

ICS 13.080.10; 13.030.01

English Version

**Sludge, treated biowaste and soil - Determination of elements  
using graphite furnace atomic absorption spectrometry (GF-  
AAS)**

Boues, bio-déchets traités et sols - Détermination des  
éléments par spectrométrie d'absorption atomique avec  
four en graphite (GF-AAS)

Schlamm, behandelter Bioabfall und Boden - Bestimmung  
von Elementen mittels Graphitrohren-  
Atomabsorptionsspektrometrie (GF-AAS)

This Technical Specification (CEN/TS) was approved by CEN on 16 June 2012 for provisional application.

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## Foreword

This document (CEN/TS 16172:2013) has been prepared by Technical Committee CEN/TC 400 "Project Committee - Horizontal standards in the fields of sludge, biowaste and soil", the secretariat of which is held by DIN.

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.

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive(s).

The preparation of this document by CEN is based on a mandate by the European Commission (Mandate M/330), which assigned the development of standards on sampling and analytical methods for hygienic and biological parameters as well as inorganic and organic determinants, aiming to make these standards applicable to sludge, treated biowaste and soil as far as this is technically feasible.

According to the CEN/CENELEC Internal Regulations, the national standards organisations of the following countries are bound to announce this Technical Specification: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

## Introduction

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

**Table 1 — Matrices for which this Technical Specification is applicable**

<b>Matrix</b>	<b>Materials tested</b>
Sludge	Municipal sludge
Biowaste	Compost Fresh compost
Soil	Agricultural soil

**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 digest solutions of sludge, treated biowaste and soil, using atomic absorption spectrometry with electrothermal atomisation 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 0,1 mg/kg to 0,01 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.

EN 15934, *Sludge, treated biowaste, soil and waste — Calculation of dry matter fraction after determination of dry residue or water content*

EN 16173, *Sludge, treated biowaste and soil — Digestion of nitric acid soluble fractions of elements*

EN 16174, *Sludge, treated biowaste and soil — Digestion of aqua regia soluble fractions of elements*

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

## 3 Principle

In graphite furnace atomic absorption spectrometry (GF-AAS) (also known as electrothermal atomic absorption spectrometry, ET-AAS), 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.