

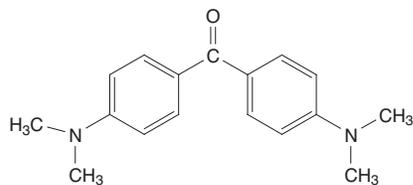
Michler's Ketone

CAS No. 90-94-8

Reasonably anticipated to be a human carcinogen

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

Also known as 4,4'-(dimethylamino)benzophenone



Carcinogenicity

Michler's ketone 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 Michler's ketone caused tumors in two rodent species and at two different tissue sites. Dietary administration of Michler's ketone caused liver cancer (hepatocellular carcinoma) in female mice and in rats of both sexes and blood-vessel cancer (hemangiosarcoma) in male mice (NCI 1979).

Cancer Studies in Humans

No epidemiological studies were identified that evaluated the relationship between human cancer and exposure specifically to Michler's ketone.

Properties

Michler's ketone is a derivative of dimethylaniline and exists as white to green crystalline leaflets or blue powder at room temperature. Michler's ketone is practically insoluble in water, very soluble in pyrimidine, soluble in alcohol and warm benzene, and very slightly soluble in ether. It is stable under normal temperatures and pressures (NCI 1979, Akron 2009, HSDB 2009). Physical and chemical properties of Michler's ketone are listed in the following table.

Property	Information
Molecular weight	268.4 ^a
Melting point	172°C ^a
Boiling point	> 360°C decomposes ^a
Log K_{ow}	3.87 ^b
Water solubility	0.4 g/L at 20°C ^b
Vapor pressure	1.07×10^{-6} mm Hg at 25°C ^b
Dissociation constant (pK _a)	12.46 ^c

Sources: ^aHSDB 2009, ^bChemIDplus 2009, ^cAkron 2009.

Use

Michler's ketone is a chemical intermediate used in the synthesis of at least 13 dyes and pigments, particularly auramine derivatives (NCI 1979, HSDB 2009). These pigments are used to make ultraviolet-cured printing ink for carton board and paper and as dyes for pen inks, carbon paper, alcoholic solvents, oils, waxes, textiles, and leather; one pigment is also used as a fungicide (Castle *et al.* 1997a,b, HSDB 2009).

Production

In 1975, U.S. production of Michler's ketone was estimated at over 908 kg (2,000 lb) (HSDB 2009). No current production data were found. In 2009, Michler's ketone was produced by one manufacturer

in Europe (SRI 2009), and was available from 29 suppliers, including 16 U.S. suppliers (ChemSources 2009). U.S. imports of Michler's ketone totaled 548 kg (1,206 lb) in 1972, 20,000 kg (44,000 lb) in 1975 (HSDB 2009), and about 10,900 kg (24,000 lb) in 1983 (USITC 1984). No more recent data on U.S. imports or exports were found.

Exposure

The routes of potential human exposure to Michler's ketone are inhalation, ingestion, and dermal contact (Akron 2009). Michler's ketone may be present in some dyes used for printing and in minute quantities in final consumer products (Ozaki *et al.* 2004). Michler's ketone was measured in recycled paper and paperboard used in food packaging in Japan at concentrations of up to 12 µg/g. It was not detected in tested virgin paper or paperboard products. In another study, Michler's ketone was not detected in food that had been in contact with packaging containing Michler's ketone at a concentration of 3.9 µg/g (the highest concentration found in tested packaging) (Castle *et al.* 1997a). The U.S. Environmental Protection Agency's Toxics Release Inventory reported environmental releases of Michler's ketone of 1,100 lb in 1988 and 1,577 lb in 1995. In 1999, two industrial facilities released 869 lb (TRI 2009). No release data have been reported since 1999.

The potential for occupational exposure is greatest for workers in facilities that manufacture Michler's ketone or any of the dyestuffs for which it is an intermediate (NCI 1979). The National Occupational Exposure Survey (conducted from 1981 to 1983) estimated that 2,026 workers, including 405 women, potentially were exposed to Michler's ketone (NIOSH 1990).

Regulations

Environmental Protection Agency (EPA)

Emergency Planning and Community Right-To-Know Act

Toxics Release Inventory: Listed substance subject to reporting requirements.

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: 5/19/09.
- Castle L, Damant AP, Honeybone CA, Johns SM, Jickells SM, Sharman M, Gilbert J. 1997a. Migration studies from paper and board food packaging materials. Part 2. Survey for residues of dialkylamino benzophenone UV-cure ink photoinitiators. *Food Addit Contam* 14(1): 45-52.
- Castle L, Offen CP, Baxter MJ, Gilbert J. 1997b. Migration studies from paper and board food packaging materials. 1. Compositional analysis. *Food Addit Contam* 14(1): 35-44.
- ChemIDplus. 2009. *ChemIDplus Advanced*. National Library of Medicine. <http://chem.sis.nlm.nih.gov/chemidplus/chemidheavy.jsp> and select Registry Number and search on CAS number. Last accessed: 5/19/09.
- ChemSources. 2009. *Chem Sources - Chemical Search*. Chemical Sources International. <http://www.chemsources.com/chemonline.html> and search on bisdimethylaminobenzophenone. Last accessed: 5/19/09.
- 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: 5/19/09.
- NCI. 1979. *Bioassay of Michler's Ketone for Possible Carcinogenicity*. NCI Technical Report Series no. 181. DHEW (NIH) Publication No. 79-1737. Bethesda, MD: National Institutes of Health. 106 pp.
- NIOSH. 1990. *National Occupational Exposure Survey (1981-83)*. National Institute for Occupational Safety and Health. Last updated: 7/1/90. <http://www.cdc.gov/noes/noes1/x1044sic.html>.
- Ozaki A, Yamaguchi Y, Fujita T, Kuroda K, Endo G. 2004. Chemical analysis and genotoxicological safety assessment of paper and paperboard used for food packaging. *Food Chem Toxicol* 42(8): 1323-1337.
- SRI. 2009. *Directory of Chemical Producers*. Menlo Park, CA: SRI Consulting. Database edition. Last accessed: 5/19/09.
- TRI. 2009. *TRI Explorer Chemical Report*. U.S. Environmental Protection Agency. <http://www.epa.gov/triexplorer> and select 4,4'-Bis(dimethylamino)benzophenone. Last accessed: 5/19/09.
- USITC. 1984. *Imports of Benzenoid Chemicals and Products, 1983*. USITC Publication No. 1548. Washington, DC: U.S. International Trade Commission.