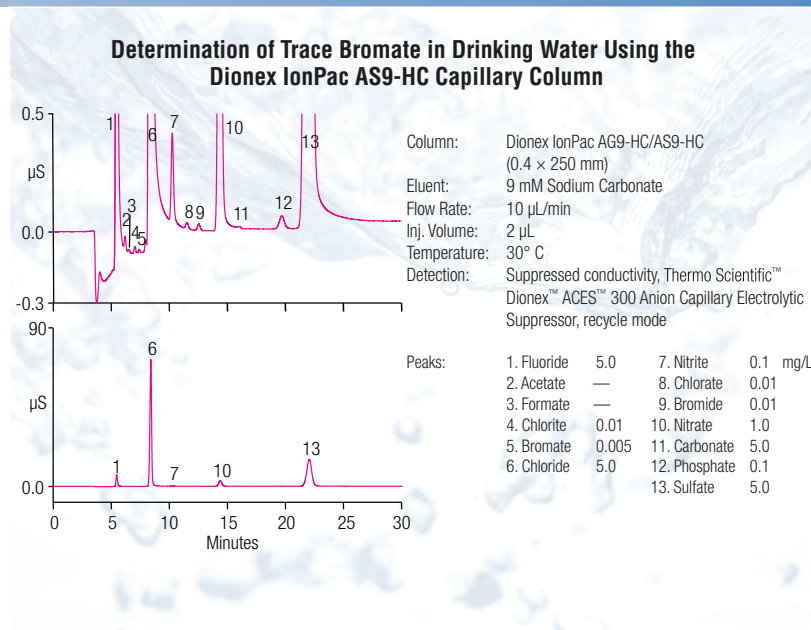


Thermo Scientific Dionex IonPac AS9-SC and AS9-HC Anion-Exchange Column

The Thermo Scientific™ Dionex™ IonPac™ AS9-SC (solvent compatible) column is a carbonate-selective anion-exchange column designed for the fast, isocratic separation of inorganic anions and oxyhalides including fluoride, chlorite, bromate, chloride, nitrite, bromide, chlorate, nitrate, phosphate, and sulfate in drinking water, groundwater, wastewater, and other diverse sample matrices. The Dionex IonPac AS9-HC is a high-capacity anion-exchange column with selectivity similar to the Dionex IonPac AS9-SC column. The Dionex IonPac AS9-HC column is also designed for the analysis of inorganic anions and oxyhalides but has higher capacity and provides improved separation for trace bromate in drinking water matrices using an isocratic carbonate eluent and a large loop injection. The high capacity Dionex IonPac AS9-HC column also offers improved retention of fluoride out of the water dip.



Dionex IonPac AS9-SC Column Features

The Dionex IonPac AS9-SC column has a unique selectivity, permitting the fast, isocratic separation of fluoride, chlorite, bromate, chloride, nitrite, bromide, nitrate, phosphate, and sulfate in less than 10 min using a bicarbonate/carbonate eluent coupled with suppressed conductivity detection as illustrated in Figure 1A. The Dionex IonPac AS9-SC column is specified in validated methods such as U.S. EPA Method 300.0 (B).

Dionex IonPac AS9-HC Column Features

The Dionex IonPac AS9-HC column provides improved separation of the common inorganic anions and the oxyhalides over the Dionex IonPac AS9-SC column as illustrated in Figure 1B. Increased retention time on the Dionex IonPac AS9-HC column (approximately 22 min) is due to the high capacity (190 µeq for 4 × 250 mm) of

the column. High capacity allows for the determination of trace bromate in drinking water using a large loop injection and an isocratic carbonate eluent. The Dionex IonPac AS9-HC column also provides improved separation of bromate/chloride, chloride/nitrite, and chlorate/nitrate analyte pairs. The Dionex IonPac AS9-HC column is specified in validated methods such as U.S. EPA Method 300.1.

High Efficiency Particle Structure

The Dionex IonPac AS9-SC column and the Dionex IonPac AS9-HC column packings have unique structures composed of a highly crosslinked core and a Thermo Scientific™ Dionex™ MicroBead™ resin anion-exchange layer attached to the surface, as shown in Figures 2 and 3. The substrate for the Dionex IonPac AS9-SC column is a 13 µm diameter microporous resin particle and the Dionex IonPac AS9-HC column substrate is a 9 µm diameter macroporous resin particle, both consisting of ethylvinylbenzene crosslinked with 55% divinylbenzene.

The anion exchange layer is functionalized with quaternary ammonium groups. This anion-exchange layer has a controlled thickness, which results in excellent mass transfer characteristics and consequently, very high efficiency peaks.

Economical Capillary Operation

The Dionex IonPac AS9-HC column is available in the 0.4 mm format for capillary operation to offer the advantage of reduced operating costs.

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

Figure 4 is an example of the separation of inorganic anions and oxyhalides using the Dionex IonPac AS9-HC capillary column.

Solvent Compatible Packing

Because the Dionex IonPac AS9-SC and the Dionex IonPac AS9-HC columns are 100% HPLC solvent compatible, organic solvents can be used for efficient column clean-up or to enhance sample solubility. The elimination of time-consuming sample preparation saves time and expense and extends the utility of the column to new applications requiring solvents. Adding organic solvents to the eluent modifies column selectivity and enables the elution of nonpolar analytes or contaminants from the column.

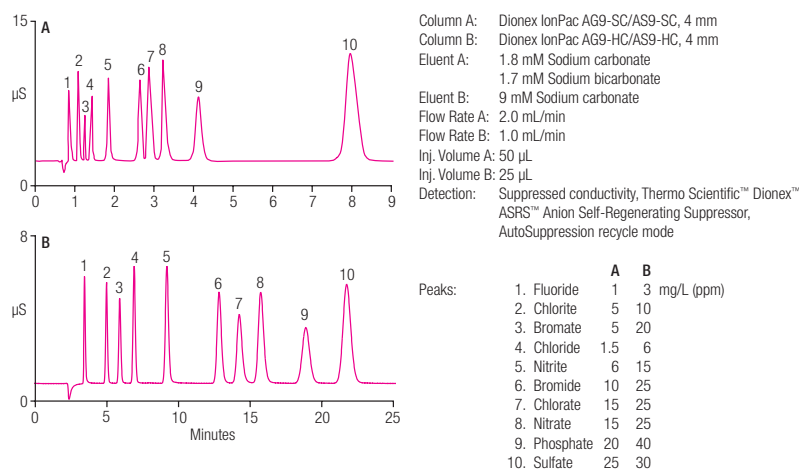


Figure 1. Comparison of the Dionex IonPac AS9-SC and the Dionex IonPac AS9-HC columns for the separation of inorganic anions and oxyhalides.

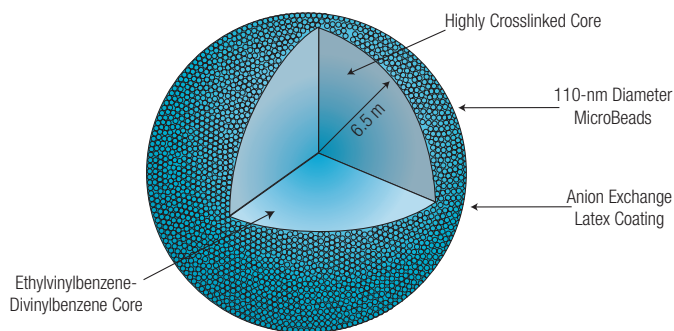


Figure 2. Structure of a Dionex IonPac AS9-SC column packing particle.

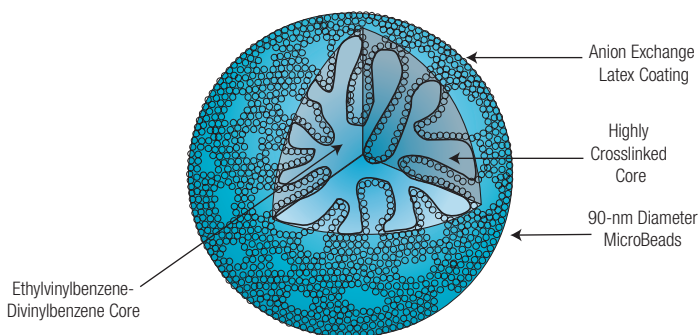


Figure 3. Structure of a Dionex IonPac AS9-HC column packing particle.

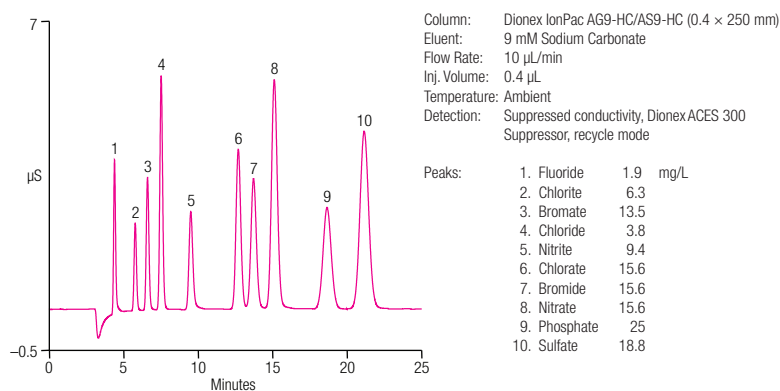


Figure 4. Separation of inorganic anions and oxyhalides using the Dionex IonPac AS9-HC capillary column.

Determination of Trace Bromate in Drinking Water Matrices

Bromate, a disinfection byproduct of the ozonation disinfection process for drinking water, has been cited by the U.S. EPA and the World Health Organization as a potential carcinogen, even at low $\mu\text{g/L}$ (ppb) concentrations.

A simple, isocratic method has been developed using the high capacity Dionex IonPac AS9-HC column to determine bromate at low $\mu\text{g/L}$ concentrations. This method uses a large loop injection with an isocratic carbonate eluent coupled with suppressed conductivity detection as illustrated in Figure 5. Figure 6 shows the separation of inorganic anions and oxyhalides in a drinking water sample spiked with 5 ppb bromate using the Dionex IonPac AS9-HC capillary column.

Sample Pretreatment

For drinking water samples containing excessive chloride concentrations, a Thermo Scientific™ Dionex™ OnGuard™ Ag cartridge can be used to remove the chloride followed by a Dionex OnGuard H cartridge to remove residual silver ions. The Dionex OnGuard H cartridge also removes carbonate. Figure 7 illustrates the use of this pretreatment.

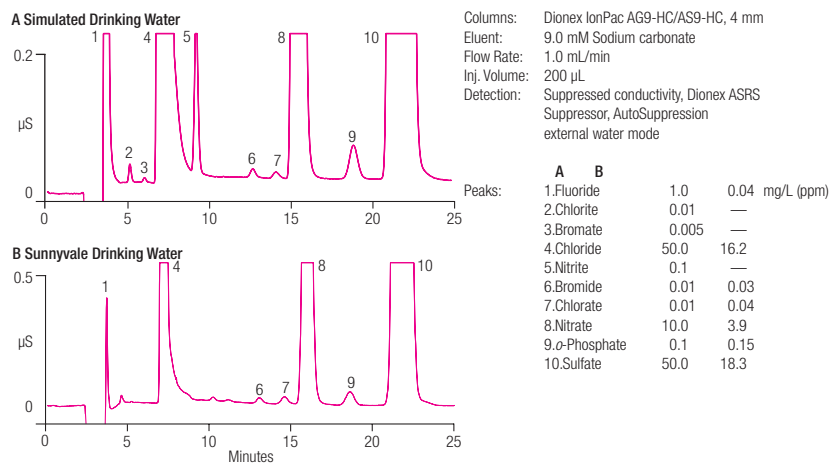


Figure 5. Determination of trace bromate in drinking water using the Dionex IonPac AS9-HC column.

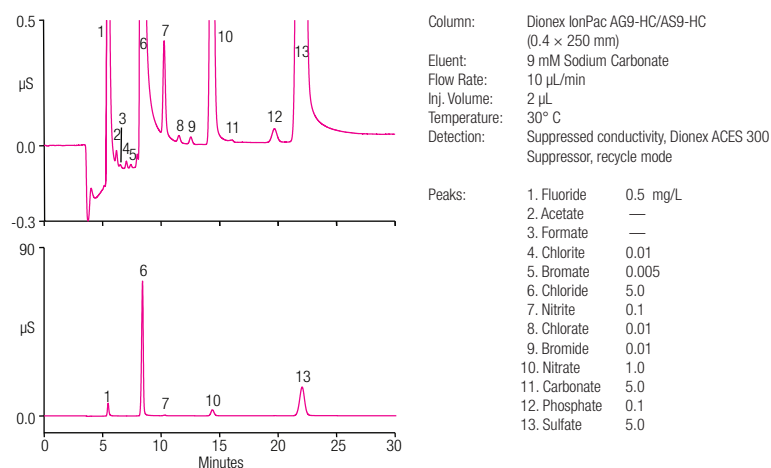


Figure 6. Determination of trace bromate in drinking water using the Dionex IonPac AS9-HC capillary column.

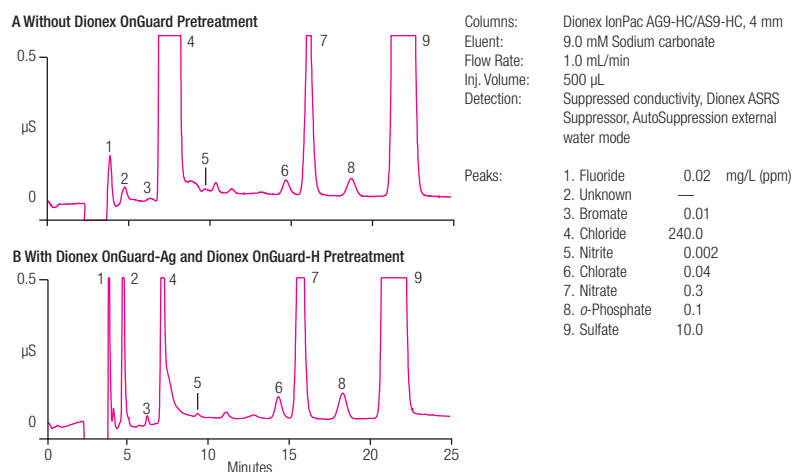


Figure 7. Effect of the Dionex OnGuard cartridge pretreatment on drinking water samples with excessive chloride concentrations.

Fast Run for Chloride and Sulfate

Sulfur and chlorine play important roles in many catalytic processes used for petrochemical production. With combustion-IC, the total sulfur and chlorine contents of polymeric catalysts can be determined with high accuracy and precision. The Dionex IonPac AS9-SC column provides a rapid method to determine chloride and sulfate in polymeric catalysts. With an optimized carbonate eluent, these analytes can be determined in less than 8 min, as illustrated in Figure 8.

Inorganic Anions in Solvents

Monitoring anionic contaminants in the manufacture of semiconductor materials such as organic solvents is important because yield and reliability can be significantly compromised by ionic contamination. An isocratic method has been developed using the high-capacity Dionex IonPac AS9-HC column to determine trace anions in water-miscible organic solvents. Figure 9 illustrates the separation of trace anions in semiconductor isopropyl alcohol. For more details on this application please refer to Application Note 85.

High Ionic Strength Samples

The high capacity Dionex IonPac AS9-HC column is ideal for difficult applications such as trace nitrite in complex matrices, including meat and milk products, fertilizers, soil extracts, and wastewater. Figure 10A illustrates the analysis of 0.2 ppm nitrite spiked into ASTM synthetic wastewater containing 2000 ppm chloride. Using an isocratic carbonate eluent and suppressed conductivity detection, a 10,000:1 ratio of chloride/nitrite can be analyzed with the Dionex IonPac AS9-HC column.

UV detection at 214 nm provides improved sensitivity for nitrite and allows ratios up to 111,000:1 of chloride/nitrite to be analyzed as illustrated in Figure 10B. Chloride, which is UV transparent, is seen as a large dip at 7 min, and does not interfere with the quantification of nitrite.

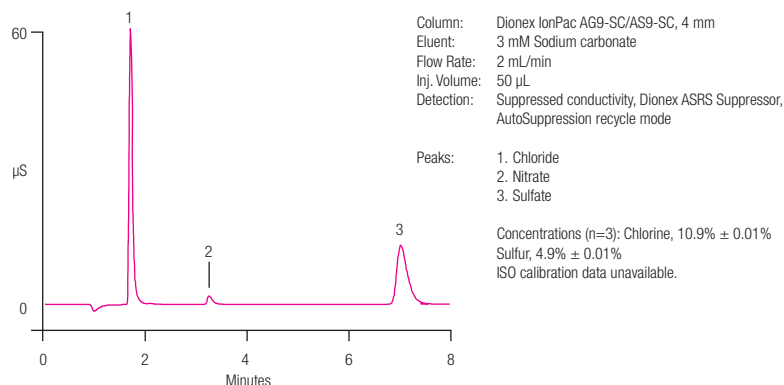


Figure 8. Determination of chloride and sulfate in a polymeric catalyst using the Dionex IonPac AS9-SC column.

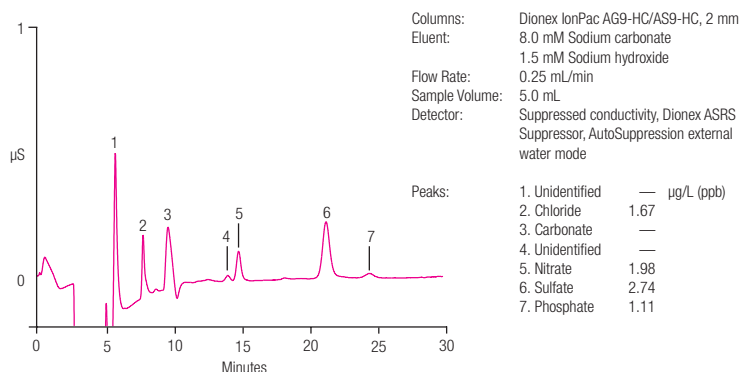


Figure 9. Trace anion analysis of spiked semiconductor isopropyl alcohol using the Dionex IonPac AS9-HC column.

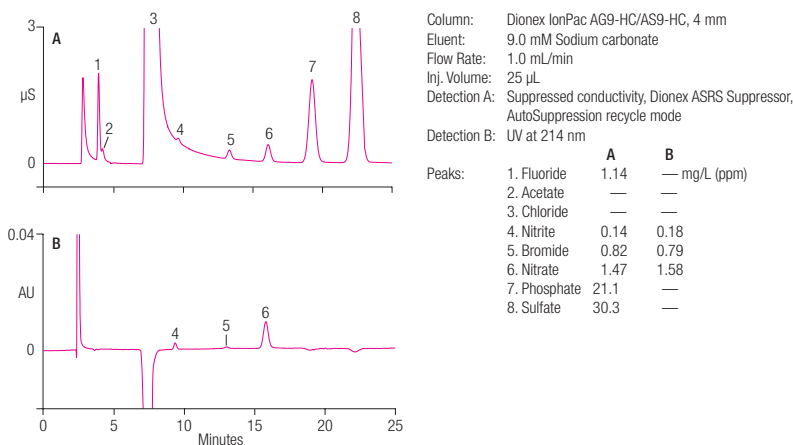


Figure 10. Comparison of suppressed conductivity detection (A) and UV detection (B) for the determination of trace nitrite in a wastewater sample containing high levels of chloride.

SPECIFICATIONS

Dionex IonPac AS9-SC Column

Dimensions:	Dionex IonPac AS9-SC Analytical Column: 4 × 250 mm Dionex IonPac AG9-SC Guard Column: 4 × 50 mm
Maximum Operating Pressure:	4000 psi
Mobile Phase Compatibility:	pH 2–11; 0–100% HPLC solvents
Substrate Characteristics:	Particle Diameter: 13 µm Crosslinking (%DVB): 55%
Latex Characteristics:	Functional Group: Alkyl quaternary ammonium ion Latex Crosslinking: 20% Latex Diameter: 110 nm Hydrophobicity: Medium
Capacity:	30–35 µeq (4 × 250 mm column)
Column Construction:	PEEK with 10–32 threaded ferrule-style end fittings. All components are nonmetallic.

Dionex IonPac AS9-HC Column

Dimensions:	Dionex IonPac AS9-HC Analytical Column: 2 × 250 mm and 4 × 250 mm Dionex IonPac AG9-HC Guard Column: 2 × 50 mm and 4 × 50 mm Dionex IonPac AS9-HC Capillary Column: 0.4 × 250 mm Dionex IonPac AG9-HC Capillary Guard Column: 0.4 × 50 mm
Maximum Operating Pressure:	4000 psi
Mobile Phase Compatibility:	pH 0–12; 0–100% HPLC solvents
Substrate Characteristics:	Particle Diameter: 9 µm Pore Size: 2000 Å Crosslinking (%DVB): 55%
Latex Characteristics:	Functional Group: Alkyl/alkanol quaternary ammonium ion Latex Crosslinking: 15% Latex Diameter: 90 nm Hydrophobicity: Medium-Low
Capacity:	47.5 µeq (2 × 250 mm column) 190 µeq (4 × 250 mm column) 1.9 µeq (0.4 × 250 mm column)
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 AS9 Columns	Part Number
Dionex IonPac AS9-SC Analytical Column (4 × 250 mm)	043185
Dionex IonPac AG9-SC Guard Column (4 × 50 mm)	043186
Dionex IonPac AS9-HC Analytical Column (4 × 250 mm)	051786
Dionex IonPac AG9-HC Guard Column (4 × 50 mm)	051791
Dionex IonPac AS9-HC Analytical Column (2 × 250 mm)	052244
Dionex IonPac AG9-HC Guard Column (2 × 50 mm)	052248
Dionex IonPac AS9-HC Capillary Column (0.4 × 250 mm)	082319
Dionex IonPac AG9-HC Capillary Guard Column (0.4 × 50 mm)	088296
Trace Anion Concentrator Columns	Part Number
Dionex IonPac TAC-2 Trace Anion Concentrator (3 × 35 mm)	043101
Dionex IonPac TAC-LP1 Trace Anion Concentrator (4 × 35 mm)	046026
Thermo Scientific™ Dionex™ IonSwift™ MAC-100 Monolith Anion Concentrator (0.5 × 80 mm) (for use with Capillary IC)	074702
Dionex IonPac TAC-LP1 Trace Anion Concentrator (4 × 35 mm)	046026
Dionex IonPac TAC-ULP1 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
Eluent Concentrates	Part Number
Sodium Carbonate/Bicarbonate Concentrate (500 mL of 100X concentrate. For use with Dionex IonPac AS9-SC column)	039513
0.5 M Carbonate Anion Eluent Concentrate (500 mL of 100X concentrate. For use with Dionex IonPac AS9-HC column)	037162

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