

Methoden voor de bepaling van elementen

1 ANALYSEMETHODEN VOOR DE BEPALING VAN ELEMENTEN

Informatie omtrent de conservering en behandeling van watermonsters wordt gegeven in WAC/I/A/010.

Voor de bepaling van de opgeloste fractie van de elementen (inclusief Hg) dient het monster gefiltreerd te worden over een membraanfilter, met een nominale poriëngrootte van 0.45 µm, zo snel mogelijk na monsternamen (te velde)

Opmerking: Indien neerslag wordt gevormd na filtratie en aanzuren van het monster of tijdens transport/bewaring, wordt het monster gedestruëerd conform WAC/III/B/001 of WAC/III/B/002.

Voor de bepaling van de totaalconcentraties van elementen als bedoeld in titel II van het VLAREM wordt een ontsluiting uitgevoerd op een niet gefiltreerd monster conform WAC/III/B/001 of WAC/III/B/002. Indien specifiek het gehalte aan Al incl. Al₂O₃, Ce incl. CeO₂, Ti incl. TiO₂ en/of Sn incl. SnO₂ wordt aangevraagd, wordt de speciale ontsluitingsmethode zoals beschreven in WAC/III/B/002 bijlage E toegepast. Op het analyseverslag dient duidelijk vermeld te worden welke ontsluitingsmethode werd toegepast.

Bij toepassing van de CV-AAS/AFS methode voor de bepaling van Hg kunnen volgende ontsluitingen worden uitgevoerd:

- Ontsluiting met BrCl oplossing bij kamertemperatuur gedurende min. 24 u volgens ISO12846:2012 § 7.4
- Ontsluiting met 2 à 4% BrCl-reagens bij 60°C gedurende 2 uur. Een volledige oxidatie kan worden bepaald door visueel te controleren of een permanente gele kleur overblijft in het monster of door gebruik te maken van een zetmeeljodide indicatorpapier om resterend vrij oxidatiemiddel te testen.¹

Bij de bepaling van de elementen (inclusief Hg) in water, bestemd voor menselijke consumptie, wordt geen filtratie uitgevoerd. Het geconserveerde monster wordt geanalyseerd zonder bijkomende digestie.

Opmerking: Indien neerslag aanwezig is, wordt het monster gedestruëerd conform WAC/III/B/001 of WAC/III/B/002.

De volgende analysemethoden kunnen gebruikt worden voor het bepalen van **elementen** in water.

aluminium

- NBN EN ISO 11885:2009 Water quality — Determination of selected elements by inductively coupled plasma optical emission spectrometry (ICP-OES) (ISO 11885:2007) (WAC/III/B/010)
- NBN EN ISO 17294-1:2006 Water quality – Application of inductively coupled plasma mass spectrometry (ICP-MS) – Part 1: General guidelines (ISO 17294-1:2004)
- **NBN EN ISO 17294-2:2016 Water quality – Application of inductively coupled plasma mass spectrometry (ICP-MS) – Part 2: Determination of**

¹ Method 1631, Revision E: Mercury in Water by Oxidation, Purge and Trap, and Cold Vapor Atomic Fluorescence Spectrometry, August 2002.

	selected elements including uranium isotopes (ISO 17294-2:2016) (WAC/III/B/011) • NBN EN ISO 15586:2003 Water quality – Determination of trace elements using atomic absorption spectrometry with graphite furnace (ISO 15586:2003) • ISO 12020: 1997 Water quality – Determination of aluminium – Atomic absorption spectrometric methods
antimoon	• NBN EN ISO 11885:2009 Water quality — Determination of selected elements by inductively coupled plasma optical emission spectrometry (ICP-OES) (ISO 11885:2007) (WAC/III/B/010) • NBN EN ISO 17294-1:2006 Water quality – Application of inductively coupled plasma mass spectrometry (ICP-MS) – Part 1: General guidelines (ISO 17294-1:2004) • NBN EN ISO 17294-2:2016 Water quality – Application of inductively coupled plasma mass spectrometry (ICP-MS) – Part 2: Determination of selected elements including uranium isotopes (ISO 17294-2:2016) (WAC/III/B/011) • NBN EN ISO 15586:2003 Water quality – Determination of trace elements using atomic absorption spectrometry with graphite furnace (ISO 15586:2003) • ISO 17378-1:2014 Water quality - Determination of arsenic and antimony - Part 1: Method using hydride generation atomic fluorescence spectrometry (HG-AFS) • ISO 17378-2:2014 Water quality - Determination of arsenic and antimony - Part 2: Method using hydride generation atomic absorption spectrometry (HG-AAS) (WAC/III/B/012)
arseen	• NBN EN ISO 11885:2009 Water quality — Determination of selected elements by inductively coupled plasma optical emission spectrometry (ICP-OES) (ISO 11885:2007) (WAC/III/B/010) • NBN EN ISO 17294-1:2006 Water quality – Application of inductively coupled plasma mass spectrometry (ICP-MS) – Part 1: General guidelines (ISO 17294-1:2004) • NBN EN ISO 17294-2:2016 Water quality – Application of inductively coupled plasma mass spectrometry (ICP-MS) – Part 2: Determination of selected elements including uranium isotopes (ISO 17294-2:2016) (WAC/III/B/011) • NBN EN ISO 15586:2003 Water quality – Determination of trace elements using atomic absorption spectrometry with graphite furnace (ISO 15586:2003) • ISO 17378-1:2014 Water quality - Determination of arsenic and antimony - Part 1: Method using hydride generation atomic fluorescence spectrometry (HG-AFS) • ISO 17378-2:2014 Water quality - Determination of arsenic and antimony - Part 2: Method using hydride generation atomic absorption spectrometry (HG-AAS) (WAC/III/B/012) • NEN 6432:1993 Water – Bepaling van het gehalte aan arseen met behulp van atomaire absorptiespectrometrie (hydridegeneratietechniek). Ontsluiting met salpeterzuur en zoutzuur.
barium	• NBN EN ISO 11885:2009 Water quality — Determination of selected elements by inductively coupled plasma optical emission spectrometry (ICP-OES) (ISO 11885:2007) (WAC/III/B/010)

	• NBN EN ISO 17294-1:2006 Water quality – Application of inductively coupled plasma mass spectrometry (ICP-MS) – Part 1: General guidelines (ISO 17294-1:2004) • NBN EN ISO 17294-2:2016 Water quality – Application of inductively coupled plasma mass spectrometry (ICP-MS) – Part 2: Determination of selected elements including uranium isotopes (ISO 17294-2:2016) (WAC/III/B/011)
boor	• NBN EN ISO 11885:2009 Water quality — Determination of selected elements by inductively coupled plasma optical emission spectrometry (ICP-OES) (ISO 11885:2007) (WAC/III/B/010) • NBN EN ISO 17294-1:2006 Water quality – Application of inductively coupled plasma mass spectrometry (ICP-MS) – Part 1: General guidelines (ISO 17294-1:2004) • NBN EN ISO 17294-2:2016 Water quality – Application of inductively coupled plasma mass spectrometry (ICP-MS) – Part 2: Determination of selected elements including uranium isotopes (ISO 17294-2:2016) (WAC/III/B/011)
cadmium	• NBN EN ISO 11885:2009 Water quality — Determination of selected elements by inductively coupled plasma optical emission spectrometry (ICP-OES) (ISO 11885:2007) (WAC/III/B/010) • NBN EN ISO 17294-1:2006 Water quality – Application of inductively coupled plasma mass spectrometry (ICP-MS) – Part 1: General guidelines (ISO 17294-1:2004) • NBN EN ISO 17294-2:2016 Water quality – Application of inductively coupled plasma mass spectrometry (ICP-MS) – Part 2: Determination of selected elements including uranium isotopes (ISO 17294-2:2016) (WAC/III/B/011) • NBN EN ISO 15586:2003 Water quality – Determination of trace elements using atomic absorption spectrometry with graphite furnace (ISO 15586:2003) • ISO 8288: 1986 Water quality – Determination of cobalt, nickel, copper, zinc, cadmium and lead – Flame atomic absorption spectrometric methods • ISO 5961: 1994 Water quality: Determination of cadmium by atomic absorption spectrometry
calcium	• NBN EN ISO 11885:2009 Water quality — Determination of selected elements by inductively coupled plasma optical emission spectrometry (ICP-OES) (ISO 11885:2007) (WAC/III/B/010) • NBN EN ISO 17294-1:2006 Water quality – Application of inductively coupled plasma mass spectrometry (ICP-MS) – Part 1: General guidelines (ISO 17294-1:2004) • NBN EN ISO 17294-2:2016 Water quality – Application of inductively coupled plasma mass spectrometry (ICP-MS) – Part 2: Determination of selected elements including uranium isotopes (ISO 17294-2:2016) (WAC/III/B/011) • NBN EN ISO 14911:1999 Water quality - Determination of dissolved Li⁺, Na⁺, NH₄⁺, K⁺, Mn²⁺, Ca²⁺, Mg²⁺, Sr²⁺ and Ba²⁺ using ion chromatography - Method for water and waste water (ISO 14911:1998)
cerium	• WAC/III/B/010 Bepaling van de geselecteerde elementen met inductief gekoppeld plasma – atomaire emissiespectrometrie

	• NBN EN ISO 17294-1:2006 Water quality – Application of inductively coupled plasma mass spectrometry (ICP-MS) – Part 1: General guidelines (ISO 17294-1:2004) • NBN EN ISO 17294-2:2016 Water quality – Application of inductively coupled plasma mass spectrometry (ICP-MS) – Part 2: Determination of selected elements including uranium isotopes (ISO 17294-2:2016) (WAC/III/B/011)
chrom	• NBN EN ISO 11885:2009 Water quality — Determination of selected elements by inductively coupled plasma optical emission spectrometry (ICP-OES) (ISO 11885:2007) (WAC/III/B/010) • NBN EN ISO 17294-1:2006 Water quality – Application of inductively coupled plasma mass spectrometry (ICP-MS) – Part 1: General guidelines (ISO 17294-1:2004) • NBN EN ISO 17294-2:2016 Water quality – Application of inductively coupled plasma mass spectrometry (ICP-MS) – Part 2: Determination of selected elements including uranium isotopes (ISO 17294-2:2016) (WAC/III/B/011) • NBN EN ISO 15586:2003 Water quality – Determination of trace elements using atomic absorption spectrometry with graphite furnace (ISO 15586:2003) • EN 1233: 1996 Water quality – Determination of chromium – Atomic absorption spectrometric methods
ijzer	• NBN EN ISO 11885:2009 Water quality — Determination of selected elements by inductively coupled plasma optical emission spectrometry (ICP-OES) (ISO 11885:2007) (WAC/III/B/010) • NBN EN ISO 17294-1:2006 Water quality – Application of inductively coupled plasma mass spectrometry (ICP-MS) – Part 1: General guidelines (ISO 17294-1:2004) • NBN EN ISO 17294-2:2016 Water quality – Application of inductively coupled plasma mass spectrometry (ICP-MS) – Part 2: Determination of selected elements including uranium isotopes (ISO 17294-2:2016) (WAC/III/B/011) • NBN EN ISO 15586:2003 Water quality – Determination of trace elements using atomic absorption spectrometry with graphite furnace (ISO 15586:2003)
fosfor	• Zie WAC/III/D in functie van het matrixtype
kalium	• NBN EN ISO 11885:2009 Water quality — Determination of selected elements by inductively coupled plasma optical emission spectrometry (ICP-OES) (ISO 11885:2007) (WAC/III/B/010) • NBN EN ISO 17294-1:2006 Water quality – Application of inductively coupled plasma mass spectrometry (ICP-MS) – Part 1: General guidelines (ISO 17294-1:2004) • NBN EN ISO 17294-2:2016 Water quality – Application of inductively coupled plasma mass spectrometry (ICP-MS) – Part 2: Determination of selected elements including uranium isotopes (ISO 17294-2:2016) (WAC/III/B/011) • NBN EN ISO 14911:1999 Water quality - Determination of dissolved Li⁺, Na⁺, NH₄⁺, K⁺, Mn²⁺, Ca²⁺, Mg²⁺, Sr²⁺ and Ba²⁺ using ion chromatography - Method for water and waste water (ISO 14911:1998)

kobalt	• NBN EN ISO 11885:2009 Water quality — Determination of selected elements by inductively coupled plasma optical emission spectrometry (ICP-OES) (ISO 11885:2007) (WAC/III/B/010) • NBN EN ISO 17294-1:2006 Water quality – Application of inductively coupled plasma mass spectrometry (ICP-MS) – Part 1: General guidelines (ISO 17294-1:2004) • NBN EN ISO 17294-2:2016 Water quality – Application of inductively coupled plasma mass spectrometry (ICP-MS) – Part 2: Determination of selected elements including uranium isotopes (ISO 17294-2:2016) (WAC/III/B/011) • NBN EN ISO 15586:2003 Water quality – Determination of trace elements using atomic absorption spectrometry with graphite furnace (ISO 15586:2003) • ISO 8288: 1986 Water quality – Determination of cobalt, nickel, copper, zinc, cadmium and lead – Flame atomic absorption spectrometric methods
koper	• NBN EN ISO 11885:2009 Water quality — Determination of selected elements by inductively coupled plasma optical emission spectrometry (ICP-OES) (ISO 11885:2007) (WAC/III/B/010) • NBN EN ISO 17294-1:2006 Water quality – Application of inductively coupled plasma mass spectrometry (ICP-MS) – Part 1: General guidelines (ISO 17294-1:2004) • NBN EN ISO 17294-2:2016 Water quality – Application of inductively coupled plasma mass spectrometry (ICP-MS) – Part 2: Determination of selected elements including uranium isotopes (ISO 17294-2:2016) (WAC/III/B/011) • NBN EN ISO 15586:2003 Water quality – Determination of trace elements using atomic absorption spectrometry with graphite furnace (ISO 15586:2003) • ISO 8288: 1986 Water quality – Determination of cobalt, nickel, copper, zinc, cadmium and lead – Flame atomic absorption spectrometric methods
lood	• NBN EN ISO 11885:2009 Water quality — Determination of selected elements by inductively coupled plasma optical emission spectrometry (ICP-OES) (ISO 11885:2007) (WAC/III/B/010) • NBN EN ISO 17294-1:2006 Water quality – Application of inductively coupled plasma mass spectrometry (ICP-MS) – Part 1: General guidelines (ISO 17294-1:2004) • NBN EN ISO 17294-2:2016 Water quality – Application of inductively coupled plasma mass spectrometry (ICP-MS) – Part 2: Determination of selected elements including uranium isotopes (ISO 17294-2:2016) (WAC/III/B/011) • NBN EN ISO 15586:2003 Water quality – Determination of trace elements using atomic absorption spectrometry with graphite furnace (ISO 15586:2003) • ISO 8288: 1986 Water quality – Determination of cobalt, nickel, copper, zinc, cadmium and lead – Flame atomic absorption spectrometric methods
magnesium	• NBN EN ISO 11885:2009 Water quality — Determination of selected elements by inductively coupled plasma optical emission spectrometry (ICP-OES) (ISO 11885:2007) (WAC/III/B/010)

	• NBN EN ISO 17294-1:2006 Water quality – Application of inductively coupled plasma mass spectrometry (ICP-MS) – Part 1: General guidelines (ISO 17294-1:2004) • NBN EN ISO 17294-2:2016 Water quality – Application of inductively coupled plasma mass spectrometry (ICP-MS) – Part 2: Determination of selected elements including uranium isotopes (ISO 17294-2:2016) (WAC/III/B/011) • NBN EN ISO 14911:1999 Water quality - Determination of dissolved Li^+, Na^+, NH_4^+, K^+, Mn^{2+}, Ca^{2+}, Mg^{2+}, Sr^{2+} and Ba^{2+} using ion chromatography - Method for water and waste water (ISO 14911:1998)
mangaan	• NBN EN ISO 11885:2009 Water quality — Determination of selected elements by inductively coupled plasma optical emission spectrometry (ICP-OES) (ISO 11885:2007) (WAC/III/B/010) • NBN EN ISO 17294-1:2006 Water quality – Application of inductively coupled plasma mass spectrometry (ICP-MS) – Part 1: General guidelines (ISO 17294-1:2004) • NBN EN ISO 17294-2:2016 Water quality – Application of inductively coupled plasma mass spectrometry (ICP-MS) – Part 2: Determination of selected elements including uranium isotopes (ISO 17294-2:2016) (WAC/III/B/011) • NBN EN ISO 15586:2003 Water quality – Determination of trace elements using atomic absorption spectrometry with graphite furnace (ISO 15586:2003)
molybdeen	• NBN EN ISO 11885:2009 Water quality — Determination of selected elements by inductively coupled plasma optical emission spectrometry (ICP-OES) (ISO 11885:2007) (WAC/III/B/010) • NBN EN ISO 17294-1:2006 Water quality – Application of inductively coupled plasma mass spectrometry (ICP-MS) – Part 1: General guidelines (ISO 17294-1:2004) • NBN EN ISO 17294-2:2016 Water quality – Application of inductively coupled plasma mass spectrometry (ICP-MS) – Part 2: Determination of selected elements including uranium isotopes (ISO 17294-2:2016) (WAC/III/B/011) • NBN EN ISO 15586:2003 Water quality – Determination of trace elements using atomic absorption spectrometry with graphite furnace (ISO 15586:2003)
natrium	• NBN EN ISO 11885:2009 Water quality — Determination of selected elements by inductively coupled plasma optical emission spectrometry (ICP-OES) (ISO 11885:2007) (WAC/III/B/010) • NBN EN ISO 17294-1:2006 Water quality – Application of inductively coupled plasma mass spectrometry (ICP-MS) – Part 1: General guidelines (ISO 17294-1:2004) • NBN EN ISO 17294-2:2016 Water quality – Application of inductively coupled plasma mass spectrometry (ICP-MS) – Part 2: Determination of selected elements including uranium isotopes (ISO 17294-2:2016) (WAC/III/B/011) • NBN EN ISO 14911:1999 Water quality - Determination of dissolved Li^+, Na^+, NH_4^+, K^+, Mn^{2+}, Ca^{2+}, Mg^{2+}, Sr^{2+} and Ba^{2+} using ion chromatography - Method for water and waste water (ISO 14911:1998)

nikkel	• NBN EN ISO 11885:2009 Water quality — Determination of selected elements by inductively coupled plasma optical emission spectrometry (ICP-OES) (ISO 11885:2007) (WAC/III/B/010) • NBN EN ISO 17294-1:2006 Water quality – Application of inductively coupled plasma mass spectrometry (ICP-MS) – Part 1: General guidelines (ISO 17294-1:2004) • NBN EN ISO 17294-2:2016 Water quality – Application of inductively coupled plasma mass spectrometry (ICP-MS) – Part 2: Determination of selected elements including uranium isotopes (ISO 17294-2:2016) (WAC/III/B/011) • NBN EN ISO 15586:2003 Water quality – Determination of trace elements using atomic absorption spectrometry with graphite furnace (ISO 15586:2003) • ISO 8288: 1986 Water quality – Determination of cobalt, nickel, copper, zinc, cadmium and lead – Flame atomic absorption spectrometric methods
seleen	• NBN EN ISO 11885:2009 Water quality — Determination of selected elements by inductively coupled plasma optical emission spectrometry (ICP-OES) (ISO 11885:2007) (WAC/III/B/010) • NBN EN ISO 17294-1:2006 Water quality – Application of inductively coupled plasma mass spectrometry (ICP-MS) – Part 1: General guidelines (ISO 17294-1:2004) • NBN EN ISO 17294-2:2016 Water quality – Application of inductively coupled plasma mass spectrometry (ICP-MS) – Part 2: Determination of selected elements including uranium isotopes (ISO 17294-2:2016) (WAC/III/B/011) • NBN EN ISO 15586:2003 Water quality – Determination of trace elements using atomic absorption spectrometry with graphite furnace (ISO 15586:2003) • ISO/TS 17379-1:2013 Water quality - Determination of selenium - Part 1: Method using hydride generation atomic fluorescence spectrometry (HG-AFS) • ISO/TS 17379-2:2013 Water quality - Determination of selenium - Part 2: Method using hydride generation atomic absorption spectrometry (HG-AAS) (WAC/III/B/012)
tin	• NBN EN ISO 11885:2009 Water quality — Determination of selected elements by inductively coupled plasma optical emission spectrometry (ICP-OES) (ISO 11885:2007) (WAC/III/B/010) • NBN EN ISO 17294-1:2006 Water quality – Application of inductively coupled plasma mass spectrometry (ICP-MS) – Part 1: General guidelines (ISO 17294-1:2004) • NBN EN ISO 17294-2:2016 Water quality – Application of inductively coupled plasma mass spectrometry (ICP-MS) – Part 2: Determination of selected elements including uranium isotopes (ISO 17294-2:2016) (WAC/III/B/011)
titanium	• NBN EN ISO 11885:2009 Water quality — Determination of selected elements by inductively coupled plasma optical emission spectrometry (ICP-OES) (ISO 11885:2007) (WAC/III/B/010) • NBN EN ISO 17294-1:2006 Water quality – Application of inductively coupled plasma mass spectrometry (ICP-MS) – Part 1: General guidelines (ISO 17294-1:2004)

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zilver	• NBN EN ISO 11885:2009 Water quality — Determination of selected elements by inductively coupled plasma optical emission spectrometry (ICP-OES) (ISO 11885:2007) (WAC/III/B/010) • NBN EN ISO 17294-1:2006 Water quality – Application of inductively coupled plasma mass spectrometry (ICP-MS) – Part 1: General guidelines (ISO 17294-1:2004) • NBN EN ISO 17294-2:2016 Water quality – Application of inductively coupled plasma mass spectrometry (ICP-MS) – Part 2: Determination of selected elements including uranium isotopes (ISO 17294-2:2016) (WAC/III/B/011) • NBN EN ISO 15586:2003 Water quality – Determination of trace elements using atomic absorption spectrometry with graphite furnace (ISO 15586:2003)
zink	• NBN EN ISO 11885:2009 Water quality — Determination of selected elements by inductively coupled plasma optical emission spectrometry (ICP-OES) (ISO 11885:2007) (WAC/III/B/010) • NBN EN ISO 17294-1:2006 Water quality – Application of inductively coupled plasma mass spectrometry (ICP-MS) – Part 1: General guidelines (ISO 17294-1:2004) • NBN EN ISO 17294-2:2016 Water quality – Application of inductively coupled plasma mass spectrometry (ICP-MS) – Part 2: Determination of selected elements including uranium isotopes (ISO 17294-2:2016) (WAC/III/B/011) • NBN EN ISO 15586:2003 Water quality – Determination of trace elements using atomic absorption spectrometry with graphite furnace (ISO 15586:2003) • ISO 8288: 1986 Water quality – Determination of cobalt, nickel, copper, zinc, cadmium and lead – Flame atomic absorption spectrometric methods
kwik	• NBN EN ISO 12846:2012 Water quality : Determination of mercury - Method using atomic absorption spectrometry (AAS) with and without enrichment (ISO 12846:2012) (WAC/III/B/014) • NBN EN ISO 17852:2008 Water quality : Determination of mercury - Method using atomic fluorescence spectrometry (ISO 17852:2006) (WAC/III/B/014) • NBN EN ISO 17294-1:2006 Water quality – Application of inductively coupled plasma mass spectrometry (ICP-MS) – Part 1: General guidelines (ISO 17294-1:2004) • NBN EN ISO 17294-2:2016 Water quality – Application of inductively coupled plasma mass spectrometry (ICP-MS) – Part 2: Determination of selected elements including uranium isotopes (ISO 17294-2:2016) (WAC/III/B/011) • EPA 200.8 Determination of trace elements in waters and wastes by inductively coupled plasma- mass spectrometry.

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