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**Soil quality — Gas chromatographic  
determination of volatile aromatic and  
halogenated hydrocarbons and selected  
ethers — Static headspace method**

*Qualité du sol — Dosage des hydrocarbures aromatiques et halogénés  
volatils et de certains éthers par chromatographie en phase gazeuse —  
Méthode par espace de tête statique*



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## Contents

Page

Foreword .....	iv
<b>1 Scope .....</b>	<b>1</b>
<b>2 Normative references .....</b>	<b>1</b>
<b>3 Principle .....</b>	<b>2</b>
<b>4 Reagents .....</b>	<b>2</b>
<b>5 Apparatus .....</b>	<b>5</b>
<b>6 Sampling, preservation and sample pretreatment .....</b>	<b>6</b>
6.1 General .....	6
6.2 Sampling using vials prefilled with methanol .....	6
6.3 Sampling using coring tube method .....	7
<b>7 Procedure .....</b>	<b>7</b>
7.1 Blank determination .....	7
7.2 Extraction .....	7
7.3 Headspace analysis .....	7
7.4 Gas chromatographic analysis .....	8
<b>8 Calculation .....</b>	<b>10</b>
8.1 Calculation of the concentration of a volatile compound in the water sample .....	10
8.2 Calculation of the concentration of a volatile compound in the soil sample .....	11
<b>9 Expression of results .....</b>	<b>11</b>
<b>10 Precision .....</b>	<b>11</b>
<b>11 Test report .....</b>	<b>11</b>
<b>Annex A (informative) Relative retention times with respect to ethylbenzene-D10 of volatile aromatic hydrocarbons and volatile halogenated hydrocarbons .....</b>	<b>12</b>
<b>Annex B (normative) Check on internal standards .....</b>	<b>14</b>
<b>Annex C (informative) Validation (general) .....</b>	<b>15</b>
<b>Annex D (informative) Validation for the pathway soil/human .....</b>	<b>18</b>
<b>Bibliography .....</b>	<b>21</b>

## 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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. 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.

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

ISO 22155 was prepared by Technical Committee ISO/TC 190, *Soil quality*, Subcommittee SC 3, *Chemical methods and soil characteristics*.

This second edition cancels and replaces the first edition (ISO 22155:2005), which has been technically revised.

# Soil quality — Gas chromatographic determination of volatile aromatic and halogenated hydrocarbons and selected ethers — Static headspace method

## 1 Scope

This International Standard specifies a static headspace method for quantitative gas chromatographic determination of volatile aromatic and halogenated hydrocarbons and selected aliphatic ethers in soil.

This International Standard is applicable to all types of soil.

The limit of determination is dependent on the detection system used and the quality of the methanol grade used for the extraction of the soil sample.

Under the conditions specified in this International Standard, the following limits of determination apply (expressed on the basis of dry matter):

Typical limit of determination when using gas chromatography/flame ionization detection (GC/FID):

- volatile aromatic hydrocarbons: 0,2 mg/kg;
- aliphatic ethers as methyl *tert*-butyl ether (MTBE) and *tert*-amyl methyl ether (TAME): 0,5 mg/kg.

Typical limit of determination when using gas chromatography/electron capture detection (GC/ECD):

- volatile halogenated hydrocarbons: 0,01 mg/kg to 0,2 mg/kg.

Lower limits of determination can be achieved for some compounds by using mass spectrometry (MS) with selected ion detection (see Annex D).

## 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 10381-1:2002, *Soil quality — Sampling — Part 1: Guidance on the design of sampling programmes*

ISO 10381-2, *Soil quality — Sampling — Part 2: Guidance on sampling techniques*

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

ISO 15680, *Water quality — Gas-chromatographic determination of a number of monocyclic aromatic hydrocarbons, naphthalene and several chlorinated compounds using purge-and-trap and thermal desorption*

ISO 18512, *Soil quality — Guidance on long and short term storage of soil samples*

ISO 22892, *Soil quality — Guidelines for the identification of target compounds by gas chromatography and mass spectrometry*

### 3 Principle

Test samples are taken from an untreated field-moist soil sample. To prevent losses of the volatiles, samples are taken in as undisturbed a way as possible in the field with a tube corer or by adding methanol immediately in the field.

The test sample is extracted with methanol. An aliquot of the methanol extract is transferred into a headspace vial with a defined amount of water and sealed. The temperature of the vials is stabilized in a thermostatic system to a temperature within the range 50 °C to 80 °C to achieve specified equilibrium conditions. Gas chromatographic analysis of the volatile compounds in gaseous phase in equilibrium with the water in the vials is carried out by using headspace injection and an appropriate capillary column. Volatile organic compounds are detected with appropriate detectors, such as a mass spectrometry detector (MS), flame ionization detector (FID), electron capture detector (ECD), photo ionization detector (PID) or electrolytic conductivity detector (ELCD).

Identification and quantification are made by comparison of retention times and peak heights (or peak areas), comparing to the internal standard added.

When using non-specific detectors, such as FID and ECD, the confirmation of the identity of the detected compounds and their concentrations should be done by repeating the gas chromatographic analysis using a column of different polarity. When using gas chromatography/mass spectrometry (GC/MS), the identity confirmation and the quantification can be done in a single run.

### 4 Reagents

All reagents shall be of recognized analytical grade. Verify whether the reagents are applicable for this specific purpose and free of interfering compounds.

**4.1 Water**, free of volatile organic contaminants, showing negligible interferences in comparison with the smallest concentration to be determined. A sufficient amount of water from the same batch should be available to complete each batch of analyses, including all preparations.

#### 4.2 Internal standard compounds

**4.2.1** For the determination of volatile aromatic hydrocarbons, preferably two internal standards shall be selected. They shall not interfere with compounds present in the methanol extract.

Examples of suitable internal standards are:

- toluene-D8 (CAS-RN<sup>1)</sup> 2037-26-5);
- ethylbenzene-D10 (CAS-RN 25837-05-2);
- 2-bromofluorobenzene (CAS-RN 1072-85-1).

**4.2.2** For the determination of volatile halogenated hydrocarbons, preferably two internal standards shall be selected. They shall not interfere with compounds present in the methanol extract.

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1) CAS-RN: Chemical Abstracts System Registry Number