Product Safety Assessment

Crude Butadiene

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

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Names
- CAS No. 68476-52-8
- CAS No. 106-99-0
- Vinylethylene
- Hydrocarbons, C4, ethylene-manuf.-by-product
- 1,3-Butadiene
- Crude butadiene

Product Overview
- Crude butadiene is produced during the steam-cracking process in the manufacture of ethylene. Crude butadiene is a colorless gas with a fragrant, gasoline-like odor. It is a mixture rich in 1,3-butadiene (butadiene) with other C4 hydrocarbons.¹ For further details, see Product Description.
- Crude butadiene is a process intermediate; it is usually processed further to isolate 1,3-butadiene. Alternatively, it can be returned for recycle cracking or hydrogenated to produce an isobutylene/butane-1 rich mixture.² For further details, see Product Uses.
- There are no consumer uses for crude butadiene, and the potential for consumer exposure to butadiene from industrial sources is very low. Environmental sources of butadiene, the main component of crude butadiene, include automobile exhaust, cigarette smoke, and other combustion sources. Because of the health risks associated with butadiene exposure, emissions of crude butadiene from manufacturing operations and occupational exposure are limited by governmental requirements.³ For further details, see Exposure Potential.
- Crude butadiene is a cancer hazard. Eye contact with crude butadiene vapor may cause irritation experienced as mild discomfort and redness. Eye or skin contact with crude butadiene in liquid form may cause frostbite as the material vaporizes. In confined or poorly ventilated areas, vapor can readily accumulate and cause unconsciousness and death. Excessive exposure may irritate the nose and throat or cause central nervous system effects. Symptoms of excessive exposure may be anesthetic or narcotic effects and dizziness or drowsiness.⁴ For further details, see Health Information.
- Crude butadiene is a blend of components. When released to the environment, crude butadiene will evaporate to the air where it will break down quickly in sunlight. The major components of crude butadiene are predicted to be biodegradable. The components have a low potential to bioaccumulate (tendency to accumulate in the food chain), and are slightly to
moderately toxic to fish and other aquatic organisms. For further details, see Environmental Information.

- Crude butadiene is a highly reactive material that should be handled only by properly trained personnel. It is extremely flammable in both liquid and vapor (gas) form. Avoid spark or flame. Vapor may cause a flash fire. Vapors may travel long distances; ignition and/or flashback may occur. Elevated temperatures can cause hazardous polymerization. Crude butadiene can react with oxidizing materials (air, rust, peroxides, etc.) to form explosive peroxides. For further details, see Physical Hazard Information.

Manufacture of Product

- **Capacity** – In 2008, the estimated annual worldwide consumption of butadiene was 9,282 metric kilotonnes (20.46 billion pounds). Dow primarily manufactures butadiene for its own use in producing synthetic rubber and other polymers and industrial chemicals. Dow’s manufacturing facilities for butadiene are located in Terneuzen, the Netherlands, and in Böhlen, Germany.

- **Process** – Nearly all (97%) of the butadiene produced globally is a co-product of the steam cracking of naphtha and gas oil to make ethylene and propylene. After ethylene and propylene are extracted from the cracker, a “C4 stream” is separated from the process, which contains predominately hydrocarbons containing four carbon atoms, e.g. butadiene and butenes. This C4 stream is “crude” or unrefined butadiene. Butadiene is extracted from this stream, distilled, and purified. Additional process detail may be found on the European Chemical Industry Council (CEFIC) Petrochemistry web site by selecting C4 stream on the flowchart and in other sources. See Additional Information.

Product Description

Crude butadiene is produced during the steam-cracking process in the manufacture of ethylene. Crude butadiene is a colorless gas with a fragrant, gasoline-like odor. DOW crude butadiene is a mixture of C4 hydrocarbons, containing between 35 and 62% 1,3-butadiene depending on the feedstock and cracker operating conditions. Other components of the mixture include butene (12–18%), isobutene (3–17%), butane (2.5–12%), and other C4 compounds. Crude butadiene is highly reactive. It is stored as a liquid under pressure in a pressure-products sphere.

Product Uses

DOW™ crude butadiene is a process intermediate that is further processed to isolate 1,3-butadiene. Alternatively, it can be returned to the cracking furnace for recycle cracking or hydrogenated to produce an isobutylene/butane-1 rich mixture. Purified 1,3-butadiene is used to manufacture styrene-butadiene rubber for tires and other rubber products, as well as impact-resistant plastics such as acrylonitrile-butadiene-styrene (ABS) and methylmethacrylate-butadiene-styrene (MMBS), and other specialized plastic and rubber compounds.

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

Crude butadiene is a process intermediate manufactured during ethylene production. Based on the uses for crude butadiene, the public could be exposed through:

- **Workplace exposure** – Exposure can occur in an ethylene manufacturing facility. Crude butadiene is produced, distributed, stored, and consumed in closed systems. Those working with this material in manufacturing operations could be exposed during maintenance, sampling, testing, or other procedures. Each manufacturing facility should have a thorough training program for employees and appropriate work processes, ventilation, and safety equipment in place to limit exposure. See Health Information.

- **Consumer exposure to products containing crude butadiene** – There are no consumer uses for crude butadiene and the potential for consumer exposure to crude butadiene from industrial sources is very low. Environmental sources of butadiene, the main component of crude butadiene, include automobile exhaust, cigarette smoke, and other combustion sources. 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. The high vapor pressure and insolubility in water make crude butadiene tend to accumulate (partition) into the air, which creates inhalation risk. This material is considered slightly to moderately toxic to aquatic organisms on an acute basis. See Environmental, Health, and Physical Hazard Information.

- **Large release** – Industrial spills or releases are infrequent and generally contained. If a large spill does occur, evacuate the area. Keep personnel upwind and out of low-lying areas. Positive-pressure, self-contained breathing apparatus (SCBA) with an approved full-face mask is recommended for emergency work. Eliminate all sources of ignition immediately. Ventilate the area. 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 extinguish. 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 downwind vapor-explosion hazards. 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 unignited vapor cloud, use water spray to knock down and control dispersion of vapors. Follow emergency procedures carefully. See Environmental, Health, and Physical Hazard Information.

For more information, request the relevant Safety Data Sheet from the Dow Customer Information Group.

Health Information

**Eye contact** – Crude butadiene vapor may cause irritation experienced as mild discomfort and redness. Liquid may cause frostbite as it vaporizes.

**Skin contact** – Skin contact with liquid material may cause frostbite. No adverse effects are anticipated by skin absorption.

**Inhalation** – In confined or poorly ventilated areas, the vapor can readily accumulate and cause unconsciousness and death. Excessive inhalation may cause irritation to the upper respiratory tract (nose and throat) or central nervous system effects. 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).
Ingestion – Swallowing is unlikely because of physical state; crude butadiene is a gas at room temperature.

Effects of repeated exposure – In animals, repeated, excessive exposure to this material has affected the bone marrow, spleen, kidneys, liver, ovaries, respiratory tract, and testes.

Cancer information – Crude butadiene 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.

Birth defects/developmental effects – This material has caused birth defects in laboratory animals, but only at doses that were toxic to the mother. Toxicity to the fetus has occurred at doses not toxic to the mother.

For more information, request the relevant Safety Data Sheet from the Dow Customer Information Group.

Environmental Information\textsuperscript{15,16} Components of crude butadiene have a high volatility and low-water solubility. If released to water, crude butadiene will evaporate to the air, where it breaks down quickly in sunlight.

Crude butadiene is unlikely to persist in the environment. The components are predicted to be biodegradable under environmental conditions.

Crude butadiene has a low potential for bioconcentration (tendency to accumulate in the food chain), and is slightly to moderately toxic to aquatic organisms on an acute basis.

For more information, request the relevant Safety Data Sheet from the Dow Customer Information Group.

Physical Hazard Information\textsuperscript{17} Crude butadiene is a highly reactive material. It is stable under recommended storage conditions. It is extremely flammable in both liquid and vapor (gas) form. Avoid spark or flame. Vapor may cause a flash fire. Vapors may travel long distances; ignition and/or flashback may occur.

Elevated temperatures can cause hazardous polymerization. Crude butadiene can react with oxidizing materials (air, oxygen, rust, peroxides, etc.) to form explosive peroxides. Crude butadiene is stored with a chemical inhibitor (p-tertiary butylcatechol) to prevent polymerization.

For more information, request the relevant Safety Data Sheet from the Dow Customer Information Group.

Regulatory Information

Regulations may exist that govern the manufacture, sale, transportation, use, and/or disposal of Crude butadiene. 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

- Safety Data Sheet (request from the Dow Customer Information Group at www.dow.com/assistance/dowcig.htm)
- European Chemical Industry Council (CEFIC) Petrochemistry web site
  Select “C4 stream” (http://www.petrochemistry.net/flowchart/flowchart.htm)

References


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