SLOVENSKI PREDSTANDARD

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Kakovost tal – Ugotavljanje porazdelitve velikosti delcev v mineralnem delu tal - Metoda s sejanjem in usedanjem

Soil quality - Determination of particle size distribution in mineral soil material -- Method by sieving and sedimentation

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Soil quality — Determination of particle size distribution in mineral soil material — Method by sieving and sedimentation

Qualité du sol — Détermination de la répartition granulométrique de la matière minérale des sols — Méthode par tamisage et sédimentation

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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 11277 was prepared by Technical Committee ISO/TC 190, *Soil quality*, Subcommittee SC 5, *Physical methods.*

Annexes A and B form an integral part of this International Standard. Annex C is for information only.

Introduction

The physical and chemical behaviour of soils is controlled in part by the amounts of mineral particles of different sizes in the soil. The subject of this International Standard is the quantitative measurement of such amounts (expressed as a proportion or percentage of the total mass of the mineral soil), within stated size classes.

The determination of particle size distribution is affected by organic matter, soluble salts, cementing agents (especially iron compounds), relatively insoluble substances such as carbonates and sulfates, or combinations of these. Some soils change their behaviour to such a degree upon drying, that the particle size distribution of the dried material bears little or no relation to that of the undried material encountered under natural conditions. This is particularly true of soils rich in organic matter, those developed from recent volcanic deposits, some highly weathered tropical soils, and soils often described as “cohesive” [6]. Other soils, such as the so-called "sub-plastic" soils of Australia, show little or no tendency to disperse under normal laboratory treatments, despite field evidence of a large clay content.

The procedures given in this International Standard recognize these kinds of differences between soils from different environments, and the methodology presented is designed to deal with them in a structured manner. Such differences in soil behaviour can be very important, but awareness of them depends usually on local knowledge. Given that the laboratory is commonly distant from the site of the field operation, the information supplied by field teams becomes crucial to the choice of an appropriate laboratory procedure. This choice can be made only if the laboratory is made fully aware of this background information.

All procedures in this International Standard should be carried out by competent, trained persons, with adequate supervision. Attention is drawn to certain known hazards, but it is essential that users follow safe working practices. If in any doubt, seek professional advice.

It is essential that users of this International Standard read all of it before commencing any operation, as failure to note certain points will lead to incorrect analysis, and could be dangerous.

Soil quality — Determination of particle size distribution in mineral soil material — Method by sieving and sedimentation

1 Scope

This International Standard specifies a basic method of determining particle size distribution applicable to a wide range of mineral soil materials, including the mineral fraction of organic soils. It also offers procedures to deal with the less common soils mentioned in the introduction. This International Standard has been developed largely for use in the field of environmental science, and its use in geotechnical investigations is something on which professional advice might be required.

A major objective of this International Standard is the determination of enough size fractions to enable the construction of a reliable particle size distribution curve.

This International Standard does not apply to the determination of the particle size distribution of the organic components of soil, i.e. the more or less fragile, partially decomposed, remains of plants and animals. It should also be realized that the chemical pretreatments and mechanical handling stages in this International Standard could cause disintegration of weakly cohesive particles that, from field inspection, might be regarded as primary particles, even though such primary particles could be better described as aggregates. If such disintegration is undesirable, then this International Standard should not be used for the determination of the particle size distribution of such weakly cohesive materials.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 565:1990, *Test sieves — Metal wire cloth, perforated metal plate and electroformed sheet — Nominal sizes of openings.*

ISO 3310-1:1990, *Test sieves — Technical requirements and testing — Part 1: Test sieves of metal wire cloth.*

ISO 3310-2:1990, *Test sieves — Technical requirements and testing — Part 2: Test sieves of perforated metal plate.*

ISO 3696:1987, *Water for analytical laboratory use — Specification and test methods*.

ISO 11464:1994, *Soil quality — Pretreatment of samples for physico-chemical analyses.*

3 Terminology and symbols

3.1 Terminology

Particles within particular size ranges or classes are commonly described as cobbles, gravel, coarse sand, silt, etc. The meaning of such trivial names differs between countries, and in some cases there are no exact translations of such words from one language to another; for example, the Dutch word "zavel" has no equivalent in English. The only fraction for which there appears to be common agreement is clay, which is defined as material of less than 0,002 mm equivalent spherical diameter [1, 6]. Such trivial names shall not be used in describing the results of particle size determination according to this International Standard. Phrases such as "...passing a 20 mm aperture sieve..." or "...less then 0,063 mm equivalent spherical diameter..." shall be used instead. If trivial names must be used, for example to cross-reference to another (inter-)national standard, then the trivial name should be defined explicitly, so as to remove any doubt as to the meaning intended, e.g. silt (0,063 mm to 0,002 mm equivalent spherical diameter) (clause 4 and, for example, [3]). Further, it is common to use the word 'texture' to describe the results of particle size distribution measurements, e.g. 'the particle size of this soil is of clay texture'. This is incorrect as the two concepts are different, and the word 'texture' shall not be used in the test report (clause 10) to describe the results obtained by use of this International Standard.

It is common to refer to sieves as having a particular mesh-size or mesh number. These are not the same as the sieve aperture, and the relationship between the various numbers is not immediately obvious. The use of mesh numbers as a measurement of particle size is difficult to justify, and shall not be used in reporting the results of this International Standard.

3.2 Symbols

The following symbols are found throughout the text and, where appropriate, units and quantities are as given below (SI convention is followed for common units e.g. g = gram; m = metre; mm = millimetre; s = second, etc.).

Mg	megagram (10^6 g)
mPa	millipascal
t	is the settling time, in seconds, of a particle of diameter d_p;
η	is the dynamic viscosity of water at the test temperature (see Table B.2), in millipascals per second;
h	is the sampling depth, in centimetres;
ρ_s	is the mean particle density, in megagrams per cubic metre (taken as 2,65; note in clause 4);
ρ_w	is the density of the liquid containing the soil suspension, in megagrams per cubic metre (taken as 1,00; note in clause 4);
g	is the acceleration due to gravity, in centimetres per second squared (taken as 981);
d_p	is the equivalent spherical diameter of the particle of interest, in millimetres;

4 Principle

Particle size distribution is determined by a combination of sieving and sedimentation, starting from air-dried soil [6] (see note below). A method for undried soil is given in Annex A. Particles not passing a 2 mm aperture sieve are determined by dry sieving. Particles passing such a sieve, but retained on a 0,063 mm aperture sieve, are determined by a combination of wet and dry sieving, whilst particles passing the latter sieve are determined by sedimentation. The pipette method is preferred. A hydrometer method is given in Annex B. A combination of sieving and sedimentation enables construction of a continuous particle size distribution curve.

The key points in this procedure are summarized as a flow chart in Figure 2. This International Standard requires that the proportions of fractions separated by sedimentation and sieving be determined from the masses of such fractions obtained by weighing. Other methods of determining the mass of such fractions rely on such things as the