Product Safety Assessment

DOW™ Butylenes

Product Safety Assessment documents are available at www.dow.com/productsafety/finder/.

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Names

- CAS No. 92045-23-3
- Hydrocarbons, C4, steam-cracker distillate
- C4 raffinate-1 /ER/
- Butenes
- DOW™ butylenes mixture
- C4 raffinate-1
- Raffinate-1
- Crude C4 – low butadiene

Product Overview

- DOW™ butylenes mixture (butylenes) is a stream produced during the steam-cracking process in the manufacture of ethylene. It is a mixture of C4 hydrocarbons, mainly 2-methylpropene (isobutylene), butanes, and butanes. DOW butylenes is a colorless gas with a pungent, gasoline-like odor. It is usually stored as a liquid under pressure.¹ ² For further details, see Product Description.
- DOW butylenes mixture is a raw material for industrial use. It is most often sold for blending into gasoline. It is also marketed with propane and butane as liquefied petroleum gas (LPG).³ For further details, see Product Uses.
- Worker exposure to butylenes is possible at an ethylene production facility, during transport, or use. Workplace exposure is minimized through engineering controls and personal protective equipment. This material is not sold directly to consumers. For further details, see Exposure Potential.
- Eye contact with butylenes vapor may cause irritation experienced as mild discomfort or redness. Eye or skin contact with liquid butylenes may cause a frostbite injury. In confined or poorly ventilated areas vapor can readily accumulate and cause unconsciousness and death. Symptoms of excessive inhalation may include anesthetic or narcotic effects and dizziness or drowsiness.⁴ For further details, see Health Information.
- Because the components of the butylenes mixture are highly volatile, butylenes released to land or surface water would quickly partition into the air and will photodegrade (breakdown by sunlight). Because butylenes are a gas and would partition into the atmosphere, even if released to water, biodegradation is not a significant environmental fate pathway. The components of butylenes have a low bioconcentration potential (tendency to accumulate in the food chain), and estimated toxicity data indicates that this material is moderately toxic to fish and other aquatic organisms.⁵ ⁶ For further details, see Environmental Information.

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- DOW™ butylenes mixture is extremely flammable in both liquid and vapor (gas) forms. Avoid static discharge or contact with ignition sources. It is stable under recommended storage conditions. Exposure to elevated temperatures can cause it to decompose. Avoid contact with air to prevent formation of explosive peroxides. Avoid contact with oxidizing materials and strong acids. For further details, see Physical Hazard Information.

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Manufacture of Product

- **Capacity** – Estimated world production of butylenes was over 52,000 metric kilotonnes (114 billion pounds) in 2007. A foreign affiliate of The Dow Chemical Company manufactures butylenes at ethylene production facilities in Terneuzen, the Netherlands, and Böhlen, Germany. Nearly 73% of global butylenes production is produced at refineries and 14.5% is derived as a co-product from ethylene production.

- **Process** – Dow manufactures butylenes as a co-product in the production of ethylene. A mixture of light hydrocarbons such as naphtha or Liquified Petroleum Gas (LPG – butane, propane, ethane) is mixed with steam, heated, and fed into a high-temperature furnace (cracker), where large molecules are broken down. The cracked mixture is quickly cooled to –130°C (~-202°C) and compressed. Under these conditions, hydrogen and methane gases are separated. The temperature is increased slightly allowing ethylene and ethane gases to be separated. The temperature is again increased allowing propane and propylene gases to be separated. Another temperature increase allows C4 gases to be separated. The C4 mixture contains about 30–60% butadiene along with butylenes and butanes. Butadiene, an important raw material for the manufacture of synthetic rubber, is then recovered from the mixture by extraction, leaving the butylenes/butane mixture, which is called raffinate-1 or butylenes.

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Product Description

DOW™ butylenes stream is a mixture of 2-methylpropene (isobutylene, about 37–50%), butenes (about 29–61%), and butanes (about 25%). Butadiene is also present at levels as high as 6%. The ratio varies based on feedstock and cracking conditions. DOW butylenes mixture is a colorless gas with a pungent, gasoline-like odor. It is usually stored as a liquid under pressure in a pressure-products sphere.

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Product Uses

DOW™ butylenes mixture is an industrial raw material used for the following applications:

- **Fuel uses** – for the manufacture of gasoline blending components such as gasoline alkylate, polymer gasoline, and dimersol; butylenes may be added directly into gasoline for volatility control

- **Other fuel uses** – with propane and butanes as liquefied petroleum gas (LPG); also used as a refinery fuel

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• **Chemical intermediate** – to manufacture sec-butyl alcohol, butadiene, polyethylene, and other chemicals; isobutylene is used to produce butyl rubber, polybutenes, methyl methacrylate, and other chemicals

*Please be advised that butane, butylenes, butadiene or crude butadiene products may not be suitable for use in cosmetics.*

**Exposure Potential**

DOW™ butylenes mixture is recovered during ethylene production. Based on the uses for butylenes, the public could be exposed through:

- **Workplace exposure** – Butylenes exposure can occur during ethylene manufacturing or during its use as a chemical intermediate or gasoline-blending component. This material is produced, distributed, stored, and consumed in closed systems. Those working with butylenes in manufacturing operations could be exposed during maintenance, sampling, testing, or other procedures. Each facility should have a thorough training program for employees and appropriate work processes and safety equipment in place to limit unnecessary exposure. See [Health Information](#).

- **Consumer exposure to products containing butylenes** – Butylenes are not sold directly to consumers. Consumer exposure to butylenes from industrial sources is unlikely. Consumers may contact the components of butylenes at very low levels either while fueling a vehicle or as a gasoline combustion product. See [Health Information](#).

- **Environmental releases** – In the event of a spill, stop the flow of gas and isolate the area until all gas has dispersed. Eliminate all sources of ignition immediately. Keep personnel upwind of spill and out of low areas. Because of the high vapor pressure and insolubility in water, the components of butylenes tend to rapidly partition into the air, where they will degrade from exposure to sunlight (photodegradation) within days. The components of butylenes have an estimated toxicity which indicates that this material is moderately toxic to fish and other aquatic organisms. See [Environmental, Health, and Physical Hazard Information](#).

- **Large release** – Industrial spills or releases are infrequent and are generally contained. If a large spill does occur, evacuate the area. Eliminate all sources of ignition immediately. Ventilate the area. Keep personnel upwind, out of low-lying areas. Positive pressure, self-contained breathing apparatus (SCBA) with an approved full-face mask is recommended for emergency work. Use only explosion-proof equipment; ground and bond all containers and handling equipment. Spills of this liquefied gas may form ice, which can plug drains and make valves inoperable. See [Environmental, Health, and Physical Hazard Information](#).

- **In case of fire** – Do not attempt to extinguish the fire. Stop the flow of product and allow the fire to burn out. If flames are accidentally extinguished, explosive re-ignition could occur. The public should be warned of any downwind vapor explosion hazard. Vapors are heavier than air and may travel a long distance and accumulate in low-lying areas. Keep vapors out of sewers. Eliminate ignition sources. For spills of liquefied gas, apply appropriate foam or vapor-suppressing agent. Warning! Contact of water with liquefied gas can result in boiling, frothing, and rapid generation of vapor. For an un-ignited vapor cloud, use water spray to knock down and control the dispersion of vapors. Firefighters should wear positive-pressure, self-contained breathing apparatus (SCBA) and protective firefighting clothing. Follow emergency procedures carefully. See [Environmental, Health, and Physical Hazard Information](#).

For more information, see the relevant [Safety Data Sheet](#).

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Health Information\textsuperscript{14,15,16}

\textbf{Eye contact} – Contact with vapor may cause irritation experienced as mild discomfort and redness. Contact with liquid may cause frostbite.

\textbf{Skin contact} – Contact with liquid may cause frostbite. No adverse effects are anticipated by skin absorption.

\textbf{Inhalation} – In confined or poorly ventilated areas, vapor can readily accumulate and cause unconsciousness and death. Symptoms of excessive exposure may be anesthetic or narcotic effects, along with dizziness or drowsiness. Excessive exposure may increase sensitivity to epinephrine and increase myocardial irritability (irregular heartbeats).

\textbf{Ingestion} – Swallowing this material is unlikely because it is a gas at room temperature.

\textbf{Effects of repeated exposure} – In animals, repeated excessive exposure to the major components in butylenes has affected the nasal tissue.

\textbf{Cancer information} – Butadiene, a minor component in the butylenes mixture (less than 1%), has caused cancer in laboratory animals. Butadiene epidemiology studies have linked employment in two different chemical operations each with a different type of cancer. The causative factors for these excess cancers have not been determined.

\textbf{Birth defects/developmental effects} – Based on animal reproductive/developmental toxicity studies conducted with 1-butene, 2-butene, and isobutylene, these components of the mixture are neither reproductive nor developmental toxicants. Butadiene, a minor component in the mixture (less than 6%), has caused birth defects in laboratory animals, but only at doses toxic to the mother. Butadiene toxicity to the fetus has occurred at doses nontoxic to the mother.

For more information, see the relevant Safety Data Sheet.

Environmental Information\textsuperscript{17,18,19}

\textsuperscript{TM} butylenes released from pressurized containment would quickly vaporize into the air. The major components of butylenes have very low boiling points and are gas under almost all environmental conditions. This material has a very high vapor pressure and is insoluble in water. If released to surface water it would have a tendency to rapidly evaporate and disperse in the atmosphere. Butylenes will then degrade by photodegradation (exposure to sunlight).

Because of their volatility, biodegradation is not expected to be a significant environmental fate pathway for the components of butylenes in surface environments. This material has a low bioconcentration potential (tendency to accumulate in the food chain), and estimated toxicity data indicate that butylenes are moderately toxic to fish and other aquatic organisms.

For more information, see the relevant Safety Data Sheet.

Physical Hazard Information\textsuperscript{20}

\textsuperscript{TM} butylenes liquids and vapors are extremely flammable. Keep away from heat, sparks, and flame. Avoid static discharge. Electronically bond and ground all containers and equipment before transferring or using butylenes. Vapors are heavier than air and can travel long distances

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and accumulate in low-lying areas. Ignition and/or flashback may occur. Use with adequate ventilation.

DOW™ butylenes mixture is stored as a liquid under pressure. It is stable under recommended storage conditions and use. Exposure to elevated temperatures can cause this material to decompose. Avoid contact with air to prevent the formation of explosive peroxides. Avoid contact with oxidizing materials and strong acids and unintended contact with peroxides. Hazardous polymerization can occur with this material. Hazardous polymerization is an uncontrolled chemical reaction that can rapidly generate large amounts of heat and pressure.

For more information, see the relevant Safety Data Sheet.

Regulatory Information

Regulations may exist that govern the manufacture, sale, transportation, use, and/or disposal of DOW™ butylenes. These regulations may vary by city, state, country, or geographic region. Information may be found by consulting the relevant Safety Data Sheet or Contact Us.

Additional Information

- Request Safety Data Sheet from Dow Customer Information Group (www.dow.com/assistance/dowcig.htm)
- Contact Us (www.dow.com/assistance/dowcig.htm)
- European Chemical Industry Council (CEFIC) Petrochemistry web site Select C4 stream (www.petrochemistry.net/flowchart/flowchart.htm)

For more business information about DOW™ butylenes, visit the Dow Customer Information Group at www.dow.com/assistance/dowcig.htm.

References

1 C-4 Raffinate-1 Safety Data Sheet, The Dow Chemical Company, April 15, 2008, Product and Company Identification section.
4 C-4 Raffinate-1 Safety Data Sheet, The Dow Chemical Company, April 15, 2008, Hazard Identification and First Aid sections.
5 C-4 Raffinate-1 Safety Data Sheet, The Dow Chemical Company, April 15, 2008, Toxicology section.

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7 C-4 Raffinate-1 Safety Data Sheet, The Dow Chemical Company, April 15, 2008, Stability and Reactivity section.
9 C-4 Raffinate-1 Safety Data Sheet, The Dow Chemical Company, April 15, 2008, Hazard Identification and First Aid sections.
11 C-4 Raffinate-1 Safety Data Sheet, The Dow Chemical Company, April 15, 2008, Hazard Identification and Exposure Controls / Personal Protection sections.
14 C-4 Raffinate-1 Safety Data Sheet, The Dow Chemical Company, April 15, 2008, Hazard Identification, First Aid and Toxicological Information sections.
17 C-4 Raffinate-1 Safety Data Sheet, The Dow Chemical Company, April 15, 2008, Ecological Information section.
19 SIAR for SIAM 17 – Isobutylene: CAS No. 115-11-7, OECD, UNEP, Arona, Italy, November 11–14, pages 8–11.
20 C-4 Raffinate-1 Safety Data Sheet, The Dow Chemical Company, April 15, 2008, Firefighting and Handling & Storage sections.

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