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BSI Standards Publication

Soil quality — Determination of trace elements in aqua regia and nitric acid digests — Graphite furnace atomic absorption spectrometry method (GFAAS)

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National foreword

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The UK participation in its preparation was entrusted to Technical Committee EH/4, Soil quality.

A list of organizations represented on this committee can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

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TECHNICAL SPECIFICATION

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Soil quality — Determination of trace elements in aqua regia and nitric acid digests — Graphite furnace atomic absorption spectrometry method (GFAAS)

Qualité du sol — Détermination des éléments en traces solubles dans l'eau régale et l'acide nitrique — Spectrométrie d'absorption atomique avec four graphite

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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.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: Foreword - Supplementary information

The committee responsible for this document is ISO/TC 190, *Soil quality*, Subcommittee SC 3, *Chemical methods and soil characteristics*.

Introduction

ISO/TS 17073 is based upon CEN/TS 16172 *Sludge, treated biowaste and soil — Determination of elements using graphite furnace atomic absorption spectrometry (GF-AAS)*, which was developed by CEN/TC 400, *Project Committee — Horizontal standards in the fields of sludge, biowaste and soil*.

This Technical Specification is applicable and validated for several types of matrices as indicated in Table 1.

Table 1 — Matrices for which this Technical Specification is applicable and validated

Matrix	Materials used for validation
Sludge	Municipal sludge
Biowaste	Compost
	Fresh compost
Soil	Agricultural soil

TECHNICAL SPECIFICATION ISO/TS 17073:2013(E)

Soil quality — Determination of trace elements in aqua regia and nitric acid digests — Graphite furnace atomic absorption spectrometry method (GFAAS)

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 the determination of trace elements in *aqua regia* or nitric acid digests or other extraction procedures of sludge, treated biowaste and soil using atomic absorption spectrometry with electrothermal atomization in a graphite furnace. The method is applicable for the determination of the following elements:

Arsenic (As), cadmium (Cd), cobalt (Co), lead (Pb), antimony (Sb), thallium (Tl), vanadium (V).

This method may be applied to other elements. The lower working range is approximately 0,01 mg/kg to 0,001 mg/kg, depending on the element to be determined.

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.

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

ISO 11466, *Soil quality — Extraction of trace elements soluble in aqua regia*

ISO 16729, *Soil quality — Digestion of nitric acid soluble fractions of elements*

ISO 16965, *Soil quality — Determination of trace elements using inductively coupled plasma mass spectrometry (ICP-MS)*

3 Principle

Graphite furnace atomic absorption spectrometry (GFAAS) (also known as Electrothermal Atomic Absorption Spectrometry (ETAAS)), discrete sample aliquots are dispensed into a graphite tube (of which there are several types), which can be heated to over 2 500 °C very rapidly and in a controlled manner. By increasing the temperature stepwise, the processes of drying, thermal decomposition of the matrix and thermal dissociation into free atoms occurs. Atomic absorption spectrometry is based on the ability of free atoms to absorb light. A light source emits light specific for a certain element (or elements). When the light beam passes through the atom cloud in the heated graphite furnace, the light is selectively absorbed by atoms of the chosen element(s). The decrease in light intensity is measured with a detector at a specific wavelength. The concentration of an element in the sample is determined by comparing the absorbance of the sample with the absorbance of calibration solutions. The signal-peak produced is, under optimum conditions, sharp and symmetrical, and of narrow half-width. The peak area is for most elements proportional to the concentration of the element in solution. The measurements are made at the wavelengths given in Table 2.