

Methoden voor de bepaling van anionen

INHOUD

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Voor de conservering en behandeling van watermonsters wordt verwezen naar WAC/I/A/010.

1 DRINKWATER

Voor de matrix drinkwater kunnen de verschillende analysemethoden, mits toepassing van de geschikte conservering, rechtstreeks op het monster worden uitgevoerd. Er dient geen voorafgaandelijk destructie/voorbehandeling te worden uitgevoerd.

De volgende analysemethoden kunnen gebruikt worden voor het bepalen van anionen in drinkwater:

Bromaat	<ul style="list-style-type: none"> • ISO 15061:2001 Water quality – Determination of dissolved bromate – Method by liquid chromatography of ions • ISO 11206:2011 Water quality - Determination of dissolved bromate - Method using ion chromatography (IC) and post column reaction (PCR) • EPA Method 321.8: Determination of bromate in drinking waters by Ion Chromatography Inductively Coupled Plasma - Mass Spectrometry
Chloride (a)	<ul style="list-style-type: none"> • ISO 10304-1:2007 Water quality - Determination of dissolved anions by liquid chromatography of ions - Part 1: Determination of bromide, chloride, fluoride, nitrate, nitrite, phosphate and sulfate (WAC/III/C/001) • ISO 10304-4:1997 Water quality - Determination of dissolved anions using liquid chromatography of ions. Part 4: Determination of chlorate, chloride and chlorite in water with low contamination • ISO 9297: 1989 Water quality – Determination of chloride – Silver nitrate titration with chromate indicator (Mohr's method) • EN ISO 15682: 2000 Water quality – Determination of chloride by flow analysis (CFA and FIA) and photometric or potentiometric detection • ISO/DIS 15923-1:2011 Water quality – Determinations of ions by a discrete analysis system and spectrophotometric detection – Part 1: Ammonium, chloride, nitrate, nitrite, orthophosphate, silicate and sulfaat (WAC/III/C/002)
Nitraat	<ul style="list-style-type: none"> • ISO 10304-1:2007 Water quality - Determination of dissolved anions by liquid chromatography of ions - Part 1: Determination of bromide, chloride, fluoride, nitrate, nitrite, phosphate and sulfate (WAC/III/C/001) • EN ISO 13395:1996 Water quality – Determination of nitrite nitrogen and nitrate nitrogen and the sum of both by flow analyses (CFA en FIA) and spectrometric detection (WAC/III/D/031) • ISO 7890-3: 1988 Water quality – Determination of nitrate – Part 3: Spectrometric method using sulfosalicylic acid • ISO/DIS 15923-1:2011 Water quality – Determinations of ions by a discrete analysis system and spectrophotometric detection – Part 1: Ammonium, chloride, nitrate, nitrite, orthophosphate, silicate and sulfaat (WAC/III/C/002)
Nitriet	<ul style="list-style-type: none"> • ISO 10304-1:2007 Water quality - Determination of dissolved anions by liquid chromatography of ions - Part 1: Determination of bromide, chloride, fluoride, nitrate, nitrite, phosphate and sulfate (WAC/III/C/001) • ISO 13395:1996 Water quality – Determination of nitrite nitrogen and nitrate nitrogen and the sum of both by flow analyses (CFA en FIA) and spectrometric detection (WAC/III/D/031) • ISO 6777:1984 Water quality – Determination of nitrite – Molecular absorption spectrometric method

	<ul style="list-style-type: none"> • ISO/DIS 15923-1:2011 Water quality – Determinations of ions by a discrete analysis system and spectrophotometric detection – Part 1: Ammonium, chloride, nitrate, nitrite, orthophosphate, silicate and sulfaat (WAC/III/C/002)
Fluoride (opgelost)	<ul style="list-style-type: none"> • ISO 10304-1: 2007 Water quality - Determination of dissolved anions by liquid chromatography of ions - Part 1: Determination of bromide, chloride, fluoride, nitrate, nitrite, phosphate and sulfate (WAC/III/C/001) • ISO 10359-1:1992 Water quality – Determination of fluoride – Part 1: Electrochemical probe method for potable and light polluted water (WAC/III/C/020)(b) • DIN38405-D4:1985 Bestimmung von Fluorid • WAC/III/C/022 Bepaling van opgelost en totaal anorganisch gebonden fluoride met doorstroomanalyse • NEN 6589:2005 Water - Potentiometrische bepaling van het gehalte aan totaal anorganisch fluoride met doorstroomsystemen (FIA en CFA) • NEN 6578:2011 Water - Potentiometrische bepaling van het totale gehalte aan totaal fluoride
Sulfaat	<ul style="list-style-type: none"> • ISO 10304-1: 2007 Water quality - Determination of dissolved anions by liquid chromatography of ions - Part 1: Determination of bromide, chloride, fluoride, nitrate, nitrite, phosphate and sulfate (WAC/III/C/001) • ISO 22743:2006 Water quality - Determination of sulfates - Method by continuous flow analysis (CFA) • ISO/DIS 15923-1:2011 Water quality – Determinations of ions by a discrete analysis system and spectrophotometric detection – Part 1: Ammonium, chloride, nitrate, nitrite, orthophosphate, silicate and sulfaat (WAC/III/C/002)

- (a) Voor de bepaling van chloride wordt bij toepassing van de titrimetrische methode, de doorstroomanalysemethode en de discrete analyser steeds een totaal halogeen gehalte (chloride, bromide, jodide) bepaald. Ionenchromatografie daarentegen is in staat om selectief chloride te meten.
- (b) Voor de bepaling van fluoride met ion-selectieve elektrode volgens ISO 10359-1 wordt het gebruik van de buffer zoals beschreven in DIN 38405-D4 aanbevolen. De validatiegegevens opgenomen in ISO 10359-1 zijn eveneens bepaald op basis van deze buffer.

2 AFVALWATER

De volgende analysemethoden kunnen gebruikt worden voor het bepalen van anionen in afvalwater:

Chloride (a)	<ul style="list-style-type: none"> • ISO 10304-1:2007 Water quality - Determination of dissolved anions by liquid chromatography of ions - Part 1: Determination of bromide, chloride, fluoride, nitrate, nitrite, phosphate and sulfate (WAC/III/C/001) • ISO 9297: 1989 Water quality – Determination of chloride – Silver nitrate titration with chromate indicator (Mohr’s method) • EN ISO 15682: 2000 Water quality – Determination of chloride by flow analysis (CFA and FIA) and photometric or potentiometric detection • ISO/DIS 15923-1:2011 Water quality – Determinations of ions by a discrete analysis system and spectrophotometric detection – Part 1: Ammonium, chloride, nitrate, nitrite, orthophosphate, silicate and sulfaat (WAC/III/C/002)
Nitraat	<ul style="list-style-type: none"> • ISO 10304-1:2007 Water quality - Determination of dissolved anions by liquid chromatography of ions - Part 1: Determination of bromide, chloride, fluoride, nitrate, nitrite, phosphate and sulfate (WAC/III/C/001) • EN ISO 13395:1996 Water quality – Determination of nitrite nitrogen and nitrate nitrogen and the sum of both by flow analyses (CFA en FIA) and spectrometric detection (WAC/III/D/031) • ISO 7890-3: 1988 Water quality – Determination of nitrate – Part 3: Spectrometric method using sulfosalicylic acid • ISO/DIS 15923-1:2011 Water quality – Determinations of ions by a discrete analysis system and spectrophotometric detection – Part 1: Ammonium, chloride, nitrate, nitrite, orthophosphate, silicate and sulfaat (WAC/III/C/002)
Nitriet	<ul style="list-style-type: none"> • ISO 10304-1:2007 Water quality - Determination of dissolved anions by liquid chromatography of ions - Part 1: Determination of bromide, chloride, fluoride, nitrate, nitrite, phosphate and sulfate (WAC/III/C/001) • ISO 13395:1996 Water quality – Determination of nitrite nitrogen and nitrate nitrogen and the sum of both by flow analyses (CFA en FIA) and spectrometric detection (WAC/III/D/031) • ISO 6777:1984 Water quality – Determination of nitrite – Molecular absorption spectrometric method • ISO/DIS 15923-1:2011 Water quality – Determinations of ions by a discrete analysis system and spectrophotometric detection – Part 1: Ammonium, chloride, nitrate, nitrite, orthophosphate, silicate and sulfaat (WAC/III/C/002)
Fluoride (opgelost)	<ul style="list-style-type: none"> • ISO 10304-1: 2007 Water quality - Determination of dissolved anions by liquid chromatography of ions - Part 1: Determination of bromide, chloride, fluoride, nitrate, nitrite, phosphate and sulfate (WAC/III/C/001) • ISO 10359-1:1992 Water quality – Determination of fluoride – Part 1: Electrochemical probe method for potable and light polluted water

	<p>(WAC/III/C/020) (b)</p> <ul style="list-style-type: none"> • DIN38405-D4:1985 Bestimmung von Fluorid • WAC/III/C/022 Bepaling van opgelost en totaal anorganisch gebonden fluoride met doorstroomanalyse • NEN 6589:2005 Water - Potentiometrische bepaling van het gehalte aan totaal anorganisch fluoride met doorstroomsystemen (FIA en CFA) • NEN 6578:2011 Water - Potentiometrische bepaling van het totale gehalte aan totaal fluoride
Fluoride (Tot. anorg. gebonden)	<ul style="list-style-type: none"> • WAC/III/C/020 Bepaling van opgelost en totaal anorganisch gebonden fluoride met ion selectieve electrode (b) • WAC/III/C/022 Bepaling van opgelost en totaal anorganisch gebonden fluoride met doorstroomanalyse
Totaal orthofosfaat (c)	<ul style="list-style-type: none"> • ISO 10304-1: 2007 Water quality - Determination of dissolved anions by liquid chromatography of ions - Part 1: Determination of bromide, chloride, fluoride, nitrate, nitrite, phosphate and sulfate (WAC/III/C/001) • ISO 15681-1: 2003 Water quality – Determination of orthophosphate and total phosphorus contents by flow analysis (FIA and CFA) – Part 1: Method by flow injection analysis (FIA) • ISO 15681-2: 2003 Water quality – Determination of orthophosphate and total phosphorus contents by flow analysis (FIA and CFA) – Part 2: Method by continuous flow analysis (CFA) (WAC/III/C/010) • ISO 6878: 2004 Water quality – Determination of phosphorus – Ammonium molybdate spectrometric method • ISO/DIS 15923-1:2011 Water quality – Determinations of ions by a discrete analysis system and spectrophotometric detection – Part 1: Ammonium, chloride, nitrate, nitrite, orthophosphate, silicate and sulfaat (WAC/III/C/002)
Sulfaat	<ul style="list-style-type: none"> • ISO 10304-1: 2007 Water quality - Determination of dissolved anions by liquid chromatography of ions - Part 1: Determination of bromide, chloride, fluoride, nitrate, nitrite, phosphate and sulfate (WAC/III/C/001) • ISO 22743:2006 Water quality - Determination of sulfates - Method by continuous flow analysis (CFA) • ISO/DIS 15923-1:2011 Water quality – Determinations of ions by a discrete analysis system and spectrophotometric detection – Part 1: Ammonium, chloride, nitrate, nitrite, orthophosphate, silicate and sulfaat (WAC/III/C/002)
Sulfide (Opgeloste en in zuur milieu oplosbare)	<ul style="list-style-type: none"> • WAC/III/C/040 Potentiometrische bepaling van sulfide • WAC/III/C/041 Spectrofotometrische bepaling van sulfide
Chroom(VI)	<ul style="list-style-type: none"> • ISO 11083:1994 Water quality – Determination of chromium(VI) – Spectrometric method using 1,5 diphenylcarbazine • ISO 10304-3:1997 Water quality - Determination of dissolved anions using liquid chromatography of ions. Part 3: Determination of chromate, iodide, sulfite, thiocyanate and thiosulfate • EPA 218.6 Determination of dissolved hexavalent chromium in drinking water, groundwater, and industrial wastewater effluents by ion chromatography (WAC/III/C/050)

Vrije en totaal chloor	<ul style="list-style-type: none">• ISO 7393-2:1985 Water quality -- Determination of free chlorine and total chlorine -- Part 2: Colorimetric method using N,N-diethyl-1,4-phenylenediamine, for routine control purposes• EPA method 330.5 Chlorine, Total Residual (Spectrophotometric, DPD)
Vrije cyanide	<ul style="list-style-type: none">• EN ISO 14403-2: 2012 Water quality - Determination of total cyanide and free cyanide using flow analysis (FIA and CFA) – Part 2: Method using continuous flow analysis (CFA) (WAC/III/C/030)

- (a) Voor de bepaling van chloride wordt bij toepassing van de titrimetrische methode, de doorstroomanalysemethode en de discrete analyser steeds een totaal halogeen gehalte (chloride, bromide, jodide) bepaald. Ionenchromatografie daarentegen is in staat om selectief chloride te meten.
- (b) Voor de bepaling van fluoride met ion-selectieve elektrode volgens ISO 10359-1 wordt het gebruik van de buffer zoals beschreven in DIN 38405-D4 aanbevolen. De validatiegegevens opgenomen in ISO 10359-1 zijn eveneens bepaald op basis van deze buffer.
- (c) Het al dan niet te velde filtreren van het monster resulteert in het onderscheid tussen opgelost en totaal orthofosfaat. Er wordt aanbevolen om in het kader van de erkenningen de parameter totaal orthofosfaat te bepalen.

3 GRONDWATER

De volgende analysemethoden kunnen gebruikt worden voor het bepalen van anionen in grondwater:

Chloride (a)	<ul style="list-style-type: none"> • ISO 10304-1:2007 Water quality - Determination of dissolved anions by liquid chromatography of ions - Part 1: Determination of bromide, chloride, fluoride, nitrate, nitrite, phosphate and sulfate (WAC/III/C/001) • ISO 10304-4:1997 Water quality - Determination of dissolved anions using liquid chromatography of ions. Part 4: Determination of chlorate, chloride and chlorite in water with low contamination • ISO 9297: 1989 Water quality – Determination of chloride – Silver nitrate titration with chromate indicator (Mohr's method) • EN ISO 15682: 2000 Water quality – Determination of chloride by flow analysis (CFA and FIA) and photometric or potentiometric detection • ISO/DIS 15923-1:2011 Water quality – Determinations of ions by a discrete analysis system and spectrophotometric detection – Part 1: Ammonium, chloride, nitrate, nitrite, orthophosphate, silicate and sulfaat (WAC/III/C/002)
Nitraat	<ul style="list-style-type: none"> • ISO 10304-1:2007 Water quality - Determination of dissolved anions by liquid chromatography of ions - Part 1: Determination of bromide, chloride, fluoride, nitrate, nitrite, phosphate and sulfate (WAC/III/C/001) • EN ISO 13395:1996 Water quality – Determination of nitrite nitrogen and nitrate nitrogen and the sum of both by flow analyses (CFA en FIA) and spectrometric detection (WAC/III/D/031) • ISO 7890-3: 1988 Water quality – Determination of nitrate – Part 3: Spectrometric method using sulfosalicylic acid • ISO/DIS 15923-1:2011 Water quality – Determinations of ions by a discrete analysis system and spectrophotometric detection – Part 1: Ammonium, chloride, nitrate, nitrite, orthophosphate, silicate and sulfaat (WAC/III/C/002)
Nitriet	<ul style="list-style-type: none"> • ISO 10304-1:2007 Water quality - Determination of dissolved anions by liquid chromatography of ions - Part 1: Determination of bromide, chloride, fluoride, nitrate, nitrite, phosphate and sulfate (WAC/III/C/001) • ISO 13395:1996 Water quality – Determination of nitrite nitrogen and nitrate nitrogen and the sum of both by flow analyses (CFA en FIA) and spectrometric detection (WAC/III/D/031) • ISO 6777:1984 Water quality – Determination of nitrite – Molecular absorption spectrometric method • ISO/DIS 15923-1:2011 Water quality – Determinations of ions by a discrete analysis system and spectrophotometric detection – Part 1: Ammonium, chloride, nitrate, nitrite, orthophosphate, silicate and sulfaat (WAC/III/C/002)
Fluoride (opgelost)	<ul style="list-style-type: none"> • ISO 10304-1: 2007 Water quality - Determination of dissolved anions by liquid chromatography of ions - Part 1: Determination of bromide, chloride, fluoride, nitrate, nitrite, phosphate and sulfate (WAC/III/C/001) • ISO 10359-1:1992 Water quality – Determination of fluoride – Part 1: Electrochemical probe method for potable and light polluted water (WAC/III/C/020)(b) • DIN38405-D4:1985 Bestimmung von Fluorid • WAC/III/C/022 Bepaling van opgelost en totaal anorganisch gebonden fluoride met doorstroomanalyse

	<ul style="list-style-type: none">• NEN 6589:2005 Water - Potentiometrische bepaling van het gehalte aan totaal anorganisch fluoride met doorstroomsystemen (FIA en CFA)• NEN 6578:2011 Water - Potentiometrische bepaling van het totale gehalte aan totaal fluoride
Sulfaat	<ul style="list-style-type: none">• ISO 10304-1: 2007 Water quality - Determination of dissolved anions by liquid chromatography of ions - Part 1: Determination of bromide, chloride, fluoride, nitrate, nitrite, phosphate and sulfate (WAC/III/C/001)• ISO 22743:2006 Water quality - Determination of sulfates - Method by continuous flow analysis (CFA)• ISO/DIS 15923-1:2011 Water quality – Determinations of ions by a discrete analysis system and spectrophotometric detection – Part 1: Ammonium, chloride, nitrate, nitrite, orthophosphate, silicate and sulfaat (WAC/III/C/002)

- (a) Voor de bepaling van chloride wordt bij toepassing van de titrimetrische methode, de doorstroomanalysemethode en de discrete analyser steeds een totaal halogeen gehalte (chloride, bromide, jodide) bepaald. Ionenchromatografie daarentegen is in staat om selectief chloride te meten.
- (b) Voor de bepaling van fluoride met ion-selectieve elektrode volgens ISO 10359-1 wordt het gebruik van de buffer zoals beschreven in DIN 38405-D4 aanbevolen. De validatiegegevens opgenomen in ISO 10359-1 zijn eveneens bepaald op basis van deze buffer.

4 OPPERVLAKTEWATER

De volgende analysemethoden kunnen gebruikt worden voor het bepalen van anionen in oppervlaktewater:

Chloride (a)	<ul style="list-style-type: none"> • ISO 10304-1:2007 Water quality - Determination of dissolved anions by liquid chromatography of ions - Part 1: Determination of bromide, chloride, fluoride, nitrate, nitrite, phosphate and sulfate (WAC/III/C/001) • ISO 10304-4:1997 Water quality - Determination of dissolved anions using liquid chromatography of ions. Part 4: Determination of chlorate, chloride and chlorite in water with low contamination • ISO 9297: 1989 Water quality – Determination of chloride – Silver nitrate titration with chromate indicator (Mohr's method) • EN ISO 15682: 2000 Water quality – Determination of chloride by flow analysis (CFA and FIA) and photometric or potentiometric detection • ISO/DIS 15923-1:2011 Water quality – Determinations of ions by a discrete analysis system and spectrophotometric detection – Part 1: Ammonium, chloride, nitrate, nitrite, orthophosphate, silicate and sulfaat (WAC/III/C/002)
Nitraat	<ul style="list-style-type: none"> • ISO 10304-1:2007 Water quality - Determination of dissolved anions by liquid chromatography of ions - Part 1: Determination of bromide, chloride, fluoride, nitrate, nitrite, phosphate and sulfate (WAC/III/C/001) • EN ISO 13395:1996 Water quality – Determination of nitrite nitrogen and nitrate nitrogen and the sum of both by flow analyses (CFA en FIA) and spectrometric detection (WAC/III/D/031) • ISO 7890-3: 1988 Water quality – Determination of nitrate – Part 3: Spectrometric method using sulfosalicylic acid • ISO/DIS 15923-1:2011 Water quality – Determinations of ions by a discrete analysis system and spectrophotometric detection – Part 1: Ammonium, chloride, nitrate, nitrite, orthophosphate, silicate and sulfaat (WAC/III/C/002)
Nitriet	<ul style="list-style-type: none"> • ISO 10304-1:2007 Water quality - Determination of dissolved anions by liquid chromatography of ions - Part 1: Determination of bromide, chloride, fluoride, nitrate, nitrite, phosphate and sulfate (WAC/III/C/001) • ISO 13395:1996 Water quality – Determination of nitrite nitrogen and nitrate nitrogen and the sum of both by flow analyses (CFA en FIA) and spectrometric detection (WAC/III/D/031) • ISO 6777:1984 Water quality – Determination of nitrite – Molecular absorption spectrometric method • ISO/DIS 15923-1:2011 Water quality – Determinations of ions by a discrete analysis system and spectrophotometric detection – Part 1: Ammonium, chloride, nitrate, nitrite, orthophosphate, silicate and sulfaat (WAC/III/C/002)
Fluoride (opgelost)	<ul style="list-style-type: none"> • ISO 10304-1: 2007 Water quality - Determination of dissolved anions by liquid chromatography of ions - Part 1: Determination of bromide, chloride, fluoride, nitrate, nitrite, phosphate and sulfate

	<p>(WAC/III/C/001)</p> <ul style="list-style-type: none"> • ISO 10359-1:1992 Water quality – Determination of fluoride – Part 1: Electrochemical probe method for potable and light polluted water (WAC/III/C/020)(b) • DIN38405-D4:1985 Bestimmung von Fluorid • WAC/III/C/022 Bepaling van opgelost en totaal anorganisch gebonden fluoride met doorstroomanalyse • NEN 6589:2005 Water - Potentiometrische bepaling van het gehalte aan totaal anorganisch fluoride met doorstroomsystemen (FIA en CFA) • NEN 6578:2011 Water - Potentiometrische bepaling van het totale gehalte aan totaal fluoride
Totaal orthofosfaat (c)	<ul style="list-style-type: none"> • ISO 10304-1: 2007 Water quality - Determination of dissolved anions by liquid chromatography of ions - Part 1: Determination of bromide, chloride, fluoride, nitrate, nitrite, phosphate and sulfate (WAC/III/C/001) • ISO 15681-1: 2003 Water quality – Determination of orthophosphate and total phosphorus contents by flow analysis (FIA and CFA) – Part 1: Method by flow injection analysis (FIA) • ISO 15681-2: 2003 Water quality – Determination of orthophosphate and total phosphorus contents by flow analysis (FIA and CFA) – Part 2: Method by continuous flow analysis (CFA) (WAC/III/C/010) • ISO 6878: 2004 Water quality – Determination of phosphorus – Ammonium molybdate spectrometric method • ISO/DIS 15923-1:2011 Water quality – Determinations of ions by a discrete analysis system and spectrophotometric detection – Part 1: Ammonium, chloride, nitrate, nitrite, orthophosphate, silicate and sulfaat (WAC/III/C/002)
Sulfaat	<ul style="list-style-type: none"> • ISO 10304-1: 2007 Water quality - Determination of dissolved anions by liquid chromatography of ions - Part 1: Determination of bromide, chloride, fluoride, nitrate, nitrite, phosphate and sulfate (WAC/III/C/001) • ISO 22743:2006 Water quality - Determination of sulfates - Method by continuous flow analysis (CFA) • ISO/DIS 15923-1:2011 Water quality – Determinations of ions by a discrete analysis system and spectrophotometric detection – Part 1: Ammonium, chloride, nitrate, nitrite, orthophosphate, silicate and sulfaat (WAC/III/C/002)

- (a) Voor de bepaling van chloride wordt bij toepassing van de titrimetrische methode, de doorstroomanalysemethode en de discrete analyser steeds een totaal halogeen gehalte (chloride, bromide, jodide) bepaald. Ionenchromatografie daarentegen is in staat om selectief chloride te meten.
- (b) Voor de bepaling van fluoride met ion-selectieve elektrode volgens ISO 10359-1 wordt het gebruik van de buffer zoals beschreven in DIN 38405-D4 aanbevolen. De validatiegegevens opgenomen in ISO 10359-1 zijn eveneens bepaald op basis van deze buffer.

Het al dan niet te velde filtreren van het monster resulteert in het onderscheid tussen opgelost en totaal orthofosfaat. Er wordt aanbevolen om in het kader van de erkenningen de parameter totaal orthofosfaat te bepalen.