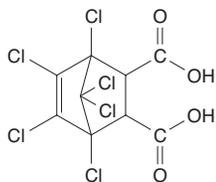


## Chlorendic Acid

### CAS No. 115-28-6

Reasonably anticipated to be a human carcinogen

First listed in the *Fifth Annual Report on Carcinogens* (1989)



### Carcinogenicity

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

#### Cancer Studies in Experimental Animals

Oral exposure to chlorendic acid caused tumors in two rodent species and at several different tissue sites. Dietary administration of chlorendic acid caused liver cancer (hepatocellular carcinoma) in female rats and male mice (NTP 1987). In male rats, it caused benign tumors of the liver (adenoma) and pancreas (acinar-cell adenoma); benign lung tumors (alveolar/bronchiolar adenoma) and malignant preputial-gland tumors (carcinoma) may also have been exposure-related.

#### Cancer Studies in Humans

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

### Properties

Chlorendic acid is structurally related to chlorinated insecticides such as heptachlor, chlordane, endosulfan, endrin, and dieldrin (NTP 1987). It is a white crystalline solid at room temperature. It is slightly soluble in water and in nonpolar organic solvents, but it is readily soluble in methanol, ethanol, and acetone. It emits chlorine when heated to decomposition (IARC 1990). Physical and chemical properties of chlorendic acid are listed in the following table.

Property	Information
Molecular weight	388.8 <sup>a</sup>
Melting point	208°C to 210°C <sup>a</sup>
Log $K_{ow}$	2.3 <sup>a</sup>
Water solubility	3.5 g/L at 25°C <sup>b</sup>
Vapor pressure	$1.4 \times 10^{-8}$ mm Hg at 25°C <sup>a</sup>
Dissociation constant ( $pK_a$ )	3.1 <sup>a</sup>

Sources: <sup>a</sup>HSDB 2009, <sup>b</sup>ChemIDplus 2009.

### Use

Chlorendic acid is used as a flame retardant in polyurethane foams, resins, plasticizers, coatings, epoxy resins, and wool fabrics; in the manufacture of alkyl resins for special paints and inks; in the manufacture of polyester resins with special applications in electrical systems, paneling, engineering plastics, and paint; and in the manufacture of corrosion-resistant tanks, piping, and scrubbers. Chlorendic acid is also used as an extreme-pressure lubricant (NTP 1987, IARC 1990, IPCS 1996, HSDB 2009).

### Production

In 1981, U.S. production of chlorendic acid was estimated at 7 million pounds, and imports were about 140,000 lb (NTP 1987). Reported worldwide production of chlorendic acid and anhydride totaled 2 million kilograms (4.4 million pounds) in 1987 (IARC 1990) and 4 million kilograms (8.8 million pounds) in 1996 (IPCS 1996). In 2009, chlorendic acid was produced by two manufacturers in Europe (SRI 2009) and was available from eleven suppliers worldwide, including five U.S. suppliers (ChemSources 2009). No recent reports of U.S. imports or exports specifically of chlorendic acid were found. Reports filed in 1986, 1990, and 2002 under the U.S. Environmental Protection Agency's Toxic Substances Control Act Inventory Update Rule indicated that U.S. production plus imports of chlorendic acid totaled 500,000 lb to 10 million pounds (EPA 2004).

### Exposure

The primary route of potential human exposure to chlorendic acid is dermal contact, but inhalation exposure also is possible (HSDB 2009). EPA's Toxics Release Inventory reported annual releases of less than 60 lb to the air from 1995 to 2001; however, one facility reported releases of 420 lb to an off-site hazardous waste landfill and 5 lb to the air in 2002. No releases of chlorendic acid were reported from 2003 to 2006 (TRI 2009). In 2007, 96 lb was released, including 88 lb to off-site management and 8 lb as fugitive air emissions. Releases to the environment can occur from sources other than the direct release of chlorendic acid (IPCS 1996). Chlorendic acid can be released as a result of hydrolytic degradation of polyesters, and it is an oxidation product of numerous pesticides, including endosulfan, chlordane, heptachlor, aldrin, dieldrin, isodrin, and endrin and their metabolites. If released to air, it is expected to exist as a particulate (HSDB 2009). It is subject to photolysis on solid surfaces and in solution, resulting in dechlorination, with a half-life of 16 days on solid surfaces and 5 days in solution (IPCS 1996, HSDB 2009). Chlorendic acid is not expected to volatilize from water or soil; it has a low potential for binding to soil and sediment and is expected to have high mobility in soil. Chlorendic acid has been found in the leachate from landfills at concentrations of up to 455 mg/L and has been identified in at least one hazardous-waste site on the National Priorities List (NTP 1987, IPCS 1996).

Chlorendic acid is manufactured in an essentially closed system, which minimizes potential occupational exposure during the manufacturing process (NTP 1987); however, releases may occur from its use (IPCS 1996). When used as a reactive flame-retardant or hardening agent, chlorendic acid bonds covalently to the polymer, reducing the potential for human exposure. Human exposure may also occur through its use as an extreme-pressure lubricant and a chemical intermediate. The National Occupational Exposure Survey (conducted from 1981 to 1983) estimated that 55 workers (classified as Machinery Workers, Except Electrical), including 29 women, potentially were exposed to chlorendic acid (NIOSH 1990).

### Regulations

#### Environmental Protection Agency (EPA)

*Emergency Planning and Community Right-To-Know Act Toxics Release Inventory:* Listed substance subject to reporting requirements.

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