Water quality - Application of inductively coupled plasma mass spectrometry (ICP-MS) - Part 2: Determination of 62 elements

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EESTI STANDARDI EESSÕNA **NATIONAL FOREWORD**

Käesolev Eesti standard EVS-EN ISO 17294-2:2004 sisaldab Euroopa standardi EN ISO 17294-2:2004 ingliskeelset teksti. Käesolev dokument on jõustatud 21.12.2004 ja selle kohta on avaldatud teade Eesti standardiorganisatsiooni ametlikus väljaandes. Standard on kättesaadav Eesti standardiorganisatsioonist.	This Estonian standard EVS-EN ISO 17294-2:2004 consists of the English text of the European standard EN ISO 17294-2:2004. This document is endorsed on 21.12.2004 with the notification being published in the official publication of the Estonian national standardisation organisation. The standard is available from Estonian standardisation organisation.

Käsitlusala: This part of ISO 17294 specifies a method for the determination of the elements aluminium, antimony, arsenic, barium, beryllium, bismuth, boron, cadmium, caesium, calcium, cerium, chromium, cobalt, copper, dysprosium, erbium, europium, gadolinium, gallium, germanium, gold, hafnium, holmium, indium, iridium, lanthanum, lead, lithium, lutetium, magnesium, manganese, molybdenum, neodymium, nickel, palladium, phosphorus, platinum, potassium, praseodymium, rubidium, rhenium, rhodium, ruthenium, samarium, scandium, selenium, silver, sodium, strontium, terbium, tellurium, thorium, thallium, thulium, tin, tungsten, uranium, vanadium, yttrium, ytterbium, zinc, and zirconium in water [for example drinking water, surface water, groundwater, wastewater and eluates (9.2)].	**Scope:** This part of ISO 17294 specifies a method for the determination of the elements aluminium, antimony, arsenic, barium, beryllium, bismuth, boron, cadmium, caesium, calcium, cerium, chromium, cobalt, copper, dysprosium, erbium, europium, gadolinium, gallium, germanium, gold, hafnium, holmium, indium, iridium, lanthanum, lead, lithium, lutetium, magnesium, manganese, molybdenum, neodymium, nickel, palladium, phosphorus, platinum, potassium, praseodymium, rubidium, rhenium, rhodium, ruthenium, samarium, scandium, selenium, silver, sodium, strontium, terbium, tellurium, thorium, thallium, thulium, tin, tungsten, uranium, vanadium, yttrium, ytterbium, zinc, and zirconium in water [for example drinking water, surface water, groundwater, wastewater and eluates (9.2)].

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Water quality

Application of inductively coupled plasma mass spectrometry (ICP-MS)

Part 2: Determination of 62 elements

(ISO 17294-2 : 2003)

Qualité de l'eau – Application de la spectrométrie de masse avec plasma à couplage inductif (ICP-MS) – Partie 2: Dosage de 62 éléments (ISO 17294-2 : 2003)

Wasserbeschaffenheit – Anwendung der induktiv gekoppelten Plasma-Massenspektrometrie (ICP-MS) – Teil 2: Bestimmung von 62 Elementen (ISO 17294-2 : 2003)

This European Standard was approved by CEN on 2004-09-30.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Management Centre or to any CEN member.

The European Standards exist in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the Management Centre has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Cyprus, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Norway, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden, Switzerland, and the United Kingdom.

CEN

European Committee for Standardization
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Foreword

International Standard

ISO 17294-2 : 2003 Water quality – Application of inductively coupled plasma mass spectrometry (ICP-MS) – Part 2: Determination of 62 elements,

which was prepared by ISO/TC 147 'Water quality' of the International Organization for Standardization, has been adopted by Technical Committee CEN/TC 230 'Water analysis', the Secretariat of which is held by DIN, as a European Standard.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, and conflicting national standards withdrawn, by April 2005 at the latest.

In accordance with the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard:

Austria, Belgium, Cyprus, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Norway, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden, Switzerland, and the United Kingdom.

Endorsement notice

The text of the International Standard ISO 17294-2 : 2003 was approved by CEN as a European Standard without any modification.

NOTE: Normative references to international publications are listed in Annex ZA (normative).

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Introduction

When applying this part of ISO 17294, it is necessary in each case, depending on the range to be tested, to determine if and to what extent additional conditions should be established.

WARNING — Persons using this part of ISO 17294 should be familiar with normal laboratory practice. This part of ISO 17294 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 in accordance with this part of ISO 17294, be carried out by suitably qualified staff.

1 Scope

This part of ISO 17294 specifies a method for the determination of the elements aluminium, antimony, arsenic, barium, beryllium, bismuth, boron, cadmium, caesium, calcium, cerium, chromium, cobalt, copper, dysprosium, erbium, europium, gadolinium, gallium, germanium, gold, hafnium, holmium, indium, iridium, lanthanum, lead, lithium, lutetium, magnesium, manganese, molybdenum, neodymium, nickel, palladium, phosphorus, platinum, potassium, praseodymium, rubidium, rhenium, rhodium, ruthenium, samarium, scandium, selenium, silver, sodium, strontium, terbium, tellurium, thorium, thallium, thulium, tin, tungsten, uranium, vanadium, yttrium, ytterbium, zinc, and zirconium in water [for example drinking water, surface water, groundwater, wastewater and eluates (9.2)].

Taking into account the specific and additionally occurring interferences, these elements can also be determined in digests of water, sludges and sediments (for example digests of water as specified in ISO 15587-1 or ISO 15587-2).

The working range depends on the matrix and the interferences encountered. In drinking water and relatively unpolluted waters, the limit of application is between 0,1 µg/l and 1,0 µg/l for most elements (see Table 1).

The detection limits of most elements are affected by blank contamination and depend predominantly on the laboratory air-handling facilities available.

The lower limit of application is higher in cases where the determination is likely to suffer from interferences (see Clause 5) or in case of memory effects (see 8.2 of ISO 17294-1).

Table 1 — Limits of application for unpolluted water

Element	Isotope often used	Limit of application[a] µg/l
Ag	^{107}Ag	1
	^{109}Ag	1
Al	^{27}Al	5
As	^{75}As	1
Au	^{197}Au	0,5
B	^{10}B	10
	^{11}B	10
Ba	^{137}Ba	3
	^{138}Ba	0,5
Be	^{9}Be	0,5
Bi	^{209}Bi	0,5
Ca	^{43}Ca	100
	^{44}Ca	50
	^{40}Ca	10
Cd	^{111}Cd	0,1
	^{114}Cd	0,5
Ce	^{140}Ce	0,1
Co	^{59}Co	0,2
Cr	^{52}Cr	1
	^{53}Cr	5
Cs	^{133}Cs	0,1
Cu	^{63}Cu	1
	^{65}Cu	2
Dy	^{163}Dy	0,1
Er	^{166}Er	0,1
Eu	^{151}Eu	0,1
	^{153}Eu	0,1
Ga	^{69}Ga	0,3
	^{71}Ga	0,3
Gd	^{157}Gd	0,1
	^{158}Gd	0,1
Ge	^{74}Ge	0,3
Hf	^{178}Hf	0,1
Ho	^{165}Ho	0,1
In	^{115}In	0,1
Ir	^{193}Ir	0,1
K	^{39}K	50
La	^{139}La	0,1
Li	^{6}Li	10
	^{7}Li	1
Lu	^{175}Lu	0,1
Mg	^{24}Mg	1
	^{25}Mg	10
Mn	^{55}Mn	3
Mo	^{95}Mo	0,5
	^{98}Mo	0,3
Na	^{23}Na	10
Nd	^{146}Nd	0,1
Ni	^{58}Ni	1
	^{60}Ni	3
P	^{60}P	5,0
Pb	^{206}Pb[b]	0,2
	^{207}Pb[b]	0,2
	^{208}Pb[b]	0,1
Pd	^{108}Pd	0,5
Pr	^{141}Pr	0,1
Pt	^{195}Pt	0,5
Rb	^{85}Rb	0,1
Re	^{185}Re	0,1
	^{187}Re	0,1
Rh	^{103}Rh	0,1
Ru	^{101}Ru	0,2
	^{102}Ru	0,1
Sb	^{121}Sb	0,2
	^{123}Sb	0,2
Sc	^{45}Sc	5
Se	^{77}Se	10
	^{78}Se	10
	^{82}Se	10
Sm	^{147}Sm	0,1
Sn	^{118}Sn	1
	^{120}Sn	1
Sr	^{86}Sr	0,5
	^{88}Sr	0,3
Tb	^{159}Tb	0,1
Te	^{126}Te	2
Th	^{232}Th	0,1
Tl	^{203}Tl	0,2
	^{205}Tl	0,1
Tm	^{169}Tm	0,1
U	^{238}U	0,1
V	^{51}V	1
W	^{182}W	0,3
	^{184}W	0,3
Y	^{89}Y	0,1
Yb	^{172}Yb	0,2
	^{174}Yb	0,2
Zn	^{64}Zn	1
	^{66}Zn	2
	^{68}Zn	3
Zr	^{90}Zr	0,2

[a] Depending on the instrumentation significantly lower limits can be achieved.

[b] In order to avoid mistakes due to the different isotope ratios in the environment, the signal intensities of ^{206}Pb, ^{207}Pb and ^{208}Pb shall be added.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

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

ISO 5667-1, *Water quality — Sampling — Part 1: Guidance on the design of sampling programmes*

ISO 5667-2, *Water quality — Sampling — Part 2: Guidance on sampling techniques*

ISO 5667-3, *Water quality — Sampling — Part 3: Guidance on the preservation and handling of water samples*

ISO 8466-1, *Water quality — Calibration and evaluation of analytical methods and estimation of performance characteristics — Part 1: Statistical evaluation of the linear calibration function*

ISO 15587-1, *Water quality — Digestion for the determination of selected elements in water — Part 1: Aqua regia digestion*

ISO 15587-2, *Water quality — Digestion for the determination of selected elements in water — Part 2: Nitric acid digestion*

ISO 17294-1:—[1)], *Water quality — Application of inductively coupled plasma mass spectrometry (ICP-MS) for the determination of elements — Part 1: General guidelines and basic principles*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 17294-1 and the following apply.

3.1
limit of application
lowest concentration of an analyte that can be determined with a defined level of accuracy and precision

4 Principle

Multi-element determination of 62 elements by inductively coupled plasma mass spectrometry (ICP-MS) consists of the following steps:

— introduction of a measuring solution into a radiofrequency plasma (for example by pneumatic nebulization) where energy transfer processes from the plasma cause dissolution, atomization and ionization of elements;

— extraction of the ions from plasma through a differentially pumped vacuum interface with integrated ion optics and separation on the basis of their mass-to-charge ratio by a mass spectrometer (for instance a quadrupole MS);

1) To be published.