SLOVENSKI STANDARD
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Nadomešča:
SIST EN 13041:2001
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Izboljševalci tal in rastni substrati - Določanje fizikalnih lastnosti - Prostorninska gostota (suha), kapaciteta za zrak, kapaciteta za vodo, vrednost skrčenja in celotna poroznost

Soil improvers and growing media - Determination of physical properties - Dry bulk density, air volume, water volume, shrinkage value and total pore space

Bodenverbesserungsmittel und Kultursubstrate - Bestimmung der physikalischen Eigenschaften - Rohdichte (trocken), Luftkapazität, Wasserkapazität, Schrumpfungswert und Gesamtporenvolumen

Amendements du sol et supports de culture - Détermination des propriétés physiques - Masse volumique apparente sèche, volume d'air, volume d'eau, valeur de rétraction et porosité totale

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ICS:

65.080	Gnojila	Fertilizers

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Foreword

This document (EN 13041:2011) has been prepared by Technical Committee CEN/TC 223 “Soil improvers and growing media”, the secretariat of which is held by ASI.

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of an identical text or by endorsement, at the latest by May 2012, and conflicting national standards shall be withdrawn at the latest by May 2012.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

This document supersedes EN 13041:1999.

The main change to the previous edition is in the scope of this document.

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1 Scope

This European Standard describes an instrumental method for the routine determination of the physical properties, dry bulk density, water volume, air volume, shrinkage value and total pore space of soil improvers or growing media.

This European Standard is not suitable for those materials which are very coarse, which do not make proper capillary contact or those which are pre-formed and non-particulate and have closed porosity. It is applicable to materials with particles ≤ 25 mm and/or flexible fibres ≤ 80 mm.

This method is not applicable to liming materials and preformed materials such as mineral wool slabs and foam slabs.

NOTE The requirements of the standard may differ from the national legal requirements for the declaration of the products concerned.

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.

EN 12579:1999, *Soil improvers and growing media — Sampling*

EN 13039, *Soil improvers and growing media — Determination of organic matter content and ash*

EN 13040:2007, *Soil improvers and growing media — Sample preparation for chemical and physical tests, determination of dry matter content, moisture content and laboratory compacted bulk density*

3 Terms and definitions

For the purposes of this document the terms and definitions given in EN 12579:1999 and the following apply.

3.1
air volume
that part of the volume of a sample filled by air measured under the conditions specified in this European Standard, in particular at a defined suction (e.g. –10 cm water = –1 kPa suction)

3.2
dry bulk density
ratio of the dry mass and volume of the sample in grams per litre

3.3
total pore space
total volume of voids filled with water and/or air measured under the conditions specified in this European Standard, in particular at a defined suction (e.g. –10 cm water = –1 kPa suction)

3.4
shrinkage value
loss in volume of the sample after drying a moist sample

3.5
water volume
that part of the volume of a sample filled by water measured under the conditions specified in this European Standard, in particular at a defined suction (e.g. –10 cm water = –1 kPa suction)

3.6
particle density
the ratio of the total mass of oven-dry solid particles (minerals, organic matter) to the volume of these particles. The volume of the internal pores of the particles and the pore spaces between particles are excluded

4 Principle

The sample is saturated in water and then equilibrated on a sand box at –50 cm water (–5 kPa) pressure head. The sample is then transferred into double ring sample cylinders, re-wetted and equilibrated at minus 10 cm water (–1 kPa) pressure head. After equilibration the physical properties are calculated from the wet and dry weights of the sample in the lower ring. After –10 cm water pressure head (= –1 kPa) it is optional also to apply –50 cm and –100 cm water (–5 kPa and –10 kPa) pressure head respectively.

5 Apparatus

5.1 Double rings (see Figure A.1)

5.1.1 General

The double rings and fixing collars described in this clause, shall be made from any rigid material that will not deform at a temperature of up to 120 °C.

5.1.2 Lower sample ring

5.1.2.1 Sample ring of internal diameter (D_1) (100 ± 1) mm and height (50 ± 1) mm.

As each ring is individually made it is necessary to determine the volume (V_1), record the mass (m_1) and identify each lower sample ring. The volume shall be determined by measuring the mean height (at least quadruplicate measurements) (h_1) and mean diameter (d_1) of the sample rings with a calliper gauge (At least triplicate measurements; top, middle and bottom).

5.1.2.2 Removable gauze-retaining ring or collar 20 mm high and 7,5 mm to 8,5 mm larger than the outer diameter of the sample ring.

5.1.2.3 Non-biodegradable synthetic gauze with a mesh size of about 0,1 mm.

5.1.3 Upper ring

5.1.3.1 Upper ring having the same internal diameter as the ring prepared in (see 5.1.2.1) and height (53 ± 1) mm.

5.1.3.2 Collar - fixed on the ring permitting the upper cylinder to be secured to the lower cylinder for the duration of the test.

5.2 Plastic tube, of approximately 14 cm diameter and 14 cm high to give a volume of about 2 l. Tightly stretch and secure the gauze (see 5.1.2.3) to one end of the tube by means of an elastic band.

5.3 Water bath, capable of holding at least 4 plastic tubes (see 5.2) standing on a coarse mesh and capable of being filled with water to the top of the plastic tubes.

5.4 Sand suction table (see Figure A.3)

Prepare the sand suction table for example in accordance with Annex A, using the fine sand to obtain the required suction. The pressure head in the plastic tubes (–50 cm water = –5 kPa) is measured from the bottom of the tube. The pressure head in the rings (–10 cm, −50 cm and –100 cm water, equivalent to –1 kPa, –5 kPa and –10 kPa, respectively) is measured from the middle of the lower ring (see Figure A.3). The setting of the pressure head can be checked with a tensiometer or pressure transducer.

5.5 **Ventilated drying oven** set at (103 ± 2) °C.

5.6 **Analytical balance** with a scale interval of 0,1 g.

5.7 **Shallow vessel**, spoon or scoop approximately 50 ml capacity.

6 Preparation

Prepare the laboratory sample in accordance with 8.4 of EN 13040:2007.

7 Procedure

7.1 Moistening, saturating and equilibration at –50 cm water (–5 kPa) pressure head

7.1.1 Fill at least 2 tubes (see 5.2) with the test portion taking care to prevent artificial air voids. Cover each tube with synthetic gauze (see 5.1.2.3) secured with an elastic band. Place the tube on the grid in a dry water bath (see 5.3).

7.1.2 Slowly, with constant flow, fill the bath with water until the level reaches to within 1 cm below the top of the tube. Filling should take approximately 30 min.

7.1.3 If a tube shows signs of floating, place a weighted disc on the top of the tube allowing air to evacuate and at the same time ensuring that compaction of the sample does not take place, (see Figure A.4).

7.1.4 Allow to stand maintaining a constant water level until the sample is thoroughly wetted (up to 36 h).

7.1.5 Remove the tubes and without delay, transfer the tubes to the sand suction table. The bottom of the tube should be fully in contact with the sand. Apply a –50 cm water (–5 kPa) pressure head, measured from the bottom of the tube, for 48 h.

7.2 Filling tubes

7.2.1 Secure the gauze (see 5.1.2.3) with the collar (see 5.1.2.2) to the base of the lower sample ring (see 5.1.2). Attach and secure the upper sample ring (see 5.1.3) to the lower sample ring.

7.2.2 Empty the tubes containing the equilibrated (–50 cm water, –5 kPa) wet sample from 7.1.5 onto a clean surface and gently mix taking care not to cause any physical damage to the sample.

7.2.3 Transfer using the shallow vessel (see 5.7) approximately 50 ml portions of the mixed sample to the prepared sample rings taking care to avoid compaction or artificial air voids and filling the cylinder and removable ring completely.

7.2.4 Fill at least 4 units with the sample. Place the unit on the grid in a dry water bath. Slowly, with constant flow, fill the bath (see 5.3) with water until the level reaches to within 1 cm below the top of the tube. Filling should take approximately 30 min.

7.2.5 Maintain a constant water level for 24 h (see Figure A.5).

NOTE Two different baths may be used, one for -10 cm water (–1 kPa) and one for –50 cm water (–5 kPa).

7.3 Suction –10 cm water (–1 kPa) pressure head

7.3.1 Carefully remove the units and without delay transfer to the sand bath (see 5.4) making sure there is contact between sand and the lower part of the unit. Cover the sand box and apply a –10 cm (–1 kPa) pressure head, measured from the middle of the lower ring.

7.3.2 It is important to regularly check that no air bubbles are present in the suction level regulator tubes.

Apply the suction until equilibrium is reached. A minimum of 48 h and up to 72 h is required.

7.4 Separation of rings

7.4.1 Remove the double ring sample cylinders from the sand box and place on a flat solid surface. Carefully remove the upper ring in a vertical movement. Use a knife or straight edge to strike off the material level with the top of the sample ring without causing compaction. The levelling of fibrous materials can best be done by cutting off excess matter with a pair of scissors exercising considerable care to avoid other disturbances.

7.4.2 Remove any materials adhering to the outside of the sample ring and record the mass (m_2) taking care not to turn the ring.

7.5 Optional suction –50 cm and –100 cm water (–5 kPa and – 10 kPa) pressure head

NOTE After –10 cm water (–1 kPa) pressure head it is possible also to determine the air and water volume at –50 cm and –100 cm water (–5 kPa and –10 kPa) pressure head. The following procedure (see 7.5) can be skipped only if values for water and air volume at –10 cm water (–1 kPa) are necessary.

7.5.1 Carefully place the ring to the sand bath (see 5.4) making sure there is contact between the sand and the lower part of the ring. Cover the sand box and apply a –50 cm water (–5 kPa) pressure head, measured from the middle of the ring.

7.5.2 It is important to regularly check that no air bubbles are present in the suction level regulator tubes.

7.5.3 Apply the suction until equilibrium is reached. A minimum of 48 h and up to 72 h is required.

7.5.4 Record the mass (m_3).

7.5.5 Carefully place the ring to the sand bath (see 5.4) making sure there is contact between the sand and the lower part of the ring. Cover the sand box and apply a –100 cm water (–10 kPa) pressure head, measured from the middle of the ring.

7.5.6 It is important to regularly check that no air bubbles are present in the suction level regulator tubes.

7.5.7 Apply the suction until equilibrium is reached. A minimum of 48 h and up to 72 h is required.

7.5.8 Record the mass (m_4).

7.6 Drying

7.6.1 Place in the drying oven (see 5.5) without altering the structure and dry at (103 ± 2) °C to constant mass (m_5).

7.6.2 Remove the ring and measure with a calliper gauge the mean height (quadruplicate measurements) (h_2) and mean diameter (triplicate measurements; top middle and bottom) (d_2) of the dried samples.

NOTE This procedure cannot be carried out with some granular materials because they do not retain their shape on drying. In these cases, it is recommended to measure the height prior to drying.

7.7 Organic matter (W_{om})

Determine the organic matter content in accordance with EN 13039.

7.8 Ash content (W_{ash})

Determine the mineral matter content in accordance with EN 13039.

8 Expression of results

8.1 Volume of the sample ring

Calculate the volume of the sample ring using the following equation:

$$V_1 = \{\pi \cdot (0,5 d_1)^2 \cdot h_1\} \quad (1)$$

where

V_1 is the volume of the ring in cubic centimetres, in cm^3;

d_1 is the diameter in centimetres of the sample ring;

h_1 is the height in centimetres of the sample ring.

8.2 Dry bulk density

$$D_{BD} = \frac{(m_3 - m_1)}{V_1} \cdot 1000 \quad (2)$$

where

D_{BD} is the dry bulk density in kilograms dry matter per cubic metre, in kg m^{-3};

m_1 is the mass in grams of the sample ring;

m_3 is the mass in grams of the dried sample plus sample ring;

V_1 is the volume in cubic centimetres of the sample ring.

8.3 Shrinkage value

Calculate the shrinkage value of the sample after drying using the following equation:

$$S_{\%} = \frac{V_1 - V_m}{V_1} \cdot 100 \tag{3}$$

where

$S_{\%}$ is the shrinkage value of the sample after drying expressed as a percentage by volume;

V_1 is the volume in cubic centimetres of the sample ring (see 8.1);

V_m is the mean volume in cubic centimetres of the dried sample $\{\pi(0{,}5 \cdot d_2)^2 \cdot h_2\}$.

8.4 Particle density

Calculate the particle density in duplicate using the following equation:

$$P_D = \frac{1}{\{W_{om}/(100 \times 1550)\} + \{W_{ash}/(100 \times 2650)\}} \tag{4}$$

where

P_D is the particle density in kilograms per cubic metre, in kg · m^{-3};

W_{om} is the organic matter content expressed as a percentage by mass, in 100 – ash %;

W_{ash} is the ash expressed as a percentage by mass;

1550 is taken as the density in kilograms per cubic metre of organic matter (see Puustjärvi [2], Verdonk [3]);

2650 is taken as the density in kilograms per cubic metre of ash (see Verdonk [3]).

8.5 Total pore space

Calculate the total pore space of the sample after applying –10 cm water (–1 kPa) pressure head using the following equation:

$$P_s = \left[1 - \left(\frac{D_{BD}}{P_D}\right)\right] \cdot 100 \tag{5}$$

where

P_S is the total pore space expressed as a percentage by volume, in % (V/V), wet sample at –10 cm water (–1 kPa) pressure head;

D_{BD} is the dry bulk density in kilograms per cubic metre, in kg m^{-3};

P_D is the mean value of the particle density in kilograms per cubic metre, in kg m^{-3}.