

# Safety Data Sheet

# 3,3'-Dimethyl- benzidine

Division of Safety  
National Institutes  
of Health



## WARNING!

THIS COMPOUND IS ABSORBED THROUGH THE SKIN AND THE RESPIRATORY AND INTESTINAL TRACTS. IT IS TOXIC AND CARCINOGENIC. AVOID FORMATION AND BREATHING OF AEROSOLS.

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 WATER, INDUCE VOMITING, OR REFER FOR GASTRIC LAVAGE. 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. USE ETHANOL TO DISSOLVE COMPOUND. WASH DOWN AREA WITH SOAP AND WATER. DISPOSE OF WASTE SOLUTIONS AND MATERIALS APPROPRIATELY.

### A. Background

3,3'-Dimethylbenzidine (o-tolidine) is toxic and carcinogenic in rodents; human data are not available. There is no evidence for mutagenicity or teratogenicity. o-Tolidine is used as an intermediate in the manufacture of dyes and in the chemical laboratory in various analytical procedures, including determination of free chlorine in water.

issued 8/82

## Chemical and Physical Data

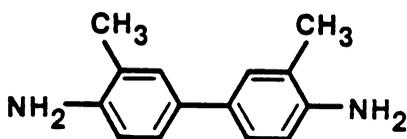
1. Chemical Abstract No.: 119-93-7

2. Synonyms:

Bianisidine	4,4'-Diamino-3,3'-dimethylbiphenyl
4,4'-Bi-o-toluidine	3,3'-Dimethylbenzidine
Diaminoditolyl	3,3'-Dimethyl-4,4'-biphenyldiamine
o-Tolidin	3,3'-Dimethylbiphenyl-4,4'-diamine
3,3'-Tolidine	Fast dark blue base R
o-Tolidine	C.I. azoic diazo component 113
2-Tolidine	C.I. 37230
3,3'-Dimethyl-[1,1'-biphenyl]-4,4'-diamine (9CI)	

3. Molecular  
formula:  
 $C_{14}H_{16}N_2$

structure:



weight:  
212.28

4. Density: No data.

5. Absorption spectroscopy: UV:  $\lambda$  ( $\log \epsilon$ ) = 287 (4.4) (Weast, 1979, p. C-211); fluorescence excitation and emission maxima have been listed (Bowman et al., 1976).

6. Volatility: No data.

7. Solubility: Slightly soluble in water; very soluble in ethan ethyl ether, and dilute acids.

8. Description, appearance: White to reddish crystals.

9. Boiling point: No data.

Melting point: 129-131°C.

10. Stability: No data.

11. Chemical reactivity: o-Tolidine exhibits the usual reactivity of primary aromatic amines (salt formation, acylation, alkylation, isocyanide formation, diazotization or tetrazotization, oxidation by various oxidants) and of aromatic compounds in

general (ring substitution). Chlorine and bromine produce an intense blue color with o-tolidine, probably corresponding to its quinone diimine.

12. Flash point: No data.
13. Autoignition temperature: No data.
14. Explosive limits in air: No data.

#### Fire, Explosion, and Reactivity Hazard Data

1. o-Tolidine does not require special fire-fighting procedures or equipment and does not present unusual fire and explosion hazards.
2. No conditions contributing to instability are known to exist. Aromatic amines in general are slightly flammable.
3. No incompatibilities are known.
4. o-Tolidine does not require nonspark equipment. 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 o-tolidine.

1. Chemical inactivation: No validated method reported.
2. Decontamination: Turn off equipment that could be affected by o-tolidine or the materials used for cleanup. If more than 1 g 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. Wipe surfaces with ethanol, then wash with copious quantities of water. Glassware should be rinsed (in a hood) with ethanol, followed by soap and water. Animal cages should be washed with water.
3. Disposal: No waste streams containing o-tolidine shall be disposed of in sinks or general refuse. Surplus o-tolidine or chemical waste streams contaminated with o-tolidine 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 o-tolidine 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 o-tolidine shall be disinfected by heat using a standard autoclave treatment and packaged for incineration, as above. Burnable waste (e.g., absorbent bench top liners) minimally contaminated with o-tolidine 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 o-tolidine shall be handled in accordance with the NIH radioactive waste disposal system.

4. Storage: Store in glass ampoules or in amber screw-capped bottles with Teflon cap liners, preferably under refrigeration. Avoid unnecessary exposure to light.

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

1. Sampling: For airborne particles smaller than  $0.3\ \mu\text{m}$ , impingers or bubblers filled with dilute hydrochloric acid are used. For larger particles, a high-volume air sampler with a fiberglass filter trap can be used. For surface sampling, cotton applicators moistened with an aqueous buffer are employed, and identification is made by spectrophotofluorimetry.
2. Separation and analysis: Spectrophotofluorimetry, preceded by solvent extraction on an alumina column, has been applied to analysis of o-tolidine in waste water and biological media (Holder et al., 1976; Bowman et al., 1976). A colorimetric procedure for o-tolidine in urine and air samples has been described (Glassman and Meigs, 1951). This method is convenient and sensitive but not specific for o-tolidine, and must be preceded by separation if other aromatic amines are likely to be present. Spot tests for o-tolidine on metal, painted, and concrete surfaces have been described (Weeks et al., 1976).

#### Biological Effects (Animal and Human)

1. Absorption: o-Tolidine may be absorbed into the animal body through intact skin, by inhalation, or by ingestion. Evidence of skin absorption in occupational exposure has been reported (Meigs et al., 1951).
2. Distribution: o-Tolidine appears to locate preferentially in large sebaceous glands (sweat, preputial, mammary, Zymbal's glands) (Griswold et al., 1968; Pliss and Zabezhinsky, 1970).
3. Metabolism and excretion: The metabolism of o-tolidine in humans appears to be similar to that of benzidine, i.e., acylation of the amino groups and/or hydroxylation on the rings

followed by conjugation of the phenolic products with sulfuric or glucuronic acid. Monoacetyl and diacetyl derivatives have been recovered in the urine. Another possibility is oxidation of one or both methyl groups to the carboxyl group, for which there is in vitro evidence (Dieteren, 1966).

4. Toxic effects: The oral LD50 of o-tolidine in rats is 404 mg/kg, and the lowest lethal dose in both mice and rats is 125 mg/kg. There is no information on target organs for toxic effects.
5. Carcinogenic effects: Mammary carcinomas occur in rats dosed with o-tolidine. Their incidence is lower than that with an equal dose of benzidine. Various reasons, including metabolic detoxification of the methyl groups of o-tolidine, have been cited for this lower carcinogenicity (Griswold et al., 1968). It is particularly noteworthy that there is no evidence of bladder tumors due to administration of, or exposure to, o-tolidine.
6. Mutagenic and teratogenic effects: No data; o-tolidine produced aberrant growth in embryonic tissue cultures.

### Emergency Treatment

1. Skin and eye exposure: For skin exposure, remove contaminated clothing and wash skin with soap and water. For eye exposure, irrigate immediately with copious quantities of running water for at least 15 minutes. Consider ophthalmological consultation.
2. Ingestion: Drink plenty of water. Induce vomiting or refer for gastric lavage.
3. Inhalation: Remove victim promptly to clean air. Administer rescue breathing if necessary.
4. Refer to physician. Oxygen may be necessary during transport. Observe for methemoglobinemia.

### References

- Bowman, M.C., J.R. King, and C.L. Holder. 1976. Benzidine and congeners: Analytical chemical properties and trace analysis in five substrates. *Int J Environ Anal Chem* 4:205-223.
- Dieteren, H.M.L. 1966. The biotransformation of o-tolidine. *Arch Environ Health* 12:30-32.
- Glassman, J.M., and J.W. Meigs. 1951. Benzidine (4,4'-diaminobiphenyl) and substituted benzidines. *Arch Ind Hyg Occup Med* 4:519-532.
- Griswold, D.P., Jr., A.E. Casey, E.K. Weisburger, and J.H. Weisburger. 1968. The carcinogenicity of multiple intragastric doses of aromatic and heterocyclic nitro or amino derivatives in young female Sprague-Dawley rats. *Cancer Res* 28:924-933.

- Holder, C.L., J.R. King, and M.C. Bowman. 1976. 4-Aminobiphenyl, 2-naphthylamine, and analogs: Analytical properties and trace analysis in five substrates. *J Toxicol Environ Health* 2:111-129.
- Meigs, J.W., R.M. Brown, and L.J. Sciarini. 1951. A study of exposure to benzidine and substituted benzidines in a chemical plant. *Arch Ind Hyg Occup Med* 4:533-540.
- Pliss, G.B., and M.A. Zabezhinsky. 1970. Carcinogenic properties of orthotolidine (3,3'-dimethylbenzidine). *J Natl Cancer Inst* 45:283-289.
- Weast, R.C., ed. 1979. *Handbook of Chemistry and Physics*, 60th ed. CRC Press, Cleveland, OH.
- Weeks, R.W., B.J. Dean, and S.K. Yasuda. 1976. Detection limits of chemical spot tests towards certain carcinogens on metal, paint and concrete surfaces. *Anal Chem* 48:2227-2233.