

Safety Data Sheet

1,2-Dibromo-3-chloropropane

Division of Safety
National Institutes
of Health



WARNING!

THIS COMPOUND IS ABSORBED THROUGH THE RESPIRATORY AND INTESTINAL TRACTS. IT IS TOXIC, CARCINOGENIC, AND MUTAGENIC. AVOID FORMATION AND BREATHING OF AEROSOLS OR VAPORS.

LABORATORY OPERATIONS SHOULD BE CONDUCTED IN A FUME HOOD, GLOVE BOX, OR VENTILATED CABINET.

AVOID SKIN CONTACT: IF EXPOSED, WASH WITH SOAP AND WATER.

FOR EYE EXPOSURE, IRRIGATE IMMEDIATELY WITH LARGE AMOUNTS OF WATER. FOR INGESTION, DRINK PLENTY OF MILK OR WATER. INDUCE VOMITING. FOR INHALATION, REMOVE VICTIM PROMPTLY TO CLEAN AIR. ADMINISTER RESCUE BREATHING IF NECESSARY. REFER TO PHYSICIAN.

IN CASE OF LABORATORY SPILL, WEAR PROTECTIVE CLOTHING DURING CLEANUP. AVOID SKIN CONTACT OR BREATHING OF AEROSOLS OR VAPORS. USE ABSORBENT PAPER TO MOP UP SPILL. AFTER THE RESIDUE HAS EVAPORATED, WASH DOWN AREA WITH SOAP AND WATER. DISPOSE OF WASTE SOLUTIONS AND MATERIALS APPROPRIATELY.

A. Background

1,2-Dibromo-3-chloropropane (DBCP) is a light yellow to dark brown mobile liquid with pungent odor; it is stable in neutral and acid solutions but hydrolyzed by alkali. It is readily absorbed through the lungs and gastrointestinal tract but only slowly absorbed through the skin. It is toxic to rodents on ingestion, with the main target organs being kidney, testes, liver, lung, and intestine. DBCP is believed to decrease sperm count among industrially exposed workers.

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DBCP is slightly to moderately carcinogenic in rodents and mutagenic in the Ames test. Its commercial use is as a soil fumigant and nematocide, and it has been reported as a contaminant of the flame retardant tris (2,3-dibromopropyl) phosphate.

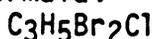
B. Chemical and Physical Data

1. Chemical Abstract No.: 96-12-8

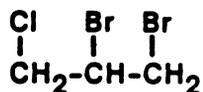
2. Synonyms:

DBCP	Nemabrom	Nemapaz
Fumagon	Nemafume	Nemaset
Fumazone	Nemagon	Nemazon
OS 1897	Nemanex	Propane, 1,2-dibromo-3-chloro- (9CI)

3. Molecular formula:



structure:



weight:
236.36

4. Density: 2.08 g/cm³.

5. Absorption spectroscopy: No data.

6. Volatility: Vapor pressure, 0.8 mm Hg at 21°C.

7. Solubility: Slightly soluble in water (0.1 g/100 g); miscible with ethanol, methanol, acetone, benzene, isopropanol, and oils.

8. Description, appearance, and odor: Light yellow to dark brown mobile liquid with pungent odor.

9. Boiling point: 196°C (with decomposition).

Melting point: 6°C.

10. Stability: Stable in neutral and acid media; unstable in alkali. Heating for 30 minutes at 180°C converts DBCP to a yellow powder with loss of Br and/or Cl atoms (Stojanovic et al., 1972).

11. Chemical reactivity: Hydrolyzed by alkali to 2-bromoallyl alcohol and in soil-water mixtures to n-propanol, chloride, and bromide. Corrosive to aluminum, magnesium, and tin alloys; noncorrosive to steel and copper alloys if it contains less than 2% water.

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12. Flash point: 77°C (open cup).
13. Autoignition temperature: No data.
14. Explosive limits in air: No data.

Fire, Explosion, and Reactivity Hazard Data

1. DBCP does not require special fire-fighting procedures or equipment. Fire-fighting personnel should wear air-supplied respirators with full-face masks.
2. DBCP flashes at temperatures above 175°C. In contact with flames or hot surfaces, it may produce toxic products.
3. Incompatible with aluminum, magnesium, and tin alloys and with steel and copper alloys in the presence of water.
4. Hazardous decomposition products include carbon monoxide, hydrochloric acid, chlorine, and bromine.
5. Nonspark equipment is not required. When handled in flammable solvents, the precautions required for such solvents apply.

Operational Procedures

The NIH Guidelines for the Laboratory Use of Chemical Carcinogens describe operational practices to be followed when potentially carcinogenic chemicals are used in NIH laboratories. The Guidelines should be consulted to identify the proper use conditions required and specific controls to be implemented during normal and complex operations or manipulations involving DBCP.

DBCP penetrates several glove materials readily (Sansone and Tewari, 1978). This factor should be taken into account when handling DBCP.

1. Chemical inactivation: No validated method reported.
2. Decontamination: Turn off equipment that could be affected by DBCP or the materials used for cleanup. If more than 100 ml has been spilled or if there is any uncertainty regarding the procedures to be followed for decontamination, call the NIH Fire Department (dial 116) for assistance. Use absorbent paper to mop up spill. After the residue has evaporated, wash surfaces with copious quantities of water. Glassware should be rinsed (in a hood) with acetone, followed by soap and water. Animal cages should be washed with water.
3. Disposal: No waste streams containing DBCP shall be disposed

of in sinks or general refuse. Surplus DBCP or chemical waste streams contaminated with DBCP shall be handled as hazardous chemical waste and disposed of in accordance with the NIH chemical waste disposal system. Nonchemical waste (e.g., animal carcasses and bedding) containing DBCP shall be handled and packaged for incineration in accordance with the NIH medical-pathological waste disposal system. Potentially infectious waste (e.g., tissue cultures) containing DBCP shall be packaged for incineration, as above. Burnable waste (e.g., absorbent bench top liners) minimally contaminated with DBCP shall be handled as potentially infectious waste and packaged for incineration, as above. Absorbent materials (e.g., associated with spill cleanup) grossly contaminated shall be handled in accordance with the chemical waste disposal system. Radioactive waste containing DBCP shall be handled in accordance with the NIH radioactive waste disposal system.

4. **Storage:** Store in sealed ampoules or screw-capped bottles with Teflon cap liners, preferably under refrigeration.

Monitoring and Measurement Procedures Including Direct Field Measurements and Sampling for Subsequent Laboratory Analysis

1. **Sampling:** The recommended method is absorption on Florisil and desorption by hexane for GC. Useful range is 0.01 to 1 mg/m³ (NIOSH, 1978).
2. **Separation and analysis:** The method of choice is gas chromatography with flame ionization (Johnson and Lear, 1969) or electron capture detectors (Newsome and Panopio, 1977; NIOSH, 1978). These methods have been developed chiefly for the determination of DBCP in soil samples and food crops, but they should be applicable to monitoring purposes. Sensitivity is 0.01 ppm.

Biological Effects (Animal and Human)

1. **Absorption:** DBCP is readily absorbed from the gastrointestinal tract and by inhalation. Absorption through the skin is slow (Torkelson et al., 1961).
2. **Distribution:** Intraperitoneal DBCP in rats accumulates within 1 to 3 hours in the intestine, liver, and kidney. Inhaled DBCP is distributed to testes in several species.
3. **Metabolism and excretion:** In the only reported study on DBCP metabolism, 14% of intraperitoneally administered DBCP is exhaled unchanged in 4 hours; none is found in the urine and therefore the major fraction is metabolized. A proposed scheme of metabolism attempts to correlate identified and postulated metabolite intermediates with toxic effects of DBCP. According to this scheme, DBCP is rapidly debrominated (with bromide retention in the kidney) to form a series of epoxides that either alkylate glutathione

to lead to mercapturic acids as urinary excretion products or are further hydrolyzed to α -chlorohydrins and α -bromohydrins (known male antifertility agents) followed by oxidation to oxalic acid (causes kidney damage) (Jones et al., 1979).

4. Toxic effects: Acute oral LD50s in the rat, rabbit, and guinea pig are 170-300 mg/kg; the dermal LD50 in the rabbit is 1,400 mg/kg. Inhalation LC50s in the rat are 103 and 368 ppm for exposure times of 8 hours and 1 hour, respectively. Target organs on inhalation or oral administration are kidney, liver, testes, ovaries, stomach, and intestine. Daily inhalation of 200 ppm for 50 weeks by rats produced gross lesions in the lungs (atelectasis, emphysema, bronchopneumonia) and intestinal mucosa, liver enlargement, and nephritis. The effects of DBCP administration on the gonads (degeneration of the seminiferous tubules, decrease in sperm count and mobility in several species; atypical estrus in rats) are especially noteworthy. There is suspicion that DBCP may have been the causative agent in producing sterility of workers in a chemical plant.
5. Carcinogenic effects: Oral DBCP has produced squamous cell carcinomas in the stomach of rats and mice and mammary carcinomas in rats.
6. Mutagenic and teratogenic effects: DBCP is mutagenic in the Ames test and against other bacteria. There are no data concerning its teratogenicity.

Emergency Treatment

1. Skin and eye exposure: For skin exposure, remove contaminated clothing and wash with soap and water. For eye exposure, irrigate immediately with copious quantities of running water for at least 15 minutes.
2. Ingestion: Drink plenty of milk or water. Induce vomiting.
3. Inhalation: Remove victim promptly to clean air. Administer rescue breathing if necessary.
4. Refer to physician. Consider treatment for pulmonary irritation.

References

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