IX. APPENDIX I

SAMPLING AND ANALYSIS

This method for sampling and analysis of o-tolidine is adapted from the NIOSH Manual of Analytical Methods, Method No. 243, for benzidine and benzidinium sulfate [67]. Although the method has not been validated for o-tolidine, it has been used successfully to analyze for other biphenyl amines and is judged to be acceptable for o-tolidine.

Principle of the Method

A known volume of air is drawn through a two-stage sampler consisting of a high-efficiency glass fiber filter followed by a bed of silica gel to collect o-tolidine and its salts. The glass fiber filter is recommended to minimize pressure drop. The filter and sorbent sections of the sampler are transferred to stoppered tubes and the o-tolidine desorbed. A solution of triethylamine in methyl alcohol is used for benzidine and should be successful for o-tolidine also. An aliquot of this solution is injected into a high-pressure liquid chromatograph (HPLC). Peak areas are determined and compared with a calibration curve obtained from injections of standard solutions of o-tolidine.

Range and Sensitivity

This method can detect 0.15-6.5 μg of benzidine/sample (3-130 μg/cu m for a 50-liter air sample) using 0.5 ml of desorbing solution and a 10-μl injection into the liquid chromatograph. The range of detection for o-tolidine should be similar. The upper limit can be extended by increasing the volume of desorbing solvent as a diluent, decreasing the sensitivity of the detector, or decreasing the aliquot injected into the liquid chromatograph. The limit of detection for o-tolidine is not known but is expected to be similar to that of benzidine, which is 0.05 μg/sample.

Interferences

Any compound sampled with o-tolidine and having the same retention time as o-tolidine interferes with the analysis. This type of interference often can be minimized by changing the operating conditions of the chromatograph, eg, by changing the composition of the mobile phase or by solvent programming.

Precision and Accuracy

Filters spiked with benzidine or its salts and stored at -15 C showed 97-98% recovery after 11 days. Recovery tended to decrease with increased

storage time. o-Tolidine recovery should be similar to that of benzidine. The precision of this method for benzidine is 7% relative standard deviation for concentrations of benzidine of 21-63 μg/cu m of air. The accuracy of the method has not been determined.

Advantages and Disadvantages of the Method

The sampler is small, portable, contains no liquids, and can be used to sample the air in the breathing zone of a worker. Temperature and humidity do not significantly affect the method. Desorption of the collected sample is simple and the analysis is accomplished by a rapid instrumental technique. Possible interferences can be obviated by changing the composition of the mobile phase or by solvent programming.

At a flowrate of 0.2 liter/minute, the linear velocity through the 4-mm inlet of the filter holder is 26.5 cm/second. It is not known if this is sufficient to capture all important particles. The method has not been field tested.

Apparatus

(a) Calibrated personal air sampling pump that can be maintained for 60 minutes at a flowrate of 0.2 liter/minute with the sampler in line.

(b) Sampler (Figure IX-1). The sampler consists of two sections, a high-efficiency glass fiber filter and a 50-mg bed of silica gel. The first section, a 13-mm type A-E glass fiber filter, is contained in a 13-mm filter holder. The sorbent tube is a 30-mm section of Pyrex glass, 6.4-mm O.D. x 4-mm I.D., flared on one end, containing 50 mg of GC grade silica gel (D-08, 30/60 mesh, 720-760 sq m/g, 4.3 g/cc). The sorbent is held by 3.5-mm diameter, 100-mesh stainless steel screens and 4-mm O.D. Teflon rings. To connect the two stages, the filter holder is pressed into the flared end of the sorbent tube. Plastic caps of 6-mm I.D. seal the ends of the sampler.

(c) Insulated container suitable for transporting samples packed in dry ice.

(d) Dry ice.

(e) HPLC equipped with an ultraviolet detector (254 nm) and injection valve.

(f) μBondapak C18 column (10-μm), 4.0-mm I.D. x 30-cm or equivalent.

(g) Potentiometer strip chart recorder.

(h) Test tubes, 1-ml, fitted with polyethylene stoppers.

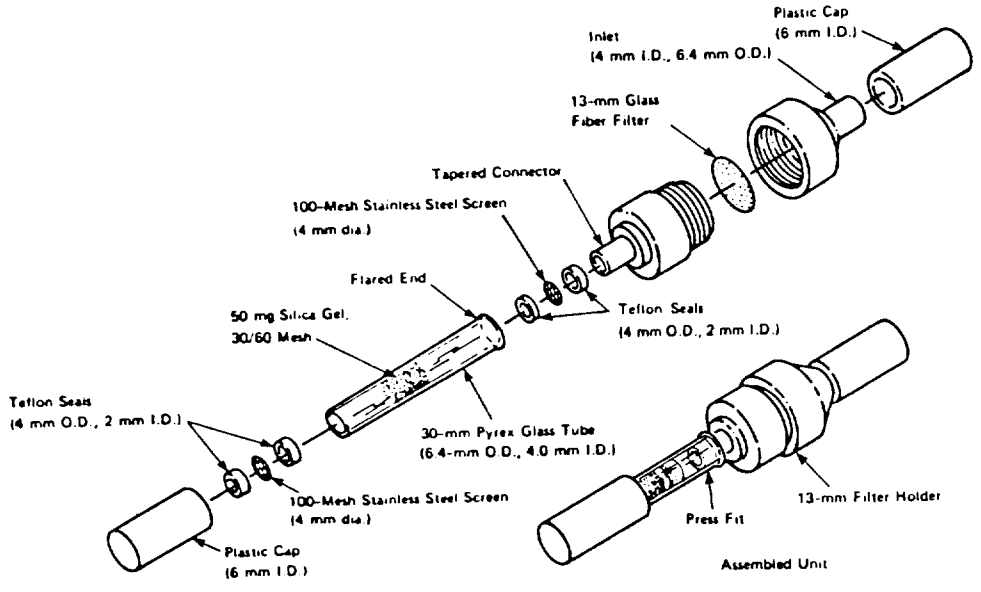

FIGURE IX-1

TWO-STAGE SAMPLER

(i) Glass syringes, 10 μl.

(j) Pipets of convenient sizes for the preparation of standard solutions.

(k) Volumetric flasks of convenient sizes for the preparation of standard solutions.

(l) Clinical centrifuge.

(m) Analytical balance.

(n) Test-tube shaker (vortex type).

Reagents

All reagents should be of analytical reagent quality or better.

(a) Methyl alcohol (UV grade), distilled in glass.

(b) Water, distilled.

(c) Mobile phase: 3/2 (v/v) methyl alcohol in water.

(d) Triethylamine.

(e) Desorbing solution: triethylamine in methyl alcohol, 0.17% (v/v).

(f) o-Tolidine, analytical standard quality.

Procedure

(a) Cleaning of Equipment

All glassware used for the laboratory analysis is washed with detergent, rinsed with tap water, distilled water, and methyl alcohol, and dried in an oven.

(b) Calibration of Personal Sampling Pumps

Each pump should be calibrated with a representative sampler in line to minimize errors in volume measurement. A bubble flowmeter or other suitable flow measuring device may be used.

(c) Collection and Shipping of Samples

(1) Immediately before sampling, the plastic caps are removed from the end of the sampler and saved for resealing after sampling.

(2) The sorbent end of the sampler is connected to the pump with plastic or rubber tubing. The sampler is positioned vertically during sampling. Sampled air must not pass through any tubing before entering the sampler.

(3) The atmosphere is sampled at a flowrate of 0.2 liter/minute for 60 minutes. The flowrate and sampling time, or the volume of sampled air, must be measured as accurately as possible.

(4) The temperature, pressure, and humidity of the atmosphere being sampled is measured and recorded.

(5) The sampler is resealed with the plastic caps immediately after sampling.

(6) Blank samples are obtained by handling random collection devices in the same manner as in sampling, except that no air is drawn through them.

(7) Samples shipped to the laboratory should be packed tightly to minimize breakage and cooled with dry ice.

(8) If samples of bulk material associated with the process under investigation are to be shipped to the laboratory, they should not be placed in the same container as the air samples or blanks.

(9) The samples should be stored at temperatures at or below -15 C prior to analysis. Because of the possible instability of the analyte, the samples should be analyzed as soon as possible after collection.

(d) Analysis of Samples

(1) Preparation of samples. Place the glass fiber filters and silica gel in separate 1-ml test tubes or other suitable vials. Teflon rings and stainless steel screens associated with the samplers may be analyzed with the appropriate stages or rinsed with the desorbing solution. Sampler caps can be discarded.

(2) Desorption of samples. Add 0.5 ml of desorbing solution to each vial containing a sampler stage. Cap the vials and shake them with a test-tube shaker. Allow them to stand for 1 hour with intermittent shaking. Centrifuge for 10 minutes. Treat blanks in the same manner.

(3) Liquid chromatographic conditions. The following conditions work for benzidine and may have to be modified to obtain proper separation of o-tolidine.

(A) Column: μBondapak C18 (30 cm x 4.0 mm I.D.).

(B) Mobile phase: Methyl alcohol/water, 3/2(v/v).

(C) Flowrate: 1.5 ml/minute, 1200 psi.

(D) Temperature: 23 C.

(E) Detector: UV (254 nm), 0.04 absorbance units full scale.

(F) Injection volume: 10 µl.

(G) Power of separation: 784 theoretical plates.

(H) Capacity ratio: 2.4.

(4) Injection. Flush the 10-µl syringe first with methyl alcohol and then with the sample solution. Carefully draw 10 µl of sample solution into the syringe to minimize the intake of particulate matter and inject into the HPLC. No more than 3% difference in peak areas for replicate injections is to be expected.

(5) Measurement of peak area. The area of the sample peak is either measured manually or with an electronic integrator. Preliminary results are read from a standard curve prepared as discussed below.

(e) Desorption Efficiency

(1) Importance of determination. The desorption efficiencies for o-tolidine and its salts can vary from one laboratory to another and also from one batch of silica gel or filters to another. Thus, it is necessary to determine the percentage of o-tolidine that can be recovered from these matrices. The desorption efficiency may also vary with the amount of o-tolidine present; therefore, measurements should be made for at least two amounts in the range of the sample size.

(2) Procedure for determining desorption efficiency. Place the filters and silica gel from unused samplers in separate 1-ml test tubes. Add to each a known amount of o-tolidine in 10-µl of methyl alcohol using the same microliter syringe for each. Five filter and silica gel samples are thus prepared at each of two different levels in the range of interest. Cap the tubes and allow them to stand overnight to assure complete adsorption of the amine on the matrix. Treat a parallel blank in the same manner. Desorb and analyze samples and blanks as described above. Prepare two or three standards at these same levels by injecting 10 µl (same syringe as above) of the o-tolidine solutions into 0.5 ml of desorbing solution. Analyze these solutions and determine the desorption efficiency.

Calibration and Standards

For accuracy in the preparation of standards, it is recommended that one standard be prepared in a relatively large volume and at a high concentration. The initial standard is prepared by weighing a selected amount of o-tolidine, eg, 125 mg, into a 250-ml volumetric flask and adding the desorbing solution to the calibration mark. Dilutions encompassing the concentration range of interest down to 0.3 ng/µl are then made from the stock solution.

CAUTION: o-Tolidine is a suspected carcinogen. Appropriate precautions must be taken in handling this compound to avoid personnel exposure and area contamination.

The standard solutions should be analyzed under the same liquid chromatographic conditions and during the same time period as the samples. This will minimize the effect of variations of the detector response or the mobile phase. A standard curve for o-tolidine is prepared by plotting the average peak area for a standard against the concentration of the standard in $\mu g/0.5$ ml.

Calculations

If the blank produces a peak with the same retention time as o-tolidine, the analyst should determine the source of the interference and eliminate or compensate for it. Read the mass (M) in μg of o-tolidine present in the sample from the calibration curve. The corrected mass (W) is determined by:

$$W = \frac{M}{D}$$

where D is the desorption efficiency for that sampler stage.

Add the masses of o-tolidine found in the two sampler stages to determine the total mass (W) collected. The concentration of o-tolidine in air (C) in $\mu g/cu\ m$ is given by:

$$C = \frac{W \times 1{,}000}{V}$$

where W is the total mass collected in μg and V is the sampling volume in liters.

This procedure calculates air concentrations as the mass of o-tolidine per volume of air.

X. APPENDIX II

ANALYSIS OF URINE SAMPLES USING FLUORESCAMINE

This method for analyzing o-tolidine in urine samples is adapted from the method described by Rinde [71].

Principle of the Method

A known volume of urine sample is extracted first with chloroform, then with 0.01 M hydrochloric acid to concentrate the o-tolidine. Fluorescamine solution is added to the sample followed by methanol to produce a yellow product. The optical density is determined at the wavelength of maximum absorption, 390 nm, and compared with the calibration curve obtained from standard solutions of o-tolidine.

Range and Sensitivity

This method can detect 0.2-5.0 μg of o-tolidine/sample of urine. For amounts greater than 5 μg, suitable dilutions of the sample are required. The limit of detection of the method is 0.2 μg/sample.

Interferences

The method is nonspecific, so any biphenyl amine other than o-tolidine may interfere with the analysis. This interference can be eliminated by using thin-layer chromatography to separate the biphenyl amines before adding the fluorescamine reagent.

Advantages and Disadvantages of the Method

Cleanup of the collected urine sample is simple, and analysis is accomplished by a rapid, instrumental technique. The fluorescamine reagent is colorless, so there is no need to extract the unreacted reagent.

The method is nonspecific without prior separation; the various compounds cannot be distinguished when o-tolidine occurs in a mixture with other biphenyl amines. This can be overcome by using paper or thin-layer chromatography to separate the biphenyl amines. However, this procedure is tedious and time consuming.

Apparatus

(a) Spectrophotometer with quartz cuvettes.

(b) Vortex mixer.

(c) Pipetes of convenient sizes to prepare standard solutions.

(d) Volumetric flasks of convenient sizes to prepare standard solutions.

(e) Glass test tubes, 12 x 75 mm.

Reagents

All reagents should be of analytical reagent quality or better.

(a) Fluorescamine.

(b) Glacial acetic acid.

(c) Methanol.

(d) Chloroform.

(e) Hydrochloric acid, 0.01 M.

(f) o-Tolidine, analytical standard quality.

(g) Water, distilled.

(h) Nitrogen gas.

Procedure

(a) Cleaning of Equipment

All glassware used for the laboratory analysis is washed with detergent, rinsed with tap water, distilled water, and methanol, and dried in an oven.

(b) Analysis of Samples

(1) Extraction of samples. Adjust the pH of the sample (100 ml) to 5-6, extract first with chloroform, then with 0.01 M hydrochloric acid. Readjust the pH of the HCl solution, and extract again with chloroform.

(2) Preparation of fluorescamine solution. Dissolve fluorescamine in glacial acetic acid (1 mg reagent/ml acid) to make the fluorescamine solution.

(3) Preparation of assay cuvettes. Evaporate the chloroform extract to dryness in 12 x 75 mm tubes using nitrogen gas. Add 50 μl of fluorescamine solution and mix for 30 seconds. After 10 minutes, add 0.5 ml methanol. Wait 10 minutes for full color development, then transfer to cuvette.

(4) Spectrophotometry. Set the spectrophotometer to 390 nm. Using a suitable blank of chloroform, adjust the optical density scale to zero.

(5) Measurement of o-tolidine concentration. Place the sample cuvete in the spectrophotometer and measure the optical density. Read preliminary results from a standard curve prepared as discussed below.

Calibration and Standards

For accuracy in the preparation of standards, it is recommended that one standard be prepared in a relatively large volume and at a high concentration. Prepare the initial standard by pouring a selected amount of o-tolidine, eg, 125 mg, into a 250-ml volumetric flask and adding chloroform to the calibration mark. Make dilutions encompassing the concentration range of interest down to 0.3 ng/μl from the stock solution.

CAUTION: o-Tolidine and chloroform are suspected carcinogens. Appropriate precautions must be taken in handling these compounds to avoid personnel exposure and area contamination.

The standard solutions should be analyzed at the same time as the samples. This will minimize the effect of variations of the spectrophotometer's response. Prepare a standard curve for o-tolidine by plotting the optical density for a standard against the concentration of the standard in μg.

XI. APPENDIX III

MATERIAL SAFETY DATA SHEET

The following items of information that are applicable to a specific product or material shall be provided in the appropriate block of the Material Safety Data Sheet (MSDS).

The product designation is inserted in the block in the upper left corner of the first page to facilitate filing and retrieval. Print in upper case letters as large as possible. It should be printed to read upright with the sheet turned sideways. The product designation is that name or code designation which appears on the label, or by which the product is sold or known by employees. The relative numerical hazard ratings and key statements are those determined by the rules in Chapter V, Part B, of the NIOSH publication, An Identification System for Occupationally Hazardous Materials. The company identification may be printed in the upper right corner if desired.

(a) Section I. Product Identification

The manufacturer's name, address, and regular and emergency telephone numbers (including area code) are inserted in the appropriate blocks of Section I. The company listed should be a source of detailed backup information on the hazards of the material(s) covered by the MSDS. The listing of suppliers or wholesale distributors is discouraged. The trade name should be the product designation or common name associated with the material. The synonyms are those commonly used for the product, especially formal chemical nomenclature. Every known chemical designation or competitor's trade name need not be listed.

(b) Section II. Hazardous Ingredients

The "materials" listed in Section II shall be those substances that are part of the hazardous product covered by the MSDS and individually meet any of the criteria defining a hazardous material. Thus, one component of a multicomponent product might be listed because of its toxicity, another component because of its flammability, while a third component could be included both for its toxicity and its reactivity. Note that a MSDS for a single component product must have the name of the material repeated in this section to avoid giving the impression that there are no hazardous ingredients.

Chemical substances should be listed according to their complete name derived from a recognized system of nomenclature. Where possible, avoid using common names and general class names such as "aromatic amine," "safety solvent," or "aliphatic hydrocarbon" when the specific name is known.

The "%" may be the approximate percentage by weight or volume (indicate basis) which each hazardous ingredient of the mixture bears to the whole mixture. This may be indicated as a range or maximum amount, ie, "10-40% vol" or "10% max wt" to avoid disclosure of trade secrets.

Toxic hazard data shall be stated in terms of concentration, mode of exposure or test, and animal used, eg, "100 ppm LC50-rat," "25 mg/kg LD50-skin-rabbit," "75 ppm LC man," or "permissible exposure from 29 CFR 1910.1000," or, if not available, from other sources of publications such as the American Conference of Governmental Industrial Hygienists or the American National Standards Institute Inc. Flashpoint, shock sensitivity, or similar descriptive data may be used to indicate flammability, reactivity, or similar hazardous properties of the material.

(c) Section III. Physical Data

The data in Section III should be for the total mixture and should include the boiling point and melting point in degrees Fahrenheit (Celsius in parentheses); vapor pressure, in conventional millimeters of mercury (mmHg); vapor density of gas or vapor (air = 1); solubility in water, in parts/hundred parts of water by weight; specific gravity (water = 1); percent volatiles (indicated if by weight or volume) at 70 F (21.1 C); evaporation rate for liquids or sublimable solids, relative to butyl acetate; and appearance and odor. These data are useful for the control of toxic substances. Boiling point, vapor density, percent volatiles, vapor pressure, and evaporation are useful for designing proper ventilation equipment. This information is also useful for design and deployment of adequate fire and spill containment equipment. The appearance and odor may facilitate identification of substances stored in improperly marked containers, or when spilled.

(d) Section IV. Fire and Explosion Data

Section IV should contain complete fire and explosion data for the product, including flashpoint and autoignition temperature in degrees Fahrenheit (Celsius in parentheses); flammable limits, in percent by volume in air; suitable extinguishing media or materials; special firefighting procedures; and unusual fire and explosion hazard information. If the product presents no fire hazard, insert "NO FIRE HAZARD" on the line labeled "Extinguishing Media."

(e) Section V. Health Hazard Information

The "Health Hazard Data" should be a combined estimate of the hazard of the total product. This can be expressed as a TWA concentration, as a permissible exposure, or by some other indication of an acceptable standard. Other data are acceptable, such as lowest LD50 if multiple components are involved.

Under "Routes of Exposure," comments in each category should reflect the potential hazard from absorption by the route in question. Comments should

indicate the severity of the effect and the basis for the statement if possible. The basis might be animal studies, analogy with similar products, or human experiences. Comments such as "yes" or "possible" are not helpful. Typical comments might be:

> Skin Contact--single short contact, no adverse effects likely; prolonged or repeated contact, possibly mild irritation.
>
> Eye Contact--some pain and mild transient irritation; no corneal scarring.

"Emergency and First Aid Procedures" should be written in lay language and should primarily represent first-aid treatment that could be provided by paramedical personnel or individuals trained in first aid.

Information in the "Notes to Physician" section should include any special medical information which would be of assistance to an attending physician including required or recommended preplacement and periodic medical examinations, diagnostic procedures, and medical management of overexposed employees.

(f) Section VI. Reactivity Data

The comments in Section VI relate to safe storage and handling of hazardous, unstable substances. It is particularly important to highlight instability or incompatibility to common substances or circumstances, such as water, direct sunlight, steel or copper piping, acids, alkalies, etc. "Hazardous Decomposition Products" shall include those products released under fire conditions. It must also include dangerous products produced by aging, such as peroxides in the case of some ethers. Where applicable, shelf life should also be indicated.

(g) Section VII. Spill or Leak Procedures

Detailed procedures for cleanup and disposal should be listed with emphasis on precautions to be taken to protect employees assigned to cleanup detail. Specific neutralizing chemicals or procedures should be described in detail. Disposal methods should be explicit including proper labeling of containers holding residues and ultimate disposal methods such as "sanitary landfill" or "incineration." Warnings such as "comply with local, state, and Federal antipollution ordinances" are proper but not sufficient. Specific procedures shall be identified.

(h) Section VIII. Special Protection Information

Section VIII requires specific information. Statements such as "Yes," "No," or "If necessary" are not informative. Ventilation requirements should be specific as to type and preferred methods. Respirators shall be specified

as to type and NIOSH or MSHA (Mine Safety and Health Administration) approval class, ie, "Supplied air," "Organic vapor canister," etc. Protective equipment must be specified as to type and materials of construction.

(i) Section IX. Special Precautions

"Precautionary Statements" shall consist of the label statements selected for use on the container or placard. Additional information on any aspect of safety or health not covered in other sections should be inserted in Section IX. The lower block can contain references to published guides or in-house procedures for handling and storage. Department of Transportation markings and classifications and other freight, handling, or storage requirements and environmental controls can be noted.

(j) Signature and Filing

Finally, the name and address of the responsible person who completed the MSDS and the date of completion are entered. This will facilitate correction of errors and identify a source of additional information.

The MSDS shall be filed in a location readily accessible to employees exposed to the hazardous substance. The MSDS can be used as a training aid and basis for discussion during safety meetings and training of new employees. It should assist management by directing attention to the need for specific control engineering, work practices, and protective measures to ensure safe handling and use of the material. It will aid the safety and health staff in planning a safe and healthful work environment and in suggesting appropriate emergency procedures and sources of help in the event of harmful exposure of employees.

MATERIAL SAFETY DATA SHEET

I PRODUCT IDENTIFICATION	
MANUFACTURER'S NAME	REGULAR TELEPHONE NO EMERGENCY TELEPHONE NO
ADDRESS	
TRADE NAME	
SYNONYMS	

II HAZARDOUS INGREDIENTS		
MATERIAL OR COMPONENT	%	HAZARD DATA

III PHYSICAL DATA		
BOILING POINT, 760 MM HG		MELTING POINT
SPECIFIC GRAVITY (H_2O=1)		VAPOR PRESSURE
VAPOR DENSITY (AIR=1)		SOLUBILITY IN H_2O, % BY WT
% VOLATILES BY VOL		EVAPORATION RATE (BUTYL ACETATE=1)
APPEARANCE AND ODOR		

IV FIRE AND EXPLOSION DATA

FLASH POINT (TEST METHOD)		AUTOIGNITION TEMPERATURE			
FLAMMABLE LIMITS IN AIR, % BY VOL.	LOWER		UPPER		
EXTINGUISHING MEDIA					
SPECIAL FIRE FIGHTING PROCEDURES					
UNUSUAL FIRE AND EXPLOSION HAZARD					

V HEALTH HAZARD INFORMATION

HEALTH HAZARD DATA

ROUTES OF EXPOSURE

INHALATION

SKIN CONTACT

SKIN ABSORPTION

EYE CONTACT

INGESTION

EFFECTS OF OVEREXPOSURE

ACUTE OVEREXPOSURE

CHRONIC OVEREXPOSURE

EMERGENCY AND FIRST AID PROCEDURES

EYES

SKIN

INHALATION

INGESTION

NOTES TO PHYSICIAN

VI REACTIVITY DATA

CONDITIONS CONTRIBUTING TO INSTABILITY

INCOMPATIBILITY

HAZARDOUS DECOMPOSITION PRODUCTS

CONDITIONS CONTRIBUTING TO HAZARDOUS POLYMERIZATION

VII SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IF MATERIAL IS RELEASED OR SPILLED

NEUTRALIZING CHEMICALS

WASTE DISPOSAL METHOD

VIII SPECIAL PROTECTION INFORMATION

VENTILATION REQUIREMENTS

SPECIFIC PERSONAL PROTECTIVE EQUIPMENT

RESPIRATORY (SPECIFY IN DETAIL)

EYE

GLOVES

OTHER CLOTHING AND EQUIPMENT

IX SPECIAL PRECAUTIONS

PRECAUTIONARY
STATEMENTS

OTHER HANDLING AND
STORAGE REQUIREMENTS

PREPARED BY

ADDRESS

DATE

XII. TABLES

TABLE XII-1

PHYSICAL AND CHEMICAL PROPERTIES OF o-TOLIDINE AND BENZIDINE

Property	o-Tolidine	Benzidine
Molecular formula	$(CH_3C_6H_3NH_2)_2$	$(C_6H_4NH_2)_2$
Formula weight	212.32	184.32
Appearance	White-to-brownish leaves or crystals, often used in paste or wet cake form	White or reddish crystalline powder
Melting point (base)	129-131 C	115-128 C
Solubility in water at 25 C		
Base	1.3 mg/ml	0.52 mg/ml
Dihydrochloride salt	76.7 mg/ml	61.7 mg/ml
Excitation wavelength		
Base	300 nm	295 nm
Dihydrochloride salt	310 nm	302 nm
Emission wavelength		
Base	384 nm	396 nm
Dihydrochloride salt	410 nm	410 nm
p-Value* with		
Hexane-acetonitrile	0.01	0.02
Hexane-80% acetone, 20% water	0.16	0.08
Hexane-dimethylformamide	0.00	0.00
Chloroform-water	1.0	1.0
Chloroform-60% methanol, 40% water	0.96	0.85
Chloroform-aqueous sodium hydroxide	1.0	1.0
Chloroform-aqueous hydrochloric acid	0.0	0.0
TLC Rf value with		
Chloroform	14	10
Chloroform-methanol (9/1, v/v)	80	70
Benzene	2	2
Benzene-methanol (9/1, v/v)	45	33

*Fractional amount partitioning into the nonpolar phase of an equal-volume, two-phase system.

Adapted from references 1,2,5,6

TABLE XII-2

OCCUPATIONS WITH POTENTIAL EXPOSURE TO o-TOLIDINE

Analytical chemistry workers
Artists
Chemical distributors
Dyemakers
Forest service chemists
Glucose diagnostic tape makers
Leather dye workers
Medical laboratory workers
Organic chemists
o Tolidine makers
Sanitarians
Sewage treatment plant workers
Swimming pool test kit makers
Swimming pool service personnel
Textile dryers
Toluene diisocyanate makers
Urethane curers
Waterworks attendants

Adapted from reference 4

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