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

Part 2:
Determination of 62 elements

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.

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ELINTARVIKKEIDEN
METODIIKKAKOMITEA

NORDIC COMMITTEE ON FOOD ANALYSIS

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METALLIT. MÄÄRITTÄMINEN ELINTARVIKKEISTA ATOMIABSORPTIOSPEKTROME TRISESTI MIKROAALTOUUNISSA TAPAHTUVAN MÄRKÄPOLTON JÄLKEEN

Tämä NMKL-menetelmä on validoitu kollaboratiivisessa tutkimuksessa AOAC International Guidelines for Collaborative Study Procedures to Validate Characteristics of a Method of Analysis -ohjeiden mukaan.

1. TARKOITUS JA SOVELTAMISALA

Tämä menetelmä kuvaa metallien lyijy, kadmium, sinkki, kupari ja rauta kvantitatiivisen määrittämisen erityyppisistä elintarvikkeista lukuunottamatta öljyjä, rasvoja ja erittäin rasvaisia elintarvikkeita. Menetelmässä käytetään atomiabsorptiospektrometria (AAS) mikroaaltouunissa tapahtuvan paineenalaisen hajoituksen jälkeen. Menetelmä on testattu vain kuivilla materiaaleilla, mutta sitä voidaan tietyissä olosuhteissa käyttää näytteille, jotka sisältävät vettä.

2. PERIAATE

Näyte märkäpoltetaan käyttäen typpihappoa ja vetyperoksidia suljetussa astiassa, jota kuumennetaan mikroaalloilla. Näyteliuos laimennetaan vedellä ja metallien pitoisuudet määritetään AAS:lla käyttäen liekki- tai grafiittiuunitekniikkaa.

3. REAGENSSIT

Reagenssien on oltava vähintään pro analysi -laatua, mieluummin suprapur-laatua, tai vastaavaa.

3.1 Vesi, tislattu tai ionivaihdettu (Millipore tai vastaava laatu).

3.2 Typpihappo, väkevä. (65% w/w).

3.2.1 Typpihappo, 0,1 mol/l: Laimenna vedellä 7 ml väkevää typpihappoa 1000 ml:ksi.

METALS. DETERMINATION BY ATOMIC ABSORPTION SPECTRO-PHOTOMETRY AFTER WET DIGESTION IN A MICROWAVE OVEN

This NMKL method has been validated in a collaborative study according to the AOAC International Guidelines for Collaborative Study Procedures to Validate Characteristics of a Method of Analysis

1. SCOPE AND FIELD OF APPLICATION

This method describes quantitative determination of the metals: lead, cadmium, zinc, copper and iron in various types of foods, with the exception of oils, fats and extremely fatty products. The method employs atomic absorption spectrophotometry (AAS) after microwave oven digestion under pressure. The method has been tested on dry materials only, but may under certain conditions be used for samples containing water.

2. PRINCIPLE

The sample is wet digested with nitric acid and hydrogen peroxide in a sealed container heated by microwaves. The sample solution is diluted with water and the concentrations of the metals are determined by flame or graphite furnace AAS.

3. REAGENTS

Reagents should be of at least analytical grade, preferably of suprapur quality, or equivalent.

3.1 Water, redistilled or deionised (Millipore or equivalent quality).

3.2 Nitric acid, Concentrated. (65% w/w).

3.2.1 Nitric acid, 0.1 mol/l: Dilute 7 ml of conc. nitric acid with water to 1000 ml.