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

*Habillement 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*



This document is a preview generated by EBS



COPYRIGHT PROTECTED DOCUMENT

© ISO 2017, Published in Switzerland

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized otherwise in any form or by any means, electronic or mechanical, including photocopying, or posting on the internet or an intranet, without prior written permission. Permission can be requested from either ISO at the address below or ISO's member body in the country of the requester.

ISO copyright office
Ch. de Blandonnet 8 • CP 401
CH-1214 Vernier, Geneva, Switzerland
Tel. +41 22 749 01 11
Fax +41 22 749 09 47
copyright@iso.org
www.iso.org

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
10 Report	8
11 Precision and bias	9
Annex A (informative) Schematic diagram of the permeation cell	10
Annex B (normative) 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
Bibliography	16

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.

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 documents 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).

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. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation on the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see the following URL: www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 94, *Personal safety — Protective clothing and equipment*, Subcommittee SC 13, *Protective clothing*.

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 ASTM F739, measure permeation of chemicals that are volatile and/or soluble in water or other liquid or gaseous collection media. In the above-mentioned standards, volatility or solubility in water or other liquid that does not interact with the material allows use of gaseous or liquid collection medium. However, based on the scopes of ISO 6529, EN 16523-1 and ASTM F739, these standards are not well-suited for quantifying the ingress of chemicals and mixtures that are involatile and/or insoluble in water and other liquids that do not interact with the material being tested. This document complements the above-mentioned standards as it is suitable for measuring chemicals that cannot be measured by other standards and vice versa.

This document 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 document 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 133,322 Pa at 25 °C) and/or insolubility in water or other liquids commonly used as collection media. 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 ASTM F739, which measure permeation of chemicals that are either volatile or soluble in water or other liquids that do not interact with the material being tested. This document 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 chemical 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 may be used for the evaluation of PPE materials that are new or those for which the product standard requires treatment, such as laundering or simulated abrasion. Details of the treatment shall be reported.

2 Normative references

No normative references are required for this document.

3 Terms and definitions

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

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

- ISO Online browsing platform: available at <http://www.iso.org/obp>
- IEC Electropedia: available at <http://www.electropedia.org/>

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.