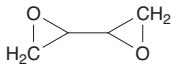
Diepoxybutane

CAS No. 1464-53-5

Reasonably anticipated to be a human carcinogen

First listed in the *Third Annual Report on Carcinogens* (1983)

Also known as butane diepoxide, butadiene diepoxide, or 1,2:3,4-diepoxybutane



Carcinogenicity

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

Cancer Studies in Experimental Animals

Diepoxybutane caused tumors in two rodent species, at several different tissue sites, and by several different routes of exposure. Dermal application of two forms of 1,2:3,4-diepoxybutane (the D,L and meso forms) caused benign and malignant skin tumors (squamous-cell papilloma and carcinoma) in mice of both sexes (Van Duuren *et al.* 1963, 1965), subcutaneous injection of the D,L racemic mixture caused tumors at the injection site (fibrosarcoma) in female mice and rats (Van Duuren *et al.* 1966), and intraperitoneal injection of L-diepoxybutane caused lung tumors in mice of both sexes (IARC 1976).

Since diepoxybutane was listed in the *Third Annual Report on Carcinogens,* one additional study in rodents has been identified. Inhalation exposure to diepoxybutane caused benign Harderian-gland tumors (adenoma) in mice and increased the incidence of benign or malignant tumors of the nasal cavity (squamous-cell papilloma or carcinoma, sarcoma, or adenocarcinoma) (Henderson *et al.* 1999).

Cancer Studies in Humans

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

Properties

Diepoxybutane is an epoxide that is a colorless liquid at room temperature. It is miscible with water and is very flammable and easily ignited by heat or sparks (Akron 2009). Diepoxybutane occurs in several enantiomeric forms, including D,L-1,2:3,4-diepoxybutane, D-1,2:3,4-diepoxybutane, L-1,2:3,4-diepoxybutane, and *meso*-1,2:3,4-diepoxybutane. Physical and chemical properties of diepoxybutane are listed in the following table (IARC 1976, HSDB 2009).

Property	Information
Molecular weight	86.1[a]
Specific gravity	0.96[a]
Melting point	–19°C (meso form)[a]
Boiling point	138°C[a]
Log K_{ow}	–0.28[a]
Water solubility	1,000 g/L[b]
Vapor pressure	3.9 mm Hg at 20°C[a]

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

Use

Diepoxybutane has been used as a research chemical, as a chemical intermediate, as a curing agent for polymers, as a cross-linking agent for textile fabrics, and to prevent microbial spoilage (IARC 1976, HSDB 2009). It has also been used to synthesize erythritol and pharmaceuticals (HSDB 2009). Because of its cross-linking properties, diepoxybutane is used as a test agent in the diagnosis of Fanconi anemia, which is characterized by chromosomal instability (Auerbach *et al.* 1989).

Production

Diepoxybutane is not produced commercially in the United States (HSDB 2009). In 2009, it was available from eleven suppliers, including four U.S. suppliers (ChemSources 2009). No data on U.S. imports or exports of diepoxybutane were found.

Exposure

The primary routes of potential human exposure to diepoxybutane are inhalation and dermal contact. Diepoxybutane is a metabolite of 1,3-butadiene, which is a widely used industrial chemical (Henderson *et al.* 1999). The only environmental releases of diepoxybutane reported in the U.S. Environmental Protection Agency's Toxics Release Inventory between 1988 and 2009 were releases to air of 70 lb in 1998 and 14 lb in 2005 (TRI 2009). Based on its physical and chemical properties, diepoxybutane is not expected to persist in the environment. In air, it is expected to exist in the vapor state and to be degraded by photochemically produced hydroxyl radicals, with a half-life of 16 days. If released to water or soil, it is expected to volatilize; it is not expected to adsorb to soils or sediments or to bioaccumulate in aquatic or terrestrial organisms. Its experimentally determined hydrolysis half-life is 4 to 7 days (HSDB 2009).

Occupational exposure to residues of diepoxybutane may occur during the manufacture of fabrics or polymers or during its use in research (HSDB 2009). Workers and health professionals involved in the formulation, packaging, or administration of pharmaceutical products synthesized from diepoxybutane or in testing for Fanconi anemia may also be exposed.

Regulations

Environmental Protection Agency (EPA)

Comprehensive Environmental Response, Compensation, and Liability Act

Reportable quantity (RQ) = 10 lb.

Emergency Planning and Community Right-To-Know Act

Reportable quantity (RQ) = 10 lb.
Threshold planning quantity (TPQ) = 500 lb.
Toxics Release Inventory: Diepoxybutane is subject to reporting requirements.

Resource Conservation and Recovery Act

Listed Hazardous Waste: Waste code for which the listing is based wholly or partly on the presence of diepoxybutane = U085.
Listed as a hazardous constituent of waste.

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