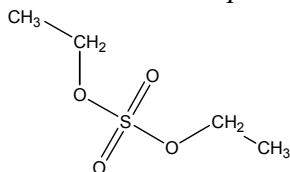


DIETHYL SULFATE

CAS No. 64-67-5

First Listed in the *Fourth Annual Report on Carcinogens*



CARCINOGENICITY

Diethyl sulfate is *reasonably anticipated to be a human carcinogen* based on sufficient evidence of carcinogenicity in experimental animals (IARC 1974, 1982, 1987, 1992, 1999). When administered by subcutaneous injection, diethyl sulfate induced local sarcomas in rats. Subcutaneous injection of diethyl sulfate to pregnant rats induced malignant tumors of the nervous system in their offspring. A few tumors of the forestomach occurred in rats given diethyl sulfate by gavage.

There is limited evidence for the carcinogenicity of diethyl sulfate from studies in humans (IARC 1982, 1987, 1992, 1999). In a historical cohort study of process workers, chemical mechanics, and refinery workers at a factory manufacturing isopropyl alcohol and ethanol by the strong acid process, a process which produces high concentrations of diethyl sulfate, excess mortality from upper respiratory (laryngeal) cancer was found among process workers.

PROPERTIES

Diethyl sulfate is a colorless, moderately viscous, oily liquid that darkens with age. It has a faint ethereal odor. It is miscible with alcohol, ether, and probably most polar organic solvents. Diethyl sulfate rapidly decomposes into monoethyl sulfate and alcohol when heated (HSDB 2001). Diethyl sulfate is available as a technical grade product that contains 99.5% active ingredient or as a laboratory chemical with a purity of 95% to greater than 98% (IARC 1992).

USE

The primary use of diethyl sulfate is as a chemical intermediate (ethylating agent) in organic synthesis. It is used in dye manufacturing and pigment production. Other primary uses are as a finishing agent in textile manufacturing and as a dye-set agent in carbonless paper. Smaller quantities are used in household products, cosmetics, agricultural chemicals, pharmaceuticals, laboratory reagents, as an accelerator in the sulfation of ethylene, and in some sulfonation processes (IARC 1992, 1999, HSDB 2001).

PRODUCTION

In 1974, IARC reported that diethyl sulfate had been produced commercially in the United States for at least 50 years (IARC 1974). There is only one current U.S. manufacturer of diethyl sulfate with an estimated annual production of 11 million lb or 5,000 metric tons (IARC 1992). The 1979 TSCA Inventory reported two producers of diethyl sulfate with a combined

production of 6.1 million lb in 1977, and nine U.S. companies importing a total of 775,000 lb (TSCA 1979). Thirteen current U.S. suppliers were identified (Chem Sources 2001). No data on exports or imports were identified.

EXPOSURE

The primary routes of potential human exposure to diethyl sulfate are inhalation and dermal contact. Exposure to diethyl sulfate may occur during its production and use as a chemical intermediate, primarily as an ethylating agent (NCI 1985, HSDB 2001). It appears, that most exposures have been associated with its use, since domestic production of diethyl sulfate has not been widespread (IARC 1974). The potential for exposure to diethyl sulfate during its use would appear to be high because a wide variety of intermediates and products are prepared from it (NCI 1985). The National Occupational Exposure Survey (1981-1983) indicated that 2,261 total workers, including 164 women, were potentially exposed to diethyl sulfate (NIOSH 1984). The National Occupational Hazard Survey, conducted by NIOSH from 1972 to 1974, estimated that 1,646 workers were potentially exposed to diethyl sulfate in the workplace in 1970 (NIOSH 1976). Quantitative exposure data were not located in the available literature (IARC 1992).

It has been documented that workers involved in the production of ethanol by the strong acid process were frequently exposed to diethyl sulfate. Analysis of the history of an ethanol plant and interviews with present and former supervisors indicated that diethyl sulfate exposures were likely to occur when process equipment was opened for manual cleaning and from leaky pump seals. It was noted that the production equipment had to be opened frequently to clean deposits that fouled absorbers, extract soakers, and other pipes and vessels. These deposits included heavy sticky materials, such as coke or tar, which prevented complete draining or purging of unit streams that contained high concentrations of diethyl sulfate. The ethanol strong acid process workers were also exposed to sulfuric acid mist, coke, tar, heat-transfer fluid vapor, sulfur trioxide, and ethyl ether (NCI 1985). EPA's Toxic Chemical Release Inventory (TRI) estimated that 3,737 lb of diethyl sulfate were released to air at the 31 facilities that produced, processed, or used the chemical in the United States in 1999. Off-site releases totaled 34,518 lb and more than 7.6 million lb of diethyl sulfate wastes were transferred off-site for further treatment (TRI99 2001).

REGULATIONS

EPA regulates diethyl sulfate under the Clean Air Act (CAA), Superfund Amendments and Reauthorization Act (SARA), and Toxic Substances Control Act (TSCA). The National Emission Standards for Hazardous Air Pollutants (NESHAP) addresses diethyl sulfate emissions from processing facilities under CAA. EPA sets threshold amounts for diethyl sulfate used, manufactured, or processed at a facility, under SARA and requires that manufacturers and importers report general production, use, and exposure information for diethyl sulfate under TSCA. EPA has proposed regulating diethyl sulfate under the hazardous waste disposal rule of the Resource Conservation and Recovery Act (RCRA).

OSHA regulates diethyl sulfate under the Hazard Communication Standard and as a chemical hazard in laboratories. Regulations are summarized in Volume II, Table 70.

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