SLOVENSKI STANDARD
SIST-TS CEN/TS 15937:2013

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Blato, obdelani biološki odpadki in tla - Določevanje specifične električne prevodnosti

Sludge, treated biowaste and soil - Determination of specific electrical conductivity

Schlamm, behandelter Bioabfall und Boden - Bestimmung der spezifischen elektrischen Leitfähigkeit

Boue, biodéchet traité et sol - Détermination de la conductivité électrique spécifique

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TECHNICAL SPECIFICATION

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English Version

Sludge, treated biowaste and soil - Determination of specific electrical conductivity

Boues, biodéchets traités et sols - Détermination de la conductivité électrique spécifique

Schlamm, behandelter Bioabfall und Boden - Bestimmung der spezifischen elektrischen Leitfähigkeit

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Foreword

This document (CEN/TS 15937:2013) has been prepared by Technical Committee CEN/TC 400 “Project Committee - Horizontal standards in the fields of sludge, biowaste and soil”, the secretariat of which is held by DIN.

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.

The preparation of this document by CEN is based on a mandate by the European Commission (Mandate M/330), which assigned the development of standards on sampling and analytical methods for hygienic and biological parameters as well as inorganic and organic determinants, aiming to make these standards applicable to sludge, treated biowaste and soil as far as this is technically feasible.

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

Introduction

The determination of the specific electrical conductivity is carried out to obtain an indication of the content of water-soluble electrolytes in soil, treated biowaste and sludge.

WARNING — Persons using this Technical Specification should be familiar with usual laboratory practice. This Technical Specification does not purport to address all of the safety problems, if any, associated with its use. It is the responsibility of the user to establish appropriate safety and health practices and to ensure compliance with any national regulatory conditions.

IMPORTANT — It is absolutely essential that tests conducted according to this Technical Specification be carried out by suitably trained staff.

1 Scope

This Technical Specification specifies a method for the determination of the specific electrical conductivity in aqueous suspensions of sludge (fresh), treated biowaste (fresh) or soil (fresh or air-dry).

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 16179, *Sludge, treated biowaste and soil — Guidance for sample pretreatment*

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

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1
electrical conductivity
specific conductance
EC
reciprocal of the resistance, measured under specified conditions, between the opposite faces of a unit cube of defined dimensions of an aqueous solution

Note 1 to entry: This is often expressed as "electrical conductivity" and may be used as a measure of the concentration of ionisable solutes present in the sample.

Note 2 to entry: The electrical conductivity is expressed in siemens per metre (S/m).

Note 3 to entry: Adapted from ISO 6107-2:2006, 130.

4 Principle

Either fresh sludge, fresh treated biowaste or air-dried (or fresh) soil is extracted with water at a ratio of 1:5 (m/V). Liquid sludge is measured without adding water. The specific electrical conductivity of the filtered extract is measured at room temperature and the result is corrected to a temperature of 25 °C.

5 Interferences

The measured values of the specific electrical conductivity can be influenced by contamination of the electrodes. Air bubbles on the electrodes perturb the measurements. Measurements < 1 mS/m are influenced by gaseous carbon dioxide (CO_2) or ammonia (NH_3) from the atmosphere. Other sources of error are associated with materials containing sulfidic minerals or volatile acids.

6 Reagents

Use only reagents of recognised analytical grade.

6.1 Water, with a specific electrical conductivity not higher than 0,2 mS/m at 25 °C (water grade 2 as specified in EN ISO 3696).

6.2 Potassium chloride solution, *c*(KCl) = 0,1 mol/l.

Dissolve in water (6.1) 7,456 g of potassium chloride, previously dried for 24 h at 220 °C ± 10 °C, and dilute to 1 000 ml at 25 °C. The specific electrical conductivity of this solution is 1 290 mS/m at 25 °C.

6.3 Potassium chloride solution, *c*(KCl) = 0,02 mol/l.

Add 200,0 ml of the potassium chloride solution (6.2) to a 1 000 ml volumetric flask and dilute to volume with water (6.1) at 25 °C. The specific electrical conductivity of this solution is 277 mS/m at 25 °C.

6.4 Potassium chloride solution, *c*(KCl) = 0,01 mol/l.

Add 100,0 ml of the potassium chloride solution (6.2) to a 1 000 ml volumetric flask and dilute to volume with water (6.1) at 25 °C. The specific electrical conductivity of this solution is 141 mS/m at 25 °C.

All the potassium chloride solutions used for calibration shall be stored in tightly sealed bottles which do not release alkali or alkali-earth metals in amounts that would compromise the specific electrical conductivity of the solutions.

NOTE For example, Polyethylene (PE) bottles can be used for storage. Conductivity standards are also available commercially.

7 Apparatus

7.1 Conductivity metre, fitted with a conductivity cell, equipped with an adjustable measuring range setting, an automatic temperature correction and having an accuracy of 1 mS/m at 20 °C. The conductivity metre should also be equipped with a cell-constant control.

7.2 Precision balance, with an accuracy of at least 1 mg.

7.3 Thermometer, capable of measuring to the nearest 0,1 °C.

7.4 Shaking device, with a horizontal movement to produce and maintain 1:5 substrate-water suspensions.

It should be placed in a room with stable temperature.

7.5 Filter paper, middle coarse of analytical grade.

7.6 Shaking bottles, of sufficient capacity, made of polyethylene (PE) with tightly fitting cap.

8 Procedure

8.1 Pretreatment

Pretreat the sample according to EN 16179 if not otherwise specified.

Air-drying can be used for all soils, except for those containing sulfidic minerals or volatile acids. In both cases, fresh soil should be used to avoid either sulfide oxidation resulting in the formation of sulfuric acid, or volatilisation of low-molecular organic acids. Regarding sludge and treated biowaste, fresh samples are

recommended. In these materials, air-drying may introduce artefacts due to a stimulation of oxidation processes and should therefore be avoided.

8.2 Extraction

The extraction procedure shall be performed at a stable temperature of (20 ± 2) °C. Weigh 20,00 g of the laboratory sample (sludge or soil) and transfer to a shaking bottle (7.6). Add 100 ml of water (6.1) at a temperature of (20 ± 2) °C. For treated biowaste, the weight may be increased from 20,00 g for heterogeneous samples as long as the ratio of sample:water is also 1:5 (m/V).

Close the bottle and place it in a horizontal position in the shaking device. Shake for 30 min. Filter directly through a filter paper (7.5).

Extraction is not applicable to liquid sludge. Measurements shall be made directly in the original sludge suspension.

For samples that absorb all the water in a 1:5 (m/V) extract ratio, a larger ratio (e.g. 1:10 (m/V)) should be used and this shall be stated in the test report.

8.3 Calibration

Measure the electrical conductivity of the potassium chloride solutions (6.2, 6.3 and 6.4) according to the instruction manual of the instrument.

Calculate for each potassium chloride solution, a cell constant according to Formula (1):

$$K = EC_S / EC_M \quad (1)$$

where

K is the cell constant in reciprocal metres (m^{-1});

EC_S is the specific electrical conductivity of one of the potassium chloride solutions in millisiemens per metre (mS/m), according to its concentration (see Clause 6);

EC_M is the measured specific electrical conductivity of the same potassium chloride solution, in millisiemens per metre (mS/m).

Use the average of the calculated values as the cell constant of the instrument. The calculated cell constant should not differ more than 5 % from the value given by the manufacturer.

Adjust the cell constant on the conductivity metre (7.1).

8.4 Measurement of the electrical conductivity

Measure the specific electrical conductivity of the filtrates using the conductivity metre (7.1) according to the manufacturer's instructions. Carry out the measurements at stable room temperature and correct the results to 25 °C.

9 Expression of results

Record the results with an accuracy of one decimal place, expressed in mS/m.