ sublime directly to gaseous form at -78.5 °C EtO: 10.6 °C
Flash Point	CO ₂ does not combust at any temperature. EtO: -18 °C (open cup)
Vapour pressure, 20°C	CO ₂ is a gas at -20 °C EtO: 1.4 Bar
Relative Vapour Density	CO ₂ : 1.5 (Air = 1) EtO: 1.52 (Air = 1)
Relative density, 20°C	EtO: 0.82 (water = 1) CO ₂ is a gas at 20 °C.
Solubility in water	CO ₂ : 0.7 mole ratio at 20 °C and 1 atm pressure

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	EtO: completely miscible in water (1,000 g/L)
Flammability range	EtO: 3 to 100 (vol % in air) CO ₂ is not combustible
Auto-ignition temperature	EtO: 429 °C
Other data	Gases mixture is heavier than air. May accumulate in confined spaces, particularly at or below ground level.

10. STABILITY AND REACTIVITY

Stability	This product may decompose violently at high temperature and/or pressure in the presence at catalyst such as iron rust or other metal oxides especially at higher EtO content.
Conditions to avoid	Air or oxygen Water, humidity High temperatures
Materials to avoid	While carbon dioxide is non-reactive, the ethylene oxide component may react violently with these materials especially at higher EtO composition; Oxidizing agents, acids, organic bases, amines, ammonia and certain salts. EtO reacts explosively with certain alcohols or mercaptans. EtO reacts with HCl to form highly toxic ethylene chlorohydrins. Avoid copper, silver, magnesium, mercury and their salts.

11. TOXICOLOGICAL INFORMATION

Acute toxicity	Ethylene Oxide LD ₅₀ /oral/rat:; 72 mg/kg LC ₅₀ /inhal/rat: 2.92 mg/ l / 15 min 1.44 mg / l / 4h Carbon dioxide Relatively non-toxic IDLH conc: 40,000 ppm (IDLH: Immediate Danger to Life and Health)
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Ethylene Oxide (9%-87%) / Carbon Dioxide – No data on acute toxicity is available for these varying mixture but presence of highly toxic ethylene oxide is a concern to human health.

Skin Irritation/Sensitization No data is available for mixture but even in small proportion, ethylene oxide is very irritating and may cause allergy reaction

Eye Irritation/Damage **Ethylene Oxide** component in this mixture may cause serious eye irritation

Inhalation/Respiratory Sensitization **Ethylene Oxide** component even in small percentage composition may cause respiratory tract irritation and may cause allergy reaction.

Carcinogenicity **Ethylene Oxide** IARC Classification Group 1: Carcinogenic to Human and thus the mixture is still considered a carcinogenic chemical.

Mutagenicity No data is available for the mixture, but ethylene oxide is a mutagenic compound.

Teratogenicity No data is available for this mixture of 9-87% EtO in CO₂.

Further information No study has been conducted on the toxicity of a 9-87% EtO in CO₂. However, care should be taken to reduce excessive exposure to this gas mixture for health safety reason.

12. ECOLOGICAL INFORMATION

General Ecological Impact No studies have been made on the ecological impact of the mixture of 9-87% in CO₂. However, any release to the environment should consider the impact of individual component as they will act independently as follow;

Carbon Dioxide is a major green-house gas which contribute to Climate Change and other ecological impact of Green-house gases. Other than that carbon dioxide is not harmful to the environment.

Ethylene Oxide is toxic and harmful to the environment.

Environmental Fate **Ethylene oxide** is highly reactive. Thus, it does not persist indefinitely in the environment. It is also very soluble in water. EtO will be converted gradually to ethylene glycol in the environment.

Aquatic Toxicity **Ethylene Oxide** environmental toxicity;
 LC₅₀ (Fat Minnow): 84 mg/L (96 hr exposure)
 LC₅₀ (Daphnia magna): 137 – 300 mg/L (48hr exposure)



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Mobility

Ethylene Oxide:

Atmosphere: Somewhat persistent in the atmosphere but will ultimately degrade by process of photolysis.

Soil: Does not readily dissolved in soil and gradually will convert to ethylene glycol.

Water: Very soluble in water but easily convert to ethylene glycol.

Persistence/degradability

Ethylene Oxide will readily undergoes biodegradation and hydrolysis in water and soil.

Bio-accumulation

Ethylene Oxide does not bio-accumulate significantly.

13. DISPOSAL CONSIDERATION

Waste Disposal

Do not dispose remaining gas to the environment. Return container and cylinder to supplier.

Additional Information


Ethylene oxide is also used as fumigant. Regulation of disposal of pesticides and containers of pesticides may apply.

Do not attempt to refill cylinder with other gases or chemicals.

14. TRANSPORT INFORMATION

Proper shipping name	Ethylene Oxide and Carbon Dioxide mixture
UN Number	UN 1041
Class	2
ADR/RID Classification Code	2TF
ADR/RID Hazard Nr	239
Packing Group	None
Labeling ADR	Label 2.3: Toxic substance Label 2.1 : Flammable gas
IMDG EmS codes	F-D, S-U
IMDG Marine pollutant	No
Passenger Aircraft	Forbidden

SPECIAL SHIPPING INFORMATION: Cylinders should be transported in a secure position, in a well-ventilated vehicle.

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15. REGULATORY INFORMATION

Department of Occupational Safety and Health, Ministry of Human Resources, Malaysia, Industrial Code of Practice on Chemicals Classification and Hazard Communication, 2014 did not classify this gas mixture as hazardous material but for safety purposes, classification for 100% **ethylene oxide** should be applied as follows;

Chemical Name:	ETHYLENE OXIDE	
CAS No.	75-21-8	
Classification	<u>H-Code</u>	<u>Classification Code</u>
	H280/281	Pressurized Gas
	H220	Flam. Gas 1
	H350	Car. 1B
	H340	Muta. 1B
	H331	Acute Tox. 3 (inh)
	H319	Eye Irrit. 2
H335	STOT SE 3	
H315	Skin Irrit. 2	

16. OTHER INFORMATION

The information and opinion presented herein are based on data and scientific information currently available. Since the use of information in this Safety Data Sheet and the conditions of use are not within the control of Balchem Sdn. Bhd., it is the user's obligation to determine the conditions for safe use of this product.

Ensure all national and local regulations are observed. Ensure operators and handlers of this product understand the hazard and toxicological effect from accidental and unnecessary exposure.

While proper care has been taken in the preparation of this document, no liability for injury or damage resulting from its use can be accepted by the manufacturer.

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