
**Soil quality — Leaching procedures
for subsequent chemical and
ecotoxicological testing of soil and
soil-like materials —**

**Part 3:
Up-flow percolation test**

*Qualité du sol — Modes opératoires de lixiviation en vue d'essais
chimiques et écotoxicologiques ultérieurs des sols et matériaux du
sol —*

Partie 3: Essai de percolation à écoulement ascendant



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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 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*.

This first edition of ISO 21268-3:2019 cancels and replaces (ISO/TS 21268-3:2007), which has been technically revised. The main changes compared to the previous edition are as follows:

- the maximum grain size has been changed to <2 mm as usual for soil;
- demineralized water has been added as possible leachant;
- the column diameter has been changed from "5 cm or 10 cm" to "5 cm to 10 cm";
- flow rate of 30 cm/d has been added as option based on robustness testing;
- [7.1](#) and [7.2](#) has been exchanged to read [7.1](#) "Particle size" and [7.2](#) "Sample preparation";
- [11.1](#) "General", [11.2](#) "Validation trials performed in Japan" and [12.3](#) "Validation results obtained in Germany (DIN 19528)" have been added;
- [B.2](#) "Particle size distribution" has been deleted;
- a new informative [Annex C](#) "Calculation of centrifugation duration depending on centrifugation speed and rotor dimensions" has been added;
- references in [Clause 2](#) and Bibliography has been updated.

A list of all parts in the ISO 21268 series can be found on the ISO website.

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

In various countries, tests have been developed to characterize and assess the substances which can be released from materials. The release of soluble substances upon contact with water is regarded as a main mechanism of release, which results in a potential risk to the environment during the use or disposal of materials. The intent of these tests is to identify the leaching properties of materials. The complexity of the leaching process makes simplifications necessary^[1].

Not all of the relevant aspects of leaching behaviour can be addressed in one standard (see description of influencing factors in [Annex A](#)).

Tests to characterise the behaviour of materials can generally be divided into three categories addressed in ISO 18772^[2] and EN 12920^[3]. The relationships between these tests are summarized below.

- a) “Basic characterization” tests are used to obtain information on the short- and long-term leaching behaviour and characteristic properties of materials. Liquid/solid (L/S) ratios, leachant composition, factors controlling leachability, such as pH, redox potential, complexing capacity, role of dissolved organic carbon (DOC), ageing of material and physical parameters, are addressed in these tests.
- b) “Compliance” tests are used to determine whether the material complies with a specific behaviour or with specific reference values. The tests focus on key variables and leaching behaviour previously identified by basic characterisation tests.
- c) “On-site verification” tests are used as a rapid check to confirm that the material is the same as that which has been subjected to the compliance test(s). On-site verification tests are not necessarily leaching tests.

The test procedure described in this method belongs to category a): basic characterization tests.

This document was originally elaborated on the basis of CEN/TS 14405:2004^[4]. Especially, modifications considering requirements on subsequent ecotoxicological testing and analysis of organic substances have been included. Validation results have been adopted from DIN 19528^[5] and from Japanese validation studies^[15,16].

Soil quality — Leaching procedures for subsequent chemical and ecotoxicological testing of soil and soil-like materials —

Part 3: Up-flow percolation test

1 Scope

This document specifies a test, which is aimed at determining the leaching behaviour of inorganic and organic substances from a soil and soil-like materials. The method is a once-through up-flow percolation test under standardized conditions of flow rate. The material is leached under dynamic hydraulic conditions. The document has been developed to measure the release of inorganic and organic substances from soil and soil-like material as well as to produce eluates for subsequent ecotoxicological testing. For ecotoxicological testing, see ISO 15799^[6] and ISO 17616^[7]. The test results enable the distinction between different release patterns, for instance wash-out and release under the influence of interaction with the matrix, when approaching local equilibrium between material and leachant.

This test method produces eluates, which can subsequently be characterized by physical, chemical and ecotoxicological methods in accordance with existing standard methods. The results of eluate analysis are presented as a function of the liquid/solid (L/S) ratio. The test is not suitable for substances that are volatile under ambient conditions.

NOTE 1 Volatile organic substances include the low-molecular-weight substances in mixtures such as mineral oil.

NOTE 2 It is not always possible to optimize test conditions simultaneously for inorganic and organic substances and optimum test conditions can also vary between different groups of organic substances. Test requirements for organic substances are generally more stringent than those for inorganic substances. The test conditions suitable for measuring the release of organic substances will generally also be applicable to inorganic substances.

NOTE 3 Within the category of organic substances, a significant difference in behaviour exists between the more polar, relatively water-soluble compounds and apolar, hydrophobic organic substances (HOCs). In the latter case, mechanisms of release (e.g. particle-bound or dissolved organic carbon-bound) can be more crucial as well as sorption losses of soluble HOCs on different materials with which they come in contact (e.g. bottles, filters). The test and the results should be used for leaching of organic substances only with thorough consideration of the specific properties of the substances in question and the associated potential problems.

NOTE 4 For ecotoxicological testing, eluates representing the release of both inorganic and organic substances are needed. In this document, ecotoxicological testing is also meant to include genotoxicological testing.

NOTE 5 The test is generally not suitable for soils with hydraulic conductivities below 10^{-8} m/s (see also [Annex B](#)). It can be difficult to maintain the designated flow rate already in the range of saturated hydraulic conductivity between 10^{-7} m/s and 10^{-8} m/s.

The application of this test method alone is not sufficient for the determination of the leaching behaviour of a material under specified conditions different to those from the test procedure, since this generally requires the application of several test methods, behavioural modelling and model validation. This document does not address issues related to health and safety. It only determines the leaching properties as outlined in [Clause 4](#).

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 3696, *Water for analytical laboratory use — Specification and test methods*

ISO 5667-3:2018, *Water quality — Sampling — Part 3: Preservation and handling of water samples*

ISO 5725-1:1994, *Accuracy (trueness and precision) of measurement methods and results — Part 1: General principles and definitions*

ISO 5725-2:1994, *Accuracy (trueness and precision) of measurement methods and results — Part 2: Basic method for the determination of repeatability and reproducibility of a standard measurement method*

ISO 7027-1, *Water quality — Determination of turbidity — Part 1: Quantitative methods*

ISO 10523, *Water quality — Determination of pH*

ISO 11465, *Soil quality — Determination of dry matter and water content on a mass basis — Gravimetric method*

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 <https://www.iso.org/obp>
- IEC Electropedia: available at <http://www.electropedia.org/>

3.1 leaching test

test during which a material is put into contact with a *leachant* (3.2) under strictly defined conditions and some substances of the material are extracted

3.2 leachant

liquid used in a *leaching test* (3.1)

Note 1 to entry: For the purposes of this document, the leachant is specified in 5.1.

3.3 eluate

solution recovered from a *leaching test* (3.1)

Note 1 to entry: Eluate is also referred to as leachate.

3.4 liquid to solid ratio L/S

ratio between the total volume of liquid (L in litres), which in this extraction is in contact with the soil sample, and the dry mass of the sample (S in kg of dry matter).

Note 1 to entry: L/S is expressed in l/kg.