

ISO/FDIS 7303:2025(en)

ISO/TC 190/SC-07/WG-4.7

Secretariat: DIN

Date: 2025-05-13/07-14

Simplified method for prediction of the oral bioaccessibility of metals and metalloids in soils

iTeh Standards

(<http://standards.iteh.ai>)
FDIS stage
Document Preview

ISO/FDIS 7303

<https://standards.iteh.ai/catalog/standards/iso/4fc127f7-9d40-4809-968e-bdc0ace8ca2d/iso-fdis-7303>

© ISO 2025

All rights reserved. Unless otherwise specified, or required in the context of its implementation, 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
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: + 41 22 749 01 11

~~Fax: +41 22 749 09 47~~

~~Email~~E-mail: copyright@iso.org
Website: www.iso.org

Published in Switzerland

iTeh Standards
(<https://standards.iteh.ai>)
Document Preview

ISO/FDIS 7303

<https://standards.iteh.ai/catalog/standards/iso/4fc127f7-9d40-4809-968e-bdc0ace8ca2d/iso-fdis-7303>

Contents

Foreword.....	iv
Introduction.....	v
1 Scope.....	1
2 Normative references.....	1
3 Terms and definitions	1
4 Test principle	2
5 Apparatus	3
6 Reagents	3
7 Procedure	3
7.1 Sample pre-treatment.....	3
7.2 Preparation of test samples	4
7.3 Extraction procedure	4
8 Data handling, quality control and presentation of results	4
8.1 General.....	4
8.2 Expression of results	5
8.3 Method performance characteristics	7
Annex A (informative) Method performance characteristics on reference materials	8
Annex B (informative) Linear regression models used to predict the bioaccessibility of As, Cd and Pb in soils	12
Annex C (informative) Graphic representation of prediction intervals	19
Annex D (informative) Method performance characteristics assessed by interlaboratory trial	23
Bibliography	38

<https://standards.iteh.ai/catalog/standards/iso/4fc127f7-9d40-4809-968e-bdc0ace8ca2d/iso-fdis-7303>

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 ~~document~~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).

ISO draws attention to the possibility that the implementation of this document may involve the use of (a) patent(s). ISO takes no position concerning the evidence, validity or applicability of any claimed patent rights in respect thereof. As of the date of publication of this document, ISO had not received notice of (a) patent(s) which may be required to implement this document. However, implementers are cautioned that this may not represent the latest information, which may be obtained from the patent database available at www.iso.org/patents. ISO shall not be held responsible for identifying any or all such patent rights.

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

For an explanation of 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 www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 190, *Soil quality*, Subcommittee SC 7, *Impact assessment*.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

Soils enriched with metals and metalloids such as arsenic (As), cadmium (Cd), and lead (Pb) pose a potential threat to human health if they are directly ingested or transferred through food. Incidental ingestion of soil particles is considered an important exposure pathway of metals and metalloids, more specifically for children through outdoor hand-to-mouth activities. In the current context of managing polluted sites and soils, assessing human health risks from the ingestion of contaminated soil particles remains a challenging area, with significant uncertainties in the methods used to protect public health. In some countries, current practices of risk assessment are based on total concentrations of metals and metalloids measured in soils. However, it is known that only a fraction of these metals and metalloids, i.e. the bioavailable fraction, is assimilated by the body and is likely to induce a toxic effect. Estimating exposure based on the total concentration of metals and metalloids therefore leads to overestimating the risk and possibly misclassifying sites as being at risk. This overestimation leads to excessive measures and costs in terms of management of these sites.

Taking into account the bioavailability of metals and metalloids in soils makes it possible to better assess exposures and risks and thus optimize the management of associated sites. Bioavailability is in practice estimated by the measurement of bioaccessibility, i.e. the soluble fraction that can be released into the gastrointestinal tract and that can reach the bloodstream. Methods have been developed and validated to mimic the availability of metals and metalloids in the human gastrointestinal tract. These in vitro laboratory tests simulate in vivo results. Among these methods, ISO 17924^[4] is a reference method for assessing the oral bioaccessibility of As, Cd and Pb. Because ISO 17924 involves high technical skills and requires numerous chemical and biological reagents to mimic biochemical conditions in the gastrointestinal tract, it can often only be used for a small number of samples. If bioaccessibility needs to be estimated on many samples, a simplified method to predict bioaccessibility is of great interest, in particular for reasons of time and cost.

It has been clearly shown that the bioaccessibility of metals and metalloids in soils critically depends on soil type, their chemical speciation, and the solid-phase distribution in soils. Consequently, a simplified single-extraction method applicable to a range of soils regardless of their pedological, physical and chemical characteristics is needed. A simplified method to study jointly both the gastric and the intestinal phases is particularly advantageous.

This document provides a rapid, simple, and reproducible approach for predicting the bioaccessibility of metals and metalloids in gastric and gastrointestinal phases. The simplified method is specifically designed for As, Cd and Pb in soil samples, as assessed using ISO 17924, and relies on mathematical equations. These equations were derived from studies on French soil samples with a wide range of physicochemical parameters (in terms of texture, pH, content of organic matter and carbonates) and metals and metalloids concentrations (described in [Reference \[2\]^{\[2\]}](#)).

Digestion with hydrochloric acid (HCl) solution fulfils the criteria to be satisfied by an extractant for routine analyses. It is easy for analytical laboratories to use and reproduces conditions that are close to human physiological conditions (i.e. solid/liquid ratio, reagent, temperature, pH and residence time in the stomach). It can be applied to a wide spectrum of soils (in terms of physicochemical parameters) and elements (more specifically As, Cd and Pb) in a wide concentration range. This document differs from ISO 17924 in terms of application and methodology. More specifically, the simplified test can be used as a suitable proxy to predict the bioaccessibility of metals and metalloids in a first-tier screening on several soil samples. It is intended to help users to select a few samples (approximately 10 % of samples but can be as high as 20- % to 30 % depending on the size of the starting sample, heterogeneity of total concentrations and context, e.g. high pH values, high carbonate content) in a second-tier study and as a validation approach complementary to the method defined in ISO 17924 for better assessment of human exposure.

Because the ISO 17924 test has only been validated against in vivo data for As, Cd and Pb, the HCl test as described in this document is only validated for approximation of the oral bioaccessibility of these elements in soils. The simplified method could potentially be used for other elements; however, because no validation

exists for the other metals or metalloids, the data obtained could only be considered as a useful line of evidence in interpreting results.

iTeh Standards
(<https://standards.iteh.ai>)
Document Preview

ISO/FDIS 7303

<https://standards.iteh.ai/catalog/standards/iso/4fc127f7-9d40-4809-968e-bdc0ace8ca2d/iso-fdis-7303>