

Methods for

Measurement of air pollution —

Part 7: Determination of mass concentration of sulphur dioxide in ambient air: Thorin spectrophotometric method

[ISO title: Air quality — Determination of mass concentration of sulphur dioxide in ambient air: Thorin spectrophotometric method]

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- Cement Makers' Federation
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- Institution of Environmental Health Officers
- Institution of Gas Engineers
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- National Industrial Fuel Efficiency Service
- National Society for Clean Air

This British Standard, having been prepared under the direction of the Environment and Pollution Standards Committee, was published under the authority of the Board of BSI and comes into effect on 31 January 1983

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National foreword

This Part of this British Standard, which has been prepared under the direction of the Environment and Pollution Standards Committee, is identical with ISO 4221:1980 “*Air quality — Determination of mass concentration of sulphur dioxide in ambient air — Thorin spectrophotometric method*”.

The International Standard was prepared by Technical Committee 146, Air quality, and published by the International Organization for Standardization (ISO) as a result of discussion in which the UK participated.

This Part of this British Standard is one of a series relating to air quality arising from the UK participation in the work of ISO/TC 146. Methods for the determination of particular constituents of ambient air will be published as further Parts of this standard. Topics relating to air quality characteristics will be published as Parts of BS 6069 “*Methods for characterization of air quality*”.

Terminology and conventions. The text of the International Standard has been approved as suitable for publication as a British Standard without deviation. Some terminology and certain conventions are not identical with those used in British Standards; attention is especially drawn to the following.

The comma has been used throughout as a decimal marker. It is current practice in British Standards to use a full point on the baseline as the decimal marker.

Wherever the words “International Standard” appear, referring to this standard, they should be read as “British Standard”.

Cross-reference

International Standard	Corresponding British Standard
ISO 4219:1979	BS 1747 <i>Methods for measurement of air pollution</i> Part 6:1982 <i>Sampling equipment used for the determination of gaseous sulphur compounds in ambient air</i> (Identical)

A British Standard does not purport to include all the necessary provisions of a contract. Users of British Standards are responsible for their correct application.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 8, an inside back cover and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

1 Scope

This International Standard specifies a Thorin¹⁾ spectrophotometric method for the determination of the mass concentration of sulphur dioxide in ambient air.

2 Field of application

This method is applicable to the determination of the mass concentration of sulphur dioxide in ambient air within the range of 3,5 to 150 µg/m³, assuming an air sample volume of 2 m³ and a sample solution volume of 50 ml. For higher concentrations, dilution of the sample may be necessary before carrying out the determination.²⁾

Interference from ammonia and hydrogen sulphide may occur if these are present in very high concentrations. Interferences from particulate matter are avoided at the sampling stage by filtering the air. (See also 8.3.)

NOTE Diluting may be sometimes unnecessary if the air sample collected over a specified period is reduced by dividing the overall sampling period into intervals of the same duration and sampling in such a way that intervals of absorption are followed by intervals where the sampling pump is switched off.

3 Reference

ISO 4219, *Air quality — Determination of gaseous sulphur compounds in ambient air — Sampling equipment*.

4 Principle

Absorption and oxidation of the sulphur dioxide present in the sampled air by drawing the sample for a specified period through an acidified solution of hydrogen peroxide of defined pH, resulting in the formation of sulphuric acid.

Precipitation of the sulphate ions formed as barium sulphate by reaction with excess barium perchlorate and determination of residual barium ions by complexing with Thorin and measurement of the coloured complex spectrophotometrically at 520 nm.

NOTE The difference between the initial and final quantity of barium ions corresponds to the concentration of sulphate ions in the absorption solution, and thus to the amount of sulphur dioxide that has been oxidized. The absorbance varies inversely with the concentration of sulphate ions present in the absorption solution.

5 Reagents

During the analysis, use only reagents of recognized analytical grade and only double-distilled or de-ionized and distilled water.

WARNING — Handle carefully the following hazardous substances: perchloric acid solution, barium perchlorate solution, dioxane and Thorin.

5.1 Hydrogen peroxide, 27 to 30 % (m/m) solution.

5.2 Absorption solution

Dilute 10 ml of the hydrogen peroxide solution (5.1) to 1 000 ml with water. Adjust the pH of the solution to between 4,0 and 4,5 with the perchloric acid solution (5.4), preferably using a pH meter.

Store this solution in a refrigerator and discard after 1 month.

5.3 Perchloric acid, 0,1 mol/l solution.

Add 4,3 ml of a 72 % (m/m) solution of perchloric acid (HClO₄) to water in a 500 ml one-mark volumetric flask. Dilute to the mark and mix.

5.4 Perchloric acid, approximately 0,01 mol/l solution.

Prepare from the 0,1 mol/l solution (5.3).

5.5 Barium perchlorate solution.

Dissolve 0,525 g of anhydrous barium perchlorate [Ba (ClO₄)₂] in a small quantity of the perchloric acid solution (5.3) in a 250 ml one-mark volumetric flask. Dilute to the mark with the same perchloric acid solution and mix.

5.6 Barium perchlorate/dioxane solution

Add 10 ml of the barium perchlorate solution (5.5) to 40 ml of water in a 1 000 ml one-mark volumetric flask. Dilute to the mark with dioxane and mix.

NOTE 1 Several organic solvents may be used, for example dioxane, isopropanol, acetone. The most favourable calibration curve, however, is obtained with dioxane.

NOTE 2 The organic solvent is chosen to minimize the solubility product of the barium sulphate, but because this is still significant in the lower region of the concentration range, a small constant amount of sulphate ion is added to the blank solution, the standard matching solutions and the aliquot portion of the exposed sample.

5.7 Thorin, 2,5 g/l solution.

Dissolve 0,125 g of Thorin in 20 ml of the standard sulphate solution (5.8.2) and a small quantity of water in a 50 ml one-mark volumetric flask. Dilute to the mark with water and mix.

Prepare this solution daily.

¹⁾ Thorin is also known as Thoron or Thoronol, the sodium salt of 4-[(2-arsonophenyl) azo]3-hydroxy 2,7-naphthalene-disulphonic acid.

²⁾ An International Standard specifying a tetrachloromercurate (TCM)/pararosaniline spectrophotometric method for the determination of the mass concentration of sulphur dioxide in ambient air is in preparation, and should be used when greater sensitivity is required.