

Australian Standard[®]

Methods for the sampling and analysis of indoor air

Method 1.2: Determination of nitrogen dioxide—Spectrophotometric method—Treated filter/passive badge sampling procedure

PREFACE

This Standard was prepared by the Standards Australia Committee on Methods for Examination of Air under the direction of the Chemical Standards Board.

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METHOD

1 SCOPE. This Standard sets out a spectrophotometric method for the determination of nitrogen dioxide in indoor air using a passive sampling, treated filter technique. This method is applicable to indoor air in which the expected nitrogen dioxide concentration is within the range 0 to 3 p.p.m. (V/V) (0 to 6 000 µg/m³) for an exposure time of 1 h, and has a detection limit of 0.035 p.p.m. for a 2 h sampling period.

2 APPLICATION. Passive sampling badges exhibit sampling rates dependent on the dimensions of the device and the properties of the diffusion barrier. If decreased sensitivity or increased sampling duration is required, the method in AS 2365.1.1 should be used. This method is unsuitable for use in areas where the air velocity is greater than that produced by a ventilation rate of two air changes per hour. In addition, a sampling time of less than 2 h is not recommended; the method gives best results for sampling times between 2 h and 12 h. The sampling procedure specified is not suitable for indoor atmospheres which fall below 0°C.

3 REFERENCED DOCUMENTS. The following documents are referred to in this Standard:

AS

- 2365 Methods for the sampling and analysis of indoor air
2365.1.1 Method 1.1: Determination nitrogen dioxide—Spectrophotometric method—Treated mesh/passive tube sampling procedure
3536 Reference gases—Preparation of gravimetric standards
3580 Methods for the sampling and analysis of ambient air
3580.2.2 Method 2.2: Preparation of reference test atmospheres—Compressed gas method
3580.5.1 Method 5.1: Determination of oxides of nitrogen—Chemiluminescence method
3753 Code of recommended practice for chemical analysis of materials by ultraviolet visible spectrophotometry

4 PRINCIPLE. Nitrogen dioxide in the indoor air is diffused at a known rate onto a fibre sheet coated with triethanolamine (TEA). After exposure, the absorbed nitrogen dioxide is reacted with a reagent to form an azo dye, and the intensity of the dye colour is read at 540 nm on a spectrophotometer.

5 DEFINITION. For the purpose of this Standard, the definition below applies.

Indoor air—the air within a building occupied for a period of at least 1 h in any day. Buildings to be covered by such a definition include homes, schools, restaurants, public buildings, residential institutions (including hostels and hospitals), and offices. The definition does not cover premises (e.g. workplaces) or other premises otherwise covered by occupational health standards.

6 REAGENTS AND MATERIALS.

6.1 General requirements. During the analysis only reagents of recognized analytical reagent grade, and distilled water or water of equivalent purity, shall be used.

6.2 Sodium nitrite solution. Dissolve 3.00 g of sodium nitrite (NaNO_2) in 1 L of water. Dilute 10.0 mL of this solution to 1 L with water.

6.3 Triethanolamine solution. Dilute 100 mL of triethanolamine to 200 mL with acetone.

6.4 Azo dye-forming reagent. Dissolve 5 g of sulfanilic acid in 700 mL of water. To this solution, add 50 mL of phosphoric acid (ρ_{20} 1.74 g/mL) and 50 mL of 0.1% (m/V) *N*-(1-naphthyl)ethylenediamine dihydrochloride solution. Dilute to 1 L with water.

6.5 Standard dye solution. Add 1.0 mL of sodium nitrite solution (6.2) to a 100 mL volumetric flask and dilute to volume with azo dye-forming reagent (6.4). This solution shall be prepared freshly for each batch of analyses.

6.6 Reference gas. A gas mixture containing between 5 p.p.m. and 100 p.p.m. (by volume) nitrogen dioxide in nitrogen prepared in accordance with the procedure described in AS 3536.

6.7 Diluent gas. Purified air containing less than 0.005 p.p.m. (by volume) nitrogen dioxide.

7 APPARATUS.

7.1 Passive sampling badge (see Figure 1)—consisting of the following:

- A badge case, constructed of a material inert to TEA and nitrogen dioxide, having a rigid back and a face of appropriate size which can be left open to the air. A 50 mm diameter plastics petri-dish with its lid can be used as a simple badge case.
- An absorbent cellulose-fibre sheet (see Note) of approximately 42 mm diameter. The sheet shall be dried in an oven at 105°C for 24 h prior to use to remove any contamination from either nitrogen dioxide or nitrites. The fibre sheet should fit neatly into the badge case.

NOTE: Whatman No 2 filter sheets have been found to be suitable.

- A diffusion controlling barrier consisting of a series of hydrophobic filters made of polytetrafluoroethylene (PTFE), of approximately 47 mm diameter, having an effective pore size of 5 μm and inserted to a thickness of 0.8 mm. The diffusion barrier shall form an effective seal against the edge of the badge case.
- A restraining device made of material inert to nitrogen dioxide (e.g. stainless steel circlip) to hold the diffusion barrier and absorbent cellulose-fibre sheet in place.