SLOVENSKI STANDARD
oSIST prEN ISO 19918:2016

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Varovalna obleka - Varovanje pred kemikalijami - Merjenje kumulativnega pronicanja kemikalij z nizkim parnim tlakom skozi materiale (ISO/DIS 19918:2016)

Protective clothing - Protection against chemicals - Measurement of cumulative permeation of chemicals with low vapour pressure through materials (ISO/DIS 19918:2016)

Schutzkleidung - Schutz gegen Chemikalien - Messung der kumulativen Permeation von Chemikalien mit niedrigem Dampfdruck durch Schutzkleidungs- und Handschuhmaterialien (ISO/DIS 19918:2016)

Vêtements de protection - Protection contre les produits chimiques - Mesure de la perméation cumulée à travers des matériaux des produits chimiques ayant une faible pression de vapeur (ISO/DIS 19918:2016)

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Protective clothing — Protection against chemicals — Measurement of cumulative permeation of chemicals with low vapour pressure through materials

Vêtements de protection — Protection contre les produits chimiques — Mesurage de la perméation cumulative des produits chimiques avec une pression de vapeur faible à travers les matériaux

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Contents

Page

Foreword ..... **iv**
Introduction ..... **v**
1 Scope **1**
2 Normative references **1**
3 Terms and definitions **1**
4 Principle **3**
5 Apparatus and supplies **3**
6 Test parameters **4**
6.1 Analytical method 4
6.2 Determination of extraction efficiency 5
6.3 Test specimens 5
7 Preparation of test chemical and test specimens **6**
8 Procedure **6**
8.1 Contamination 6
8.2 Extraction and analysis 7
9 Expression of results **7**
9.1 Calculation 7
10 Report **8**
11 Precision and bias **9**
Annex A (normative) **Schematic diagram of the permeation cell** **10**
Annex B (informative) **Drawing and measurements of the permeation cell, washer, and bolts** **11**
Annex C (informative) **Sources of permeation test cells, and permeation cell parts** **13**
Annex D (informative) **Selection of gasket and pressure** **14**
Annex E (informative) **Interlaboratory Test Data** **15**
Annex ZA (informative) **Relationship between this European Standard and the Essential Requirements of EU Directive 89/686/ECC** **16**
Bibliography **17**

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 19918 was prepared by Technical Committee ISO/TC 94, *Personal safety — Protective clothing and equipment*, Subcommittee SC 13, *Protective clothing* and by Technical Committee CEN/TC 162, *Protective clothing including hand and arm protection and lifejackets* in collaboration.

Introduction

When assessing the performance of personal protective equipment (PPE) against chemical risks, it is clearly important to determine the ability of PPE materials to resist chemical ingress. The term “ingress” is used here specifically so as not to distinguish between penetration and permeation. Penetration is ingress through physical holes in the fabric such as pores, stitch-holes, and gaps in a protective coating. Penetration is usually quite a rapid process, leading to the ingress of chemical within a matter of minutes, whereas permeation is usually a slower process with molecular diffusion through a polymer or elastomer. However, from the perspective of the wearer of PPE (gloves, footwear, protective clothing) the mechanism of ingress is far less relevant than the fact that a quantity of chemical may at some point migrate through the fabric of the personal protective equipment.

Standards to measure permeation are designed to measure the performance of materials that include a polymer or elastomer as the movement in these materials is at the molecular level. However, although they are intended to measure movement of chemicals at a molecular level, it may be difficult to differentiate between penetration and permeation in materials with small pores, pinholes, and gaps in coating. A number of standards, including ISO 6529, EN 16523-1, and AS/TM 739, measure permeation of chemicals that are volatile and/or soluble in water or other liquid or gaseous collection media. However, these standards are not well-suited for quantifying the ingress of involatile and/or non-water soluble liquid chemicals and mixtures. This method complements the above-mentioned standards as it is suitable for measuring permeation of active ingredients (in pesticide formulations) with low vapour pressure and often low solubility, but not permeation of volatile chemicals.

This test method is intended to be used to evaluate the barrier effectiveness materials used in personal protective equipment against permeation by solid and liquid chemicals with low vapour pressure and/or low solubility in commonly used liquid and gaseous collection media. This test method is not suitable for measurement of volatile chemicals that may evaporate before the chemical analysis is complete.

Protective clothing — Protection against chemicals — Measurement of cumulative permeation of chemicals with low vapour pressure through materials

1 Scope

This international standard describes laboratory test methods to determine the resistance of materials, closures, and seams used in personal protective equipment (PPE) to permeation by solid or liquid chemicals with low vapour pressure (less than 1 mm Hg at 25°C) and/or insolubility in water or other liquids that do not interact with the PPE material. These chemicals that are often part of pesticide formulations and other mixtures cannot be measured using other standards for measuring permeation. This test method is suitable for field strength and concentrated pesticide formulations as well as other mixtures in which the active ingredient is a chemical with low vapour pressure and/or low solubility in commonly used liquid and gaseous collection media.

This test method is not intended to be used in place of standards such as ISO 6529, EN 16523-1, and AS/TM 739, which use liquid and gaseous collection media. This test method is not suitable for measurement of volatile chemicals that may evaporate before the chemical analysis is complete.

The degree of contamination depends on numerous factors, such as type of exposure, application technique, and pesticide formulation. As the level of exposure can vary considerably, this method is designed to rate relative performance of PPE materials for different durations.

This method is designed to measure cumulative permeation. Breakthrough time cannot be measured by this method. This test method does not measure resistance to penetration or degradation.

The test method standard can be used for the evaluation of PPE materials that are new or those that have undergone treatment, such as laundering or simulated abrasion. Details of the treatment shall be reported.

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.

ISO 2859-1, *Sampling procedures for inspection by attributes — Part 1: Sampling schemes indexed by acceptance quality limit (AQL) for lot-by-lot inspection*

3 Terms and definitions

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

3.1
analytical technique
method of quantifying the amount of permeated chemical in the collection medium

Note 1 to entry: Such methods are often specific to individual chemical and collection-medium combinations.

3.2
breakthrough detection time
elapsed time measured from the start of the test to the sampling time that immediately precedes the sampling time at which the test chemical is first detected

3.3
cumulative permeation mass
total amount of chemical that permeates during a specified time from the time the material specimen is first contacted with the test chemical

3.4
degradation
a deleterious change in one or more properties due to contact with a chemical or heat

3.5
Limit of quantification
minimum quantity of a substance which can be measured

Note 1 to entry: It is the value where the uncertainty of measurement is equal to 50% of the determined value.

3.6
penetration
process by which a chemical and/or microorganism moves through porous materials, seams, pinholes, or other imperfections in a material on a non-molecular level

Note 1 to entry: For the purpose of this standard, penetration refers to only chemicals, not micro-organisms.

Note 2 to entry: For the purpose of this standard, materials include protective clothing, footwear, and glove materials,

3.7
permeation
process by which a chemical moves through a material on a molecular level

Note 1 to entry: Permeation involves (1) adsorption of molecules of the chemical onto the contacted (outside) surface of a material, (2) diffusion of the adsorbed molecules into and through the material, and (3) desorption of the molecules from the opposite (inside) surface of the material.

Note 2 to entry: For the purpose of this standard, materials include protective clothing, footwear, and glove materials.

3.8
solid collection medium
solid material on the “clean” side of the test specimen in which any permeated chemical is collected

3.9
test chemical
chemical or mixture of raw materials, including but not limited to, active ingredients, inert ingredients, and a base solvent used in pesticide formulation

Note 1 to entry: For the purpose of this test method, test chemicals are limited to liquids (including mixtures) with low vapour pressure.

3.10
vapour pressure
pressure exerted by the vapour above the liquid in equilibrium at a given temperature

3.11
insoluble chemical
a chemical having a solubility in water of less than 50 mg/L at 23°C

3.12
closure
system or component which makes possible the closing of an item of PPE

4 Principle

A prepared solid collector disc shall be used to measure the cumulative permeation of pesticides or other chemicals with low vapour pressure (less than 1 mm Hg at 25°C) and/or insolubility in water and other commonly used collection media.

The solid collector disc is placed under the test material in the test assembly (see Annex A). The cell is placed on a horizontal surface and filled with test chemical.

After the predetermined duration of the test, the cell is emptied and the solid collector disc is removed for extraction and quantitative analysis.

The data are used to calculate cumulative permeation.

5 Apparatus and supplies

5.1 The permeation cell consists of a base and a cylinder that are assembled with three bolts to form a cell. The centre of the base and the bottom surface of the cylinder are raised to improve contact between the two surfaces. See Annex B for a technical drawing, including measurements for the permeation cell. The gasket, solid collector disc, and test specimen are placed between the base and the cylinder. The material's normal inside surface is in contact with the solid collector disc. The material's outer surface is toward the side that faces the test cylinder. The two pieces are connected with three bolts. The top surface of the cylinder has a spout to make it easier to drain the test chemical. A cylindrical, hollow insert fits into the centre of the cell. (See figure B.4 in Annex B for technical drawing.) The insert is filled to bring the weight to 100 ± 1 g.

The schematic diagram of the permeation cell is shown in Annex A.

See Annex B for the drawing and description of PTFE cell used for the interlaboratory study. Measurements (including tolerance limits) in Figures B.2 – B.4 pertain to the cell in Annex B.

NOTE 1 Annex C includes a list of suppliers for the PTFE permeation cell, gaskets, and solid collection discs.

NOTE 2 Cells made with other materials and designs have not been tested.

Other cells are acceptable provided they are similar in design to the schematic diagram in Annex A and meet the following criteria.

— The inner diameter of the permeation cell shall be 35 mm ± 0.3 mm.

— The cylinder should have sufficient capacity to hold 35 ± 1 g of test chemical.

NOTE The weight of the test chemical helps maintain the contact between the test specimen and solid collector disc.

— The outer surface of the test sample is in contact with the test chemical and the solid collector disc is in contact with the inner surface of the specimen.

— The materials of construction of the apparatus shall be such that they do not alter the nature or composition of the test chemical, the collector disc, or any of the test chemical that has permeated through the fabric.

— The dimensions of the gasket shall be determined by the cell design.

5.2 Gasket with 90 mm outer diameter (OD) and 35 mm ± 0.1 mm inner diameter (ID) with holes for the bolts.

The gasket shall be used to prevent leakage. Care shall be taken to ensure that test chemical cannot leak out of the challenge side of the apparatus, flow around the edge of the test specimen, and then leak into the collection side. This is most likely to happen by capillary action if the outer side of a multicomponent