

# Characterization of air quality —

## Part 3: Workplace atmospheres —

### Section 3.1 Method for the determination of vinyl chloride using a charcoal tube and a gas chromatograph

# Committees responsible for this British Standard

The preparation of this British Standard was entrusted by the Environmental and Pollution Standards Policy Committee (EPC/-) to Technical Committee EPC/35, upon which the following bodies were represented:

- Association of Consulting Scientists
- British Coal Corporation
- British Gas plc
- British Steel plc
- Department of Health
- Department of the Environment (Her Majesty's Inspectorate of Pollution)
- Department of Trade and Industry (Laboratory of the Government Chemist)
- Department of Trade and Industry (Warren Spring Laboratory)
- Electricity Supply Industry in England and Wales
- GAMBICA (BEAMA Ltd.)
- Health and Safety Executive
- Institute of Occupational Hygienists
- Institute of Petroleum
- Institution of Environmental Health Officers
- Institution of Gas Engineers
- Lead Development Association
- National Society for Clean Air
- Society of Chemical Industry

The following bodies were also represented in the drafting of the standard, through subcommittees and panels:

- Asbestos Information Centre Ltd.
- Asbestosis Research Council
- Chemical Industries Association
- Council for Environmental Conservation
- Engineering Equipment and Materials Users' Association
- Fibre Cement Manufacturers' Association Limited
- Institute of Occupational Medicine
- London Regional Transport
- Royal Society of Chemistry

This British Standard, having been prepared under the direction of the Environmental and Pollution Standards Policy Committee, was published under the authority of the Board of BSI and comes into effect on 28 February 1990

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## Amendments issued since publication

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# National foreword

This Section of BS 6069, which has been prepared under the direction of the Environment and Pollution Standards Policy Committee, is identical with ISO 8762:1988 “*Workplace air — Determination of vinyl chloride — Charcoal tube/gas chromatographic method*”. The International Standard was prepared by Technical Committee 146, Air quality of the International Organization for Standardization (ISO) with the active participation and approval of the UK.

BS 6069 is being published in a series of Parts and Sections that will generally correspond to particular International Standards arising from the UK participation in the work of ISO/TC 146. This Section of BS 6069 is one of several relating to workplace atmospheres that are being published as Sections of Part 3. Methods concerning stationary sources are being published as Sections of Part 4 of BS 6069. Topics relating to other aspects of air quality characterization will be published as further Parts or Sections of BS 6069.

The following Parts of BS 6069 have been published:

- *Part 1: Units of measurement;*
- *Part 2: Glossary.*

Methods for the determination of particular constituents of ambient air are being published as Parts of BS 1747 “*Methods for the measurement of air pollution*”.

## Cross-references

| International Standard | Corresponding British Standard                                                                                                                                                                      |
|------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| ISO 5725:1986          | BS 5497 <i>Precision of test methods</i><br>Part 1:1987 <i>Guide for the determination of repeatability and reproducibility for a standard test method by inter-laboratory tests</i><br>(Identical) |
| ISO 6349:1979          | BS 4559 <i>Methods for preparation of calibration gas mixtures</i><br>Part 7:1981 <i>Permeation method</i><br>(Identical)                                                                           |

**Textual errors.** When adopting the text of the International Standard the textual errors given below were discovered. They have been marked in the text and have been reported to ISO in a proposal to amend the text of the International Standard.

- a) Clause **5.1**, paragraph 1. In line 1 insert “constructed of glass,” after “Charcoal tube,”. At the end of this paragraph add “Alternatively use a metal tube of similar dimensions.”
- b) Clause **5.10**. Delete “or glass-stoppered,”.
- c) Clause **B.2.2.2**. After “Calibrated flowmeter” insert “(see **A.3.2**)”.

**Typographical error.** Please note that in clause **B.1**, line 8, “bach” should read “batch”.

**Additional information.** Note that Table 1 contains references to trade names. 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 charcoal tube/gas chromatographic method for the determination of the vinyl chloride monomer concentration in workplace air.

The method is valid for vinyl chloride concentrations in the range from 250  $\mu\text{g}/\text{m}^3$  ( $\approx 100 \mu\text{l}/\text{m}^3$ ) to 25  $\text{mg}/\text{m}^3$  ( $\approx 10 \text{ ml}/\text{m}^3$ ) when sampling 30 litres of air[1].

**NOTE** The upper limit of the useful range is set by the adsorptive capacity of the charcoal tube used. This capacity is measured as a break-through volume of air, which volume should not be exceeded during sampling. The lower limit is set by a number of parameters, including the noise level of the detector, blank concentrations due to contamination of the charcoal and carbon disulfide by vinyl chloride, poor desorption efficiency at very low sample loadings, and interference of the solvent peak in the gas chromatographic analysis.

This procedure is compatible with low flow-rate personal sampling equipment and can be used for personal and fixed location sampling. It cannot be used to measure instantaneous or short-term fluctuations in vinyl chloride concentrations. Alternative on-site procedures, such as gas chromatography or infra-red spectrometry, should be used to measure rapidly changing concentrations. Organic components which have the same or nearly the same retention time as vinyl chloride during the gas chromatographic analysis will interfere. Interferences can be minimized by proper selection of gas chromatographic columns and programme conditions.

For certain applications, alternative detectors such as the photo-ionization detector may offer greater selectivity and sensitivity to vinyl chloride.

Water mists, high relative humidity, and other vapours at high concentrations reduce the adsorptive capacity of the charcoal for vinyl chloride.

The sampling method gives a time-weighted average result.

## 2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the standards listed below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 5725:1986, *Precision of test methods — Determination of repeatability and reproducibility for a standard test method by inter-laboratory tests.*

ISO 6349:1979, *Gas analysis — Preparation of calibration gas mixtures — Permeation method.*

## 3 Principle

A known volume of air sample is passed through a glass or metal tube packed with activated charcoal. The vinyl chloride is adsorbed onto the charcoal. The collected vinyl chloride is desorbed using carbon disulfide and analysed with a gas chromatograph equipped with a flame ionization detector.

## 4 Reagents

During the analysis, use only reagents of recognized analytical grade and only distilled water or water of equivalent quality.

**4.1 Vinyl chloride** liquid in a small gas cylinder.

**WARNING — Vinyl chloride is recognized as a human carcinogen. Avoid any exposure by inhalation or skin contact. Personal protection (e.g. an effective respirator) shall be available in all cases where exposure to vinyl chloride is possible.**

**Vinyl chloride vapour is highly flammable. Usage shall be restricted to a well-ventilated fume cupboard. An effective fire extinguisher shall be permanently available.**

**4.2 Carbon disulfide** ( $\text{CS}_2$ ), chromatographic quality, previously checked for compounds coincident with the vinyl chloride peak. The  $\text{CS}_2$  shall not contain impurities that coelute with vinyl chloride giving a response greater than 0,06 ng of vinyl chloride at an injection volume of 1  $\mu\text{l}$ . This requirement shall be checked for each batch of  $\text{CS}_2$ .

**WARNING — Carbon disulfide vapour is toxic. Avoid any exposure by inhalation or skin contact. Carbon disulfide is highly flammable. Usage shall be restricted to a well-ventilated fume cupboard. An effective fire extinguisher shall be permanently available.**

**Small waste quantities of carbon disulfide shall be disposed of only in accordance with local regulations and accepted practices.**

**4.3 Activated coconut shell charcoal**, particle size 0,35 mm to 0,85 mm. Before packing the tubes, the charcoal shall be heated in an inert atmosphere, e.g. high-purity nitrogen, at approximately 600 °C for 1 h. To prevent recontamination of the charcoal, it shall be kept in a clean atmosphere during cooling to room temperature, storage and loading into the tubes.

**NOTE** Suitable tubes containing pretreated coconut charcoal are commercially available (see 5.1).