

3,3'-Dichlorobenzidine

91-94-1

Hazard Summary

3,3'-Dichlorobenzidine was used in the past in the production of dyes and pigments; it is no longer used to manufacture dyes in the United States. No information is available on the acute (short-term), reproductive or developmental effects of 3,3'-dichlorobenzidine in humans. Chronic (long-term) exposure may result in effects on the gastrointestinal, respiratory, and central nervous system (CNS) in humans. A human study detected a possible association between benzidine-based azodyes (including 3,3'-dichlorobenzidine). Animal studies, via the oral route, have reported an increased incidence of tumors at a variety of sites. EPA has classified 3,3'-dichlorobenzidine as a Group B2, probable human carcinogen.

Please Note: The main sources of information for this fact sheet are EPA's Integrated Risk Information System (IRIS) (4), which contains information on the carcinogenic effects of 3,3'-dichlorobenzidine including the unit cancer risk for oral exposure, and the Agency for Toxic Substances and Disease Registry's (ATSDR's) Toxicological Profile for 3,3'-Dichlorobenzidine. (1)

Uses

- 3,3'-Dichlorobenzidine is no longer used to manufacture dyes in the United States. In the past, it was used in the manufacture of pigments for printing ink, textiles, plastics, and crayons and as a curing agent for solid urethane plastics. (7)
- It is not used in commonplace consumer products. (1)

Sources and Potential Exposure

- 3,3'-Dichlorobenzidine has not been detected in ambient air, and has only been detected at very low levels (<10 parts per billion [ppb]) in water. (1)
- Occupational exposure to 3,3'-dichlorobenzidine may occur for workers involved in the synthesis of pigments and for workers in the garment, leather, printing, paper, and homecraft industries where benzidine-based pigments are used. (1)

Assessing Personal Exposure

- 3,3'-Dichlorobenzidine and its metabolites can be measured in urine and blood. (1)

Health Hazard Information

Acute Effects:

- No information is available on acute exposure to 3,3'-dichlorobenzidine in humans.
- Tests involving acute exposure of rats have shown 3,3'-dichlorobenzidine to have **low** to **moderate** toxicity from oral exposure and **moderate** toxicity from dermal exposure. (2)

Chronic Effects (Noncancer):

- Chronic exposure may result in effects on the gastrointestinal, respiratory, and CNS (e.g., headache and dizziness) in humans, but the length and conditions of exposure were not reported. (1,3)
- Animal studies have reported mild liver injury from oral exposure to 3,3'-dichlorobenzidine. (1)
- EPA has not established a Reference Dose (RfD) or a Reference Concentration (RfC) for 3,3'-dichlorobenzidine. (4)

Reproductive/Developmental Effects:

- No information is available on the reproductive or developmental effects of 3,3'-dichlorobenzidine in humans.
- Animal studies have reported abnormal growth in the kidneys of the fetuses of pregnant mice treated subcutaneously with 3,3'-dichlorobenzidine. No data were reported on maternal effects. (1)

Cancer Risk:

- Three epidemiologic studies have found no association between 3,3'-dichlorobenzidine exposure and bladder cancer. However, these studies are limited due to their small cohort size, limited statistical power, brief exposure periods, and incomplete followup. (1,4)
- A study reported an increased incidence of bladder tumors among workers exposed to benzidine-based azodyes including 3,3'-dichlorobenzidine. (1)
- Animal studies have shown an increased incidence of tumors at a variety of sites in rats, mice, and dogs exposed orally to 3,3'-dichlorobenzidine. (1,4)
- EPA has classified 3,3'-dichlorobenzidine as a Group B2, probable human carcinogen. (4)
- EPA uses mathematical models, based on animal studies, to estimate the probability of a person developing cancer from ingesting water containing a specified concentration of a chemical. EPA calculated an oral cancer slope factor of $0.45 \text{ (mg/kg/d)}^{-1}$ and an oral unit risk estimate of $1.3 \times 10^{-5} \text{ (}\mu\text{g/L)}^{-1}$. EPA estimates that, if an individual were to continuously ingest water containing 3,3'-dichlorobenzidine at an average of $0.08 \mu\text{g/L}$ ($8 \times 10^{-5} \text{ mg/L}$) over his or her entire lifetime, that person would theoretically have no more than a one-in-a-million increased chance of developing cancer as a direct result of ingesting water containing this chemical. Similarly, EPA estimates that ingesting water containing $0.8 \mu\text{g/L}$ ($8 \times 10^{-4} \text{ mg/L}$) would result in not greater than a one-in-a-hundred thousand increased chance of developing cancer, and water containing $8.0 \mu\text{g/L}$ ($8 \times 10^{-3} \text{ mg/L}$) would result in not greater than a one-in-ten-thousand increased chance of developing cancer. For a detailed discussion of confidence in the potency estimates, please see IRIS. (4)

Physical Properties

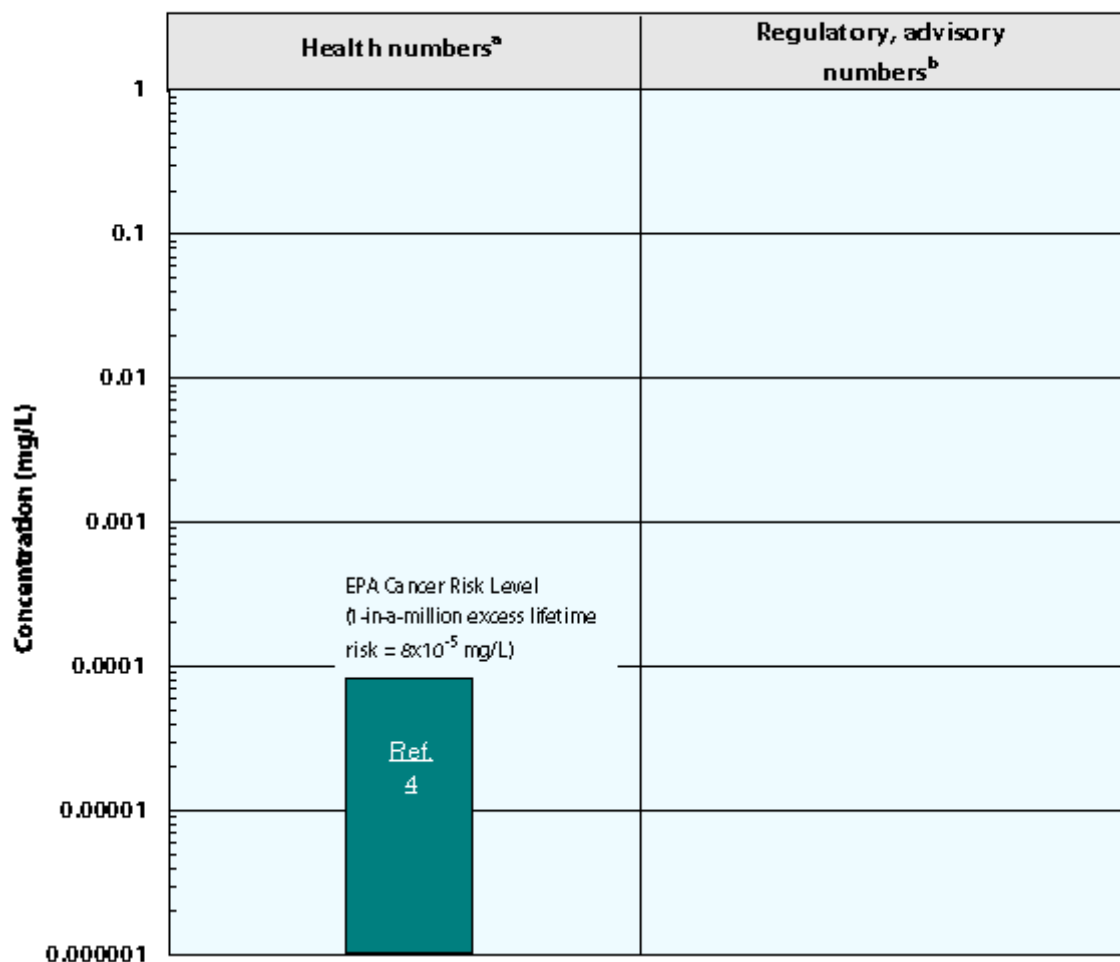
- 3,3'-Dichlorobenzidine is a gray or purple crystalline solid. (5,6)
- The chemical formula for 3,3'-dichlorobenzidine is $\text{C}_{12}\text{H}_{10}\text{Cl}_2\text{N}_2$ and the molecular weight is 253.13 g/mol. (6)
- The vapor pressure for 3,3'-dichlorobenzidine is 1.15×10^{-7} mm Hg at 25 °C and it has a log octanol/water partition coefficient ($\log K_{ow}$) of 3.64. (2)
- The odor threshold for 3,3'-dichlorobenzidine has not been established.

Conversion Factors:

To convert concentrations in air (at 25 °C) from ppm to mg/m^3 : $\text{mg/m}^3 = (\text{ppm}) \times (\text{molecular weight of the compound}) / (24.45)$. For 3,3'-dichlorobenzidine: $1 \text{ ppm} = 10.35 \text{ mg/m}^3$.

Health Data from Oral Exposure

3,3-Dichlorobenzidine



The health values cited in this factsheet were obtained in December 1999.

^a Health numbers are toxicological numbers from animal testing or risk assessment values developed by EPA.

^b Regulatory numbers are values that have been incorporated in Government regulations, while advisory numbers are nonregulatory values provided by the Government or other groups as advice.

Summary created in April 1992, updated January 2000

References

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4. U.S. Environmental Protection Agency. Integrated Risk Information System (IRIS) on 3,3'-Dichlorobenzidine. National Center for Environmental Assessment, Office of Research and Development, Washington, DC. 1999.
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6. M. Sittig. Handbook of Toxic and Hazardous Chemicals and Carcinogens. 2nd ed. Noyes Publications, Park Ridge, NJ. 1985.

