

ICS 13.030.01; 13.080.10

English Version

**Sludge, treated biowaste and soil - Determination of elements  
using inductively coupled plasma optical emission spectrometry  
(ICP-OES)**

Boues, bio-déchets et sols - Détermination des éléments  
en traces par spectrométrie d'émission optique avec  
plasma induit par haute fréquence (ICP-OES)

Schlamm, behandelter Bioabfall und Boden - Bestimmung  
von Elementen mittels optischer Emissionsspektrometrie  
mit induktiv gekoppeltem Plasma (ICP-OES)

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

The period of validity of this CEN/TS is limited initially to three years. After two years the members of CEN will be requested to submit their comments, particularly on the question whether the CEN/TS can be converted into a European Standard.

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## Foreword

This document (CEN/TS 16170:2012) 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.

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 European Standard: 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**

Matrix	Materials tested
Sludge	Municipal sludge
Biowaste	Compost
Soil	Sludge amended soils

**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 a method for the determination of the following elements in *aqua regia*, nitric acid digest solutions of sludge, treated biowaste and soil:

Aluminium (Al), antimony (Sb), arsenic (As), barium (Ba), beryllium (Be), bismuth (Bi), boron (B), cadmium (Cd), calcium (Ca), chromium (Cr), cobalt (Co), copper (Cu), gallium (Ga), indium (In), iron (Fe), lead (Pb), lithium (Li), magnesium (Mg), manganese (Mn), mercury (Hg), molybdenum (Mo), nickel (Ni), phosphorus (P), potassium (K), selenium (Se), silicon (Si), silver (Ag), sodium (Na), strontium (Sr), sulfur (S), thallium (Tl), tin (Sn), titanium (Ti), tungsten (W), uranium (U), vanadium (V), zinc (Zn) and zirconium (Zr).

Table A.1 lists the elements for which this method is applicable along with the recommended wavelength and typical instrumental detection limits for clean matrices.

## 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

Digests of sludge, treated biowaste or soil with nitric acid or *aqua regia* (see EN 16173 and EN 16174) are analysed by inductively coupled plasma optical emission spectrometry (ICP-OES) using sequential or simultaneous optical systems and axial or radial viewing of the plasma.

The instrument measures characteristic emission spectra by optical spectrometry. Analyte species originating in the digest solution are nebulised and the resulting aerosol is transported to the plasma torch. Element-specific emission spectra are produced by a radio-frequency inductively coupled plasma. The spectra are dispersed by a grating spectrometer, and the intensities of the emission lines are monitored by photosensitive devices.

## 4 Interferences

Background correction is required for trace element determination. Background correction is not required in cases of line broadening where a background correction measurement would actually degrade the analytical result. Additional interferences and matrix effects shall be recognised and appropriate corrections made. Tests for their presence are described below.

Spectral interferences are caused by background emission from continuous or recombination phenomena, stray light which causes background increase or overlap of a spectral line from another element, or unresolved overlap of molecular band spectra.