SLOVENSKI PREDSTANDARD

OSIST prEN 15051:2004

december 2004

Zrak na delovnem mestu – Meritve zaprašenosti razsutih materialov – Zahteve in referenčne preskusne metode

Workplace atmospheres - Measurement of the dustiness of bulk materials - Requirements and reference test methods

ICS 13.040.30

Referenčna številka
OSIST prEN 15051:2004(en;fr;de)

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

DRAFT
prEN 15051

September 2004

ICS

English version

Workplace atmospheres - Measurement of the dustiness of bulk materials - Requirements and reference test methods

Atmosphères des lieux de travail - Mesure de l'empoussièrement dû aux matériaux en vrac - Exigences et méthodes références d'essai

Arbeitsplatzatmosphäre - Messung des Staubungsverhaltens von Schüttgütern - Anforderungen und Referenzprüfverfahren

This draft European Standard is submitted to CEN members for enquiry. It has been drawn up by the Technical Committee CEN/TC 137.

If this draft becomes a European Standard, CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

This draft European Standard was established by CEN 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.

CEN members are the national standards bodies of Austria, Belgium, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom.

Warning : This document is not a European Standard. It is distributed for review and comments. It is subject to change without notice and shall not be referred to as a European Standard.

EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

Management Centre: rue de Stassart, 36 B-1050 Brussels

Ref. No. prEN 15051:2004: E

Contents

Page

Foreword

This document (prEN 15051:2004) has been prepared by Technical Committee CEN/TC 137 “Assessment of workplace exposure to chemical and biological agents”, the secretariat of which is held by DIN.

This document is currently submitted to the CEN Enquiry.

Introduction

The control of dust emissions during the handling and transportation of materials is an important consideration in the design and operation of many industrial processes. Excessive airborne dust levels in workplaces are undesirable for a number of reasons:

a) they can cause adverse health effects to the work force;
b) their control can involve the use of costly ventilation and filtration systems;
c) they can be costly in terms of lost product;
d) they can contaminate machinery and products.

It is advantageous, therefore, for occupational hygienists and process engineers to have accurate information about the propensity of materials to produce airborne dust (the '*dustiness*' of the material) so that risks can be evaluated, controlled and minimised.

No single method of dustiness testing is likely to represent and reproduce the various types of processing and handling used in industry. Therefore a number of dustiness testing methods are in use in different industries. Different methods use different test apparatus and measuring principles, and express results in different ways. Methods that do not separate the dust cloud produced into the three health-related size fractions - inhalable, thoracic and respirable dust - can serve the needs of manufacturing industry for process and batch control, but give limited information on the health hazard due to the dustiness of the material.

Dustiness is a relative term and the measurement obtained will depend on the test apparatus used, the properties of the dust and various environmental variables. The test and the variables therefore need to be closely specified to ensure reproducibility. Recognising the above it was concluded that there was a need for standardised reference methods to measure the dustiness of bulk materials, based on the biologically relevant aerosol fractions defined in EN 481.

This document establishes reference test methods that classify the dustiness, in terms of health-related fractions, of bulk solid materials. The dustiness classification is intended to provide users (e.g. manufacturers, producers, occupational hygienists and workers) with information on the potential for dust emissions when the material is handled or processed in workplaces. It provides the manufacturers of materials with information that can help to improve their products. It allows the users of the materials to assess the effects of pre-treatments, and also to select less dusty products, if available. Although this document does not discuss the analysis of dust released from bulk materials (except in terms of health-related fractions), the test method produces samples with the potential for chemical analysis of the contents.

This document also provides reference methods to which users of alternative dustiness test methods can compare their own measurements. A standardised test of equivalence is used to test whether the alternative test method is capable of reproducing the dustiness classifications of the reference methods, for a range of standardised test dusts. If the requirements for equivalence are satisfied the alternative test method can be used to classify the dustiness of bulk materials.

This document was developed based on the results of the European project SMT4-CT96-2074 Development of a Method for Dustiness Testing (see [1]).

1 Scope

This document specifies the reference test apparatus and reference test methods for the reproducible production of dust from a bulk material under standard conditions, and the measurement of the inhalable, thoracic and respirable fractions of this dust, with reference to the existing CEN standards, where relevant.

This document specifies the environmental conditions, the sample handling and analysis procedures and the method of calculating and presenting the results. A classification scheme for dustiness is specified, to provide a standardised way to express and communicate the results to users of the bulk materials.

Two reference test methods are given: Method A produces dust by a multiple continuous dropping process of the bulk material, whereas Method B produces dust by dropping the bulk material once under gravity. Both methods are intended to simulate general handling processes, which involve dropping processes of powdery material at some stage. The two test methods differ however with respect to the intensity and the duration of treatment of the bulk material. This is intentional, as in practice the dust-creating processes in the workplace will also have different characteristics. In some few cases the two test methods will give different results. Examples of this are bulk materials that can agglomerate and bulk materials that comprise brittle powder structures that can break after prolonged handling. Because of these effects, users of this document should choose the dustiness test method most appropriate to their material and handling process, and should state this chosen test method in their test report.

In Annex D, a test method is described that enables dustiness information produced by test methods other than these two reference test methods to be related to that produced using these standard reference test methods.

This document is applicable to powdered, granular or pelletised materials. A standard sample volume is used.

This document is not applicable to test the dust released when solid materials are mechanically reduced (e.g. cut, crushed) or to test handling procedures for the materials.

2 Normative references

The following referenced documents are indispensable for the application 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.

EN 481, *Workplace atmospheres — Size fraction definitions for measurement of airborne particles*

EN 1232, *Pumps for the sampling of chemical agents with a volume flow rate of up to 5 l/min — Requirements and test methods*

EN 13205, *Workplace atmospheres: Assessment of performance of instruments for measurement of airborne particle concentrations*

ISO 15767, *Workplace atmospheres – Controlling and characterizing errors in weighing collected aerosols*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1
airborne dust
finely divided matter in solid form, dispersed in air

3.2
health-related fractions
the inhalable, thoracic and respirable fractions of airborne dust, as defined in EN 481

3.3
collected sample
the airborne particles collected on the sampling media (e.g. filter, foam or impaction plate) for subsequent analysis

NOTE Sample deposits in other parts of the sampler such as inner walls are only included in the collected sample where the method description includes specific instructions for the recovery of such deposits.

3.4
dustiness
the propensity of materials to produce airborne dust during handling

NOTE For the purposes of this document, dustiness is derived from the dust emitted during a standard test procedure.

3.5
inhalable dustiness
the dustiness classification of the inhalable fraction

NOTE Classification assigned according to the scheme described in Clause 7.

3.6
thoracic dustiness
the dustiness classification of the thoracic fraction

NOTE Classification assigned according to the scheme described in Clause 7.

3.7
respirable dustiness
the dustiness classification of the respirable fraction

NOTE Classification assigned according to the scheme described in Clause 7.

3.8
inhalable dustiness mass fraction
$w_{I,A}$, $w_{I,B}$
the ratio of the inhalable dust produced by the dustiness test procedure, in milligrams, to the test mass of material used for the test, in kilograms

NOTE For test method A the value of the test mass equals the initial mass, and for test method B the value of the test mass equals the mass collected in the collector tank.

3.9
thoracic dustiness mass fraction
$w_{T,A}$
the ratio of the thoracic dust produced by the dustiness test procedure, in milligrams, to the initial mass of material used for the test, in kilograms

3.10
respirable dustiness mass fraction
$w_{R,A}$, $w_{R,B}$
the ratio of the respirable dust produced by the dustiness test procedure, in milligrams, to the test mass of material used for the test, in kilograms

NOTE For test method A the value of the test mass equals the initial mass, and for test method B the value of the test mass equals the mass collected in the collector tank.

4 Principle

A dustiness tester consists of the following elements:

— dust generation section;

— dust transfer section;

— sampling section;

— size fractionator(s);

— dust collection section.

A standard volume of bulk material, with known moisture content, is weighed and then placed in the dust generation section, where it is agitated under standard conditions for a set period of time. The airborne dust released is drawn from the dust generation section, through the dust transfer section, into the sampling section. Here, the size fractionator(s) classifies the airborne dust according to aerodynamic particle size. The dust collection section deposits the dust fractions onto suitable media for gravimetric analysis. The results are used to calculate the inhalable, thoracic and respirable dustiness mass fractions of the released dust, in relation to the initial mass of material used. These data are used to classify the dustiness of the material.

5 Requirements

5.1 Condition of the material

The material should be tested in the state in which it is intended to be used.

5.2 Sample and environmental control

Materials that have a large specific area are sensitive to ambient conditions such as relative humidity, temperature, electrostatic effects and to their own moisture content, compaction, agglomeration etc. Therefore for accurate results a system controlling the test atmosphere within a narrow range of temperature and humidity should be used. In all cases the environmental conditions shall be documented.

The following test conditions should conform with EN 12341:

— relative humidity (RH): 50 % ± 5 %;

— temperature: 20° C ± 2 °C;

— electrostatic charge – earth testers and dust containers.

5.3 Moisture content

The moisture content of the bulk material shall be determined and documented according to the procedure given in Annex B.

5.4 Bulk density

The bulk density of the test material shall be determined and documented according to the procedure given in Annex C.

5.5 Test procedure

The dustiness shall be tested according to one of the test methods described in Clause 6 and Annex A. The choice of test method should be justified in the test report, see Scope.

Providing the requirements for equivalence are satisfied, the dustiness may be tested using an alternative test method.

5.6 Replication

Replicate tests shall be carried out according to the specific reference test methods A or B, see Clause 6.

5.7 Reporting

The test results shall be reported as specified in Clause 7.

6 Reference test methods

6.1 Method A: Rotating drum method

6.1.1 General

The rotating drum method involves the continuous multiple dropping of a sample of the material in a slow horizontal winnowing current of air. The dust released from dropping material is conducted by the airflow to a sampling section where it is separated aerodynamically into the three health-related fractions by a process of horizontal elutriation and inertial impaction in two stages of porous metal foam.

The standard reference test apparatus is described in A.1.

6.1.2 Preparation of test sample

Test samples should be extracted from the bulk material using a method, which would result in representative sampling (see e.g. BS 3406-1). A minimum of six samples is required. Sample bottles able to be sealed should be used to minimise contamination of the atmosphere.

Test samples with volume 35 cm^3 should be extracted and weighed to the nearest $\pm$ 0,1 g.

6.1.3 Preparation of test apparatus

Prior to the tests being carried out, the rotating drum is cleaned thoroughly using a suitable vacuum cleaner, wiped with a damp cloth and allowed to dry. For material that sticks to the internal surfaces it can also be necessary to wash the surfaces with a solution of a detergent in water followed by thorough washing with water, or to clean with a suitable solvent (e.g. propanol). Assemble the inlet and outlet stages to appropriate ends of the drum. Switch on the pump and set the flow rate to 38 l min^{-1}.

6.1.4 Test procedure

Remove the inlet and outlet stages at both ends of the drum. Spread the test sample evenly along the bottom of the drum. Replace the inlet stage with a fresh protective filter, and assemble the outlet stage to the drum.

The timing circuit is then switched on and the test programme allowed to proceed. At the end of the test, carefully remove the foams and the filter from the outlet end of the drum and place them in an environmentally controlled balance room, taking care not to disturb the collected sample.