

Dichloromethane

Synonyms: methyl (methylene) chloride; methylene dichloride

CAS: 75-09-2

MF: CH₂Cl₂

MW: 84.93

Solubility in water: 1.3 g/100 ml, at 20°C. Soluble in ethanol, ethyl ether and acetone.

Major uses

Dichloromethane is widely used in several industries as a solvent for organic compounds, for example, as a paint remover, as an aerosol propellant and as a blowing agent for polyurethane foams, and in the manufacture of photographic film. In the food industry, it is used to decaffeinate coffee and to prepare extracts of hops and other flavorings. It is also used as a fumigant pesticide for stored strawberries and grains [1].

Dichloromethane does not appear to occur naturally in the environment. It is made from methane gas or wood alcohol [1].

Human toxicity

Dichloromethane is toxic by ingestion, inhalation or dermal exposure. It is irritating to the eyes, skin, and mucous membranes. Acute exposure may cause narcotic effects. Lethal symptoms include the central nervous system (CNS) depression, respiratory failure and pulmonary edema, as well as metabolic acidosis. Hypotension, hypertension, tachycardia, and cardiac arrest have been reported after ingestion of dichloromethane. Other symptoms after ingestion may be gastrointestinal burns, hemorrhage, and necrosis. The lowest oral dose reported to cause death was 375 mg/kg. [1].

Permissible concentration of dichloromethane in blood is 0.8 mg/l [2]. Blood levels exceeding 1 mg/l can be regarded as toxic; concentrations over 5 mg/l can be fatal [3]. According to Winek [4], the lethal plasma/serum level of dichloromethane is 280 mg/l. Mean post-mortem blood dichloromethane concentration, based on data from several handbooks, was 360 mg/l (from 280 to 496 mg/l) [5].

Threshold Limit Value/Time Weighted Average (TLV/TWA): 50 ppm [3].

Carcinogenicity: dichloromethane is possibly carcinogenic in humans. Carcinogen rating: 2B (IARC) [3].

Kinetic data

Absorption: the major route of exposure is through inhalation. Dichloromethane is rapidly absorbed via the lungs and the gastrointestinal tract. It may be absorbed through intact skin [2].

Kinetics: apparently first-order? [5].

Volume of distribution (Vd): not defined; possibly about 0.6 l/kg? [5].

Distribution: the absorbed dichloromethane is distributed to all body tissues, but at first line to the liver, brain and subcutaneous adipose tissues.

Passage of blood-brain barrier: free [5].

Blood protein binding: not reported [5].

Time to peak blood concentration: 2 h [5].

Elimination: dichloromethane is mainly eliminated unchanged via expired air, and through metabolism (formation of carbon monoxide, CO).

The mean elimination half-life from blood: about 40 min [5]

Metabolism and excretion

Dichloromethane is metabolized in the liver by the microsomal cytochrome P450-enzyme system to carbon monoxide (CO), formaldehyde and carbon dioxide. CO binds to hemoglobin, resulting in formation of carboxyhemoglobin (COHb) in the blood and toxic effects. There is a linear relationship between the COHb level and dichloromethane exposure concentrations [7].

When heated to decomposition, dichloromethane releases toxic phosgene, hydrogen chloride gas, and chlorine gas.

Excretion: only a small fraction of the dose is excreted unchanged in the urine [6]. The half-life of the excretion of the CO is approximately 13 h [6].

Toxicological mechanisms

Toxicity of dichloromethane is mainly associated with its biotransformation to carbon monoxide, which itself is the CNS depressant, and with the formation of COHb. Elevated levels in blood of carbon monoxide and COHb can cause the CNS depression and heart failure [5].

Target organs: CNS, heart [5].

References

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Written by Ada Kolman, January 2006; revised March 2007
ada.kolman@telia.com