SLOVENSKI STANDARD
SIST-TS CEN/TS 17338:2019

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Sredstva za apnjenje - Določanje potrebe po apnjenju tal - Metoda z amonijevim acetatnim pufrom pH 5,5

Liming materials - Determination of the lime requirement in soil - Ammonium acetate buffer method pH 5,5

Kalkdünger - Bestimmung des Kalkbedarfs in Böden - Ammoniumazetat Pufferverfahren pH 5

Amendements minéraux basiques - Détermination du besoin en bases d'un sol - Méthode tampon d'acétate d'ammonium pH 5,5

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65.080	Gnojila	Fertilizers

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TECHNICAL SPECIFICATION

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CEN/TS 17338

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ICS 65.080

English Version

Liming materials - Determination of the lime requirement in soil - Ammonium acetate buffer method pH 5,5

Amendements minéraux basiques - Détermination du besoin en chaux d'un sol - Méthode tampon d'acétate d'ammonium pH 5,5

Kalkdünger - Bestimmung des Kalkbedarfs von Böden - Ammoniumacetat-Pufferverfahren pH 5,5

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EUROPEAN COMMITTEE FOR STANDARDIZATION
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European foreword

This document (CEN/TS 17338:2019) has been prepared by Technical Committee CEN/TC 260 “Fertilizers and liming materials”, the secretariat of which is held by DIN.

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Introduction

pH target levels for liming of soils depend on soil types, crops to be grown and regional climatic conditions.

When pH targets have been fixed under each condition, this buffer method can be used, in addition to determine total soil acidity, to predict the amount of an effective liming material to be used to achieve this required lime status, irrespective of soil type. The buffer method will reveal the buffering capacity of any soil prior to its admixture of a liming material.

1 Scope

This document specifies a method for the determination of the lime requirement of acid soils to target pH levels at requested time of maintenance as determined by reaction with 0,1 mol/l ammonium acetate pH 5,5.

Due to general soil buffering systems, the method is applicable to all soils which are acid enough to dissociate hydrogen ions from the soil colloid system to depress the pH of the buffer solution.

NOTE 1 The method originates from research in Canada and Norway, see [1] and [2].

NOTE 2 Annex A gives regression equations to predict the maintenance of a range of pH levels at different times after liming in mineral and organic soils in Europe.

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 12944-3, *Fertilizers and liming materials - Vocabulary - Part 3: Terms relating to liming materials*

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

EN ISO 11272, *Soil quality - Determination of dry bulk density (ISO 11272)*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 12944-3 apply.

— IEC Electropedia: available at http://www.electropedia.org/

— ISO Online browsing platform: available at http://www.iso.org/obp/

4 Principle

The acidity of a test portion of the soil sample is liberated by reaction with an aliquot of ammonium acetate pH 5,5, corresponding to the immediate lime requirement to achieve soil neutrality or another defined pH target. To determine the lime requirement in the field the density of the soil is measured simultaneously in the laboratory.

5 Reagents

All reagents shall be of recognized analytical grade unless otherwise stated.

5.1 Water, grade 3 according to EN ISO 3696.

5.2 Hydrochloric acid solution, c = 0,1 mol/l.

5.3 Sodium hydroxide solution, c = 0,1 mol/l.

5.4 Ammonium acetate solution, c = 0,1 mol/l, with a molecular mass of 77,082 5 g.

Weigh 19,27 g into a 2,5 l beaker and add 2 l of water (5.1). Measure the pH, and if necessary adjust to pH 5,50 by adding hydrochloric acid (5.2) or sodium hydroxide (5.3). Transfer to a 2,5 l volumetric flask, rinse the walls of the beaker, and dilute to the mark.

This solution has a limited lifetime, as it can be readily contaminated by microbiological growth and shall therefore be treated accordingly. Do not prepare more buffer than required for every 5 days of operation and immediately store the excess portion in a refrigerator for daily use.

NOTE Alternatively, a stock solution of ammonium acetate can be adjusted to pH 5,5 by hydrochloric acid or sodium hydroxide in case an alteration has occurred.

5.5 Standard buffer solution pH 4,0, commercial solution.

NOTE This solution has a limited lifetime.

5.6 Standard buffer solution pH 7,0, commercial solution.

NOTE This solution has a limited lifetime.

6 Apparatus

6.1 pH meter, with an appropriate electrode for soil suspensions.

6.2 Shaking machine.

6.3 Cups, capacity 50 ml with tight lids.

7 Preparation of the test portion

7.1 Dry the soil sample at 30 °C for about 48 h.

7.2 Grind the soil sample and let it pass through a 2 mm sieve, and discard the remainder.

7.3 Determine the field soil density according to EN ISO 11272.

7.4 Fill a stainless steel measure of 10 ml capacity with the soil sample (7.2) to overflow, tap with a rod to eliminate voids, level, transfer to a tarred cup (6.3) and weigh the test portion to the nearest 0,01 g.

8 Procedure and determination

8.1 Add 20 ml buffer solution (5.4) to the test potion (7.4), close the lid, and let it be swirled on the shaking machine (6.2) at 250 oscillations min^{-1} for 30 min.

8.2 Calibrate the pH meter with two standard buffer solutions, pH 4,0 (5.5) and pH 7,0 (5.6) to exactly the indicated values.

8.3 Transfer the test portion immediately from the shaking machine to the pH meter when the shaking is completed, and measure the pH value directly in the soil suspension.

The soil suspension is highly buffered, and a stable pH value is rapidly obtained. It is recommended to use a small stirring rod, e.g. of 0,5 cm to 1 cm, in the bottom of the cup while measuring.

8.4 Repeat the determination twice, with parallel soil samples, and notice the measured pH values each time.

9 Calculation and expression of the results

The calculation is valid as far as soil-buffer pH in suspension is below 5,5. If the pH in the suspension is higher than 5,5 it means it is an alkaline soil and a lime requirement cannot be determined.

The sample lime requirement, L_S, to be neutralized by the buffer solution at pH 5,5 immediately in the 10 ml of the soil sample, in milliequivalents, is given by Formula (1).

$$L_S = -23,78 + 18,98 \times \mathrm{pH} - 4,434 \times \mathrm{pH}^2 + 0,3319 \times \mathrm{pH}^3 \quad (1)$$

where

L_S is the lime requirement of 10 ml test portion;

pH is the measured soil-buffer pH value in suspension (8.4).

The lime requirement, L_D, to be neutralized by the buffer solution at pH 5,5 immediately in a soil with a plough layer of a given depth, in kgequiv ha^{-1}, is given by Formula (2).

$$L_D = L_S \times 1\,000 \times D \times d \times 10 \times m^{-1} \quad (2)$$

An example for a soil depth of 20 cm is given in Formula (3).

$$L_{20} = L_S \times 1\,000 \times 0,2 \times d \times 10 \times m^{-1} \quad (3)$$

where

L_D is the lime requirement per ha;

L_{20} is the lime requirement per ha (20 cm depth);

200 (= 1 000 × 0,2) is the conversion factor from milliequivalents per 10 ml to kiloequivalents per ha soil (volume to 20 cm depth):

$$\frac{10^{-3}\,\text{equivalent} \times 10\,000\,m^2 \times 0,2\,m}{10^{3}\,\text{equivalent} \times 10\,m^3 \times 10^{-6}}$$

d is the soil density, in kg × dm^{-3};

10 is the conversion factor from weighed soil to soil volume 10 ml;

D is the depth of soil, in m

m is the mass of the test portion (7.4), in g.

Calculate the mean value of L_{20} of the two replicates.

NOTE 1 For the deduction of Formula (1), see [2], Vol. I, p. 63.

NOTE 2 20 kiloequivalents of any alkaline material correspond to 1 t of a liming material with a neutralizing value of 50, readily available for soil reaction by fine grinding.

NOTE 3 1 kiloequivalent lime requirement can be calculated to correspond to kg CaO or HO^- in 100 kg of a liming material: 1 kiloequivalent = 100 kg liming material with NV = 25 (eq. CaO) or NV = 15,16 (eq. HO^-).