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HORIZONTAL PUBLICATION

Determination of certain substances in electrotechnical products - Part 13: Bisphenol A in plastics by liquid chromatography-diode array detector (LC-DAD), liquid chromatography-mass spectrometry (LC-MS) and liquid chromatography-tandem mass spectrometry (LC-MS/MS)

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CONTENTS

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IEC 62321-13 has been prepared by technical committee 111: Environmental standardization for electrical and electronic products and systems. It is an International Standard.

This document has been given the status of a horizontal document in accordance with the ISO/IEC Directives, Part 1.

The text of this International Standard is based on the following documents:

Draft	Report on voting
111/884/FDIS	111/898/RVD

Full information on the voting for its approval can be found in the report on voting indicated in the above table.

The language used for the development of this International Standard is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/publications.

A list of all parts in the IEC 62321 series, published under the general title *Determination of certain substances in electrotechnical products*, can be found on the IEC website.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under webstore.iec.ch in the data related to the specific document. At this date, the document will be

– reconfirmed,
– withdrawn, or
– revised.

INTRODUCTION

The widespread use of electrotechnical products has drawn increased attention to their impact on the environment. In many countries this has resulted in the adaptation of regulations affecting waste, substances and energy use of electrotechnical products.

The use of certain substances (e.g. lead (Pb), cadmium (Cd), mercury (Hg) and polybrominated diphenyl ethers (PBDEs)) and phthalates in electronical products is a source of concern in current and proposed regional legislation.

The purpose of the IEC 62321 series is therefore to provide test methods that will allow the electrotechnical industry to determine the levels of certain substances of concern in electrotechnical products on a consistent global basis.

This first edition of IEC 62321-13 introduces a new subject covering Bisphenol A in the IEC 62321 series.

1 Scope

This document specifies three techniques for the determination of free Bisphenol A (BPA) in plastics of electrotechnical products.

This document describes the use of liquid chromatography–diode array detector (LC-DAD), liquid chromatography mass spectrometry (LC-MS), liquid chromatography tandem mass spectrometry (LC-MS/MS) with these test methods detailed in Annex A and Annex B.

These test methods have been evaluated for use with PC, PC/ABS, PP matrices containing free BPA between 20 mg/kg to 500 mg/kg as shown in the Pre-IIS 13 results in Annex C and IIS 13 results in Annex D [1], [2]. The use of these methods for BPA concentration ranges of plastics, other than those specified in Annex C and Annex D, has not been evaluated.

This document is a basic environment horizontal publication focusing on test methods and is primarily intended for use by committees in the preparation of publications within the area of environment in accordance with the principles laid down in IEC Guide 123. Wherever applicable, it is the responsibility of committees to make use of environment basic publications in the preparation of their environment group and product publications. Committees can apply this document directly to products when they do not develop a product publication in the area of environment.

WARNING – Persons using this document should be familiar with normal laboratory practice. This document does not purport to address all of the safety problems, if any, associated with its use. It is the responsibility of the user to establish appropriate safety and health practices and to ensure compliance with any national regulatory conditions.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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.

IEC 62321-1:2013, *Determination of certain substances in electrotechnical products - Part 1: Introduction and overview*

IEC 62321-2, *Determination of certain substances in electrotechnical products - Part 2: Disassembly, disjointment and mechanical sample preparation*

ISO 3696:1987, *Water for analytical laboratory use - Specification and test methods*

3 Terms, definitions and abbreviated terms

3.1 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 62321-1 and the following apply.

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

– IEC Electropedia: available at https://www.electropedia.org/
– ISO Online browsing platform: available at https://www.iso.org/obp

3.1.1
free bisphenol A
chemically unbound bisphenol A (BPA), as present in material

3.2 Abbreviated terms

For the purpose of this document, the following abbreviated terms apply.

ABS	acrylonitrile-butadiene-styrene
BPA	bisphenol A
BPC	bisphenol C
CCC	continuing calibration check standard
CRM	certified reference material
IS	internal standard
LC	liquid chromatography
LC-DAD	liquid chromatography-diode array detector
LC-MS	liquid chromatography-mass spectrometry
LC-MS/MS	liquid chromatography-tandem mass spectrometry
MDL	method detection limit
PC	polycarbonate
PC/ABS	polycarbonate/Acrylonitrile-butadiene-styrene
PP	polypropylene
PTFE	polytetrafluoroethylene
QC	quality control
RSD	relative standard deviation
RM	raw material

4 Principle

Free BPA is determined using ultrasonic extraction followed by high-performance liquid chromatography separation and tandem mass spectrometry and liquid chromatography-diode array detection. When preparing a test specimen (see Clause 7) of polycarbonate (PC) or similar type of epoxy resins, thermal stress of the specimen should be avoided, since heat can affect the test results.

Free BPA is determined using ultrasonic extraction followed by high-performance liquid chromatography separation with either mass-spectrometry (LC-MS), or tandem mass spectrometry (LC-MS/MS), or diode array detector (LC-DAD).

5 Reagents and materials

The reagent chemicals used for the tests described in this document shall have a minimum purity as described from a) to i) in Clause 5. This is intended to ensure the reagents are free from contamination and prevent proliferation of blank values. There is a risk of elevated blank values due to the ubiquitous nature of BPA (CAS #80-05-7). Laboratories should assure to verify the blank value of the test method especially in case the calibration curve shows an offset.

These are the reagents used in the tests described in this document:

a) methanol (purity LC grade or higher);

b) tetrahydrofuran (purity LC grade or higher);