INTERNATIONAL STANDARD

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Soil quality — Sampling —

Part 6:
Guidance on the collection, handling and storage of soil for the assessment of aerobic microbial processes in the laboratory

Qualité du sol — Échantillonnage —

Partie 6: Lignes directrices pour la collecte, la manipulation et la conservation de sols destinés à une étude en laboratoire des processus microbiens aérobies

Reference number
ISO 10381-6:1993(E)

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

International Standard ISO 10381-6 was prepared by Technical Committee ISO/TC 190, *Soil quality*, Sub-Committee SC 2, *Sampling*.

ISO 10381 consists of the following parts, under the general title *Soil quality — Sampling*:

— *Part 1: Guidance on the design of sampling programmes*

— *Part 2: Guidance on sampling techniques*

— *Part 3: Guidance on safety of sampling*

— *Part 4: Guidance on the investigation of natural and cultivated soils*

— *Part 5: Guidance on the investigation on soil contamination of urban and industrial sites*

— *Part 6: Guidance on the collection, handling and storage of soil for the assessment of aerobic microbial processes in the laboratory*

Annex A of this part of ISO 10381 is for information only.

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Introduction

Soils are both complex and heterogenous because they consist of both living and non-living components occuring in different combinations. Therefore, the condition of the soil, from collection to completion of an experiment, should be considered in relation to effects on the soil microflora. Temperature, water content, availability of oxygen and duration of storage are all known to affect the soil microflora, and thus the processes they mediate.

Soils can, however, be used effectively in laboratory systems to investigate microbially-mediated processes, provided that the dynamics of the living microflora are appreciated. This part of ISO 10381 provides guidance on the collection, handling and storage of soil for laboratory use where aerobic microbial activity is the main component of the study. It describes how to minimize the effects of differences in temperature, water content and availability of oxygen on aerobic processes to facilitate reproducible laboratory determinations. [Anderson (1987) [1], Bartha and Pramer (1965) [2]].

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Soil quality — Sampling —

Part 6:
Guidance on the collection, handling and storage of soil for the assessment of aerobic microbial processes in the laboratory

1 Scope

This part of ISO 10381 provides guidance on the collection, handling and storage of soil for subsequent testing under aerobic conditions in the laboratory.

These recommendations are not applicable to the handling of soil where anaerobic conditions are to be maintained throughout.

2 Normative reference

The following standard contains provisions which, through reference in this text, constitute provisions of this part of ISO 10381. At the time of publication, the edition indicated was valid. All standards are subject to revision, and parties to agreements based on this part of ISO 10381 are encouraged to investigate the possibility of applying the most recent edition of the standard indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 11461:—[1], *Soil quality — Determination of soil water content calculated on a volume basis — Gravimetric method.*

3 Definitions

For the purposes of this part of ISO 10381, the following definitions apply.

3.1 aerobic: Descriptive of a condition in which molecular oxygen is freely available.

3.2 anaerobic: Descriptive of a condition in which molecular oxygen is not available.

3.3 soil water content: The mass of water per unit mass of oven-dried (105 °C) soil.

4 Procedure

4.1 Selection of sampling locations

The locations of the sites from which samples are taken should be selected according to the purpose of the study.

These locations should be identified and recorded, for example on a map by reference to easily recognizable static objects or using a detailed map reference. If practicable, the locations should be marked so that they may be used for comparative tests or for obtaining replicate samples.

4.2 Description of field site

Selection of a soil sampling site will depend on the purpose of a particular study, and knowledge of the field site history is always desirable. The site should be accurately described and its history given. Details of vegetation cover, and of chemical and biological additions or accidental contamination, should be recorded and reported.

1) To be published.

4.3 Sampling conditions

Soil required for studies conducted under laboratory conditions should, if practicable, be sampled in the field with a soil water content which facilitates sieving. Sampling should be avoided during or immediately following long periods (> 30 d) of drought, freezing or flooding. If laboratory tests are to be used for field monitoring, conditions existing in the field should be accepted.

4.4 Sampling methods

The sampling technique will depend on the purpose of the study. If aerobic agricultural soil is required, sampling will usually be conducted at a maximum depth of 20 cm. Any surface vegetation cover, moss-covered litter layer, visible roots, large pieces of plant or woody plant litter and soil fauna should be removed to minimize the addition of fresh organic carbon to the soil. Organic constituents introduced from roots or other sources can cause unpredictable changes in the activities and composition of the soil microflora. If natural soils show distinct horizons, samples should be taken from these horizons.

4.5 Sample marking

Sample containers should be clearly and unambiguously marked and identified so that each sample can be related to the location from which it was taken. Use of containers which either absorb water from the soil or release materials, e.g. solvents or plasticizers, into the soil should be avoided.

4.6 Transportation conditions

Samples should be transported in a manner which minimizes changes in the soil water content, and should be kept in the dark with free access of air. A loosely-tied polyethylene bag is generally adequate for this purpose. Extreme environmental conditions should be avoided: the soil should be kept as cool as possible but it is essential that it is not allowed to freeze, dry out or become water-logged. Exposure to light for extended periods should be avoided as this encourages the growth of algae on the surface of the soil. Physical compaction should be avoided as far as is practicable.

4.7 Soil processing

The soil should be processed as soon as possible after sampling. Vegetation, larger soil fauna and stones should be removed prior to passing the soil through a 2 mm sieve. Sieving soil through a 2 mm sieve facilitates gaseous exchange between particles and is therefore recommended for maintaining the aerobic nature of the soil. It also removes small stones, fauna and plant debris. Some organic materials such as mor layers or peat will not pass easily through a 2 mm sieve and should be sieved in the moist condition through a 5 mm sieve. This necessitates manual operation and the quality of the material passing the sieve depends on the operator. If the soil is too wet to sieve, it should be spread out, in a gentle air stream where possible, to facilitate uniform drying. The soil should be finger crumbled and turned over frequently to avoid excessive surface drying. Normally this should be performed at ambient temperature. If drying is required, the soil should not be dried more than is necessary to facilitate sieving. If further storage is necessary following processing, consideration should be given to the parameters discussed in 4.8 and 4.9.

4.8 Storage conditions

Samples should be stored in the dark at 4 °C ± 2 °C with free access of air. A loosely tied plastic bag or equivalent is generally adequate for this purpose. Care should be taken to ensure that the soil is not stored in quantities which will allow anaerobic conditions to occur in the bottom of storage containers. The soil should be processed (see 4.7) before storage in order to ensure stable aerobic conditions. It is essential that the soil is not allowed to freeze, dry out or become water-logged during storage. Samples should not be stored on top of one another.

4.9 Storage period

It is preferable to use soils as soon as possible after sampling. Any delays due to transportation should be minimized. If storage is unavoidable, this should not exceed 3 months unless evidence showing continued microbial activity is provided. The active soil microflora decrease with increasing storage time, even at low temperatures, and the rate of decrease depends on the composition of the soil and the microflora.

4.10 Pre-incubation

Before the processed soil is used for a specific laboratory test, it should be pre-incubated to allow germination and removal of seeds, and to re-establish an equilibrium of microbial metabolism following the change from sampling or storage conditions to incubation conditions. Pre-incubation conditions will depend on the purpose of the study but should approach test conditions as far as is practicable. The period of pre-incubation will depend on the purpose of the study, the soil composition and the storage/pre-incubation conditions. Between 2 d and 28 d is generally adequate.

5 Test report

The detailed sampling report will depend on the sampling objectives but, in general, the following data should be reported:

a) a reference to this part of ISO 10381;

b) location of the site (sufficiently precise for another person to find it without further guidance);

c) a comprehensive description of the relevant details and features of the site;

d) history of the site, including previous use and any known accidental or intentional chemical or biological additions;

e) the date and time of sample collection;

f) the weather conditions at the time or immediately prior to sampling, including air temperature, rainfall, sunshine, cloud, etc.;

g) the precise location from which the sample was taken;

h) the type of device used to take the sample;

i) whether or not the sample needed drying before sieving;

j) any other factor that might influence the results of subsequent testing.

Annex A
(informative)

Bibliography

[1] ANDERSON, J.P.E., Handling and Storage of Soils for Pesticide Experiments, *Pesticide Effects and Soil Microflora* (1987) (Sommerville, L. and Greaves, M.P. eds.), pp. 45-60, Taylor and Francis.

[2] BARTHA, R. and PRAMER, D., Features of a flask and method for measuring the persistence and biological effects of pesticides in soil (1965), *Soil Science* **100**, pp. 68-70.

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