SLOVENSKI STANDARD
SIST EN 16087-1:2020

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Nadomešča:
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Izboljševalci tal in rastni substrati - Določevanje aerobne biološke aktivnosti - 1. del: Stopnja porabe kisika

Soil improvers and growing media - Determination of the aerobic biological activity - Part 1: Oxygen uptake rate (OUR)

Bodenverbesserungsmittel und Kultursubstrate - Bestimmung der aeroben biologischen Aktivität - Teil 1: Sauerstoffaufnahme (OUR)

Amendements du sol et supports de culture - Détermination de l'activité biologique aérobie - Partie 1 : Cinétique d'absorption de l'oxygène (OUR)

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ICS:

65.080	Gnojila	Fertilizers

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EUROPEAN STANDARD

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English Version

Soil improvers and growing media - Determination of the aerobic biological activity - Part 1: Oxygen uptake rate (OUR)

Amendements du sol et supports de culture - Détermination de l'activité biologique aérobie - Partie 1 : Cinétique d'absorption de l'oxygène (OUR)

Bodenverbesserungsmittel und Substrate - Bestimmung der aeroben biologischen Aktivität - Teil 1: Sauerstoffaufnahme (OUR)

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

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Contents

Page

European Foreword

This document (EN 16087-1:2020) has been prepared by Technical Committee CEN/TC 223 “Soil improvers and growing media”, 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of an identical text or by endorsement, at the latest by July 2020, and conflicting national standards shall be withdrawn at the latest by July 2020.

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

This document supersedes EN 16087-1:2011.

The main changes compared with the previous edition are as follows:

— For the balance (5.6) requirements are added;

— Clarification of sample preparation (7.1) is added;

— Formula 3 and 5 are corrected;

— The figures in Annex B have been updated;

— The Bibliography has been corrected.

SAFETY PRECAUTIONS — Care should be taken when handling substances of caustic nature or samples that may contain sharps or is of a dusty nature.

According to the CEN-CENELEC Internal Regulations, the national standards organisations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Republic of North Macedonia, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

1 Scope

This document describes a method to determine the aerobic biological activity of growing media and soil improvers or constituents thereof by measuring the oxygen uptake rate (OUR). The oxygen uptake rate is an indicator of the extent to which biodegradable organic matter is being broken down within a specified time period. The method is not suitable for material with a content of particle sizes > 10 mm exceeding 20 %.

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.

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

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

EN 45501, *Metrological aspects of non-automatic weighing instruments*

EN ISO 3696, *Water for analytical laboratory use – Specification and test methods (ISO 3696)*

3 Terms and Definitions

No terms and definitions are listed in this document.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at http://www.electropedia.org/
- ISO Online browsing platform: available at https://www.iso.org/obp/ui

4 Principle

The material is suspended in water. The respiration rate (i.e. oxygen uptake rate) is estimated by measuring the pressure drop in the headspace (i.e. gas phase in the closed space above the water phase). The produced CO_2 (carbon dioxide) is removed by a suitable alkaline absorbent. The measurements are performed under defined conditions.

5 Apparatus

5.1 Testing facility

Temperature controlled room, climate cabinet or water bath, temperature adjustable to (30 ± 2) °C.

5.2 Pressure transducer

Operating range 0 kPa to 20 kPa (accuracy ± 0,1 kPa) and record for measuring 2 to 4 times per hour for seven days.

5.3 CO_2-absorbent containing unit

5.4 Reaction vessel

1 000 ml to 2 500 ml with a CO_2-absorbent containing unit (see 5.3) and the pressure transducer (see 5.2) gastight connected (see Figure B.1).

5.5 Mixing device

Shaking table (120 ± 20) rpm or magnetic stirring unit and banded magnetic stirrer (see Figure B.2).

5.6 Balance

Meeting EN 45501 class II tolerances with a verification scale interval of 0,01 g.

5.7 pH meter

With slope adjustment and temperature control.

5.8 Dispenser

Dispensers or pipettes, adjustable units of 0,5 ml.

5.9 Glassware

Beakers and measuring cylinder.

5.10 Sieve

10 mm mesh size.

6 Reagents

6.1 Water of class 3

According to EN ISO 3696.

6.2 pH buffer

86 g/l KH_2PO_4, 89 g/l $Na_2HPO_4 \cdot 2H_2O$, mix ratio of 1:4 for pH 7; the solution is stable for 2 months if stored at (5 ± 3) °C.

Commercially available buffers may be used as well.

6.3 Macronutrient solution

Solve the following masses of chemical compounds in 1 000 ml water (see 6.1): 4,3 g NH_4Cl,

5,4 g $CaCl_2 \cdot 2H_2O$, 4,3 g $MgSO_4 \cdot 7H_2O$, 0,03g $FeCl_3 \cdot 6H_2O$.

6.4 Micronutrient solution

Dissolve the following masses or volumes of chemical compounds in 1 000 ml water (see 6.1): 5,0 g EDDHA iron chelate (60 g Fe/kg), 1,4 g $MnSO_4$, 1,1 g $ZnSO_4$, 4,2 g $Na_2B_4O_7$, 0,2 g $CuSO_4$, 0,13 g Na_2MoO_4, 1 ml/l HCl (360 g/kg).

6.5 Complete nutrient solution

Add 1 ml of micronutrient solution (see 6.4) to 1 000 ml of macronutrient solution (see 6.3). The solution is stable for 2 months if stored at (5 ± 3) °C.

6.6 Nitrification inhibitor

4 g/l N-Allylthiourea, $C_4H_8N_2S$ (ATU).

NOTE In closed containers, the solution is stable for at least 3 months.

6.7 CO_2-absorbent

Such as NaOH-pellets, KOH-pellets or soda lime (mixture of $Ca(OH)_2$, NaOH, KOH and water), preferably with colour indicator.

NOTE Based on experience, 4,0 g of pellets (carbon dioxide absorption capacity > 200 g/kg) per container is sufficient.

6.8 NaOH (0,5 mol/l)

6.9 HCl (0,5 mol/l)

7 Procedure

7.1 Sample preparation

Manually, but carefully, break up lumps and agglomerates only that have been caused by, for example, compression during transport. Break up lumps and agglomerates only and pass the sample through a 10 mm sieve (see 5.10), gently agitating the material if required. Particles > 10 mm shall not be broken up and shall be removed. Record the % mass of particles > 10 mm. If this amount is > 20 % of the total fresh mass, the test is not applicable. The moist sample shall be stored at (5 ± 3) °C (max. 2 weeks).

7.2 Determination of moisture content and organic matter content

The moisture content shall be determined according to EN 13040 and the organic matter content according to EN 13039.

7.3 Starting the procedure

Calculate the mass of fresh material (EOM) to be added to the reaction vessel based on 2 g of organic matter per litre according to Formula (1).

$$EOM(g) = \frac{20000}{W_{om} \times W_d} \quad (1)$$

where

W_{om} is the organic matter content, in % mass of the dried sample according to EN 13039;

W_d is the dry matter content, in % mass of the fresh sample according to EN 13040.

Calculate the required mass of sample (W_S) to perform the test according to Formula (2).

$$W_S\,(g) = EOM \cdot C_V \tag{2}$$

where

C_V is the capacity of the vessel in litres.

Place the calculated quantity of the sample in the clean reaction vessel (see 5.4). Add 180 ml water (see 6.1) and 10 ml complete nutrient solution (see 6.5) using a dispenser (see 5.8). Add 10 ml pH buffer (see 6.2) using a dispenser (see 5.8). Add 2,5 ml nitrification inhibitor (see 6.6) using a dispenser (see 5.8). Place the sample on the mixing device (see 5.5) and start the mixing for 4 h to 8 h in the conditioned room (see 5.1). Do not close the bottles.

The nitrification inhibitor is added to prevent the use of oxygen for nitrification processes.

Then measure the pH of the suspension. The value should be between 6,5 and 7,5. If this is not the case, base or acid should be added (see 6.8 and 6.9).

The analyses shall be performed at least in duplicate.

At first instance, an equivalent of 2 g organic matter should be used for analysis. If it appears during the test that the pressure drop during the first three days is not higher than 2 kPa, then the amount of organic matter should be increased but with a maximum of 20 g dry matter. If on the other hand the pressure drop during the first three days is more than 5 kPa, the amount of organic matter should be adjusted to 1 g.

NOTE If it appears there is not enough material available, the complete test can be repeated with new material.

7.4 Respiration measurement

Fill the CO_2-absorbent containing unit (see 5.3) with the absorbent (see 6.7). The pellets can be used several times. Before every use, they shall be inspected for colour changes. If the colour has changed, they shall be replaced. Replace the bottle top sensor and ensure a gas-tight fit.

Start the shaking table (120 ± 20) rpm or magnetic stirrer (between 180 rpm and 450 rpm) and measure the pressure over seven days. Record the pressure 2 to 4 times per hour over seven days with the connected pressure transducer (see 5.2). The measurement ends, in principle, after seven days but can be ended if the pressure difference between the maximum and minimum value is more than 10 kPa.

NOTE If a magnetic stirrer is used and the amount of sand and gravel in the sample is high, it is important to check that the stirrer is not in contact with the base.

To check the tightness of the measurement system, it is necessary to include a blank measurement without sample material, but all necessary solutions.