SLOVENSKI STANDARD
SIST EN ISO 11274:2014

01-maj-2014

Kakovost tal - Določevanje karakteristik zadrževanja vode - Laboratorijske metode (ISO 11274:1998 + C1:2009)

Soil quality - Determination of the water-retention characteristic - Laboratory methods (ISO 11274:1998 + C1:2009)

Bodenbeschaffenheit - Bestimmung des Wasserrückhaltevermögens - Laborverfahren (ISO 11274:1998 + Cor. 1:2009)

Qualité du sol - Détermination de la caractéristique de la rétention en eau - Méthodes de laboratoire (ISO 11274:1998 + C1:2009)

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Soil quality - Determination of the water-retention characteristic - Laboratory methods (ISO 11274:1998 + Cor 1:2009)

Qualité du sol - Détermination de la caractéristique de la rétention en eau - Méthodes de laboratoire (ISO 11274:1998 + Cor 1:2009)

Bodenbeschaffenheit - Bestimmung des Wasserrückhaltevermögens - Laborverfahren (ISO 11274:1998 + Cor 1:2009)

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Foreword

The text of ISO 11274:1998, including Cor 1:2009 has been prepared by Technical Committee ISO/TC 190 "Soil quality" of the International Organization for Standardization (ISO) and has been taken over as EN ISO 11274:2014 by 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of an identical text or by endorsement, at the latest by September 2014, and conflicting national standards shall be withdrawn at the latest by September 2014.

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Endorsement notice

The text of ISO 11274:1998, including Cor 1:2009 has been approved by CEN as EN ISO 11274:2014 without any modification.

INTERNATIONAL STANDARD

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Soil quality — Determination of the water-retention characteristic — Laboratory methods

Qualité du sol — Détermination de la caractéristique de la rétention en eau — Méthodes de laboratoire

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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.

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.

International Standard ISO 11274 was prepared by Technical Committee ISO/TC 190, *Soil quality*, Subcommittee SC 5, *Physical methods*.

Annexes A and B of this International Standard are for information only.

Introduction

Soil water content and matric pressure are related to each other and determine the water-retention characteristics of a soil. Soil water which is in equilibrium with free water is at zero matric pressure (or suction) and the soil is saturated. As the soil dries, matric pressure decreases (i.e. becomes more negative), and the largest pores empty of water. Progressive decreases in matric pressure will continue to empty finer pores until eventually water is held in only the finest pores. Not only is water removed from soil pores, but the films of water held around soil particles are reduced in thickness. Therefore a decreasing matric pressure is associated with a decreasing soil water content [5], [6]. Laboratory or field measurements of these two parameters can be made and the relationship plotted as a curve, called the soil water-retention characteristic. The relationship extends from saturated soil (approximately 0 kPa) to oven-dry soil (about -10^6 kPa).

The soil water-retention characteristic is different for each soil type. The shape and position of the curve relative to the axes depend on soil properties such as texture, density and hysteresis associated with the wetting and drying history. Individual points on the water-retention characteristic may be determined for specific purposes.

The results obtained using these methods can be used, for example:

- to provide an assessment of the equivalent pore size distribution (e.g. identification of macro- and micropores);
- to determine indices of plant-available water in the soil and to classify soil accordingly (e.g. for irrigation purposes);
- to determine the drainable pore space (e.g. for drainage design, pollution risk assessments);
- to monitor changes in the structure of a soil (caused by e.g. tillage, compaction or addition of organic matter or synthetic soil conditioners);
- to ascertain the relationship between the negative matric pressure and other soil physical properties (e.g. hydraulic conductivity, thermal conductivity);
- to determine water content at specific negative matric pressures (e.g. for microbiological degradation studies);
- to estimate other soil physical properties (e.g. hydraulic conductivity).

Soil quality — Determination of the water-retention characteristic — Laboratory methods

1 Scope

This International Standard specifies laboratory methods for determination of the soil water-retention characteristic.

This International Standard applies only to measurements of the drying or desorption curve.

Four methods are described to cover the complete range of soil water pressures as follows:

a) method using sand, kaolin or ceramic suction tables for determination of matric pressures from 0 kPa to – 50 kPa;

b) method using a porous plate and burette apparatus for determination of matric pressures from 0 kPa to – 20 kPa;

c) method using a pressurized gas and a pressure plate extractor for determination of matric pressures from – 5 kPa to – 1500 kPa;

d) method using a pressurized gas and pressure membrane cells for determination of matric pressures from – 33 kPa to – 1500 kPa.

Guidelines are given to select the most suitable method in a particular case.

2 Definitions

For the purposes of this International Standard, the following definitions apply.

2.1
soil water-retention characteristic
relation between soil water content and soil matric head of a given soil sample

2.2
matric pressure
amount of work that must be done in order to transport, reversibly and isothermally, an infinitesimal quantity of water, identical in composition to the soil water, from a pool at the elevation and the external gas pressure of the point under consideration, to the soil water at the point under consideration, divided by the volume of water transported

2.3
water content mass ratio
w
mass of water evaporating from the soil when dried to constant mass at 105 °C, divided by the dry mass of the soil (i.e. the ratio between the masses of water and solid particles within a soil sample)

2.4
water content volume fraction
θ
volume of water evaporating from the soil when dried to constant mass at 105 °C, divided by the original bulk volume of the soil (i.e. the ratio between the volume of liquid water within a soil sample and the total volume including all pore space of that sample)

NOTE 1 The soil water-retention characteristic is identified in the scientific literature by various names including soil water release curve, soil water-retention curve, pF curve and the capillary pressure-saturation curve. Use of these terms is deprecated.

NOTE 2 The pascal is the standard unit of pressure but many other units are still in use. Table A.1 provides conversions for most units.

NOTE 3 Sometimes suction is used instead of pressure to avoid the use of negative signs (see Introduction). However, this term can cause confusion and is deprecated as an expression of the matric pressure.

NOTE 4 For swelling and shrinking soils, seek the advice of a specialist laboratory since interpretation of water-retention data will be affected by these properties.

3 Guidelines for choice of method

Guidelines are given below to help select the most suitable method in a particular case.

3.1 Sand, kaolin or ceramic suction tables for determination of pressures from 0 kPa to – 50 kPa

The sand, kaolin and ceramic suction table methods are suitable for large numbers of determinations at high pressures on cores or aggregates of different shapes and sizes. Analyses on samples of a wide range of textures and organic matter contents can be carried out simultaneously since equilibration is determined separately for each core. The suction table methods are suitable for a laboratory carrying out analyses on a routine basis and where regular equipment maintenance procedures are implemented.

3.2 Porous plate and burette apparatus for determination of pressures from 0 kPa to – 20 kPa

The porous plate and burette apparatus allows analysis of only one sample at a time, and several sets of equipment are therefore necessary to enable replication and full soil profile characterization. The method is particularly suited to soils with weak structures and sands which are susceptible to slumping or slaking, since minimal sample disturbance occurs. Capillary contact is not broken during the procedure and all samples, particularly soils with higher organic matter content or sandy textures, will equilibrate more rapidly using this technique. This is a simple technique suitable for small laboratories.

3.3 Pressure plate extractor for determination of pressures from – 5 kPa to – 1500 kPa

The pressure plate method can be used for determinations of all pressures to – 1500 kPa. However, different specifications of pressure chambers and ceramic plates are required for the range of pressures, e.g. 0 kPa to 20 kPa, 20 kPa to 100 kPa and 100 kPa to 1500 kPa. The method is, however, best suited to pressures of – 33 kPa or lower, since air entrapment at high negative pressures can occur. It is preferable that soils with similar water-release properties are analysed together to ensure equilibration times are approximately the same, though in practice it may be difficult. Sample size is usually smaller than for the previous two methods and therefore the technique is less suitable for heterogeneous soil horizons, or for those with a strong structural composition. Analysis of disturbed soils is traditionally carried out using this method.