SVENSK STANDARD
SS-EN ISO 16072:2011

Fastställd/Approved: 2011-07-20
Publicerad/Published: 2011-09-28
Utgåva/Edition: 1
Språk/Language: engelska/English
ICS: 13.080.30

Markundersökningar – Laboratoriemetod för bestämning av mikrobiell markrespiration (ISO 16072:2002)

Soil quality – Laboratory methods for determination of microbial soil respiration (ISO 16072:2002)

Standarder får världen att fungera

SIS (Swedish Standards Institute) är en fristående ideell förening med medlemmar från både privat och offentlig sektor. Vi är en del av det europeiska och globala nätverk som utarbetar internationella standarder. Standarder är dokumenterad kunskap utvecklad av framstående aktörer inom industri, näringsliv och samhälle och befrämjar handel över gränser, bidrar till att processer och produkter blir säkrare samt effektiviserar din verksamhet.

Delta och påverka
Som medlem i SIS har du möjlighet att påverka framtida standarder inom ditt område på nationell, europeisk och global nivå. Du får samtidigt tillgång till tidig information om utvecklingen inom din bransch.

Ta del av det färdiga arbetet
Vi erbjuder våra kunder allt som rör standarder och deras tillämpning. Hos oss kan du köpa alla publikationer du behöver – allt från enskilda standarder, tekniska rapporter och standard-paket till handböcker och onlinetjänster. Genom vår webbtjänst e-nav får du tillgång till ett lättnavigerat bibliotek där alla standarder som är aktuella för ditt företag finns tillgängliga. Standarder och handböcker är källor till kunskap. Vi säljer dem.

Utveckla din kompetens och lyckas bättre i ditt arbete
Hos SIS kan du gå öppna eller företagsinterna utbildningar kring innehåll och tillämpning av standarder. Genom vår närhet till den internationella utvecklingen och ISO får du rätt kunskap i rätt tid, direkt från källan. Med vår kunskap om standarders möjligheter hjälper vi våra kunder att skapa verklig nytta och lönsamhet i sina verksamheter.

Vill du veta mer om SIS eller hur standarder kan effektivisera din verksamhet är du välkommen in på www.sis.se eller ta kontakt med oss på tel 08-555 523 00.

Standards make the world go round

SIS (Swedish Standards Institute) is an independent non-profit organisation with members from both the private and public sectors. We are part of the European and global network that draws up international standards. Standards consist of documented knowledge developed by prominent actors within the industry, business world and society. They promote cross-border trade, they help to make processes and products safer and they streamline your organisation.

Take part and have influence
As a member of SIS you will have the possibility to participate in standardization activities on national, European and global level. The membership in SIS will give you the opportunity to influence future standards and gain access to early stage information about developments within your field.

Get to know the finished work
We offer our customers everything in connection with standards and their application. You can purchase all the publications you need from us - everything from individual standards, technical reports and standard packages through to manuals and online services. Our web service e-nav gives you access to an easy-to-navigate library where all standards that are relevant to your company are available. Standards and manuals are sources of knowledge. We sell them.

Increase understanding and improve perception
With SIS you can undergo either shared or in-house training in the content and application of standards. Thanks to our proximity to international development and ISO you receive the right knowledge at the right time, direct from the source. With our knowledge about the potential of standards, we assist our customers in creating tangible benefit and profitability in their organisations.

If you want to know more about SIS, or how standards can streamline your organisation, please visit www.sis.se or contact us on phone +46 (0)8-555 523 00

Europastandarden EN ISO 16072:2011 gäller som svensk standard. Detta dokument innehåller den officiella engelska versionen av EN ISO 16072:2011.

Denna standard ersätter SS-ISO 16072, utgåva 1.

The European Standard EN ISO 16072:2011 has the status of a Swedish Standard. This document contains the official version of EN ISO 16072:2011.

This standard supersedes the Swedish Standard SS-ISO 16072, edition 1.

Upplysningar om sakinnehållet i standarden lämnas av SIS, Swedish Standards Institute, telefon 08-555 520 00. Standarder kan beställas hos SIS Förlag AB som även lämnar allmänna upplysningar om svensk och utländsk standard.

Information about the content of the standard is available from the Swedish Standards Institute (SIS), telephone +46 8 555 520 00. Standards may be ordered from SIS Förlag AB, who can also provide general information about Swedish and foreign standards.

Denna standard är framtagen av kommittén för Karaktärisering av avfall, mark och slam, SIS/TK 535.

Har du synpunkter på innehållet i den här standarden, vill du delta i ett kommande revideringsarbete eller vara med och ta fram andra standarder inom området? Gå in på www.sis.se - där hittar du mer information.

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN ISO 16072

June 2011

ICS 13.080.30

English Version

Soil quality - Laboratory methods for determination of microbial soil respiration (ISO 16072:2002)

Qualité du sol - Méthodes de laboratoire pour la détermination de la respiration microbienne du sol (ISO 16072:2002)

Bodenbeschaffenheit - Laborverfahren zur Bestimmung der mikrobiellen Bodenatmung (ISO 16072:2002)

This European Standard was approved by CEN on 10 June 2011.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

CEN members are the national standards bodies of 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, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom.

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

Management Centre: Avenue Marnix 17, B-1000 Brussels

Ref. No. EN ISO 16072:2011: E

Contents

Page

Foreword

The text of ISO 16072:2002 has been prepared by Technical Committee ISO/TC 190 “Soil quality” of the International Organization for Standardization (ISO) and has been taken over as EN ISO 16072:2011 by Technical Committee CEN/TC 345 “Characterization of soils” 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 December 2011, and conflicting national standards shall be withdrawn at the latest by December 2011.

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.

According to the CEN/CENELEC Internal Regulations, the national standards organizations 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, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and the United Kingdom.

Endorsement notice

The text of ISO 16072:2002 has been approved by CEN as a EN ISO 16072:2011 without any modification.

Introduction

This International Standard is derived from the German standard DIN 19737 (see [1]). It describes methods for the determination of microbial soil respiration in the laboratory.

Microbial soil respiration results from the mineralization of organic substances. In this process, organic substances are oxidized to the end products carbon dioxide and water, with concurrent uptake of O_2 for aerobic microorganisms. The soil respiration is measured by the determination of O_2 consumption and/or by CO_2 release. Respiration is a measure of the overall activity of soil microorganisms.

Soil quality — Laboratory methods for determination of microbial soil respiration

1 Scope

This International Standard describes methods for the determination of soil microbial respiration of aerobic, unsaturated soils. The methods are suitable for the determination of O_2 uptake or CO_2 release, either after addition of a substrate (substrate-induced respiration), or without substrate addition (basal respiration).

This International Standard is applicable to the measurement of soil respiration in order to:

— determine the microbial activity in soil (see [3]);

— establish the effect of additives (nutrients, pollutants, soil improvers, etc.) on the metabolic performance of microorganisms;

— determine the microbial biomass (see [4]);

— determine the metabolic quotient qCO_2.

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.

ISO 10381-6:1993, *Soil quality — Sampling — Guidance on the collection, handling and storage of soil for the assessment of aerobic microbial processes in the laboratory*

ISO 11274:1998, *Soil quality — Determination of the water-retention characteristic — Laboratory methods*

ISO 11465:1993, *Soil quality — Determination of dry matter and water content on a mass basis — Gravimetric method*

3 Terms and definitions

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

3.1
basal respiration
microbial soil respiration without addition of nutrients

3.2
substrate-induced respiration
SIR
microbial soil respiration after addition of nutrients

NOTE Glucose is an example of an added nutrient.

3.3
microbial activity
metabolic performance of microorganisms

NOTE It can be measured, for example, as O_2 uptake or CO_2 release.

3.4
metabolic quotient
qCO_2
specific metabolic activity of soil microorganisms, which can be calculated as the quotient basal respiration: microbial biomass

NOTE Metabolic quotient is usually expressed as milligrams of CO_2 carbon released per hour per gram of microbial biomass carbon.

3.5
rate of CO_2 formation [O_2 consumption]
R_{CO_2} [R_{O_2}]
amount of CO_2 released [O_2 consumed] per time unit from a mass unit of soil

NOTE 1 Soil respiration is usually measured as the rate of CO_2 formation or O_2 consumption.

NOTE 2 It is usually expressed as milligrams CO_2 [or O_2] per gram per hour (mg CO_2 [or O_2]·g^{-1}·h^{-1}).

3.6
microbial biomass
mass of intact microbial cells in a given soil

NOTE This is usually estimated from the measurement of carbon or nitrogen content of these cells.

4 Procedure

4.1 General conditions

4.1.1 Soil sampling and storage

Sample, store and pre-incubate soils in accordance with ISO 10381-6, independently of the choice of the procedure and the respiration parameter to be measured (basal respiration, SIR).

4.1.2 Measuring and incubation conditions

Soil respiration is strongly influenced by water content and temperature. Therefore these parameters should be recorded in the final report. At suction pressures > 0,03 MPa, the soil respiration will decrease considerably. The water content of the test soil is optimal when it corresponds with a pore water pressure of – 0,01 MPa to – 0,03 MPa (measured with an accuracy of 5 %, in accordance with ISO 11274) or 40 % to 60 % of the maximum water-holding capacity, respectively. A stable temperature should be used. Incubation temperatures between 20 °C and 30 °C are generally recommended, but other temperatures may be used if required. In the description of the methods, examples of incubation temperatures are given as well as the accuracy of temperature maintenance and measurement.

If a method is used for the determination of soil microbial biomass, a temperature of 22 °C is recommended because biomass calculations have been calibrated to this temperature.

When soil samples are compared with respect to soil respiration, they should have the same moisture status (pore water pressure or percentage of maximum water-holding capacity).

4.2 Choice of the measuring system

Each measurement method has its own advantages and disadvantages. Care is needed, because the results obtained by O_2 uptake and by CO_2 release are not strictly compatible. It is the responsibility of the investigator to decide which of these methods is to be used.

One of the systems described in Clause 5 should be used.

Systems for measuring CO_2 do not distinguish between CO_2 released from microbial activities and CO_2 resulting from abiotic processes. For alkaline soils and soils with a high organic matter content, which can release considerable amounts of abiotically released CO_2, methods using O_2 uptake are recommended.

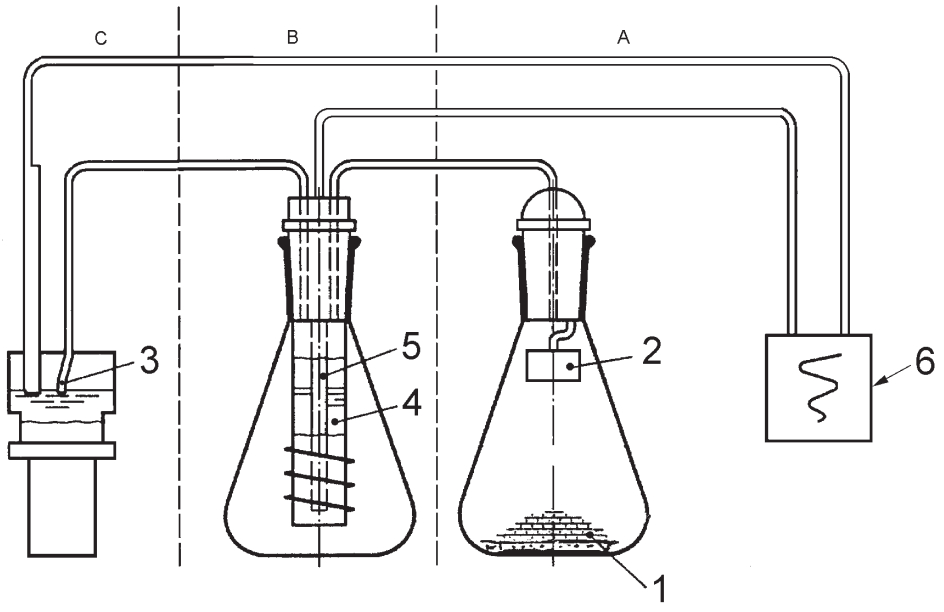
NOTE The advantages and disadvantages are described in the individual descriptions of the methods.

5 Measuring systems

5.1 Determination of O_2 consumption by static incubation in a pressure-compensation system

5.1.1 Principle

The determination is based on the measurement of O_2 consumption during incubation of a soil sample in a closed system. The O_2 in the system is replenished electrochemically. The CO_2 released is absorbed by calcium hydroxide [$Ca(OH)_2$].



Key

A	reaction vessel	1	soil sample	4	electrolyte
B	oxygen generator	2	CO_2 absorbent	5	electrodes
C	pressure indicator	3	pressure cell	6	recorder with display

Figure 1 — Determination of O_2 consumption (showing connection of a measuring unit)

5.1.2 Apparatus

A detailed description of the apparatus can be found in [4]; the essential features are as follows.