BS ISO 6323-1:2024

BSI Standards Publication

Workplace air — Determination of arsenic and arsenic compounds by electrothermal atomic absorption spectrometry

Part 1: Arsenic and arsenic compounds, except arsine by ET-AAS

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National foreword

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Workplace air — Determination of arsenic and arsenic compounds by electrothermal atomic absorption spectrometry —

Part 1: Arsenic and arsenic compounds, except arsine by ET-AAS

Air des lieux de travail — Détermination de l'arsenic et des composés d'arsenic par spectrométrie d'absorption atomique avec atomisation électrothermique —

Partie 1: Arsenic et composés d'arsenic, à l'exception de l'arsine par ET-AAS

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Foreword

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The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO document should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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This document was prepared by Technical Committee ISO/TC 146, *Air quality*, Subcommittee SC 2, *Workplace atmospheres*.

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Introduction

Arsenic and arsenic compounds are toxic and are recognized as human carcinogens. In particular arsenic and arsenic compounds are a hazard to the health of workers in many industries through exposure by inhalation. Industrial hygienists and other public health professionals need to determine the effectiveness of measures taken to control workers' exposure. The collection of samples of air during a work activity and then measuring the amount of particular arsenic and arsenic compounds are often done to assess an individual's exposure, the effectiveness of workplace controls or respiratory protection measures. The air sampling can be done as stationary or personal air sampling. Electrothermal atomic absorption spectrometry (ET-AAS) analysis of particular arsenic and arsenic compounds in a sample of respirable or inhalable dust collected on a collection substrate (membrane filter) is employed in many countries to measure and estimate exposure to arsenic and arsenic compounds. ET-AAS is able to quantify arsenic and arsenic compounds.

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Workplace air — Determination of arsenic and arsenic compounds by electrothermal atomic absorption spectrometry —

Part 1:
Arsenic and arsenic compounds, except arsine by ET-AAS

1 Scope

This document specifies a method for the determination of the mass concentration of particulate arsenic and arsenic compounds in workplace air sampled on a filter (e. g. 37 mm cellulose nitrate filter), digested with acid or an acid mixture and analysed quantitively by using electrothermal atomic absorption spectrometry (ET-AAS). The method is not suitable for determination of arsenic in the form of metal arsenides, which decompose in the presence of water or acid, or for arsenic trioxide vapour.

Many different types of sampling apparatus are used to collect respirable or inhalable dust, according to the occupational hygiene convention. This document is designed to accommodate the variety of samplers and collection substrates available to analysts. This document is intended to be used in conjunction with ISO 21832 which promotes best practices for these analyses.

The method is applicable to the determination of masses of approximately 0,2 µg to 2 µg of arsenic per sample, for analysis of test solutions prepared using sample solution aliquots in the recommended range (see 10.1.3 and 10.1.4.1). The concentration range for arsenic in air, for which this procedure is applicable, is determined in part by the sampling procedure selected by the user.

The method is applicable to personal and stationary air sampling.

A number of transition metals can interfere with the determination of arsenic by electrothermal atomic absorption spectrometry (see 11.3).

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 1042, *Laboratory glassware — One-mark volumetric flasks*

ISO 3696, *Water for analytical laboratory use — Specification and test methods*

ISO 7708, *Air quality — Particle size fraction definitions for health-related sampling*

ISO 13137, *Workplace atmospheres — Pumps for personal sampling of chemical and biological agents — Requirements and test methods*

ISO 18158, *Workplace air — Terminology*

ISO 20581, *Workplace air — General requirements for the performance of procedures for the measurement of chemical agents*

ISO 21832, *Workplace air — Metals and metalloids in airborne particles — Requirements for evaluation of measuring procedures*

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DIN 12353, *Laboratory ware made from fused quartz and fused silica; boiling flasks made from fused quartz; round bottom flasks, flat bottom flasks and conical flasks*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 18158 apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

4 Principle

A filter (6.2.1; see Table 1) is mounted in a sampler (6.1.1) designed to collect the respirable or inhalable fraction of airborne particles. The sampling can be performed with personal or stationary fixed samplers. Before sampling is performed, the filter batch used shall be verified with regard to its metal content and consequently the suitability of the minimum requirements for the performance of measuring methods.

Currently limit values in different countries exist for arsenic and its compounds either as “total dust”, defined by the performance of a sampler, or in the inhalable size selective fraction. A suitable sampling device for the applicable particle fraction shall be used considering the existing limit value/particle fraction.

The fraction separated on the filter is analysed for arsenic after acid digestion using ET-AAS. As digestion media, nitric acid or a mixture of nitric and hydrochloric acid can be used. The sample solution is allowed to cool and diluted to a given volume with ultrapure water (7.3.1), depending on the digestion type used. A test solution is prepared by transferring an aliquot of the sample solution to a volumetric flask and dilution to volume with ultrapure water.

The atomic absorption spectrometer is equipped with an arsenic hollow cathode lamp or electrodeless charge lamp and heated electrically.

Absorbance measurements are made at 193,7 nm or 197,2 nm, using a graphite furnace with platform and a matrix modifier (7.4.1.2). For background compensation, Zeeman-Mode is used. Deuterium background compensation can also be used as an option. Results obtained by the analytical-curve technique or the analyte addition technique.

5 Requirement

The measuring procedure shall conform to ISO 20581 or ISO 21832, which specify performance requirements for procedures for measuring chemical agents in workplace air.

6 Apparatus and equipment

6.1 Sampling equipment

6.1.1 Sampler

The performance of the sampler used shall match the criteria for respirable or inhalable dust as specified in ISO 7708. Samplers that use 37 mm diameter filters (6.2.1) as the collection substrate are required. A plastic filter capsule for filters with a diameter of 37 mm are necessary. A suitable supporting grid can be necessary.

Each sampler should be labelled with a unique number, in order to identify samplers that start to under-perform after long-term use.

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