



**International
Standard**

ISO 22036

**Environmental solid matrices —
Determination of elements using
inductively coupled plasma optical
emission spectrometry (ICP-OES)**

*Matrices solides environnementales — Dosage d'éléments par
spectroscopie d'émission optique avec plasma induit par haute
fréquence (ICP-OES)*

**Second edition
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ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Email: copyright@iso.org
Website: www.iso.org

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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 document 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 of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 190, *Soil quality*, Subcommittee SC 3, *Chemical and physical characterization*, in collaboration with the European Committee for Standardization (CEN) Technical Committee CEN/TC 444, *Environmental characterization of solid matrices*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

This second edition cancels and replaces the first edition (ISO 22036:2008), which has been technically revised.

The main changes are as follows:

- the content of ISO 22036:2008 and EN 16170:2017 has been merged;
- the Scope has been widened to include treated biowaste, waste, sludge and sediment;
- the document has been developed parallel with CEN according to the Vienna Agreement;
- applicable digestion and extraction methods have been updated;
- the text has been editorially revised.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

This document is applicable and validated for several types of matrices as indicated in [Table 1](#) (see [Annex A](#) for the results of validation).

Table 1 — Matrices for which this International Standard is applicable and validated

Matrix	Materials used for validation
Sludge	Municipal sludge Industrial sludge Sludge from electronic industry Ink waste sludge Sewage sludge
Biowaste	Compost Composted sludge
Soil	Agricultural soil Sludge amended soils
Waste	City waste incineration fly ash ("oxidised" matrix) City waste incineration bottom ash ("silicate" matrix) Ink waste sludge (organic matrix) Electronic industry sludge ("metallic" matrix) BCR 146R (sewage sludge) BCR 176 (city waste incineration ash)
Sediments	ISE 859 (Sediment from de Bilt / Netherlands)

The choice of calibration method depends on the extractant and can be adapted to the extractant concentration.

Environmental solid matrices — Determination of elements using inductively coupled plasma optical emission spectrometry (ICP-OES)

WARNING — Persons using this document should be familiar with usual laboratory practice. This document 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 document be carried out by suitably trained staff.

1 Scope

This document specifies a method for the determination of the following elements in aqua regia, nitric acid or mixture of hydrochloric (HCl), nitric (HNO₃) and tetrafluoroboric (HBF₄)/hydrofluoric (HF) acid digests of soil, treated biowaste, waste, sludge and sediment:

Aluminium (Al), antimony (Sb), arsenic (As), barium (Ba), beryllium (Be), bismuth (Bi), boron (B), cadmium (Cd), calcium (Ca), cerium (Ce), chromium (Cr), cobalt (Co), copper (Cu), dysprosium (Dy), erbium (Er), europium (Eu), gallium (Ga), gadolinium (Gd), germanium (Ge), gold (Au), hafnium (Hf), holmium (Ho), indium (In), iridium (Ir), iron (Fe), lanthanum (La), lead (Pb), lithium (Li), lutetium (Lu), magnesium (Mg), manganese (Mn), mercury (Hg), molybdenum (Mo), neodymium (Nd), nickel (Ni), palladium (Pd), phosphorus (P), platinum (Pt), potassium (K), praseodymium (Pr), rhodium (Rh), ruthenium (Ru), samarium (Sm), scandium (Sc), selenium (Se), silicon (Si), silver (Ag), sodium (Na), strontium (Sr), sulfur (S), tantalum (Ta), tellurium (Te), terbium (Tb), thallium (Tl), thulium (Tm), thorium (Th), tin (Sn), titanium (Ti), tungsten (W), vanadium (V), yttrium (Y), ytterbium (Yb), zinc (Zn) and zirconium (Zr).

The method is also applicable to other extracts or digests originating from, for example, DTPA extraction, fusion methods or total digestion methods, provided the user has verified the applicability.

The method has been validated for the elements given in [Table A.1](#) (sludge), [Table A.2](#) (compost) and [Table A.3](#) (soil). The method is applicable for other solid matrices and other elements as listed above, provided the user has verified the applicability.

This method is also applicable for the determination of major, minor and trace elements in aqua regia and nitric acid digests and in eluates of construction products (EN 17200^[22]).

NOTE Construction products include e.g. mineral-based products; bituminous products; metals; wood-based products; plastics and rubbers; sealants and adhesives; paints and coatings.

2 Normative references

There are no normative references in this document.

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at <https://www.iso.org/obp>