

Product Stewardship Summary Methylene Chloride

Summary

Methylene chloride is a colorless, volatile liquid. Its chemical formula is CH₂Cl₂. Methylene chloride is an aggressive solvent, making it a good choice for paint removers as well as an effective carrier and extraction solvent. Under normal conditions it has no flash point and can be used to reduce the flammability of other substances. It does not contribute significantly to the formation of smog, to the depletion of ozone, or to global warming.

1. Chemical Identity

Name: Methylene Chloride

Synonyms: Dichloromethane

Chemical Abstracts Service (CAS) number: 75-09-2

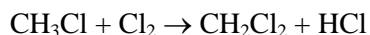
Chemical Formula: CH₂Cl₂

Molecular Weight: 84.94

Methylene chloride is a colorless, volatile liquid. It has a mildly sweet, chloroform-like odor. The vapors are heavier than air and tend to sink to low areas.

2. Production

Methylene chloride is produced by the reaction of methyl chloride with chlorine:



OxyChem is a leading manufacturer of methylene chloride and operates production facilities in Geismar, Louisiana and Wichita, Kansas.

3. Uses

OxyChem does not sell methylene chloride to household consumers. Methylene chloride is used in a wide variety of applications. Some of its uses include:

- Methylene chloride is the active ingredient in some paint removers.
- Methylene chloride is used in nonflammable adhesive formulations for industrial applications.
- Methylene chloride is used in aerosols as a strong solvent, flammability suppressant, vapor pressure depressant, and viscosity thinner. Aerosol uses of methylene chloride include specialized spray paints and lubricants.
- Methylene chloride is used as a solvent in the extraction of several pharmaceutical compounds and in the production of antibiotics and vitamins. It also has been used as a carrier for tablet coatings. In

these applications, essentially no methylene chloride is left in the tablet coating. Residue tolerances have been established by the Food and Drug Administration (FDA) for this use.

- Methylene chloride is employed in the manufacture of polycarbonate resin used for the production of thermoplastics.
- Methylene chloride is used as a solvent in the production of cellulose triacetate, which serves as a base for photographic film.
- Methylene chloride is used in the solvent welding of plastic parts, and as a releasing agent to prevent the manufactured part from permanently bonding to the mold.
- Methylene chloride is often used to remove grease, oil, or similar substances during metal fabrication.
- Methylene chloride is used as an auxiliary blowing agent in the production of softer grades of slabstock flexible polyurethane foams for the furniture and bedding industries. Evaporation of the solvent during production of the urethane polymer expands the cells of the foam, reducing its density without making it stiff or rigid.
- Methylene chloride also is used as an extractant in the recovery and purification of a wide variety of materials, including oils, fats, and waxes.
- Methylene chloride is used to decaffeinate coffee and tea, to extract oleoresins from a variety of spices, and for the extraction of hops. Little or none of the chemical remains in the finished product.
- Methylene chloride also is used as a chemical intermediate in the production of hydrofluorocarbon (HFC) 32, which is used in refrigerant blends developed to replace substances with higher global warming potential.

4. Physical and Chemical Properties

Flammability

Methylene chloride has no measurable flash point at normal temperature and pressure. It is sometimes added to a mixture to reduce the flammability of other components in a mixture. If methylene chloride is involved in a fire, extinguish the fire using foam, dry chemical, carbon dioxide or water spray.

Reactivity

Methylene chloride can be stored in vessels made of common materials of construction. However, it may react with aluminum, and it will attack some forms of plastics, rubber, and some coatings.

5. Health Effects

Inhalation

Overexposure to methylene chloride vapor may cause central nervous system depression (anesthesia) and irritation to the mucous membranes and respiratory tract. Symptoms can include nausea, lightheadedness, confusion, vomiting, headache, and fatigue. These effects become more pronounced as the vapor concentration increases, but generally are not observed below 200 parts per million (ppm). Visible symptoms of anesthesia have been reported in experimental animals during exposure to concentrations of 4,000 ppm and greater. Continued exposure to high levels may cause unconsciousness and even death.

Carbon monoxide (CO) is an end product of metabolism of methylene chloride. Studies in humans have demonstrated that 8-hour exposures to concentrations of 100 to 200 ppm of methylene chloride vapor produce carboxyhemoglobin (COHb) concentrations of 3 to 7 percent, approximating those produced by CO at 50 ppm and well below COHb levels generally required to produce symptoms.

Eye Contact

Methylene chloride can cause pain and irritation if splashed into the eyes.

Skin Contact

Skin contact may cause pain and irritation.

Ingestion

Swallowing methylene chloride may cause nausea or vomiting. If vomiting occurs, the material can get into the lungs. It can also be absorbed through the gastrointestinal tract and may cause central nervous system depression (anesthesia) with symptoms similar to those described above under inhalation.

Cancer Studies

Methylene chloride is considered “possibly carcinogenic to humans” (Group 2B) by the International Agency for Research on Cancer (IARC) and “reasonably anticipated to be a human carcinogen” by NTP. It is considered a potential human carcinogen by the Occupational Safety and Health Administration (OSHA).

Methylene chloride in the drinking water of mice and rats did not cause tumors. Similarly, hamsters exposed via inhalation for two years did not experience tumors. Rats exposed via inhalation had an increase in the number of benign mammary gland tumors. The mammary gland tumors showed no progression toward malignancy. A small increase in ventral neck region tumors in and around the salivary glands also was observed among male (but not female) rats inhaling methylene chloride. This increase was not seen in subsequent studies and was not thought by EPA’s Science Advisory Board to have relevant human health implications. Mice exposed by inhalation have experienced an increased incidence of malignant liver and lung tumors.

The significance of the animal data to humans has been studied. Benign mammary gland tumors occur spontaneously at a relatively high rate in the strains of rats tested, and the frequency of occurrence in the NTP study was within, or only slightly above, historical control frequency data. EPA’s Science Advisory Board concluded that the increase in benign mammary gland tumors was not sufficient evidence for a finding of carcinogenicity in rats. A research program to investigate species differences in the metabolism of methylene chloride and the mechanism responsible for its induction of lung and liver tumors in laboratory mice found that mice are uniquely sensitive at high exposure levels to methylene chloride-induced lung and liver cancer. Humans and other rodent species metabolize methylene chloride differently.

The conclusions regarding inter-species differences are supported by the available epidemiology studies that show no association between increased cancer risk and exposure to relatively high concentrations of methylene chloride. Studies of five occupational cohorts are available for the assessment of mortality effects in exposed populations. Considered as a whole, the available epidemiological evidence does not indicate a carcinogenic risk associated with occupational exposures to methylene chloride. The studies consistently demonstrate no excess mortality for all causes of death, total cancer, and the cancers that were observed in the NTP mouse bioassay (lung and liver cancers). In addition, no positive dose-response relationships have been observed. A small number of excess deaths from biliary tract tumors observed in one study has not been replicated in the other investigations. Similarly, findings of excess prostate and cervical cancer in one study were not replicated in the other studies.

Reproductive Studies

Based on studies using laboratory animals, methylene chloride does not cause adverse reproductive or developmental effects.

6. Environmental Effects

If released to land, methylene chloride is expected to have very high mobility in soil. Volatilization from moist soil surfaces to the air is expected to be an important process. Methylene chloride may volatilize from dry soil surfaces based upon its vapor pressure. Biodegradation in soil may occur, based on activated sludge studies.

If released to water, methylene chloride is not expected to adsorb to suspended solids and sediment. Biodegradation is possible in natural waters but will probably be very slow compared with evaporation. The estimated volatilization half-lives for a model river and model lake are 1 hr and 4 days, respectively.

If released to air, methylene chloride will exist solely as a vapor in the ambient atmosphere. Vapor-phase methylene chloride will be degraded in the atmosphere by reaction with photochemically-produced hydroxyl radicals; the half-life for this reaction in air is estimated to be 119 days.

Methylene chloride has exhibited low toxicity in aquatic organisms. This compound is not expected to bioconcentrate in aquatic organisms.

7. Exposure

The most likely ways exposures could occur are:

- Worker exposure – Exposure could occur in the manufacturing facility or in industrial facilities that use methylene chloride. Exposures could occur by inhalation of vapors. Good industrial hygiene practices and personal protective equipment minimize the risk of exposure.
- Consumer exposure – OxyChem does not sell methylene chloride for use directly in consumer products. However, members of the general public can be exposed to methylene chloride that is formulated into consumer products such as paint remover.
- Releases – If a spill occurs, emergency personnel should wear protective equipment to minimize exposures.

8. Recommended Risk Management Measures

Methylene chloride is volatile liquid. Personnel exposure must be controlled. Prior to using methylene chloride, carefully read and comprehend the Material Safety Data Sheet. The following are some risk management measures that are effective against these hazards:

- Work areas where methylene chloride is used should be well ventilated to limit solvent vapors to below exposure limits.
- To avoid overexposure to methylene chloride vapors, monitor the vapor concentration in the work place. If vapors are above exposure limits, install additional engineering controls (such as localized ventilation) to reduce methylene chloride vapor concentrations to safe operating levels.
- To prevent eye contact, protective eye wear (such as splash goggles, a full face shield, or safety glasses with side shields) must be worn.

- To prevent skin contact, wear protective clothing (including gloves) when working with methylene chloride.
- Proper labeling, handling and storage of methylene chloride will reduce the likelihood of accidental exposure.
- Equipment used for methylene chloride storage or processing should be constructed of the proper materials. For example, bulk storage containers should be constructed of either mild carbon, or stainless steel. Do not use aluminum as a material of construction. Storage tanks should not be constructed of, nor contain, any non-compatible plastic components. Carbon steel is the material of choice for piping.
- Personnel involved with methylene chloride manufacturing operations should be properly trained.
- People using formulated products containing methylene chloride should carefully read and follow the instructions on the product label.

9. Product Stewardship Programs

OxyChem provides bulletins to help methylene chloride customers handle the product safely. For example, bulletins are available for topics such as unloading from tank trailers.

OxyChem is a member of the Halogenated Solvents Industry Association (HSIA). Through the HSIA, OxyChem sponsors studies of methylene chloride under EPA's High Production Volume (HPV) Program.

10. Regulatory Compliance Information

The following is a summary of regulations and guidelines that may pertain to methylene chloride (additional regulations and guidelines may apply):

U.S. Environmental Protection Agency:

- Clean Air Act: Methyl chloride is included on the Clean Air Act, Section 112(b) list of Hazardous Air Pollutants.
- Clean Water Act: Methyl chloride is included on the Clean Water Act, Section 126 list of Priority Pollutants.
- Comprehensive Environmental Response, Compensation, and Liability Act: Releases of methylene chloride in excess of the Reportable Quantity of 1000 pounds must be reported.
- Emergency Planning and Community Right-to-know Act: Methylene chloride is a listed substance that is subject to reporting requirements under Section 313 of the act. These reports are often called Toxic Release Inventory (TRI) Reports.
- Resource Conservation and Recovery Act: Listed Hazardous Waste Codes in which listing is based wholly or partly on methylene chloride include U080 and F002.

Occupational Safety and Health Administration - Permissible Exposure Limits:

- 8 hour time weighted average: 25 ppm
- 15 minute short term limit: 125 ppm
- Methylene chloride is a specifically regulated substance. The regulations that apply to methylene chloride are in 29 Code of Federal Regulations 1910.1052.

American Conference of Governmental Industrial Hygienists - Threshold Limit Values

- 8 hour time weighted average: 50 ppm

National Institute for Occupational Safety and Health – Recommended Exposure Levels:

- Immediately Dangerous to Life and Health concentration: 2,300 ppm

11. Sources for Additional Information

ACGIH, Documentation of the Threshold Limit Values and Biological Exposure Indices, 7th ed.

ATSDR, Toxicological Profile for Methylene Chloride, 1993.

Halogenated Solvents industry Association, Methylene Chloride White Paper, March 2008.

http://www.hsia.org/white_papers/paper.shtml

HSDB, Hazardous Substances Databank Number: 66, Last Revision Date: 20050624.

IARC (1999), IARC Monographs on the Evaluation of Carcinogenic Risks to Humans, Vol. 71, Re-evaluation of Some Organic Chemicals, Hydrazine and Hydrogen Peroxide, pp. 251-315.

IUCLID Dataset, Dichloromethane, Substance ID: 75-09-2, February 19, 2000.

NIOSH, Methylene Chloride, IDLH Documentation, August 16, 1996.

National Toxicology Program (NTP), U.S. Department of Health and Human Services, National Institutes of Environmental Health Sciences, Eleventh Report on Carcinogens.

OxyChem Material Safety Data Sheet web site: <http://msds.oxy.com/>

Reprotox, Reprotox Record Number: 1363, Last Revision Date: November 1, 2007.

RTECS, RTECS Number: PA8050000, Review Date: 200902.

U.S. EPA. Updated Health Effects Assessment for Methylene Chloride. U.S. Environmental Protection Agency, Washington, D.C., EPA/600/8-89/092 (NTIS PB90142449).

12. Contact Information: For additional information, call 1-800-752-5151 or 1-972-404-3700.

13. Preparation Date: December 2, 2009

This Product Stewardship Summary is intended to give general information about the product discussed above. It is not intended to provide an in-depth discussion of all health and safety information about the product or to replace any required regulatory communications.

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