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Standards

Irish Standard
I.S. EN ISO 12782-1:2012

Soil quality - Parameters for geochemical modelling of leaching and speciation of constituents in soils and materials - Part 1: Extraction of amorphous iron oxides and hydroxides with ascorbic acid (ISO 12782-1:2012)

I.S. EN ISO 12782-1:2012

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This document replaces:

This document is based on:
EN ISO 12782-1:2012

Published:
13 June, 2012

This document was published
under the authority of the NSAI
and comes into effect on:
13 June, 2012

ICS number:
13.080.05

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ICS 13.080.05

English Version

**Soil quality - Parameters for geochemical modelling of leaching
and speciation of constituents in soils and materials - Part 1:
Extraction of amorphous iron oxides and hydroxides with
ascorbic acid (ISO 12782-1:2012)**

Qualité du sol - Paramètres pour la modélisation
géochimique de la lixiviation et de la spéciation des
constituants des sols et des matériaux - Partie 1: Extraction
des oxydes et hydroxydes de fer amorphe à l'acide
ascorbique (ISO 12782-1:2012)

Bodenbeschaffenheit - Parameter zur geochemischen
Modellierung der Elution und Speziation von Bestandteilen
in Böden und Materialien - Teil 1: Extraktion amorpher
Eisenoxide und -hydroxide mittels Ascorbinsäure (ISO
12782-1:2012)

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Foreword

This document (EN ISO 12782-1:2012) has been prepared by Technical Committee ISO/TC 190 "Soil quality" in collaboration with Technical Committee CEN/TC 345 "Characterization of soils" the secretariat of which is held by NEN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by December 2012, and conflicting national standards shall be withdrawn at the latest by December 2012.

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The text of ISO 12782-1:2012 has been approved by CEN as a EN ISO 12782-1:2012 without any modification.

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I.S. EN ISO 12782-1:2012
**INTERNATIONAL
STANDARD**

**ISO
12782-1**

First edition
2012-06-01

**Soil quality — Parameters for geochemical
modelling of leaching and speciation of
constituents in soils and materials —**

Part 1:

**Extraction of amorphous iron oxides and
hydroxides with ascorbic acid**

*Qualité du sol — Paramètres pour la modélisation géochimique de la
lixiviation et de la spéciation des constituants des sols et des matériaux —*

*Partie 1: Extraction des oxydes et hydroxydes de fer amorphe à
l'acide ascorbique*



Reference number
ISO 12782-1:2012(E)

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Published in Switzerland

Foreword

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The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

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ISO 12782-1 was prepared by Technical Committee ISO/TC 190, *Soil quality*, Subcommittee SC 7, *Soil and site assessment*.

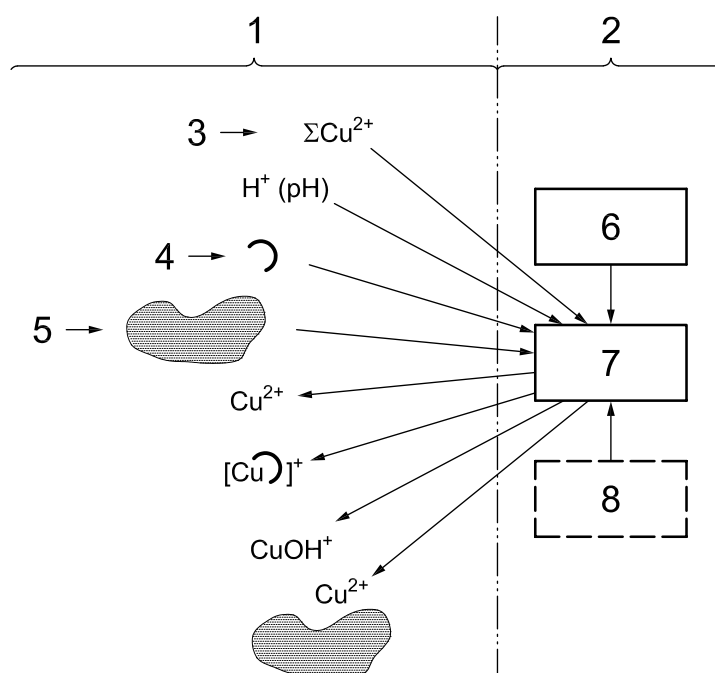
ISO 12782 consists of the following parts, under the general title *Soil quality — Parameters for geochemical modelling of leaching and speciation of constituents in soils and materials*:

- *Part 1: Extraction of amorphous iron oxides and hydroxides with ascorbic acid*
- *Part 2: Extraction of crystalline iron oxides and hydroxides with dithionite*
- *Part 3: Extraction of aluminium oxides and hydroxides with ammonium oxalate/oxalic acid*
- *Part 4: Extraction of humic substances from solid samples*
- *Part 5: Extraction of humic substances from aqueous samples*

Introduction

In addition to leaching procedures for subsequent chemical and ecotoxicological testing of soil and other materials including waste, predictive models are becoming indispensable tools in the environmental risk assessment of these materials. Models are particularly required when the results of laboratory leaching tests are to be translated to specific scenarios in the field, with regard to assessing the risks of both contaminant migration and bioavailability.

In the past few years, geochemical models have been shown to be valuable tools to be combined with the data obtained from characterization leaching standards, such as pH-dependence and percolation tests. These models have the advantage of being based on fundamental thermodynamic parameters that have general validity. In order to enable extrapolation of laboratory leaching data to the mobility and/or bioavailability of a constituent in a specific field scenario, these models require additional input parameters for specific soil properties (see Figure 1).



Key

- 1 experiment
- 2 geochemical speciation modelling
- 3 available metal concentration
- 4 dissolved humic substances
- 5 reactive (solid) surfaces
- 6 database with stability constants
- 7 computer program
- 8 assumptions

Figure 1 — Relationships between experimental data, as obtained from laboratory leaching/extraction tests, and geochemical modelling of the speciation of a heavy metal in the environment (modified after M. Gfeller & R. Schulin, ETH, Zürich)

Characterization leaching standards provide information on the concentrations of the contaminant of interest as a function of, in particular, pH and liquid/solid (L/S) ratio. In addition, a more complete analysis of the leachates also provides information on the major ion composition and dissolved organic carbon (DOC), parameters that are particularly important for the chemical speciation of constituents through processes such as precipitation, complexation and competition for adsorption on reactive mineral and organic surfaces in the soil. As illustrated

in Figure 1 for the example of copper, geochemical modelling enables calculation of the metal distribution among these different chemical species in the system of interest. This provides necessary information for risk-assessment purposes, as these different chemical forms play distinct roles in the mobility and bioavailability of the metal in the soil. In addition to information obtained from the leaching standards (in their current state of development/definition), the following two additional types of information are required.

- a) The “available” (sometimes also referred to as “active” or “exchangeable”) concentration of the constituent in the solid phase, as opposed to the total concentration determined by acid destruction of the solid matrix. This “available” concentration can be obtained by leaching at low pH, a condition that can be obtained by extending the pH range in the pH-dependent leaching test (ISO/TS 21268-4) down to $\text{pH} \approx 0,5$ to $\text{pH} \approx 1$.
- b) The concentration of reactive organic and mineral surfaces in the soil, which constitute the major binding (adsorption) sites for most constituents in the soil matrix.

The major reactive surfaces that control the binding of constituents by sorption processes to the soil matrix are particulate organic matter and iron and aluminium (hydr)oxides. It is generally accepted that the reactivity of these mineral and organic surfaces can strongly vary as a function of their specific surface area/crystallinity [iron and aluminium (hydr)oxides] and composition (organic matter). When the results are intended to be used for the above-described purposes of geochemical modelling in conjunction with leaching tests, it is important that the methods be selective for reactive surfaces for which generic thermodynamic adsorption parameters are also available for the most important major and trace elements.

This part of ISO 12782 aims to determine the content of “reactive” iron in the form of *amorphous* iron oxides and hydroxides in soil and materials using an ascorbic acid extract. The procedure is based on Reference [5], described in Reference [6], while generic thermodynamic adsorption parameters for amorphous iron (hydr)oxide are available in Reference [7].

Thermodynamic parameters for adsorption models other than those used in Reference [7] are also available in the literature and may also be used to model the binding of constituents to amorphous iron (hydr)oxides.

Iron can be present in several forms in soils, of which the most important for the binding of trace constituents are well-crystallized and insoluble oxides and hydroxides (e.g. goethite, haematite, magnetite) and the poorly ordered, more soluble oxides and hydroxides (e.g. ferrihydrite, hydrous ferric oxide). Amorphous and crystalline forms have a different reactivity towards binding of trace constituents as a result of differences in specific surface areas and characteristics of the binding “sites” on the surface.

I.S. EN ISO 12782-1:2012

Soil quality — Parameters for geochemical modelling of leaching and speciation of constituents in soils and materials —

Part 1:

Extraction of amorphous iron oxides and hydroxides with ascorbic acid

1 Scope

This part of ISO 12782 specifies the determination of the content of “reactive” iron in the form of amorphous iron oxides and hydroxides in soil and other materials by extraction with ascorbic acid. Other materials also include waste. The content of “reactive” iron can be used as input in geochemical models to represent the content of amorphous iron (hydr)oxides.

NOTE Although the ammonium oxalate/oxalic acid extraction (ISO 12782-3) is commonly used to estimate “reactive” iron in the form of iron oxides and hydroxides, this part of ISO 12782, in conjunction with ISO 12782-2, has been shown to be more specific for the extraction of amorphous and crystalline iron (hydr)oxides, respectively.

2 Normative references

The following referenced documents are indispensable for the application 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, *Water quality — Sampling — Part 3: Preservation and handling of water samples*

ISO 10381-1, *Soil quality — Sampling — Part 1: Guidance on the design of sampling programmes*

ISO 10381-2, *Soil quality — Sampling — Part 2: Guidance on sampling techniques*

ISO 10381-3, *Soil quality — Sampling — Part 3: Guidance on safety*

ISO 10381-4, *Soil quality — Sampling — Part 4: Guidance on the procedure for investigation of natural, near-natural and cultivated sites*

ISO 10381-5, *Soil quality — Sampling — Part 5: Guidance on the procedure for the investigation of urban and industrial sites with regard to soil contamination*

ISO 10381-6, *Soil quality — Sampling — Part 6: Guidance on the collection, handling and storage of soil under aerobic conditions for the assessment of microbiological processes, biomass and diversity in the laboratory*

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

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

EN 14899, *Characterization of waste — Sampling of waste materials — Framework for the preparation and application of a sampling plan*

EN 15002, *Characterization of waste — Preparation of test portions from the laboratory sample*

CEN/TR 15310-3, *Characterization of waste — Sampling of waste materials — Part 3: Guidance on procedures for sub-sampling in the field*

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