SLOVENSKI STANDARD
SIST EN 13528-2:2003

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Kakovost zunanjega zraka - Difuzijski vzorļ evalniki za doloļ evanje koncentracije plinov in par - Zahteve in preskusne metode - 2. del: Posebne zahteve in preskusne metode

Ambient air quality - Diffusive samplers for the determination of concentrations of gases and vapours - Requirements and test methods - Part 2: Specific requirements and test methods

Außenluftqualität - Passivsammler zur Bestimmung der Konzentrationen von Gasen und Dämpfen - Anforderungen und Prüfverfahren - Teil 2: Spezifische Anforderungen und Prüfverfahren

Qualité de l'air - Echantillonneurs par diffusion pour la détermination des concentrations des gaz et des vapeurs - Exigenges et méthodes d'essai - Partie 2: Exigences spécifiques et méthodes d'essai

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Ambient air quality - Diffusive samplers for the determination of concentrations of gases and vapours - Requirements and test methods - Part 2: Specific requirements and test methods

Qualité de l'air - Echantillonneurs par diffusion pour la détermination des concentrations des gaz et des vapeurs - Prescriptions et méthodes d'essai - Partie 2: Prescriptions spécifiques et méthodes d'essai

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This European Standard was approved by CEN on 28 July 2002.

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This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the Management Centre has the same status as the official versions.

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Contents

Foreword

This document (EN 13528-2:2002) has been prepared by Technical Committee CEN/TC 264 “Air Quality”, the secretariat of which is held by DIN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by March 2003, and conflicting national standards shall be withdrawn at the latest by March 2003.

This European Standard is a multi-part standard having the following parts:

— Part 1: (Ambient Air Quality) General requirements;

— Part 2: (Ambient Air Quality) Specific requirements and test methods;

— Part 3: (Ambient Air Quality) Guide to selection, use and maintenance.

The annexes A and B are normative, annex C is informative.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Malta, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

Introduction

This European Standard specifies requirements and test methods for the determination of performance characteristics of diffusive samplers used for the determination of concentrations of gases and vapours in ambient atmospheres.

With regard to air quality, the objectives fixed in the 5th Action Program of the European Union are for the effective protection of all people against recognised risks from air pollution and the establishment of permitted concentration levels of air pollutants, which should take into account the protection of the environment. These objectives include monitoring and control of concentrations with regard to standards.

Successive programs of action of the European Union on the protection of the environment have stressed the need to find a balance between the use of different tools: product standards, emission limits and environmental objectives/standards.

The implementation of existing Directives has highlighted the existence of various problems, which are being addressed in the Council Directive on Ambient Air Quality Assessment and Management [1]. These include:

— the different monitoring strategies in comparable situations between and within Member States;

— the harmonisation of measuring methods;

— the quality of the measurements which depends on the calibration and quality assurance procedures.

Diffusive samplers used to measure air quality have to fulfil some general requirements, which are given in EN 13528-1. These requirements include unambiguity, selectivity and Data Quality Objectives, including uncertainty.

Such general requirements can also be appropriate for other measurement procedures used in the assessment of ambient air quality.

In addition, diffusive samplers used to measure ambient air quality have to also fulfil some specific requirements in addition to those specified in EN 13528-1. These specific requirements are given in this part of EN 13528 (see clause 5). prEN 13528-3 gives guidance on the selection, use and maintenance of diffusive samplers used to measure ambient air quality.

It is the user's primary responsibility to choose appropriate procedures or devices that meet the requirements of this European Standard. One way of doing this is to obtain information or confirmation from the manufacturer. Type testing, or more generally, the assessment of performance criteria of procedures or devices, can be undertaken by the manufacturer, user, test house or research and development laboratory, as is most appropriate.

Although this standard specifically addresses ambient air, diffusive sampling is also relevant to the assessment of air quality in indoor air. Both pumped and diffusive sampling procedures are considered appropriate for such measurements, depending on circumstances (particularly any requirement for time resolution) [2]. prEN 14412 gives guidance on the selection, use and maintenance of diffusive samplers used to measure indoor air quality.

This part of EN 13528 is similar in content to EN 838 and EN 13528-1 is similar in content to EN 482. The series of standards on the use of diffusive samplers for ambient air has been created in addition to those for workplace air because the underlying European Directives are different and the consequent definitions and practical applications of the estimation of the uncertainty of measurements are different.

1 Scope

This European Standard specifies specific performance requirements and test methods under prescribed laboratory and field conditions for diffusive samplers used for the determination of the concentration of gases or vapours in ambient air.

Such requirements apply to all diffusive samplers, irrespective of the physical nature of the rate-controlling process and irrespective of the nature of the sorption process and the analytical determination.

This standard applies to all stages of the measuring procedure, including transportation and storage of the sample where appropriate.

This standard applies to measuring procedures with separate sampling and analysis stages, and also to direct-reading devices.

This European Standard is applicable to diffusive samplers according to 3.6 of EN 13528-1:2002.

This European Standard should enable manufacturers and users of diffusive samplers to adopt a consistent approach to sampler validation and provide a framework for the assessment of sampler performance against criteria specified in EN 13528-1. It is the responsibility of the manufacturer or of those who assemble the diffusive samplers to ensure that the sampler complies with the data quality objectives given in this European Standard.

For the purpose of demonstrating compliance with data quality objectives prescribed for methods to be used in support of the Council Directive on Ambient Air Quality Assessment and Management, this part of EN 13528 provides the relevant requirements and test methods for the determination of measurement uncertainty. As indicated in 6.5.2 to 6.5.4, some of these procedures are to be undertaken by a single representative laboratory, some by several laboratories in an interlaboratory trial, and some by the laboratory implementing the method. This division of responsibility is in accordance with Table 1 of CEN Report CR 14377:2002 [3].

Where only one laboratory is involved in establishing the performance characteristics of a method, as in a manufacturer's assessment, the reproducibility elements of the uncertainty budget shall be estimated under within-laboratory reproducibility conditions, i.e. by performing the relevant experiments independently, as far as reasonably practicable. This type of assessment is identified as level 2 (see clause 8).

This standard can encourage the development of new types of diffusive sampler. Prior to conducting a full evaluation according to this standard, it would be useful to conduct laboratory or field intercomparisons with established samplers. These intercomparisons should be conducted by experienced institutes.

2 Normative references

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text, and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies (including amendments).

ENV 13005:1999, *Guide to the expression of uncertainty in measurement.*

ISO 5725, *Accuracy (trueness and precision) of measurement methods and results (all parts).*

3 Terms and definitions

For the purpose of this European Standard the following terms and definitions apply.

3.1
ambient air
outdoor air in the troposphere, excluding indoor air and workplaces

3.2
averaging time
period of time for which the measuring procedure yields a single value [EN 482]

3.3
bias
difference between the expectation of the test results and an accepted reference value [ISO 3534-1]

3.4
combined standard uncertainty
standard uncertainty of the result of a measurement when that result is obtained from the values of a number of other quantities, equal to the positive square root of a sum of terms, the terms being the variances or covariances of these other quantities weighted according to how the measurement result varies with changes in these quantities [ENV 13005]

3.5
desorption efficiency
ratio of the mass of analyte desorbed from a sampling device to that applied [EN 838]

3.6
diffusive sampler
device which is capable of taking samples of gases or vapours from the atmosphere at a rate controlled by a physical process such as gaseous diffusion through a static air layer or a porous material and/or permeation through a membrane, but which does not involve the active movement of air through the device

NOTE 1 Active normally refers to the pumped movement of air.

NOTE 2 This definition differs from that in EN 838:1995 by the addition of the words “or a porous material”.

3.7
diffusive uptake rate
rate at which the diffusive sampler collects a particular gas or vapour from the atmosphere, expressed in picograms per parts per billion[1] per minute (pg ppb^{-1} min^{-1}) or cubic centimetres per minute (cm^3 min^{-1})

NOTE 1 pg ppb^{-1} min^{-1} are equivalent to ng ppm^{-1} min^{-1}.

NOTE 2 This definition differs from that in EN 838:1995 by the substitution of “picograms per parts per billion” for “nanograms per parts per million”. The expression is numerically the same, but ambient concentrations are usually in the ppb range.

3.8
expanded uncertainty
quantity defining an interval about the result of a measurement that may be expected to encompass a large fraction of the distribution of values that could reasonably be attributed to the measurand

NOTE 1 The fraction may be viewed as the coverage probability or level of confidence of the interval.

NOTE 2 To associate a specific level of confidence with the interval defined by the expanded uncertainty requires explicit of implicit assumptions regarding the probability distribution characterised by the measurement result and its combined standard

[1] ppb is volume fraction, $(\phi)=10^{-9}$; ppm is volume fraction, $(\phi)=10^{-6}$.

uncertainty. The level of confidence that can be attributed to the interval can be known only to the extent to which such assumptions may be justified.

NOTE 3 Expanded uncertainty is termed *overall uncertainty* in ENV 13005.

[ENV 13005]

3.9
measuring procedure
procedure for sampling and analysing one or more pollutants in ambient air and including storage and transportation of the sample

3.10
nominal uptake rate
the diffusive uptake rate determined experimentally under specified conditions

3.11
repeatability conditions
conditions where independent test results are obtained with the same method on identical test items in the same laboratory by the same operator using the same equipment within short intervals of time [ISO 3534-1]

3.12
reproducibility conditions
conditions where test results are obtained with the same method on identical test items in different laboratories with different operators using different equipment [ISO 3534-1]

3.13
standard uncertainty
uncertainty of the result of a measurement expressed as a standard deviation [ENV 13005]

3.14
uncertainty (of measurement)
parameter, associated with the results of a measurement, that characterises the dispersion of values that could reasonably be attributed to the measurand

NOTE 1 The parameter may be, for example, a standard deviation (or given multiple of it), or the half width of an interval having a stated level of confidence.

NOTE 2 Uncertainty of measurement comprises, in general, many components. Some of these components may be evaluated from the statistical distribution of the results of a series of measurements and can be characterised by experimental standard deviations. The other components, which can also be characterised by standard deviations, are evaluated from assumed probability distributions based on experience or other information.

NOTE 3 It is understood that the result of a measurement is the best estimate of the value of a measurand, and that all components of uncertainty, including those arising from systematic effects, such as components associated with corrections and reference standards, contribute to this dispersion [ENV 13005].

Attention is drawn to the fact that the terms Assessment, Limit Value and Pollutant are defined in Directive 96/62/EC [1].

4 Symbols and abbreviations

A cross-sectional area of the diffusion path, or equivalent sorption surface, in square centimetres;

C observed concentration, in micrograms per cubic meter;

C' observed concentration, in parts per billion (volume fraction = 10^{-9});

D diffusion coefficient of analyte, in square centimetres per minute;

D_1 diffusion coefficient of analyte 1, in square centimetres per minute;

D_2 diffusion coefficient of analyte 2, in square centimetres per minute;

b_i blank level, expressed as a percentage of the concentration level*, i;*

d desorption efficiency;

l length of static air layer in sampler (or equivalent for permeation types), in centimetres;

m_b mass of the analyte which is desorbed from the blank sampler, in picograms;

m_d mass of the analyte which is desorbed from exposed samplers, in picograms;

m_s mass of the analyte which is sorbed by diffusion, in picograms;

m_1 mass loss from permeation tube, in micrograms per minute;

m_2 mean exposure dose in parts per billion (volume fraction = 10^{-9}) minutes (direct-reading samplers) or mean mass uptake in picograms (indirect-reading samplers) of samplers exposed continuously to an intermediate concentration (see 7.3);

m_3 mean exposure dose in parts per billion (volume fraction = 10^{-9}) minutes (direct-reading samplers) or mean mass uptake in picograms (indirect-reading samplers) of samplers exposed to alternately 2 x the intermediate concentration and clean air (see 7.3);

P pressure of the sampled atmosphere during sampling, in kilopascals;

t exposure time, in minutes;

U diffusive uptake rate, in cubic centimetres per minute;

U_1 diffusive uptake rate of analyte 1, in cubic centimetres per minute;

U_2 diffusive uptake rate of analyte 2, in cubic centimetres per minute;

U' diffusive uptake rate, in picograms per parts per billion (volume fraction = 10^{-9}) per minute (pg ppb^{-1} min^{-1});

V volumetric flow rate of air, in cubic meters per minute;

x_i mean result for test (subscript) at concentration level i*;*

δ bias;

ρ delivered concentration, in micrograms per cubic meter;

ρ_i test concentration, at level i, in micrograms per cubic meter;

σ_i standard deviation for test (subscript) at concentration level *i;*

ϕ delivered concentration in parts per billion (volume fraction = 10^{-9}).