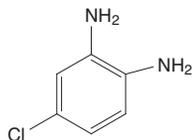


4-Chloro-*o*-phenylenediamine

CAS No. 95-83-0

Reasonably anticipated to be a human carcinogen

First listed in the *Fourth Annual Report on Carcinogens* (1985)



Carcinogenicity

4-Chloro-*o*-phenylenediamine 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 4-chloro-*o*-phenylenediamine caused tumors in two rodent species and at several different tissue sites. Dietary administration of technical-grade 4-chloro-*o*-phenylenediamine caused benign or malignant liver tumors (hepatocellular adenoma or carcinoma) in mice of both sexes and benign or malignant tumors of the urinary bladder and forestomach (papilloma or carcinoma) in rats of both sexes (NCI 1978).

Cancer Studies in Humans

No epidemiological studies were identified that evaluated the relationship between human cancer and exposure specifically to 4-chloro-*o*-phenylenediamine.

Properties

4-Chloro-*o*-phenylenediamine is a chlorinated aromatic amine that exists as a brown crystalline solid or powder at room temperature (Akron 2009). It is slightly soluble in water, but it is soluble in benzene and very soluble in ethanol and ether. 4-Chloro-*o*-phenylenediamine is stable at normal temperatures and pressures. Physical and chemical properties of 4-chloro-*o*-phenylenediamine are listed in the following table.

Property	Information
Molecular weight	142.6 ^a
Melting point	76°C ^a
Boiling point	229°C ^b
Log K_{ow}	1.28 ^a
Water solubility	6.6 g/L at 25°C ^b
Vapor pressure	2.06×10^{-3} mm Hg 25°C ^b
Dissociation constant (pK_a)	3.83 at 25°C ^b

Sources: ^aHSDB 2009, ^bChemIDplus 2009.

Use

4-Chloro-*o*-phenylenediamine can be used as an oxidation base for dye preparation, as a chemical intermediate to produce 5-chlorobenzotriazole, as a curing agent for epoxy resins, as a reagent in gas chromatography, and to synthesize experimental pharmaceuticals. It has been used as a chemical intermediate in dye production and was patented as a hair-dye component, but there is no evidence that it is currently used in the United States for these purposes (IARC 1982, HSDB 2009).

Production

4-Chloro-*o*-phenylenediamine was first produced commercially in the United States in 1941 (IARC 1982). In 2009, 4-chloro-*o*-phenylenediamine was produced by three manufacturers worldwide, including one in India and two in Europe (SRI 2009), and was available from 20 suppliers worldwide, including 9 U.S. suppliers (ChemSources 2009). U.S. production in 1977 was estimated at 1,000 to 10,000 lb (IARC 1982). No data on U.S. imports or exports of 4-chloro-*o*-phenylenediamine were found. Under the U.S. Environmental Protection Agency's Toxic Substances Control Act Inventory Update Rule, U.S. production plus imports totaled 10,000 to 500,000 lb in 1986 (EPA 2004); no later inventory update reports were filed.

Exposure

Because of its limited use in consumer products, little exposure of the general population to 4-chloro-*o*-phenylenediamine is expected. Nevertheless, exposure could potentially occur if residues were present in hair dyes or in products made from 5-chlorobenzotriazole (IARC 1982, HSDB 2009). The primary routes of potential human exposure to 4-chloro-*o*-phenylenediamine are ingestion, inhalation, and dermal contact by workers in the dye and chemical industries and those involved in pharmaceutical research (NCI 1978). Exposure could occur during production and use of 4-chloro-*o*-phenylenediamine or following accidental releases. No data were found on the numbers of workers potentially exposed to 4-chloro-*o*-phenylenediamine.

Regulations

No specific regulations or guidelines relevant to reduction of exposure to 4-chloro-*o*-phenylenediamine were identified.

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: 5/09.
- ChemIDplus. 2009. *ChemIDplus Advanced*. National Library of Medicine. <http://chem.sis.nlm.nih.gov/chemidplus/> and select Registry Number and search on CAS number. Last accessed: 5/09.
- ChemSources. 2009. *Chem Sources - Chemical Search*. Chemical Sources International. <http://www.chemsources.com/chemonline.html> and search on chlorophenylenediamine. Last accessed: 5/09.
- EPA. 2004. *Non-confidential IUR Production Volume Information*. U.S. Environmental Protection Agency. <http://www.epa.gov/oppt/iur/tools/data/2002-vol.html> and search on CAS number.
- 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: 5/09.
- IARC. 1982. 4-Chloro-*ortho*- and 4-chloro-*meta*-phenylenediamine. In *Some Aromatic Amines, Anthraquinones and Nitroso Compounds and Inorganic Fluorides Used in Drinking Water and Dental Preparations*. IARC Monographs on the Evaluation of Carcinogenic Risk of Chemicals to Humans, vol. 27. Lyon, France: International Agency for Research on Cancer. pp. 81-89.
- NCI. 1978. *Bioassay of 4-Chloro-*o*-Phenylenediamine for Possible Carcinogenicity*. Technical Report Series No. 63. DHEW (NIH) Publication No. 78-1313. Bethesda, MD: National Institutes of Health. 52 pp.
- SRI. 2009. *Directory of Chemical Producers*. Menlo Park, CA: SRI Consulting. Database edition. Last accessed: 6/4/09.