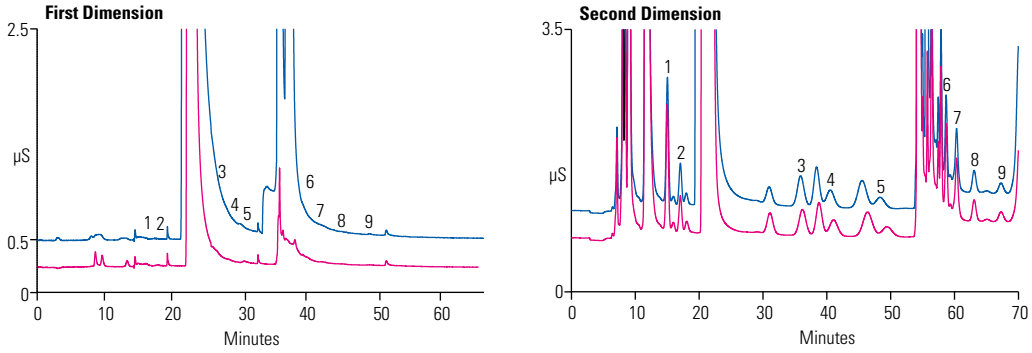
Product Specifications

Obtain excellent sensitivity for haloacetic acid anions using the Dionex IonPac AS24A Anion-Exchange Column with Two-Dimensional Ion Chromatography (2D-IC).

Thermo Scientific Dionex IonPac AS24A Anion-Exchange Column

2D-IC Analysis of HAAs in Reagent and High-Ionic-Strength Water Using the Dionex IonPac AS24A Column in the First Dimension



Pink Trace: 100 ppm ammonium chloride
Blue Trace: High Ionic Water (250 ppm chloride, 250 ppm sulfate, 150 ppm bicarbonate, 20 ppm nitrate and 100 ppm ammonium chloride)

Peaks:				
1. MCAA	5 µg/L	6. TCAA	5
2. MBAA	5	7. BDCAA	5
3. DCAA	5	8. CDBAA	5
4. BCAA	5	9. TBAA	5
5. DBAA	5		

The Dionex IonPac™ AS24A anion-exchange column is designed for the separation of haloacetic acid (HAA) anions in drinking water. When used with the 2D-IC method and suppressed conductivity detection, low µg/L (ppb) detection levels can be obtained.

The Dionex IonPac AS24A column is a high capacity, hydroxide selective anion-exchange column recommended for the separation of haloacetic acid (HAA) anions in drinking water samples. Minimal baseline shifts and enhanced analyte sensitivity are obtained using the Thermo Scientific Dionex ASRS 300 Anion Self-Regenerating Suppressor. Reagent-Free™ IC systems provide simple, reproducible operation with eluent generation, requiring only a deionized water source to produce consistent, accurate potassium hydroxide (KOH) eluent.

The 2D-IC method for the analysis of HAAs uses the Dionex IonPac AS24A standard bore column in the first dimension, while the Dionex IonPac AS26 capillary column is used in the second dimension. The 2D-IC method allows for the analysis of high-ionic-strength samples without sample pretreatment. The Dionex IonPac AS24A is available in standard bore (4 mm i.d.) format allowing flow rates up to 2.0 mL/min.

Highlights

- Separation of haloacetic acid anions in drinking water samples
- Low µg/L (ppb) levels of HAAs can be determined using the 2D-IC method
- Determine HAAs in high-ionic-strength samples without sample pretreatment

High-Efficiency Particle Structure

The Dionex IonPac AS24A column has been developed using a unique polymer synthesis technology. The stationary phase consists of a novel, hyper-branched anion-exchange condensation polymer, electrostatically attached to the surface of a sulfonated wide-pore polymeric substrate. The resin capacity is controlled through the number of alternating coating cycles and Aggregate Monolith Technology, which uses resin agglomerates produced by combining two oppositely charged resins, then packing these resin agglomerates into a column before adding the final two layers of the monomer and amine. This achieves higher capacity while still maintaining high chromatographic efficiency and reasonable column pressure. The Dionex IonPac AS24A 4 mm column uses a high-capacity resin (520 µeq per column) with optimized selectivity for the haloacetic acids and other anions in drinking water.

Determination of Haloacetic Acids in Drinking Water Using Conductivity Detection

Haloacetic acids containing chlorine and bromine are formed during the chlorination disinfection of drinking water. The presence of haloacetic acids in drinking water has been linked to several adverse effects including bladder, kidney, and colorectal cancer.

The Dionex IonPac AS24A column can separate the following HAAs:

- Monochloroacetic acid (MCAA)
- Dichloroacetic acid (DCAA)
- Trichloroacetic acid (TCAA)
- Monobromoacetic acid (MBAA)
- Dibromoacetic acid (DBAA)
- Tribromoacetic acid (TBAA)
- Bromochloroacetic acid (BCAA)
- Dibromochloroacetic acid (DBCAA)
- Dichlorobromoacetic acid (DCBAA)

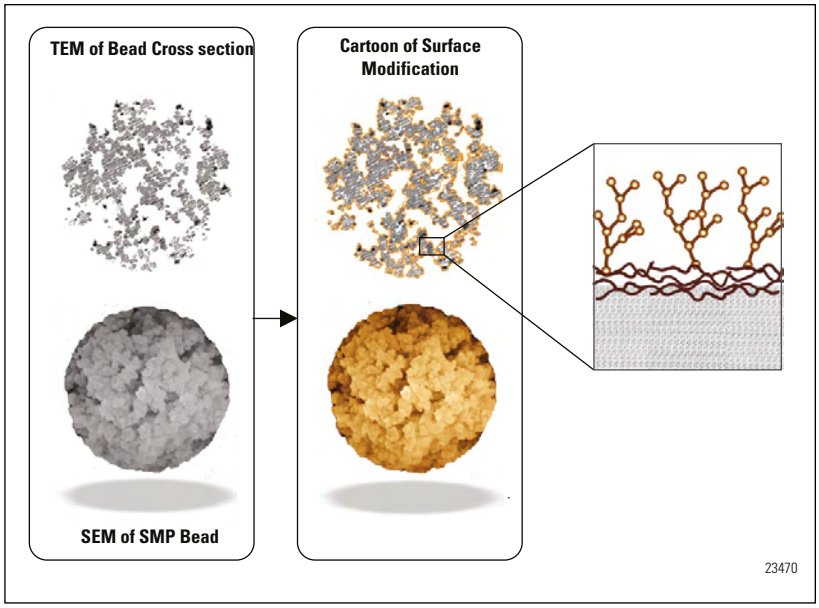


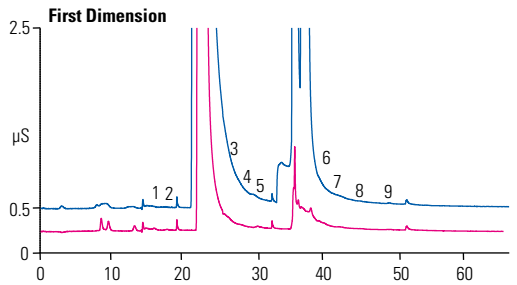
Figure 1. Structure of a Dionex IonPac AS24A packing particle.

First Dimension Conditions

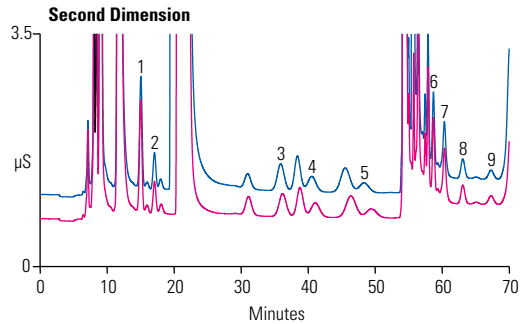
Column:	Dionex IonPac AS24A/AG24A 4 mm
Eluent:	KOH: 7 mM from 0 to 12 min, 7 to 18 mM from 12 to 42 min, step to 65 mM at 42 min
Eluent Source:	Dionex EGC III KOH cartridge
Flow Rate:	1.0 mL/min
Inj. Volume:	500 µL
Temperature:	15 °C
Detection:	Suppressed Conductivity, Dionex ASRS™ 300, AutoSuppression, external water mode

Second Dimension Conditions

Column:	Dionex IonPac AS26/AG26 Capillary
Eluent:	KOH: 6 mM from 0 to 50 min, step to 160 mM at 50 min, 160 mM from 50 to 57 min, step to 130 mM at 57 min
Eluent Source:	Dionex EGC III KOH capillary cartridge
Flow Rate:	0.012 mL/min
Concentrator:	Thermo Scientific Dionex IonSwift MAC-200
Temperature:	14 °C
Detection:	Suppressed Conductivity, Thermo Scientific Dionex ACES 300, AutoSuppression, external water mode



Peaks:	µg/L
1. MCAA	5
2. MBAA	5
3. DCAA	5
4. BCAA	5
5. DBAA	5
6. TCAA	5
7. BDCAA	5
8. CDBAA	5
9. TBAA	5



Pink Trace: 100 ppm ammonium chloride
Blue Trace: High Ionic Water (250 ppm chloride, 250 ppm sulfate, 150 ppm bicarbonate, 20 ppm nitrate and 100 ppm ammonium chloride)

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Figure 2. Determination of haloacetic acids using the Dionex IonPac AS24A column and 2D-IC.

Five HAAs including MCAA, DCAA, TCAA, MBAA, and DBAA are cited in the US EPA haloacetic acid regulation. This regulation requires that the total of these five HAAs does not exceed a maximum concentration limit (MCL) of 60 µg/L.[1] All drinking water plants in the United States must have a method to determine HAA levels in drinking water.

The IonPac AS24A 4 mm column is designed for analysis of haloacetic acids by 2D-IC in high-ionic- strength matrices. In the first dimension, the Dionex IonPac AS24A column provides the initial separation between the haloacetic acids anions and the major matrix ions, such as chloride, sulfate and carbonate. The matrix ions are diverted to waste while the haloacetic acids anions are concentrated on the Thermo Scientific Dionex IonSwift MAC-200 Monolith Anion Concentrator column. In the second dimension, the Dionex IonPac AS26 capillary column provides the final separation of the haloacetic acids prior to suppressed conductivity detection. Figure 2 shows determination of haloacetic acids in a drinking water sample using a potassium hydroxide gradient delivered by the Eluent Generator (EG). Low µg/L (ppb) levels of haloacetic acids can easily be determined using 2D-IC.

MBAA, CDBAA, and TBAA degrade readily at a high pH. The reaction is temperature dependent. To minimize sample degradation, the separation is performed at sub-ambient temperature, specifically at 15 °C. A refrigerated autosampler capable of maintaining samples at a temperature less than or equal to 10 °C is also recommended.

Determination of Haloacetic Acids Using Suppressed Conductivity Detection

The Dionex IonPac AS24A (4 × 250 mm) column is optimized for separation of haloacetic acids in drinking water matrices with suppressed conductivity detection. Figure 3 shows the determination of haloacetic acids using the Dionex IonPac AS24A 4 mm column.

		Peaks:		
Column:	Dionex IonPac AG24A/AS24A, 4 mm		1. MCAA	100 µg/L (ppb)
Eluent:	KOH Gradient		2. MBAA	100
	7 mM KOH from 0 to 12 min		3. DCAA	100
	7 mM to 18 mM KOH from 12 to 32 min		4. BCAA	100
	65 mM KOH from 32 to 60 min		5. DBAA	100
Eluent Source:	Dionex EGC III KOH		6. TCAA	100
Flow Rate:	1.0 mL/min		7. BDCAA	100
Injection Volume:	1000 µL		8. CDBAA	100
Temperature:	15 °C		9. TBAA	100
Detection:	Suppressed Conductivity, Dionex ASRS 300, 4 mm, AutoSuppression, recycle mode			

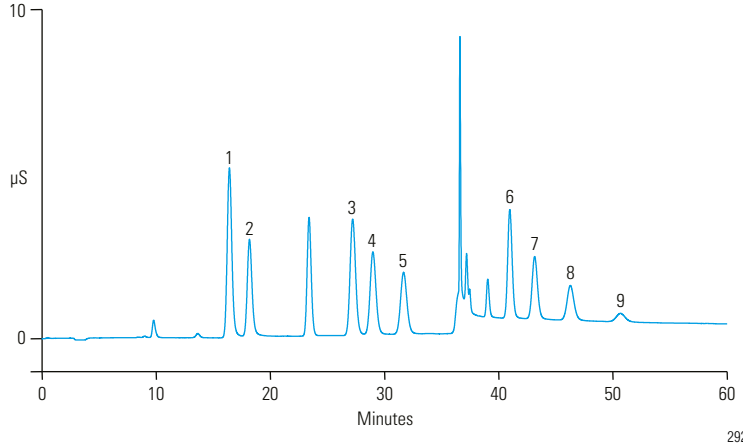

Figure 3. Determination of haloacetic acids using the Dionex IonPac AS24A 4 mm column and suppressed conductivity detection.

		Peaks:		
Column:	Dionex IonPac AG24A/AS24A, 4 mm		1. Fluoride	5 mg/L (ppm)
Eluent:	KOH Gradient		2. Acetate	15
	5 mM to 15 mM KOH from 0 to 12 min		3. Formate	15
	15 mM to 30 mM KOH from 10 to 20 min		4. Chlorite	15
	30 mM to 60 mM KOH from 20 to 38 min		5. Bromate	15
Eluent Source:	Dionex EGC III KOH		6. Chloride	15
Flow Rate:	1.2 mL/min		7. Trifluoroacetate	15
Injection Volume:	10 µL		8. Nitrite	15
Temperature:	15 °C		9. Sulfate	15
Detection:	Suppressed Conductivity, Dionex ASRS 300, 4 mm, AutoSuppression, recycle mode		10. Chlorate	25
			11. Bromide	25
			12. Oxalate	25
			13. Nitrate	25
			14. Phosphate	40
			15. Arsenate	40
			16. Thiosulfate	40
			17. Chromate	40
			18. Citrate	40

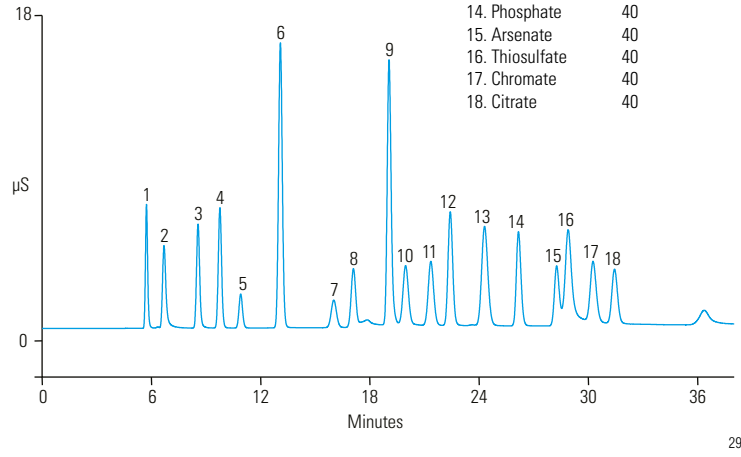

Figure 4. Separation of various anions including inorganic anions, organic acids, oxyanions, and oxyhalides using a Dionex IonPac AS24A 4 mm column and potassium hydroxide eluent delivered by an Eluent Generator.

Extended Application Capabilities

The unique selectivity and high capacity of the Dionex IonPac AS24A column makes it ideal for the development of specialized applications, providing excellent separation of environmental anions including inorganic anions, oxyhalides, oxyanions, and organic acids using potassium hydroxide eluent. Using gradient elution, these analytes are easily separated in < 37 minutes as shown in Figure 4.

System Requirements

The Dionex IonPac AS24A column is designed for use with the Thermo Scientific Dionex ICS-5000 RFIC systems equipped with an EG. The Dionex IonPac AS24A column can also be used with older Dionex IC systems equipped with an EG or RFC-30 Reagent-Free Controller. The EG is used to automatically produce potassium hydroxide gradients from deionized water. The haloacetic acids MBAA, CDBAA and TBAA degrade under basic conditions at higher temperatures. The use of a column oven capable of maintaining 15 °C and an autosampler capable of maintaining 10 °C is required for optimal performance.

Suppressor Recommendations

For optimum ease of use and economy, the Dionex IonPac AS24A column should be used with the Dionex ASRS 300 Anion Self-Regenerating Suppressor.

Anion Trap Columns

When using the EG for eluent delivery, a Thermo Scientific Dionex Continuously Regenerated Anion Trap Column (Dionex CR-ATC) should be installed between the EG cartridge and the EG degas module. As an alternative for 4 mm and 2 mm systems, a Thermo Scientific Dionex ATC-HC column can be installed between the pump outlet and inlet of the EG cartridge in the eluent generator module. Alternately, when performing sodium hydroxide gradient anion-exchange applications with the Dionex IonPac AS24A column using hand-prepared bottled eluents, the Thermo Scientific Dionex ATC-3 Anion Trap column should be installed between the gradient pump and the injection valve to remove anionic contaminants from the eluent.

Concentrator Columns

For concentrator work with a 4 mm Dionex IonPac AS24A column, use the IonPac AG24A guard column, the Thermo Scientific Dionex UTAC-LP1, UTAC-ULP1, UTAC–XLP1, UTAC-LP2, UTAC-ULP2, or UTAC-XLP2 Ultra Trace Anion Concentrator columns; the Thermo Scientific Dionex TAC-ULP1 Trace Anion Concentrator column; or the Dionex TAC-2 Trace Anion Concentrator column, when a single piston pump such as the AXP pump (pulse damper required) is used for sample delivery. Use the Dionex UTAC-LP1, UTAC-LP2 or TAC-LP1 Trace Anion Concentrator column when the sample is delivered with a syringe or with a low pressure autosampler, such as the Thermo Scientific Dionex AS-DV. For two-dimensional IC methods use the Dionex IonSwift™ MAC-200 concentrator column.

References

1. Stage 1 Disinfectants and Disinfection Byproducts Rule: A Quick Reference Guide, p. 2, US EPA, 816-F-01-010

Product Specifications

SPECIFICATIONS

Dimensions	Dionex IonPac AS24A Analytical Column: 4 × 250 mm Dionex IonPac AG24A Guard Column: 4 × 50 mm
Maximum Operating Pressure	3000 psi
Mobile Phase Compatibility	pH 0–14; 0–100% HPLC solvents
Substrate Characteristics	Analytical Column: Supermacroporous resin Bead diameter (µm): 7.0 µm Pore size: 2000 Å Crosslinking: (%DVB): 55%
Guard Column	Microporous resin Bead diameter: 11 µm Pore size: <10 Å Crosslinking (%DVB): 55%
Ion-Exchange Group	Functional group: alkanol quaternary ammonium ion
Functional Group Characteristics	Hydrophobicity: Ultra Low
Capacity	520 µeq/column (4 × 250 mm) 6 µeq/column (4 × 50 mm)
Column Construction	PEEK™ with 10-32 threaded ferrule-style end fittings. All components are nonmetallic.

ORDERING INFORMATION

To order in the U.S., call 1-800-346-6390, or contact the Thermo Fisher Scientific office nearest you. Outside the U.S., order through your local Thermo Fisher Scientific office or distributor. Refer to the following part numbers.

Dionex IonPac AS24A Columns	**Part Number**
Dionex IonPac AS24A Analytical Column (4 × 250 mm)	076010
Dionex IonPac AG24A Guard Column (4 × 50 mm)	076011

Trap Columns	**Part Number**
Dionex CR-ATC Continuously Regenerated Anion Trap Column (For use with systems equipped with an eluent generator or RFC-30 Reagent-Free Controller)	060477
Dionex ATC-3 Anion Trap Column (9 × 24 mm) for use with 4 mm columns	059660
Dionex ATC-3 Anion Trap Column (4 × 35 mm) for use with the 2 mm columns	079932
Dionex ATC-HC Anion Cation Trap Column (9 × 75 mm) for use with the EG)	059604

Trace Anion Concentrator Columns	**Part Number**
Dionex IonSwift MAC-200 Monolith Anion Concentrator (0.75 × 80 mm)	075461
Dionex TAC-LP1 Trace Anion Concentrator (4 × 35 mm)	046026
Dionex TAC-2 Trace Anion Concentrator Column	043101
Dionex TAC-ULP1 Trace Anion Concentrator (5 × 23 mm)	061400
Dionex UTAC-LP1 Ultra Trace Anion Concentrator Column Low Pressure (4 × 35 mm)	063079
Dionex UTAC-ULP1 Ultra Trace Anion Concentrator Column Ultra Low Pressure (5 × 23 mm)	063475
Dionex UTAC-XLP1 Ultra Trace Anion Concentrator Column Extremely Low Pressure (6 × 16 mm)	063459
Dionex UTAC-LP2 Ultra Trace Anion Concentrator Column Low Pressure (4 × 35 mm)	079917
Dionex UTAC-ULP2 Ultra Trace Anion Concentrator Column Ultra Low Pressure (5 × 23 mm)	079918
Dionex UTAC-XLP2 Ultra Trace Anion Concentrator Column Extremely Low Pressure (6 × 16 mm)	072781

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Thermo Scientific Dionex products are designed, developed, and manufactured under an ISO 9001 Quality System.

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