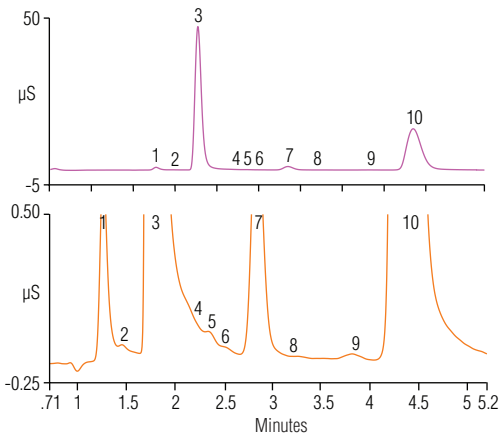
Thermo Scientific Dionex IonPac AS22 and AS22-Fast Anion-Exchange Columns

The Thermo Scientific™ Dionex™ IonPac™ AS22 column is a carbonate based anion-exchange column designed for the determination of inorganic anions and low-molecular-weight organic acids including fluoride, acetate, chloride, nitrite, bromide, nitrate, phosphate, and sulfate. The Dionex IonPac AS22 column is used with isocratic carbonate/bicarbonate eluents and suppressed conductivity detection. The Dionex IonPac AS22 column can be used in combination with Dionex Eluent Generators and the Electrolytic pH Modifier (EPM), which automatically produce potassium carbonate/bicarbonate eluents from water. The Dionex IonPac AS22-Fast column is ideal for fast IC using eluent generation or eluent regeneration.

Analysis of a Municipal Drinking Water Sample Using the Dionex IonPac AS22-Fast 4 × 150 mm Column



Column:	Dionex IonPac AS22-Fast (4 × 150 mm)
Eluent:	4.5 mM sodium carbonate/ 1.4 mM sodium bicarbonate
Flow Rate:	2.0 mL/min
Inj. Volume:	25 µL
Temperature:	30 °C
Detection:	Suppressed conductivity, Dionex ASRS 300, 4 mm, AutoSuppression recycle mode

Peaks:		
	1. Fluoride	6. Bromide
	2. Formate	7. Nitrate
	3. Chloride	8. Carbonate
	4. Nitrite	9. Phosphate
	5. Chlorate	10. Sulfate

Column Performance

The Dionex IonPac AS22 column meets the performance requirements specfied in U.S. Environmental Protection Agency (EPA) Method 300.0 (A). The common inorganic anions are easily separated in a variety of sample matrices, including drinking water, wastewater, process streams, and scrubber solutions. The Dionex IonPac AS22 column selectivity provides excellent retention of fluoride from the water dip and resolution of fluoride, acetate, and formate. Solvent compatibility permits easy column cleanup after the analysis of samples with hydrophobic components. The Dionex IonPac AS22 column is available in 4 mm, 2 mm and 0.4 mm formats.

Fast IC

The Dionex IonPac AS22-Fast column is ideal for Fast IC as it is designed to have sufficient capacity to maintain resolution even in a short column format. Fast separations are achieved on any Thermo Scientific Dionex system at higher flow rates. In a short column format, backpressures produced at higher flow rates are reduced while allowing overall shorter run times. This allows for the determination of anions with high resolution even in drinking, surface, groundwater, and wastewater matrices in under 5 min. Laboratories can achieve higher productivity and increased throughput. The Dionex IonPac AS22-Fast column is available in 4 mm and 2 mm formats.

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Analyze Inorganic Anions in Diverse Sample Matrices

- Source water and drinking water
- Municipal and industrial wastewater
- Industrial cooling water
- Hazardous waste extracts and dump site leachates
- Acid rain
- Foods and beverages
- Anionic counterions in pharmaceutical preparations and synthetic peptides
- Polymers such as polyols and polysulfonates
- Scrubber solutions

Superior Chromatographic Performance

- Fast isocratic separation of the common inorganic anions in simple sample matrices in 8 min.
- Isocratic separation of common inorganic anions in complex sample matrices in 12 min.
- High speed separation of the common inorganic anions in less than 5 min using the Dionex IonPac AS22-Fast Column.
- Carbonate peak well resolved from common inorganic anions.
- Meets performance requirements specified in EPA Method 300.0 (A).
- Ideal alternative for Dionex IonPac AS4A-SC, AS12A, AS14, and AS14A inorganic anion applications.
- Simplified Reagent-Free™ ion chromatography (RFIC™) System operation provided by Dionex Eluent Generators and EPM, which require only a deionized water source to produce potassium carbonate/bicarbonate eluent.
- Ideal column for use with Eluent Regeneration, enabling simple, non-stop operation for up to 28 days.
- Simple, accurate eluent preparation with the Dionex IonPac AS22 Eluent Concentrate—just dilute in deionized water and start operation.
- Eluent suppression using the Thermo Scientific Dionex AERS 500 Anion Electrolytically Regenerated Suppressor or Thermo Scientific™ Dionex™ ACES™ Anion Capillary Electrolytic Suppressor technology provides RFIC operation with low backgrounds and enhanced analyte sensitivity.
- High capacity: 210 µeq/col. (4 × 250 mm column).
- Operate at ambient or elevated temperatures. Column selectivity is optimized for a 30 °C operating temperature to ensure reproducible retention times.
- Compatible with organic solvents to enhance analyte solubility, modify column selectivity, or for effective column cleanup.

High Efficiency Particle Structure

The Dionex IonPac AS22 column was developed using a unique polymer bonding technology. The stationary phase consists of a novel hyper-branched anion-exchange condensation polymer, electrostatically attached to the surface of a wide-pore polymeric substrate. The substrate is surface-sulfonated in exactly the same manner as is common in Dionex latex coated anion-exchange materials. However, in this anion-exchange resin, alternating treatments of epoxy monomer and amines produce a coating which is grown directly off the substrate surface as illustrated in Figure 1. Resin capacity is controlled through the number of alternating coating cycles. The Dionex IonPac AS22 column uses a high-capacity resin (210 µeq/4 mm column) with optimized selectivity for the common inorganic anions in a variety of sample matrices.

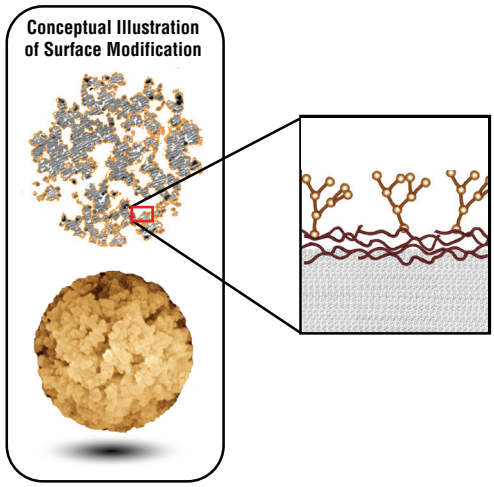

Figure 1. Structure of a Dionex IonPac AS22 column particle.

Economical Capillary Operation

The Dionex IonPac AS22 column is available in 0.4 mm i.d. for capillary operation offering the advantage of reduced operating costs.

- Ideal for limited sample volumes due to higher mass sensitivity.
- One hundred fold reduction in eluent consumption and waste disposal.
- 4 mm applications can be directly transferred to the 0.4 mm format by reducing flow rate by one hundred fold.

Figure 2 is an example of the separation of inorganic anions and acetate using the Dionex IonPac AS22 capillary column.

Isocratic Separation of Common Inorganic Anions

The Dionex IonPac AS22 column provides excellent separation of fluoride, chloride, nitrite, bromide, nitrate, phosphate and sulfate using an isocratic carbonate/bicarbonate eluent and suppressed conductivity detection. Using a 4.5 mM carbonate/1.4 mM bicarbonate eluent, the common inorganic anions plus acetate can be resolved in approximately 12 min as shown in Figure 3.

Column:	Dionex IonPac AG22/AS22 (0.4 × 250 mm)	Peaks:	1. Fluoride	1.25 mg/L (ppm)
Eluent:	4.5 mM sodium carbonate/		2. Acetate	5.0
	1.4 mM sodium bicarbonate		3. Chloride	2.5
Temperature:	30 °C		4. Nitrite	3.75
Flow Rate:	12 µL/min		5. Bromide	6.25
Inj. Volume:	0.4 µL		6. Nitrate	6.25
Detection:	Suppressed conductivity, Dionex ACES 300		7. Phosphate	10.0
	suppressor, 4 mm, AutoSuppression recycle mode		8. Sulfate	7.5

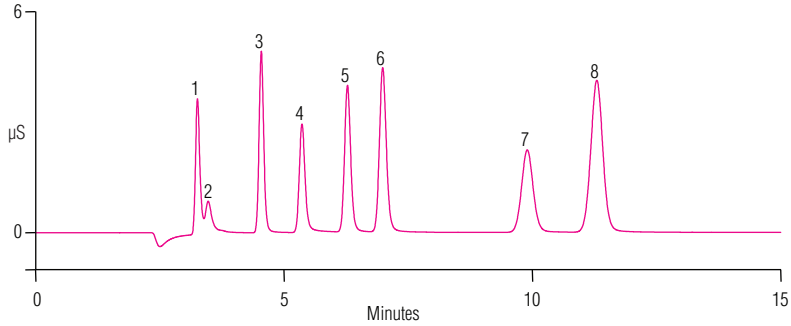

Figure 2. Separation of inorganic anions and acetate using the Dionex IonPac AG22/AS22 capillary column.

Column:	Dionex IonPac AG22, AS22, 4 mm	Peaks:	1. Fluoride	5	mg/L (ppm)
Eluent:	4.5 mM sodium carbonate/		2. Acetate	20	
	1.4 mM sodium bicarbonate		3. Chloride	10	
Temperature:	30 °C		4. Nitrite	15	
Flow Rate:	1.2 mL/min		5. Bromide	25	
Inj. Volume:	10 µL		6. Nitrate	25	
Detection:	Suppressed conductivity, Dionex ASRS 300		7. Phosphate	40	
	suppressor, 4 mm, AutoSuppression recycle mode		8. Sulfate	30	

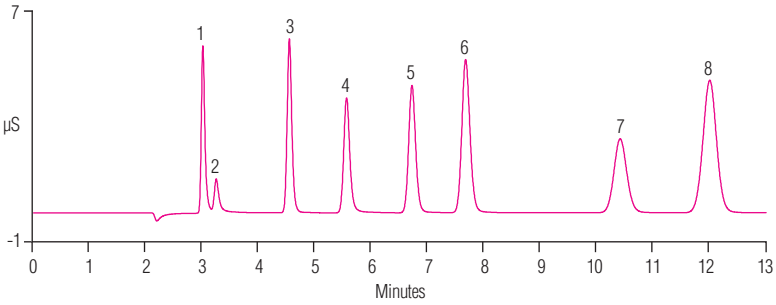

Figure 3. Separation of common inorganic anions plus acetate on an Dionex IonPac AS22 column using a 4.5 mM carbonate/1.4 mM bicarbonate eluent.

Inorganic Anions in Drinking Water

The Dionex IonPac AS22 column is ideal for compliance monitoring of drinking water and wastewater. The column meets or exceeds the performance requirements of U.S EPA Method 300.0 (A). Common inorganic anions are separated in approximately 12 min in drinking water as shown in Figure 4. The analysis of a drinking water sample using the Dionex IonPac AS22 capillary column is shown in Figure 5.

Column:	Dionex IonPac AG22, AS22, 4 mm	Peaks:	1. Fluoride	0.84 mg/L (ppm)	7. Bromide 0.02
Eluent:	4.5 mM sodium carbonate/ 1.4 mM sodium bicarbonate		2. Formate	0.03	8. Nitrate 0.89
			3. Chloride	15.59	9. Carbonate NQ
Temperature:	30 °C		4. Nitrite	0.01	10. Phosphate 0.22
Flow Rate:	1.2 mL/min		5. Unknown	NQ	11. Sulfate 20.45
Inj. Volume:	25 µL		6. Chlorate	0.18	
Detection:	Suppressed conductivity, Dionex ASRS 300 suppressor, 4 mm, AutoSuppression recycle mode				NQ: Not Quantified

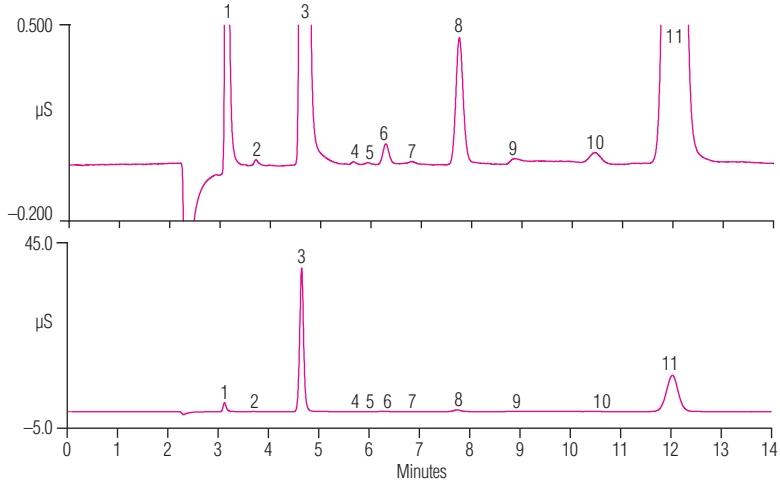

Figure 4. Determination of inorganic anions in a municipal drinking water sample using the Dionex IonPac AS22 column.

Column:	Dionex IonPac AG22/AS22 (0.4 × 250 mm)	Peaks:	1. Fluoride	2.06 mg/L (ppm)	7. Nitrate 0.86
Eluent:	4.5 mM sodium carbonate/ 1.4 mM sodium bicarbonate		2. Formate	NQ	8. Phosphate 0.10
			3. Chloride	16.41	9. Sulfate 21.67
Temperature:	30 °C		4. Nitrite	0.04	10. Unknown NQ
Flow Rate:	0.012 mL/min		5. Unknown	NQ	
Inj. Volume:	0.4 µL				NQ: Not Quantified
Detection:	Suppressed conductivity, Dionex ACES 300 suppressor, 4 mm, AutoSuppression recycle mode				

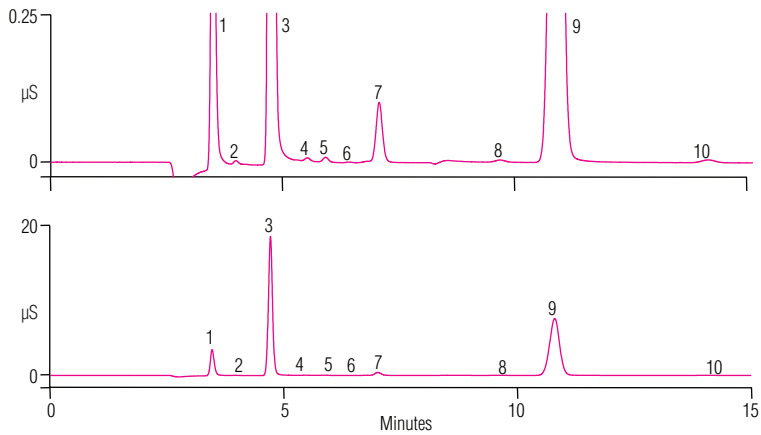

Figure 5. Analysis of municipal drinking water using the Dionex IonPac AS22 capillary column.

Fast IC

The Dionex IonPac AS22-Fast column is suitable for separations requiring higher flow rates for the fast analysis of inorganic anions in simple sample matrices as shown in Figure 6. The Dionex IonPac AS22-Fast column (4 × 150 mm) was operated with the same eluent at 1.2 and 2.0 mL/min. Using a higher flow rate in a shorter column format, the overall run time was reduced to 4.5 min with optimal resolution of the common inorganic anions.

The use of a Dionex IonPac AS22-Fast 2 × 150 mm column format allows greater linear velocities and reduced eluent consumption compared to a 4 mm format. Figure 7 shows the excellent resolution for the common inorganic anions in less than 4 min.

Column:	Dionex IonPac AS22-Fast (4 × 150 mm)	Peaks:	1. Fluoride	5.0 mg/L (ppm)
Eluent:	4.5 mM sodium carbonate/		2. Chloride	10.0
	1.4 mM sodium bicarbonate		3. Nitrite	15.0
Flow Rate:	A. 1.2 mL/min		4. Bromide	25.0
	B. 2.0 mL/min		5. Nitrate	25.0
Inj. Volume:	10 µL		6. Phosphate	40.0
Temperature:	30 °C		7. Sulfate	30.0
Detection:	Suppressed conductivity, Dionex ASRS 300 suppressor, 4 mm, AutoSuppression recycle mode			

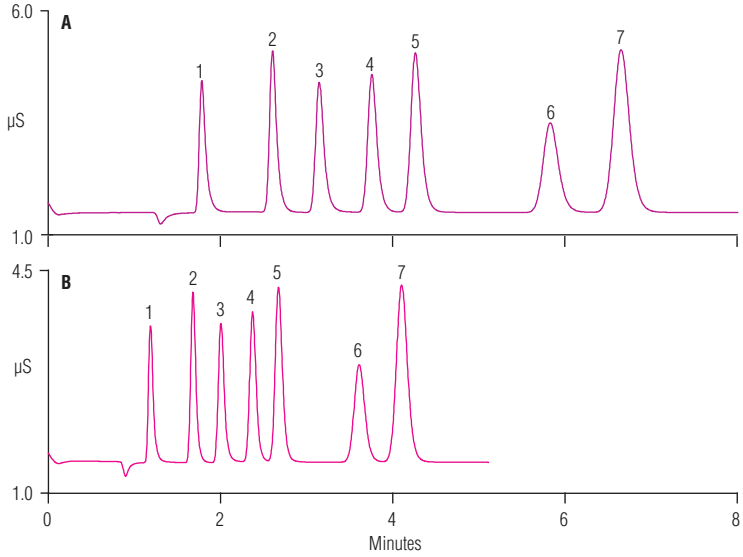

Figure 6. Separation of common inorganic anions using the Dionex IonPac AS22-Fast 4 × 150 mm column.

Column:	Dionex IonPac AS22-Fast (2 × 150 mm)	Peaks:	1. Fluoride	5.0 mg/L (ppm)
Eluent:	4.5 mM sodium carbonate/		2. Chloride	10.0
	1.4 mM Sodium bicarbonate		3. Nitrite	15.0
Flow Rate:	A. 0.3 mL/min		4. Bromide	25.0
	B. 0.5 mL/min		5. Nitrate	25.0
	C. 0.63 mL/min		6. Phosphate	40.0
Inj. Volume:	2.5 µL		7. Sulfate	30.0
Temperature:	30 °C			
Detection:	Suppressed conductivity, Dionex ASRS 300 suppressor, 2 mm, AutoSuppression recycle mode			

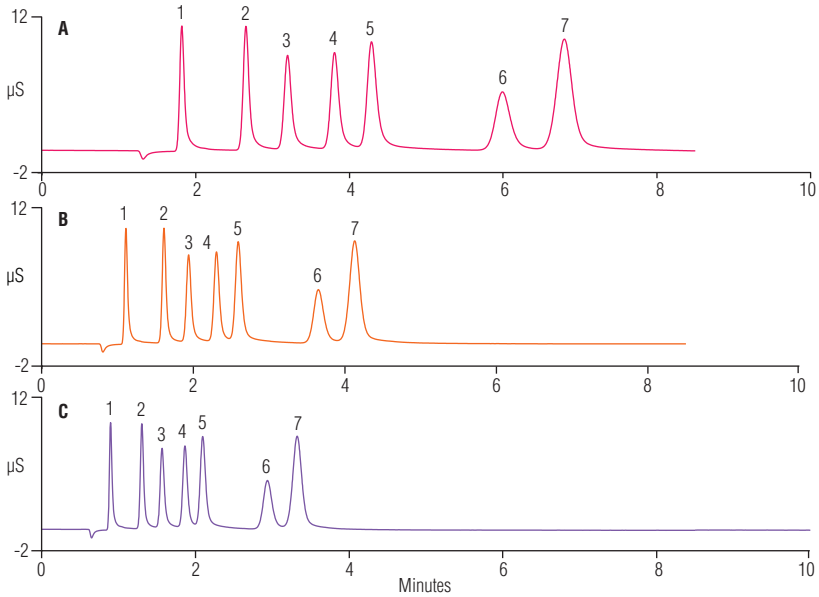

Figure 7. Separation of common inorganic anions using the Dionex IonPac AS22-Fast 2 × 150 mm column.

Figure 8 illustrates the analysis of a municipal drinking water sample using the Dionex IonPac AS22-Fast (4 × 150 mm) column. At 2.0 mL/min, the anions can be separated in less than 5 min. The bottom trace shows an enlarged image of the separation. The anions are well resolved even in the presence of disparate anion concentrations including fluoride/formate and chloride/nitrite.

Extended Application Capabilities

The unique selectivity and high capacity of the Dionex IonPac AS22 column makes it ideal for methods development of specialized anion applications. Figure 9 shows the separation of a variety of environmental anions including inorganic anions, oxyhalides, oxyanions, and organic acids using an isocratic carbonate/bicarbonate eluent. These 18 analytes are easily separated in less than 30 min.

		Peaks:	
Column:	Dionex IonPac AS22-Fast (4 × 150 mm)		1. Fluoride, 2. Formate, 3. Chloride, 4. Nitrite, 5. Chlorate, 6. Bromide, 7. Nitrate, 8. Carbonate, 9. Phosphate, 10. Sulfate
Eluent:	4.5 mM sodium carbonate/ 1.4 mM sodium bicarbonate		
Flow Rate:	2.0 mL/min		
Inj. Volume:	25 µL		
Temperature:	30 °C		
Detection:	Suppressed conductivity, Dionex ASRS 300 suppressor, 4 mm, AutoSuppression recycle mode		

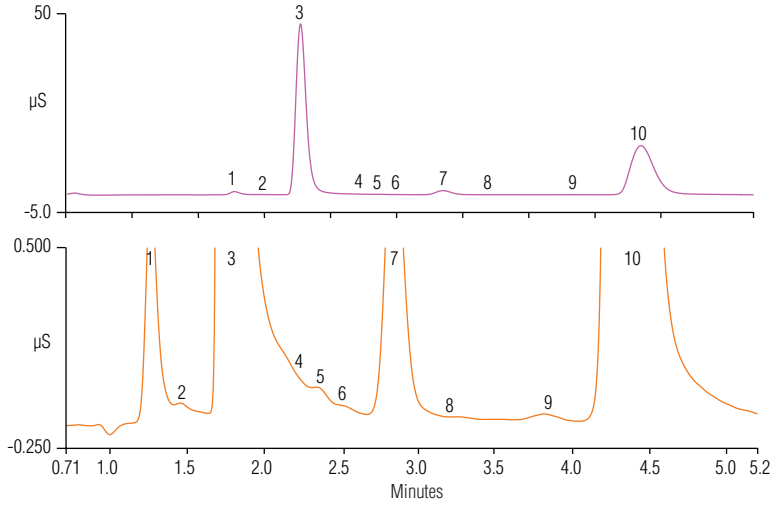

Figure 8. Analysis of a municipal drinking water sample using the Dionex IonPac AS22-Fast 4 × 150 mm column.

		Peaks:					
Column:	Dionex IonPac AG22, AS22, 4 mm		1. Fluoride	3	mg/L (ppm)	10. Phosphate	40
Eluent:	4.8 mM sodium carbonate/ 1.0 mM sodium bicarbonate		2. Acetate	20		11. Sulfate	30
			3. Formate	10		12. Selenate	30
Flow Rate:	1.5 mL/min		4. Bromate	20		13. Iodide	40
Temperature:	30 °C		5. Chloride	5		14. Arsenate	30
Inj. Volume:	10 µL		6. Nitrite	15		15. Thiocyanate	40
Detection:	Suppressed conductivity, Dionex ASRS 300 suppressor, 4 mm, AutoSuppression recycle mode		7. Chlorate	25		16. Perchlorate	40
			8. Bromide	25		17. Thiosulfate	40
			9. Nitrate	25		18. Chromate	40

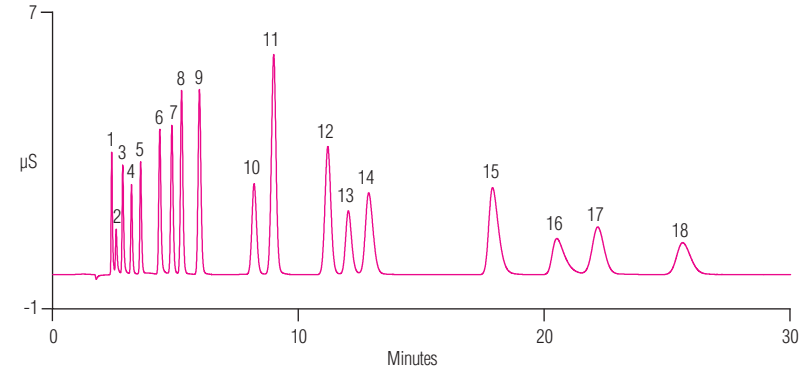

Figure 9. Anion separation including inorganic anions, organic acids, oxyanions, and oxyhalides using the Dionex IonPac AS22 column.

The Dionex IonPac AS22 column is also ideal for the determination of anions in food and beverage samples containing high concentrations of carbonate. Carbonated bottled water contains up to 500 mg/L (ppm) of carbonate. The unique selectivity of the Dionex IonPac AS22 column positions carbonate well away from the common inorganic anions and does not interfere with quantification of the analytes of interest. Figure 10 shows the determination of inorganic anions in carbonated water using the Dionex IonPac AS22 column. Figure 11 shows the analysis of carbonated water using the Dionex IonPac AS22 capillary column. The sample was sonicated for 15 min to remove some of the carboante.

The Dionex IonPac AS22 column can be used to evaluate the mass balance of drugs and synthetic peptide preparations. Figure 12 illustrates the use of the Dionex IonPac AS22 column to determine the anionic counterion amount and type. The common inorganic anions plus trifluoroacetate can be determined in less than 14 min.

		Peaks:		
Column:	Dionex IonPac AG22, AS22, 4 mm		1. Fluoride	0.49 mg/L (ppm)
Eluent:	4.5 mM sodium carbonate/		2. Chloride	61.38
	1.4 mM sodium bicarbonate		3. Bromide	0.19
Temperature:	30 °C		4. Nitrate	2.53
Flow Rate:	1.2 mL/min		5. Carbonate	NQ
Inj. Volume:	10 µL		6. Phosphate	0.17
Detection:	Suppressed conductivity, Dionex ASRS 300 suppressor, 4 mm, AutoSuppression recycle mode		7. Sulfate	4.4

NQ: Not Quantified

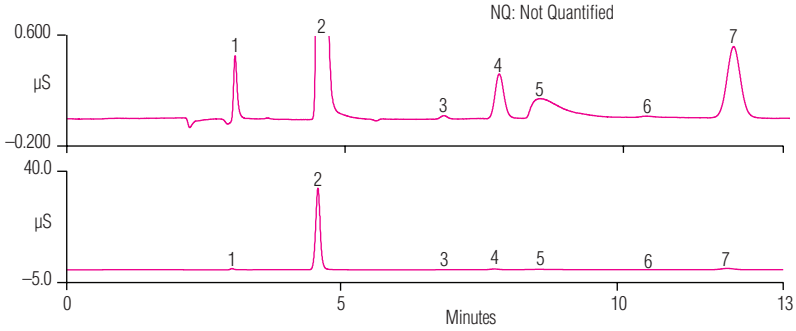

Figure 10. Determination of inorganic anions in carbonated water using the Dionex IonPac AS22 column.

		Peaks:		
Column:	Dionex IonPac AG22/AS22 (0.4 × 250 mm)		1. Fluoride	0.022 mg/L (ppm)
Eluent:	4.5 mM sodium carbonate/		2. Chloride	0.802
	1.4 mM sodium bicarbonate		3. Nitrite	0.005
Temperature:	30 °C		4. Bromide	0.017
Flow Rate:	12 µL/min		5. Chlorate	NQ
Inj. Volume:	0.4 µL		6. Nitrate	2.440
Detection:	Suppressed conductivity, Dionex ACES 300 suppressor, 4 mm, AutoSuppression recycle mode		7. Carbonate	NQ
			8. Phosphate	0.024
Sample Prep:	Sonication		9. Sulfate	0.374

NQ: Not Quantified

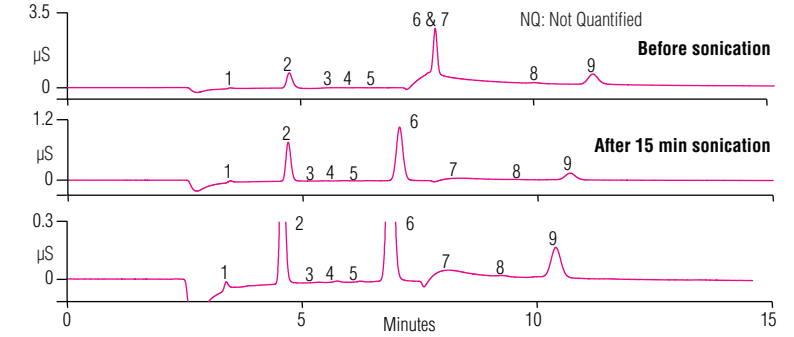

Figure 11. Analysis of the common inorganic anions in carbonated water using the Dionex IonPac AS22 capillary column.

		Peaks:		
Column:	Dionex IonPac AG22, AS22, 4 mm		1. Fluoride	2 mg/L (ppm)
Eluent:	4.5 mM sodium carbonate/		2. Acetate	20
	1.4 mM sodium bicarbonate		3. Chloride	4
Temperature:	30 °C		4. Trifluoroacetate	10
Flow Rate:	1.2 mL/min		5. Bromide	10
Inj. Volume:	10 µL		6. Nitrate	10
Detection:	Suppressed conductivity, Dionex ASRS 300 suppressor, 4 mm, AutoSuppression recycle mode		7. Phosphate	20
			8. Sulfate	10

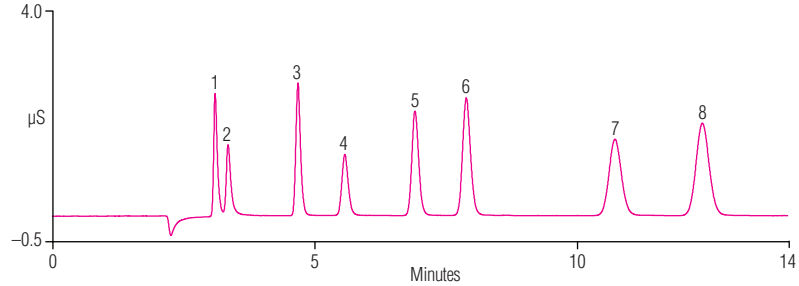

Figure 12. Analysis of the common inorganic anions and TFA using the Dionex IonPac AS22 column.

System Requirements

The Dionex IonPac AS22 Capillary Column is recommended for use with the Thermo Scientific™ Dionex™ ICS-5000+ or ICS-4000 Capillary Reagent-Free™ HPIC™ system. The Dionex IonPac AS22 and AS22-Fast Analytical Columns are recommended for use with Dionex ICS-2100 or ICS-5000+ RFIC system equipped with an eluent generator and EPM. The Dionex IonPac AS22 Analytical Column can also be used with older Dionex IC systems equipped with an eluent generator of a Thermo Scientific Dionex RFC-30 Reagent-Free Controller. The eluent generator is used to automatically produce carbonate and bicarbonate eluents from deionzied water.

Suppressor Recommendation

For optimum ease-of-use and economy, the Dionex IonPac AS22 and AS22-Fast columns should be used with the Dionex AERS 500 Anion Electrolytically Regenerated Suppressor or the Dionex ACES-300 Anion Capillary Electrolytic Suppressor.

Concentrator Columns

For concentrator work with a 2 mm or 4 mm Dionex IonPac AS22 column, use the: Dionex IonPac AG22 guard column; Ultratrace Anion Concentrator Columns (Dionex IonPac UTAC-ULP1, UTAC-XLP1, UTAC-ULP2, or UTAC-XLP2) or Trace Anion Concentrator Column (Dionex IonPac TAC-ULP1) when a single piston pump such as the Thermo Scientific Dionex AXP Auxiliary Pump (pulse damper required) is used for sample delivery. In addition to the concentrator columns listed above, use the Dionex IonPac UTAC-LP1, UTAC-LP2 or TAC-LP1 when the sample is delivered using a syringe or a low-pressure AutoSampler, e.g., the Thermo Scientific Dionex AS-DV AutoSampler.

For concentrator work with a 0.4 mm capillary column, use the Dionex IonPac AG22 Capillary Guard Column or the Thermo Scientific™ Dionex™ IonSwift™ MAC-100 concentrator column.

SPECIFICATIONS	
Dimension	Dionex IonPac AS22 Analytical Column (2 × 250 mm), (4 × 250 mm) Dionex IonPac AS22 Capillary Column (0.4 × 250 mm) Dionex IonPac AS22-Fast Analytical Column (2 x 150 mm), (4 x 250 mm) Dionex IonPac AG22 Guard Column (2 × 50 mm), (4 × 50 mm) Dionex IonPac Capillary Guard Column (0.4 × 50 mm) Dionex IonPac AG22-Fast Guard Column (2 × 30 mm), (4 × 30 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)	6.5
Pore Size Å	2000
Cross-Linking (%DVB)	55
Guard Column	Microporous resin
Bead Diameter (µm)	11
Pore Size Å	<1
Cross-Linking (%DVB)	55%
Ion-Exchange Functional Group	
Alkanol quaternary ammonium ion	
Functional Group Characteristics	
Hydrophobicity Ultralow	
Capacity	
2.1 ueq	(0.4 x 250 mm capillary column)
0.06 ueq	(90.4 x 50 mm capillary guard column)
52.5 µeq	(2 × 250 mm analytical column)
1.5 µeq	(2 × 50 mm guard column)
210 µeq	(4 × 250 mm analytical column)
6 µeq	(4 × 50 mm guard column)
126 µeq	(4 × 150 mm analytical column)
4.0 µeq	(4 × 30 mm guard column)
31.5 µeq	(2 × 150 mm analytical column)
1.0 µeq	(2 × 30 mm guard column)
Column Construction	PEEK™ with 10–32 threaded ferrule style end fittings. All components are nonmetallic.

Ordering Information

For more information or to place an order, contact the Thermo Scientific Dionex Products office nearest you or your local distributor. Phone numbers and addresses for worldwide subsidiaries can be found in the About Us section of www.thermoscientific.com/dionex.

Product Description	Part Number
Dionex IonPac AS22 Capillary Column (0.4 × 250 mm)	079057
Dionex IonPac AG22 Capillary Guard Column (0.4 × 50 mm)	079058
Dionex IonPac AS22 Analytical Column (4 × 250 mm)	064141
Dionex IonPac AG22 Guard Column (4 × 50 mm)	064139
Dionex IonPac AS22 Analytical Column (2 × 250 mm)	064137
Dionex IonPac AG22 Guard Column (2 × 50 mm)	064135
Dionex IonPac AS22-Fast Analytical Column (4 × 150 mm)	079936
Dionex IonPac AG22-Fast Guard Column (4 × 30 mm)	072784
Dionex IonPac AS22-Fast Analytical Column (2 × 150 mm)	079937
Dionex IonPac AG22-Fast Guard Column (2 × 30 mm)	072785
Dionex IonPac AMC-1 Anion MicroConcentrator (2 × 15 mm)	051760
Dionex IonPac TAC-2 Trace Anion Concentrator (3 × 35 mm)	043101
Dionex IonPac TAC-LP1 Low Pressure Trace Anion Concentrator (4 × 35 mm)	046026
Dionex IonPac TAC-ULP1 Ultra Low Pressure Trace Anion Concentrator (5 × 23 mm)	061400
Dionex IonPac UTAC-LP1 Ultra Trace Anion Concentrator–Low Pressure (4 × 35 mm)	063079
Dionex IonPac UTAC-ULP1 Ultra Trace Anion Concentrator–Ultra Low Pressure (5 × 23 mm)	063475
Dionex IonPac UTAC-XLP1 Ultra Trace Anion Concentrator–Extremely Low Pressure (6 × 16 mm)	063459
Dionex IonPac UTAC-LP2 Ultra Trace Anion Concentrator- Low Pressure (4 × 35 mm)	079917
Dionex IonPac UTAC-ULP2 Ultra Trace Anion Concentrator- Ultra Low Pressure (5 × 23 mm)	079918
Dionex IonPac UTAC-XLP2 Ultra Trace Anion Concentrator- Extremely Low Pressure (6 × 16 mm)	072781
Dionex IonPac AS22 Sodium Carbonate/Bicarbonate Eluent Concentrate (250 mL of 100X concentrate)	063965

www.thermoscientific.com/dionex

Thermo Fisher Scientific, Sunnyvale, CA USA is ISO 9001:2008 Certified.

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