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**Soil quality — Dissolution for the  
determination of total element content —**

**Part 2:  
Dissolution by alkaline fusion**

*Qualité du sol — Mise en solution pour la détermination des teneurs  
élémentaires totales —*

*Partie 2: Mise en solution par fusion alcaline*



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## 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 3.

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 part of ISO 14869 may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

International Standard ISO 14869-2 was prepared by Technical Committee ISO/TC 190, *Soil quality*, Subcommittee SC 3, *Chemical methods and soil characteristics*.

ISO 14869 consists of the following parts, under the general title *Soil quality — Dissolution for the determination of total element content*:

- Part 1: *Dissolution with hydrofluoric and perchloric acids*
- Part 2: *Dissolution by alkaline fusion*

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# Soil quality — Dissolution for the determination of total element content —

## Part 2: Dissolution by alkaline fusion

### 1 Scope

This part of ISO 14869 specifies a method for the dissolution of total contents for the following elements in soils:

Na, K, Mg, Ca, Ti, Mn, Fe, Al, Si.

This list is not exhaustive, and other elements are applicable for determination, provided

— they are not lost during the fusion process,

—  $w > (3d \cdot V/m)$

where

$w$  is the mass content of the element, expressed in milligrams per kilogram soil,

$d$  is the detection limit, in milligrams per litre, for the element and analytical method considered,

3 is a conventional factor,

$V$  is the adjusted volume, in litres, of the final solution containing the dissolved sample, and

$m$  is the mass of the test portion, in kilograms,

— the determination is not adversely affected by the high salt concentration in the resultant solution.

The flux proposed in this method is suitable for a wide range of materials, among which soil samples are relatively easy to deal with.

### 2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of ISO 14869. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this part of ISO 14869 are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

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

ISO 11464:1994, *Soil quality — Pretreatment of samples for physico-chemical analyses*

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

### 3 Principle

To avoid reduction of metallic oxides to metals, the dried and ground sample is first ignited at 450 °C and afterwards fused with a mixture of dilithium tetraborate (one part) and lithium metaborate (four parts). While still liquid, the melt is poured quantitatively into dilute nitric acid. The suspension is then stirred until the solid phase dissolves completely.

### 4 Reagents

The reagents used shall meet the purity requirements of the subsequent analysis.

**4.1 Water**, complying with grade 2 of ISO 3696.

**4.2 Dilithium tetraborate**,  $\text{Li}_2\text{B}_4\text{O}_7$ , apparent density when packed = 1.

**4.3 Lithium metaborate**,  $\text{LiBO}_2$ , apparent density when packed = 0,8.

**4.4 Nitric acid**,  $c(\text{HNO}_3) = 15,2 \text{ mol/l}$ ,  $\rho = 1,41 \text{ g/ml}$ .

**4.5 Nitric acid**,  $c(\text{HNO}_3) = 0,5 \text{ mol/l}$ .

Dilute 32 ml of nitric acid (4.4) with water (4.1) to make 1 l of solution.

### 5 Apparatus

**5.1 Grinding mill**, capable of grinding dried soils without contamination by the elements of interest.

**5.2 Drying oven and dessicator**, for the determination of dry matter in accordance with ISO 11465.

**5.3 Analytical balance**, capable of weighing accurately to 0,000 1 g.

**5.4 Furnace**, which can reach a temperature of  $450 \text{ °C} \pm 25 \text{ °C}$  within 1 h.

**5.5 Heating device**, capable of heating the proposed flux above its melting point.

Several devices are allowed:

- inductively heated furnace;
- muffle furnace;
- air-propane Meker burner.

**5.6 Crucible**, of about 30 ml capacity, preferably made of platinum:gold (95:5) alloy or vitreous carbon.

Molten borates wet some metals and their alloys. For this reason, the use of the above type of crucible is strongly recommended. Failure to do so can result in loss of melt, and the possibility of carry-over between subsequent dissolutions.

**5.7 Usual laboratory glassware**, including beakers of 800 ml capacity.

**5.8 Magnetic stirrer**, with polytetrafluoroethylene (PTFE)-coated follower.

### 6 Procedure

Mill a representative portion of the dried sample, prepared in accordance with ISO 11464, as fine as possible in order to obtain a subsample of approximately 20 g. Use a portion of that milled sample to determine the water content in accordance with ISO 11465.