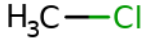
CHAPTER 4. CHEMICAL AND PHYSICAL INFORMATION

4.1 CHEMICAL IDENTITY

Industrial chloromethane is a colorless liquid or compressed gas while environmental chloromethane is a trace component of the atmosphere. Chloromethane is composed of a single carbon atom bound to three hydrogen atoms and one chlorine atom. The chemical was previously used widely as a refrigerant, but this use has been replaced by other chemicals such as hydrofluorocarbons. At some time after a series of chloromethane related-deaths in 1928 and 1929, acrolein was added to chloromethane refrigerants as a nasal irritating tracer to help warn those who might be exposed (McNally 1946). Chloromethane is used mainly in the production of adhesives, sealants, and in the production of silicones, but it is also an impurity in vinyl chloride, such that is it present in polyvinyl chloride (PVC) products. Chloromethane is produced from methanol and hydrogen chloride using an aluminum oxide catalyst.

Table 4-1. lists common synonyms, trade names, and other pertinent identification information for chloromethane.

Table 4-1. Chemical Identity of Chloromethane

Characteristic	Information	Reference
Chemical name	Chloromethane	PubChem 2019
Synonym(s) and Registered trade name(s)	R 40; Artic; methyl chloride; methane, chloro-; Freon 40; MeCl; monochloromethane	PubChem 2019
	Chloride, Methyl; chloromethane; methyl chloride	PubChem 2019
Chemical formula	CH_3Cl	PubChem 2019
Chemical structure		PubChem 2019
CAS registry number	74-87-3	PubChem 2019
UNII:	A6R43525YO	PubChem 2019
EPA hazardous waste number	U045	PubChem 2019

CAS = Chemical Abstracts Service; EPA = Environmental Protection Agency; UNII = Unique Ingredient Identifier

4.2 PHYSICAL AND CHEMICAL PROPERTIES

Chloromethane exists as a gas at room temperate and atmospheric pressure. It is moderately soluble in water and several other organic solvents. It is miscible in chloroform and ether. Chloromethane has a relatively high vapor pressure, which contributes to its flammability. In addition to being highly water soluble, chloromethane has a relatively low K_{ow} suggesting that it is unlikely to bioaccumulate.

Chloromethane's low K_{oc} indicates a high mobility in soil. The Henry's Law constant for chloromethane suggests that it will rapidly volatilize from the surface of water and that it may volatilize from moist soil; the high vapor pressure of chloromethane indicates that it will volatilize from dry soil surfaces. Table 4-2. lists important physical and chemical properties of chloromethane.

Table 4-2. Physical and Chemical Properties of Chloromethane

Property	Information	Reference
Molecular weight	50.488 g/mol	Tsai 2017
Color	Colorless	PubChem 2019
Physical state	Gas (can leak as a liquid or vapor)	PubChem 2019
Melting point(s)	-97.6 °C	PubChem 2019
Boiling point(s)	-23.7 °C	PubChem 2019
Critical temperature and pressure	416.25 K and 6.679 MPa	PubChem 2019
Density	0.911 g/cm^3 at 25 °C 0.997 g/cm^3 at -24 °C	PubChem 2019; Tsai 2017
Viscosity	0.106 mPas (gas at 20 °C)	Tsai 2017
Taste	Sweet taste	PubChem 2019
Odor	Faint sweet ethereal odor Mild odor[a]	PubChem 2019
Odor threshold:		PubChem 2019
Water	No data	
Air	21 mg/m^3 [a]	
Solubility:		PubChem 2019
Water	5040 mg/L at 25 °C	
Organic solvent(s) at 20 °C	benzene 4723 mg/L, carbon tetrachloride 3756 mg/L, glacial acetic acid 3679 mg/L, ethanol 3740 mg/L; miscible with ethyl ether, acetone, benzene, chloroform	
Partition coefficients:		
Log K_{oa}	1.565	Vallero 2014
Log K_{ow}	0.91	PubChem 2019
Log K_{oc}	13	PubChem 2019
Relative Vapor Density	1.8 (air=1)	PubChem 2019; Tsai 2017
Vapor pressure at 25 °C	4300 mmHg	PubChem 2019
Henry's law constant at 24 °C	8.82x10^{-3} atm-m^3/mol	PubChem 2019
Degradation half-life in air via reaction with OH radicals	3.6x10^{-14} cu cm/molecule-sec at 25 °C	PubChem 2019
Dissociation constants:	No data	PubChem 2019
Heat of combustion	-5290 Btu/lb	PubChem 2019
Heat of vaporization	18.92 kJ/mol at 25 °C 21.40 kJ/mol at boiling point	PubChem 2019

Table 4-2. Physical and Chemical Properties of Chloromethane

Property	Information	Reference
Autoignition temperature	1170 °F	PubChem 2019
Flashpoint	-50 °F (closed cup)	PubChem 2019
Flammability limits in air	8.1 - 17.4%	PubChem 2019; Tsai 2017
Conversion factors:	1 mg/L = 484 ppm; 1 ppm = 2.06 mg/m^3 at 25 °C and 760 torr	PubChem 2019
Explosive limits	Moderate explosion hazard when exposed to flames and sparks	PubChem 2019
Incompatibilities and reactivity	Chloromethane will attack some forms of plastics, rubber, and coatings; also attacks aluminum, magnesium and zinc; Incompatible with strong oxidizing agents and iron	PubChem 2019

[a] Chloromethane is not noticeable at dangerous concentrations.