

# Dimethyl Sulfate

77-78-1

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## Hazard Summary

Exposure to dimethyl sulfate is primarily occupational. Acute (short-term) exposure of humans to the vapors of dimethyl sulfate may cause severe inflammation and necrosis of the eyes, mouth, and respiratory tract. Acute oral or inhalation exposure to dimethyl sulfate primarily damages the lungs but also injures the liver, kidneys, heart, and central nervous system (CNS), while dermal contact with dimethyl sulfate may produce severe blistering in humans. Human data on the carcinogenic effects of dimethyl sulfate are inadequate. Tumors have been observed in the nasal passages, lungs, and thorax of animals exposed to dimethyl sulfate by inhalation. EPA has classified dimethyl sulfate as a Group B2, probable human carcinogen.

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Please Note: The main sources of information for this fact sheet are EPA's Integrated Risk Information System (IRIS) (2), which contains information on the carcinogenic effects of dimethyl sulfate, and EPA's Health and Environmental Effects Profile for Dimethyl Sulfate. (4)

## Uses

- Dimethyl sulfate is used as a methylating agent in the manufacture of many organic chemicals. It is also used in the manufacture of dyes and perfumes, for the separation of mineral oils, and for the analysis of auto fluids. (2-4)
- Formerly, dimethyl sulfate was used as a war gas. (2-4)

## Sources and Potential Exposure

- Individuals are most likely to be exposed to dimethyl sulfate in the workplace. (1)
- Dimethyl sulfate has been detected in fly ash and in airborne particulate matter generated by coal combustion processes; individuals may also be exposed to low levels by breathing ambient air near coal-fired power generating plants. (1,2)

## Assessing Personal Exposure

- No information was located regarding the measurement of personal exposure to dimethyl sulfate.

## Health Hazard Information

### Acute Effects:

- Acute exposure of humans to the vapors of dimethyl sulfate may cause severe inflammation and necrosis of the eyes, mouth, and respiratory tract; severe damage to the lungs may result. (3)
- Acute oral or inhalation exposure to dimethyl sulfate primarily damages the lungs but also injures the liver, kidneys, heart, and CNS in humans. Coma and death may result from exposure to very high concentrations. Delayed appearance of symptoms may permit unnoticed exposure to lethal quantities of dimethyl sulfate.(3)
- Dermal contact with dimethyl sulfate may produce severe blistering in humans. (3)
- Tests involving acute exposure of rats, mice, and guinea pigs, have demonstrated dimethyl sulfate to have **high** to **extreme** acute toxicity from inhalation and **high** acute toxicity from oral exposure. (5)

#### Chronic Effects (Noncancer):

- No information is available on the chronic (long-term) effects of dimethyl sulfate in humans.
- Decreased body weight and increased mortality have been observed in rats and mice exposed to dimethyl sulfate by inhalation. (2)
- EPA has not established a Reference Concentration (RfC) or a Reference Dose (RfD) for dimethyl sulfate. (4)

#### Reproductive/Developmental Effects:

- No information is available on the reproductive or developmental effects of dimethyl sulfate in humans.
- Dimethyl sulfate has been reported to produce tumors in the offspring of rats exposed intravenously. (2,4,6)

#### Cancer Risk:

- Human data on the carcinogenic effects of dimethyl sulfate are inadequate, with two studies available. The first study did not report a statistically significant increase in cancer among workers exposed to dimethyl sulfate, and the second study lacked adequate exposure information. (4)
- Tumors have been observed in the nasal passages, lungs, and thorax of animals exposed to dimethyl sulfate by inhalation. (2-4)
- EPA has classified dimethyl sulfate as a Group B2, probable human carcinogen. (4)

## Physical Properties

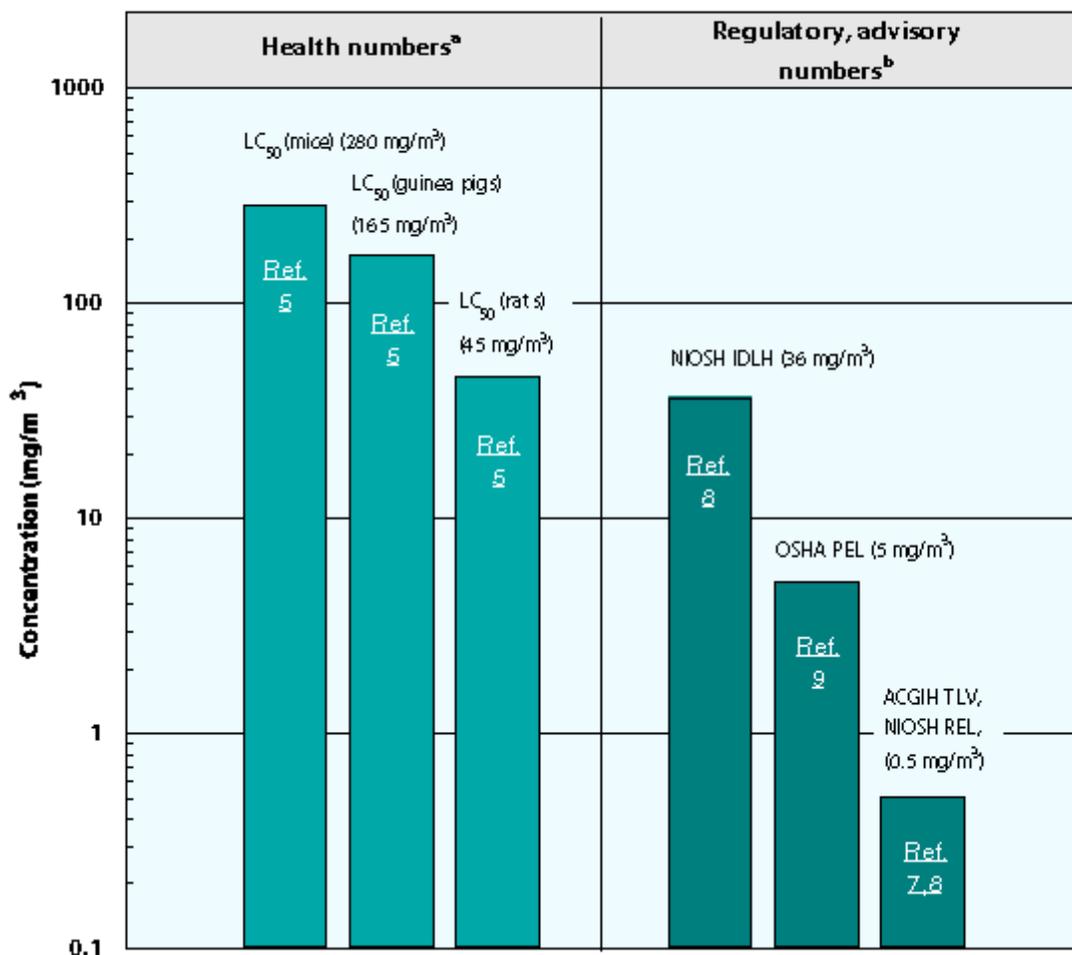
- The chemical formula of dimethyl sulfate is  $C_2H_6O_4S$ , and it has a molecular weight of 126.13 g/mol. (2)
  - Dimethyl sulfate is a colorless, oily liquid that is slightly soluble in water. (3,4)
  - Dimethyl sulfate has a faint, onion-like odor; the odor threshold has not been established. (4)
  - The vapor pressure for dimethyl sulfate is 0.5 mm Hg at 20 °C, and it has a log octanol/water partition coefficient ( $\log K_{ow}$ ) of 0.032. (1,4)
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#### Conversion Factors:

To convert concentrations in air (at 25 °C) from ppm to  $mg/m^3$ :  $mg/m^3 = (ppm) \times (\text{molecular weight of the compound}) / (24.45)$ . For dimethyl sulfate: 1 ppm = 5.16  $g/m^3$ .

### Health Data from Inhalation Exposure

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ACGIH TLV --American Conference of Governmental and Industrial Hygienists' threshold limit value expressed as a time-weighted average; the concentration of a substance to which most workers can be exposed without adverse effects.

LC<sub>50</sub> (Lethal Concentration <sub>50</sub>)--A calculated concentration of a chemical in air to which exposure for a specific length of time is expected to cause death in 50% of a defined experimental animal population.

NIOSH IDLH --National Institute of Occupational Safety and Health's immediately dangerous to life or health limit; NIOSH recommended exposure limit to ensure that a worker can escape from an exposure condition that is likely to cause death or immediate or delayed permanent adverse health effects or prevent escape from the environment.

NIOSH REL --NIOSH's recommended exposure limit; NIOSH-recommended exposure limit for an 8- or 10-h time-weighted-average exposure and/or ceiling.

OSHA PEL --Occupational Safety and Health Administration's permissible exposure limit expressed as a time-weighted average; the concentration of a substance to which most workers can be exposed without adverse effect averaged over a normal 8-h workday or a 40-h workweek.

The health and regulatory values cited in this factsheet were obtained in December 1999.

<sup>a</sup> Health numbers are toxicological numbers from animal testing or risk assessment values developed by EPA.

<sup>b</sup> Regulatory numbers are values that have been incorporated in Government regulations, while advisory numbers are nonregulatory values provided by the Government or other groups as advice. OSHA numbers are regulatory, whereas NIOSH and ACGIH numbers are advisory.

Summary created in April 1992, updated January 2000

## References

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- National Library of Medicine, National Toxicology Information Program, Bethesda, MD. 1993.
2. U.S. Environmental Protection Agency. Health and Environmental Effects Profile for Dimethyl Sulfate. EPA/600/x-85/392. Environmental Criteria and Assessment Office, Office of Health and Environmental Assessment, Office of Research and Development, Cincinnati, OH. 1985.
  3. The Merck Index. An Encyclopedia of Chemicals, Drugs, and Biologicals. 11th ed. Ed. S. Budavari. Merck and Co. Inc., Rahway, NJ. 1989.
  4. U.S. Environmental Protection Agency. Integrated Risk Information System (IRIS) on Dimethyl Sulfate. National Center for Environmental Assessment, Office of Research and Development, Washington, DC. 1999.
  5. U.S. Department of Health and Human Services. Registry of Toxic Effects of Chemical Substances (RTECS, online database). National Toxicology Information Program, National Library of Medicine, Bethesda, MD. 1993.
  6. International Agency for Research on Cancer (IARC). IARC Monographs on the Evaluation of the Carcinogenic Risk of Chemicals to Man: Some Aromatic Amines, Hydrazines and Related Substances, N-Nitroso Compounds and Miscellaneous Alkylating Agents. Volume 4. World Health Organization, Lyon. 1982.
  7. American Conference of Governmental Industrial Hygienists (ACGIH). 1999 TLVs and BEIs. Threshold Limit Values for Chemical Substances and Physical Agents. Biological Exposure Indices. Cincinnati, OH. 1999.
  8. National Institute for Occupational Safety and Health (NIOSH). Pocket Guide to Chemical Hazards. U.S. Department of Health and Human Services, Public Health Service, Centers for Disease Control and Prevention. Cincinnati, OH. 1997.
  9. Occupational Safety and Health Administration (OSHA). Occupational Safety and Health Standards, Toxic and Hazardous Substances. Code of Federal Regulations. 29 CFR 1910.1000. 1998.