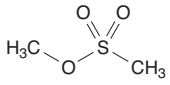
Methyl Methanesulfonate

CAS No. 66-27-3

Reasonably anticipated to be a human carcinogen

First listed in the *Sixth Annual Report on Carcinogens* (1991)



Carcinogenicity

Methyl methanesulfonate is *reasonably anticipated to be a human carcinogen* based on sufficient evidence of carcinogenicity from studies in experimental animals.

Cancer Studies in Experimental Animals

Methyl methanesulfonate caused tumors in mice and rats at several different tissue sites and by several different routes of exposure. Administration of methyl methanesulfonate in the drinking water caused benign lung tumors (adenoma) and lymphoma of the thymus in male mice. In male rats, subcutaneous injection of methyl methanesulfonate caused cancer at the injection site (squamous-cell carcinoma and polymorphic-cell sarcoma), and 1 of 12 rats developed kidney cancer (nephroblastoma). A single intraperitoneal injection of methyl methanesulfonate caused tumors of the nervous system (oligodendroglioma, malignant neurofibroma, astrocytoma, malignant neurinoma, mixed glioma, or meningioma of the spinal cord) in adult rats of both sexes and in the offspring of pregnant rats exposed on gestation day 15 or 21 (Clapp *et al.* 1968, IARC 1974).

Since methyl methanesulfonate was listed in the *Sixth Annual Report on Carcinogens,* additional studies in rodents have been identified. In female mice, subcutaneous injection of methyl methanesulfonate caused cancer at the injection site (sarcoma) (Segal *et al.* 1987). In male rats exposed to methyl methanesulfonate by inhalation for six weeks and then observed for life, the incidence of nasal tumors (mainly squamous-cell carcinoma) was significantly increased (IARC 1999).

Cancer Studies in Humans

No epidemiological studies were identified that evaluated the relationship between human cancer and exposure specifically to methyl methanesulfonate.

Properties

Methyl methanesulfonate is an ester of sulfuric acid that exists as a colorless to amber liquid at room temperature. It is soluble in water, dimethyl formamide, and propylene glycol, but only slightly soluble in nonpolar solvents. Methyl methanesulfonate is stable under normal temperatures and pressures, but it forms irritating corrosive compounds or toxic gases in the presence of fire (IARC 1974, Akron 2009). Physical and chemical properties of methyl methanesulfonate are listed in the following table.

Property	Information
Molecular weight	110.1[a]
Specific gravity	1.2943 at 20°C/4°C[a]
Melting point	20°C[a]
Boiling point	203°C at 753 mm Hg[a]
Log K_{ow}	–0.66[b]
Water solubility	1,000 g/L at 25°C[b]
Vapor pressure	0.31 mm Hg at 25°C[b]

Sources: [a]HSDB 2009, [b]ChemIDplus 2009.

Use

Methyl methanesulfonate is used experimentally as a research chemical and as a solvent catalyst in polymerization, alkylation, and esterification reactions (IARC 1974, Wyatt and Pittman 2006, NIH 2007). It has been tested as a cancer chemotherapeutic agent, and the monoesters of methanesulfonic acid were considered for possible use as a reversible insect and mammalian pest chemosterilant and as a human male contraceptive (IARC 1974).

Production

Production of methyl methanesulfonate is limited, because it is used only in research (IARC 1974, 1999). Methyl methanesulfonate is not produced commercially in the United States (IARC 1999, HSDB 2009). In 2009, methyl methanesulfonate was available from 21 suppliers worldwide, including 13 U.S. suppliers (ChemSources 2009). No data on U.S. imports or exports of methyl methanesulfonate were found.

Exposure

Exposure to methyl methanesulfonate appears to be limited to laboratory research personnel (IARC 1974, 1999). If released to air, methyl methanesulfonate will exist in the vapor phase and will react slowly with hydroxyl radicals, with a half-life of 69 days. If released to a moist environment, it will hydrolyze with a half-life of 4.56 hours at 25°C. It is not expected to bioconcentrate in aquatic organisms or volatilize from water (HSDB 2009).

Regulations

Environmental Protection Agency (EPA)

Resource Conservation and Recovery Act

Listed as a hazardous constituent of waste.

References

Akron. 2009. *The Chemical Database.* The Department of Chemistry at the University of Akron. http://ull.chemistry.uakron.edu/erd and search on CAS number. Last accessed: 5/19/09.

ChemIDplus. 2009. *ChemIDplus Advanced*. National Library of Medicine. http://chem.sis.nlm.nih.gov/chemidplus/chemidheavy.jsp and select Registry Number and search on CAS number. Last accessed: 5/19/09.

ChemSources. 2009. *Chem Sources - Chemical Search*. Chemical Sources International. http://www.chemsources.com/chemonline.html and search on methyl methanesulfonate. Last accessed: 5/19/09.

Clapp NK, Craig AW, Toya RE Sr. 1968. Oncogenicity by methyl methanesulfonate in male RF mice. *Science* 161: 160-161.

HSDB. 2009. *Hazardous Substances Data Bank.* National Library of Medicine. http://toxnet.nlm.nih.gov/cgi-bin/sis/htmlgen?HSDB and search on CAS number. Last accessed: 5/19/09.

IARC. 1974. Methyl methanesulfonate. In *Some Anti-thyroid and Related Substances, Nitrofurans and Industrial Chemicals*. IARC Monographs on the Evaluation of Carcinogenic Risk of Chemicals to Humans, vol. 7. Lyon, France: International Agency for Research on Cancer. pp. 253-260.

IARC. 1999. Methyl methanesulfonate. In *Re-evaluation of Some Organic Chemicals, Hydrazine, and Hydrogen Peroxide*. IARC Monographs on the Evaluation of Carcinogenic Risk of Chemicals to Humans, vol. 71. Lyon, France: International Agency for Research on Cancer. pp. 1059-1078.

Segal A, Seidman I, Melchionne S. 1987. Induction of thymic lymphomas and squamous cell carcinomas following topical application of isopropyl methanesulfonate to female Hsd:(ICR)BR mice. *Cancer Res* 47(13): 3402-3405.

Wyatt MD, Pittman DL. 2006. Methylating agents and DNA repair responses: Methylated bases and sources of strand breaks. *Chem Res Toxicol* 19(12): 1580-1594.