
Practice for use of the ethanol- chlorobenzene dosimetry system

*Pratique de l'utilisation d'un système dosimétrique à l'éthanol
chlorobenzène*

Sample Document

get full document from standards.iteh.ai



Reference number
ISO/ASTM 51538:2017(E)

© ISO/ASTM International 2017

Sample Document

get full document from standards.iteh.ai



COPYRIGHT PROTECTED DOCUMENT

© ISO/ASTM International 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. In the United States, such requests should be sent to ASTM International.

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

ASTM International
100 Barr Harbor Drive, PO Box C700
West Conshohocken, PA 19428-2959, USA
Tel. +610 832 9634
Fax +610 832 9635
khooper@astm.org
www.astm.org

Contents

	Page
1 Scope	1
2 Referenced documents	2
3 Terminology	2
4 Significance and use	3
5 Effect of Influence Quantities	3
6 Interferences	4
7 Apparatus	4
8 Reagents	4
9 Preparation of dosimeters	4
10 Calibration of the mercuric nitrate solution	5
11 Calibration of the dosimetry system	5
12 Application of dosimetry system	6
13 Minimum documentation requirements	6
14 Measurement Uncertainty	6
15 Keywords	6
Annexes	7
Table 1 Radiation chemical yields (G) for the formation of HCl in typical ECB solution formulations	3
Table 2 Temperature coefficients k ($^{\circ}\text{C}$) ⁻¹ for typical ECB solution formulations as derived from Ref (17)	4
Table A3.1 Characteristics of some applicable methods	10

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. International Standards are drafted in accordance with the editorial rules of ISO/IEC Directives, Part 2 (see www.iso.org/directives).

ASTM International is one of the world's largest voluntary standards development organizations with global participation from affected stakeholders. ASTM technical committees follow rigorous due process balloting procedures.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO and ASTM International shall 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 ASTM Committee E61 Radiation Processing and by Technical Committee ISO/TC 85, nuclear energy, nuclear technologies and radiological protection.

This third edition cancels and replaces the second edition (ISO/ASTM 51538:2009), which has been technically revised.

ISO/ASTM 51538:2017(E)



Standard Practice for Use of the Ethanol-Chlorobenzene Dosimetry System¹

This standard is issued under the fixed designation ISO/ASTM 51538; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision.

1. Scope

1.1 This practice covers the preparation, handling, testing, and procedure for using the ethanol-chlorobenzene (ECB) dosimetry system to measure absorbed dose to water when exposed to ionizing radiation. The system consists of a dosimeter and appropriate analytical instrumentation. For simplicity, the system will be referred to as the ECB system. The ECB dosimeter is classified as a type I dosimeter on the basis of the effect of influence quantities. The ECB dosimetry system may be used as a reference standard dosimetry system or as a routine dosimetry system.

1.2 This document is one of a set of standards that provides recommendations for properly implementing dosimetry in radiation processing, and describes a means of achieving compliance with the requirements of ISO/ASTM Practice 52628 for the ECB system. It is intended to be read in conjunction with ISO/ASTM Practice 52628.

1.3 This practice describes the mercurimetric titration analysis as a standard readout procedure for the ECB dosimeter when used as a reference standard dosimetry system. Other readout methods (spectrophotometric, oscillographic) that are applicable when the ECB system is used as a routine dosimetry system are described in Annex A1 and Annex A2.

1.4 This practice applies only to gamma radiation, X-radiation/bremsstrahlung, and high energy electrons.

1.5 This practice applies provided the following conditions are satisfied:

1.5.1 The absorbed dose range is between 10 Gy and 2 MGy for gamma radiation and between 10 Gy and 200 kGy for high current electron accelerators (1, 2).² (**Warning**—the boiling

point of ethanol chlorobenzene solutions is approximately 80 °C. Ampoules may explode if the temperature during irradiation exceeds the boiling point. This boiling point may be exceeded if an absorbed dose greater than 200 kGy is given in a short period of time.)

1.5.2 The absorbed-dose rate is less than 10⁶ Gy s⁻¹ (2).

1.5.3 For radionuclide gamma-ray sources, the initial photon energy is greater than 0.6 MeV. For bremsstrahlung photons, the energy of the electrons used to produce the bremsstrahlung photons is equal to or greater than 2 MeV. For electron beams, the initial electron energy is greater than 8 MeV (3).

NOTE 1—The same response relative to ⁶⁰Co gamma radiation was obtained in high-power bremsstrahlung irradiation produced by a 5 MeV electron accelerator (4).

NOTE 2—The lower energy limits are appropriate for a cylindrical dosimeter ampoule of 12-mm diameter. Corrections for dose gradients across the ampoule may be required for electron beams. The ECB system may be used at X-ray energies as low as 120 kVp (5). However, in this range of photon energies the effect caused by the ampoule wall is considerable.

NOTE 3—The effects of size and shape of the dosimeter on the response of the dosimeter can adequately be taken into account by performing the appropriate calculations using cavity theory (6).

1.5.4 The irradiation temperature of the dosimeter is within the range from -30 °C to 80 °C.

NOTE 4—The temperature dependence of dosimeter response is known only in this range (see 5.2). For use outside this range, the dosimetry system should be calibrated for the required range of irradiation temperatures.

1.6 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use. Specific warnings are given in 1.5.1, 9.2 and 10.2.*

1.7 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

¹ This practice is under the jurisdiction of ASTM Committee E61 on Radiation Processing and is the direct responsibility of Subcommittee E61.02 on Dosimetry Systems, and is also under the jurisdiction of ISO/TC 85/WG 3.

Current edition approved April 25, 2017. Published June 2017. Originally published as ASTM E1538-93. Last previous ASTM edition E1538-99. ASTM E1538-93 was adopted by ISO in 1998 with the intermediate designation ISO 15563:1998(E). The present International Standard ISO/ASTM 51538:2017 (E) is a major revision of ISO/ASTM 51538:2009(E). DOI:10.1520/ISOASTM51538-17.

² The boldface numbers in parentheses refer to the bibliography at the end of this practice.