Product Safety Assessment

Vinylbenzyl Chloride


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Names
   • CAS No. 30030-25-2
   • Vinylbenzyl chloride
   • VBC
   • Chloromethyl styrene
   • CMS

Product Overview
   • Vinylbenzyl chloride has two different functional (reactive) groups and is used to produce a variety of polymers and other products.¹ For further details, see Product Description.
   • Vinylbenzyl chloride is a monomer that can be reacted with other materials before or after polymerization. The ability to perform these reactions before polymerization can produce a wide variety of monomers with other pendant groups. Vinylbenzyl chloride can be reacted with other vinylbenzyl chloride units (homopolymerized), or with other monomers (copolymerized), or chemically modified to produce films, beads, coatings and many other structures for use in a vast number of applications.² For further details, see Product Uses.
   • Vinylbenzyl chloride is not sold for consumer use, so consumer exposure is not likely. Workplace exposure is possible.³ For further details, see Exposure Potential.
   • Exposure to vinylbenzyl chloride is unlikely if properly stored and handled. Exposure to this material may cause severe skin and eye pain. Exposure to vinylbenzyl chloride vapors may cause lacrimation (tears). Exposure causes skin irritation and can cause allergic skin reaction. It is harmful if absorbed through the skin.⁴ For further details, see Health Information.
   • Vinylbenzyl chloride is biodegradable, has a moderate potential to bioconcentrate (accumulate in the food chain), and is very toxic to aquatic organisms on an acute basis.⁵ For further details, see Environmental Information.
   • Vinylbenzyl chloride is a combustible, toxic, reactive material which can be handled safely if proper precautions are taken.⁶ For further details, see Physical Hazard Information.
Manufacture of Product

- **Location** – The Dow Chemical Company produces vinylbenzyl chloride in facilities in Midland, Michigan USA.
- **Process** – Vinylbenzyl chloride is produced via a high-temperature chlorination of vinyltoluene. The product is then purified by distillation.

Product Description

DOW™ vinylbenzyl chloride is a clear, slightly yellow liquid with a pungent odor. It is a monomer with two functional groups that can polymerize through the vinyl group and react through the benzyl group. As sold by Dow, vinylbenzyl chloride monomer is a mixture of 57 percent meta-isomer and 43 percent para-isomer. See the diagram below.

![Diagram of vinylbenzyl chloride isomers](image)

Product Uses

Vinylbenzyl chloride monomer can be used to make unique polymers in two key ways, as shown in the diagram. It can first be reacted with other chemicals and then polymerized; or it can be polymerized and then reacted.

Figure key:  
A = reactant
B = monomer

Vinylbenzyl chloride can be used to make a wide variety of products and structures, including:

- **Polyelectrolytes** – for use in latex electrodeposition on metals, polymeric surfactants, flocculating agents, phase transfer catalysts, electron carriers, ion exchange resins and polymeric mordants (used to affix dyes) for photographic and inkjet printing
- **Polymeric supports** – for catalysts to synthesize peptides and other molecules
- **Polymer reactant** – to create other chemicals and monomers for polymerization or reactions; these materials are used to produce specialty polymers, chelating agents, paper manufacturing, fiber and textile applications, coatings, membranes
- **Light-sensitive polymers** – for use in lithography, and photocurable, photochromic and photoconductive polymers
- **Analytical applications** – for chromatographic separations to test for the purity of other chemicals
- **Elastomers** – to inhibit elastomer decomposition, increase temperature and weather resistance and produce photocurable, water soluble elastomers
- **Fire-resistant polymers** – for a variety of potential applications to reduce fire hazards
- **Transparent, UV-resistant polymers** – for various potential applications to improve appearance and durability
- **Biological / combination chemistry** – for biological templates used to fix carbohydrates, synthesis of compounds for drug screening and supports for reagents
- **Membranes** – for reverse osmosis membranes, photoresists and coatings
- **Silane coupling agents** – for use in glass-reinforced materials to promote adhesion
Exposure Potential
Vinylbenzyl chloride is used in the production of industrial and consumer products. Based on the uses for this product, individuals could be exposed through:

- **Workplace exposure** – Exposure can occur either in a facility that manufactures vinylbenzyl chloride or in the various industrial or manufacturing facilities that use this material. It is produced, distributed, stored, and consumed in closed systems. Those working with vinylbenzyl chloride 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, personal protective equipment, and safety equipment in place to limit exposure. Butyl rubber gloves are the most resistant to vinylbenzyl chloride breakthrough. Vinylbenzyl chloride is a solvent for many rubber-based and synthetic rubber products, so selection of protective clothing requires particular care. See Health Information.

- **Consumer exposure to products containing vinylbenzyl chloride** – Dow does not sell vinylbenzyl chloride for direct consumer use, but it is used as a component in many materials. Consumers are not likely to come into direct contact with vinylbenzyl chloride, but could come into contact with products made using vinylbenzyl chloride. Residual or unreacted quantities of vinylbenzyl chloride remaining in any of these products would be extremely small. Please review product labels and follow all instructions and guidelines for proper use to help prevent unnecessary exposure. See Health Information.

- **Environmental releases** – In the event of a spill, the focus is on containing the spill to prevent contamination of soil, surface or ground water. If vinylbenzyl chloride is present in a fire situation, it can produce toxic fumes and can cause hazardous polymerization. Proper protective equipment should be worn. If released to the environment, vinylbenzyl chloride is expected to bind to soils, although some partitioning to air, water, and sediment may also occur. Vinylbenzyl chloride will degrade in the environment, and is expected to be removed by wastewater-treatment facilities. See Environmental, Health, and Physical Hazard Information.

- **Large release** – Industrial spills or releases are infrequent. Manufacturing facilities are designed to contain spills. If a large spill does occur, the material should be captured, collected and re-processed, or disposed of according to federal, state/provincial or local regulations. In case of a large spill of vinylbenzyl chloride, the area should be isolated to minimize risk of inhalation, contact, fire and uncontrolled reactions. Some absorbent materials are not suitable for use with vinylbenzyl chloride. For small spills, absorb with materials such as cellulose, cellulose-based absorbents, soda ash, and cob grit. Collect in suitable and properly labeled containers. Do not use absorbent materials such as clay, clay-based absorbents, vermiculite, dirt, or equivalent filler, sand, or sawdust. Spills can be covered with water, preferably using a water fog, to suppress the odor, but care should be taken to keep contaminated water away from sewers and the surrounding area. Spills or discharge to natural waterways is likely to kill aquatic organisms. Emergency personnel should wear proper protective equipment and follow emergency procedures carefully. When relevant in scale or risk, the community should be notified of the hazards associated with the specific release event. See Environmental, Health, and Physical Hazard Information.

- **In case of fire** – Deny any unnecessary entry into the area and consider the use of unmanned hose holders. Use water spray or fog, carbon-dioxide or dry-chemical extinguishers, or foam to fight the fire. Use of a direct water stream may spread the fire. Firefighters should wear positive-pressure, self-contained breathing apparatus (SCBA) and protective firefighting clothing. Individuals 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. Immediately withdraw all personnel from the area in case of rising sounds from venting safety device or discolorations of the container. Keep fire water out of waterways and sewers to minimize the potential for environmental damage. Follow emergency procedures carefully. See Environmental, Health, and Physical Hazard Information.

For more information, see the relevant Safety Data Sheet.

Health Information

**Eye contact** – May cause slight eye irritation. May cause slight corneal injury. Vapor may cause lacrimation (tears). May cause pain disproportionate to the level of irritation to the eye tissues. Human experience indicates that even small amounts in the eye can cause severe pain. Unusual sensitivity to light may also occur.

**Skin contact** – Prolonged contact may cause skin irritation. Repeated exposure may cause skin burns. Symptoms may include pain, local redness, swelling and tissue damage. Vinylbenzyl chloride can be absorbed in harmful amounts through the skin. Because vinylbenzyl chloride is poorly soluble in water, isopropanol should be used to decontaminate skin, if available.
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**Inhalation** – Excessive exposure may cause irritation to upper respiratory tract (nose and throat) and lungs.

**Ingestion** – While acute oral toxicity is low, vinylbenzyl chloride should never be ingested. Swallowing large amounts may cause injury.

**Repeated exposure** – Repeated dose toxicity in animals has reported effects on the eyes and respiratory tract. Skin contact may cause an allergic skin reaction.

**Other** – Did not cause cancer in laboratory animals.

For more information, see the relevant Safety Data Sheet.

**Environmental Information**

Environmental information for vinylbenzyl chloride is summarized on the relevant Safety Data Sheet. An overview of environmental information appears below.

Vinylbenzyl chloride is poorly soluble in water and is expected to exhibit moderate volatility. Volatile components are expected to photodegrade. If released to water, vinylbenzyl chloride would be expected to sink or bind particulates. If released to soils, this material is anticipated to associate strongly with soils and exhibit low mobility in the soil compartment.

Vinylbenzyl chloride is expected to degrade in the environment in response to chemical and biological processes. This compound has a moderate potential to bioconcentrate, and is anticipated to be very toxic to aquatic organisms on an acute basis.

For more information, see the relevant Safety Data Sheet.

**Physical Hazard Information**

Vinylbenzyl chloride is combustible and reactive. This reactive monomer will polymerize with potentially hazardous results under high temperatures, low inhibitor concentrations and low oxygen content. Vinylbenzyl chloride also gives off considerable heat during polymerization. Refrigeration and lower temperatures extend storage time.

**Storage / Reactivity Considerations** – Vinylbenzyl chloride should never be stored at temperatures above 26°C (79°F). For storage periods longer than thirty days, refrigeration between -18°C (-0.4°F) and 10°C (50°F) is recommended. Polymerization is generally of greatest concern during shipment and storage of vinylbenzyl chloride. Under certain conditions (i.e., increased heat, low inhibitor concentration, contamination and low oxygen content), rapid, runaway polymerization may occur with potentially serious consequences such as excessive heat and pressure buildup. This is particularly true if the product has been shipped and stored at temperatures above 26°C (79°F).

TBC (4-tert-butylcatechol) is added to VBC (Vinylbenzyl chloride) to inhibit polymer formation and oxidative degradation. When sufficient oxygen is present, the tertiary-butylcatechol prevents polymerization by reacting with oxidation products (monomer peroxy-free radicals) in the monomer. In the absence of oxygen, however, polymerization will proceed as if no inhibitor were present.

Maintaining the shelf life of vinylbenzyl chloride involves four major precautions:
1. Maintaining the inhibitor level above a minimum concentration.
2. Maintaining the oxygen content of the monomer.
3. Storage at proper temperatures.
4. Using recommended materials of construction for storage and handling equipment.

Because of the reactivity of vinylbenzyl chloride, it should not come into contact with the following materials:
- Acids, bases, oxidizing materials
- Polymerization catalysts

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• Clays, micas, diatomaceous earth and sweeping compounds which may cause an exothermic reactions and ignition
• Metal halides, metal oxides or metals such as rust, iron, steel, stainless steel, alloys and other heavy metals such as lead, zinc or their salts or oxides
• Materials such as silica, silicone grease, activated carbon, etc., because they may cause a run-away chemical reaction

**Fire Considerations** – Under fire and high-temperature conditions, polymerization can occur and toxic gases can be generated. Smoke may contain the original material in addition to unidentified toxic and/or irritating compounds. Hazardous combustion products may include and are not limited to hydrogen chloride. Dense smoke is emitted when burned without sufficient oxygen. If cooling with water, steam generation and eruption can create a hazard.

The fire area should be isolated and people kept away. Fire run-off should be contained to prevent environmental damage. Fire fighters should wear positive-pressure, self-contained breathing apparatus (SCBA) and protective firefighting clothing.

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 vinylbenzyl chloride. These regulations may vary by city, state, country, or geographic region. Information may be found by consulting the relevant [Safety Data Sheet](#).

**Additional Information**

- Safety Data Sheet ([www.dow.com/webapps/msds/msdssearch.aspx](#))
- The Dow Answer Center on the Dow Specialty Monomers site

For more business information about VBC, visit Dow’s [Specialty Monomers](#) site at [www.dow.com/specialtymonomers/](#).
References

NOTICES

As part of its 2015 Sustainability Goals, Dow has committed to make publicly available safety assessments for its products globally. This product safety assessment is intended to give general information about the chemical (or categories of chemicals) addressed. It is not intended to provide an in-depth discussion of health and safety information. Additional information is available through the relevant Safety Data Sheet, which should be consulted before use of the chemical. This product safety assessment does not replace required communication documents such as the Safety Data Sheet.

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