



International
Standard

ISO 13536

**Soil quality — Determination of the
potential cation exchange capacity
and exchangeable cations using
barium chloride solution buffered
at pH = 8,1**

*Qualité du sol — Détermination de la capacité d'échange
cationique potentielle et des teneurs en cations échangeables en
utilisant une solution tampon de chlorure de baryum à pH = 8,1*

**Second edition
2024-11**

**Corrected version
2026-07**

Sample Document

get full document from standards.iteh.ai



COPYRIGHT PROTECTED DOCUMENT

© ISO 2024

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
Email: copyright@iso.org
Website: www.iso.org

Published in Switzerland

Contents

Page

Foreword	iv
1 Scope	1
2 Normative references	1
3 Terms and definitions	1
4 Principle	1
5 Procedures	2
5.1 Leaching	2
5.1.1 Reagents	2
5.1.2 Procedure	2
5.2 Determination of the CEC	3
5.2.1 Principle	3
5.2.2 Reagents	3
5.2.3 Calibration series	3
5.2.4 Procedure	4
5.2.5 Calculation	4
5.3 Determination of exchangeable sodium and potassium	5
5.3.1 Principle	5
5.3.2 Reagents	5
5.3.3 Calibration series	5
5.3.4 Procedure	5
5.3.5 Calculations	5
5.4 Determination of exchangeable calcium and magnesium	6
5.4.1 Principle	6
5.4.2 Reagents	6
5.4.3 Calibration series	7
5.4.4 Procedure	7
5.4.5 Calculations	7
6 Test report	7
Bibliography	9

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).

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 3, *Chemical and physical characterization*.

This second edition cancels and replaces the first edition (ISO 13536:1995), which has been technically revised.

The main changes are as follows:

- revision of the [Formula \(2\)](#) for the calculation of the cation exchange capacity (CEC) of the soil;
- addition of a note on possible misleading of the correction procedure in the analysis of calcareous soils;
- update of bibliography.

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.

This corrected version of ISO 13536:2024 incorporates the following correction:

- [Formula \(6\)](#) has been corrected.

Soil quality — Determination of the potential cation exchange capacity and exchangeable cations using barium chloride solution buffered at pH = 8,1

WARNING — Barium is a very toxic element if ingested. The barium ion has health risks for laboratory personnel working with this chemical; it is also harmful for the environment.

1 Scope

This document specifies a method for the determination of the potential cation exchange capacity (CEC) of soil buffered at pH = 8,1 and for the determination of the content of exchangeable sodium, potassium, calcium and magnesium in soil.

This document is applicable to all types of air-dried soil samples.

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.

ISO 11464, *Soil quality — Pretreatment of samples for physico-chemical analysis*

ISO 11465, *Sludge, treated biowaste, soil and waste — Determination of dry residue or water content and calculation of the dry matter fraction on a mass basis*

3 Terms and definitions

No terms and definitions are listed in this document.

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

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

4 Principle

The determination of cation exchange capacity (CEC) as specified in this document is a modification of the method proposed by Mehlich^{[1],[2]} and modified by Bascomb^[3]. The CEC of soil samples is determined in barium chloride solution buffered at pH = 8,1 using triethanolamine.

The soil is first saturated with respect to barium by treating the soil three times with buffered barium chloride solution. Subsequently, a known excess of 0,02 mol/l magnesium sulfate solution is added. All the barium present, in solution as well as adsorbed, is precipitated in the form of highly insoluble barium sulfate and the sites with exchangeable ions are then readily occupied by magnesium. The excess magnesium is determined by either flame atomic absorption spectrometry (FAAS) or inductively coupled plasma atomic emission spectrometry (ICP-AES).