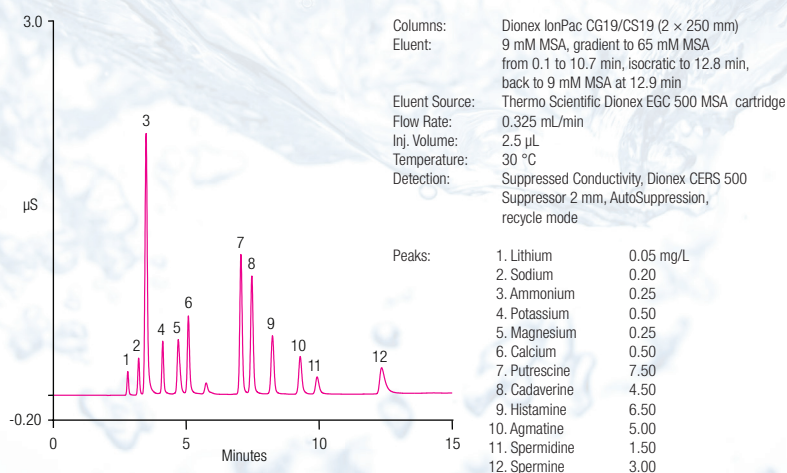


Thermo Scientific Dionex IonPac CS19 Cation-Exchange Column

The Thermo Scientific™ Dionex™ IonPac™ CS19 cation-exchange column has moderately high capacity and moderate hydrophobicity, and is recommended for isocratic and gradient separations of polar amines such as alkanolamines, methylamines, and moderately hydrophobic amines including biogenic amines. The Dionex IonPac CS19 column is ideally used with a Reagent-Free™ Ion Chromatography (RFIC™) system for automatic methanesulfonic acid (MSA) eluent generation and electrolytic eluent suppression with conductivity detection. Available Dionex IonPac CS19 column formats include 0.4 × 250 mm, 2 × 250 mm, and 4 × 250 mm, allowing flow rates from 10 µL/min to 1.5 mL/min.

Separation of Biogenic Amines and Common Inorganic Cations Using the Dionex IonPac CS19 Column



NOTE: Concentrations are only approximate.

Superior Chromatographic Performance

- Universal column for polar amines, including alkanolamines and methylamines in diverse sample matrices.
- Universal column for moderately hydrophobic amines including biogenic amines.
- Simplified RFIC system requires only a deionized water source to produce MSA eluent.
- The Dionex IonPac CS19 capillary and microbore columns offer reduced eluent consumption and reduced operating costs.
- More rugged and reliable column for most Dionex IonPac CS18 column applications.
- RFIC eluent suppressors (Thermo Scientific™ Dionex™ CERS™ 500 Cation Electrolytically Regenerated Suppressor or Thermo Scientific™ Dionex™ CCES™ 300 Cation Capillary Electrolytic Suppressor) and trap column (Thermo Scientific Dionex CR-CTC Continuously Regenerated Cation Trap Column) together provide electrolytic suppression with minimal baseline shift during gradients and enhanced analyte sensitivity.
- Compatible with 10% organic solvents such as acetonitrile and acetone (excluding alcohols) to enhance analyte solubility, modify column selectivity, and allow effective column cleanup.
- Moderately high capacity: 2400 µeq/col (4 × 250 mm column). Allows easier analysis of high ionic strength samples.
- Samples include power plant waters treated with ammonium, morpholine or ethanolamine, chemical additives, chemical process solutions, refinery scrubber solutions, personal care products, and foods.

Unique Carboxylate Cation Exchanger for Small Amines

The Dionex IonPac CS19 column is a unique moderately hydrophobic, moderately high capacity, weak cation exchanger designed for polar amines, and moderately hydrophobic amines, plus the common inorganic cations using suppressed conductivity detection. The supermacroporous resin bead structure of the Dionex IonPac CS19 column is composed of a polymeric 5.5 μm substrate consisting of ethylvinyl benzene cross-linked with 55% divinylbenzene. The raw resin bead is then grafted with weak carboxylic acid groups as shown in Figure 1. The Dionex IonPac CS19 resin bead is produced using a novel low surface area substrate. All commercially available grafted cation exchange materials make use of high surface area substrates which provide good capacity but tend to preclude good peak shape, especially for hydrophobic cations which interacts strongly with the substrate surface. The Dionex IonPac CS19 resin bead architecture overcomes these issues by making use of a low surface area substrate.

The Dionex IonPac CS19 column offers optimum isocratic resolution of sodium, ammonium, and ethanolamine. The common inorganic cations can be separated by gradient elution from methylamine, dimethylamine, and trimethylamine. The column is polymer-based and can be used with eluents of pH 0–7. This column is compatible with 10% of the organic solvents used with IC (acetonitrile and acetone). The Dionex IonPac CS19 column allows gradient elution to resolve difficult analyte pairs and reduce total run time, all with minimal baseline shift during gradients.

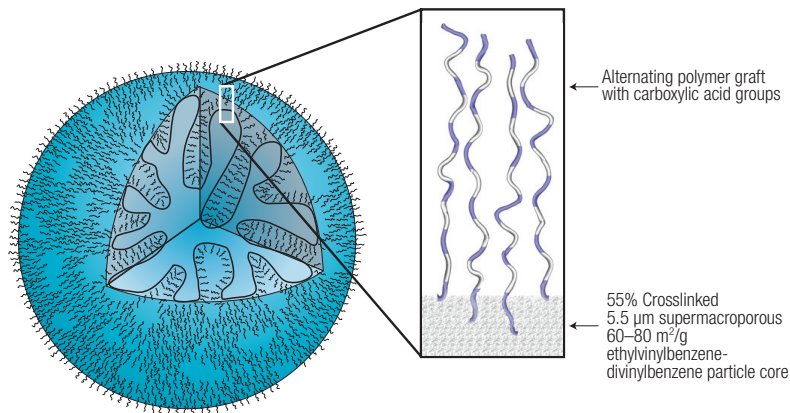
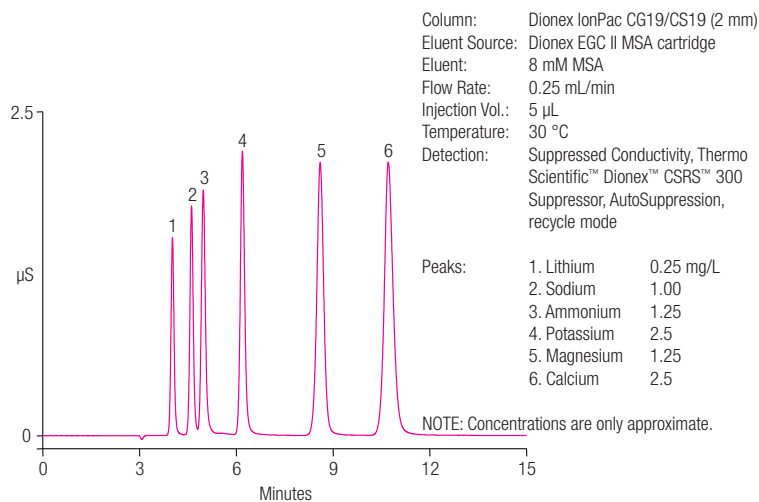


Figure 1. Structure of a Dionex IonPac CS19 packing particle.

Common Inorganic Cations

The common inorganic cations plus ammonium are separated on the Dionex IonPac CS19 column with 8 mM MSA eluent in approximately 11 min, as shown in Figure 2. Figure 3 illustrates the separation of the common inorganic cations, plus ammonium and ethylamines. Using 4 mM MSA coupled with suppressed conductivity detection, these analytes can be separated in approximately 26 min.



29016

Figure 2. Isocratic separation of six common cations using the Dionex IonPac CG19/CS19 column.

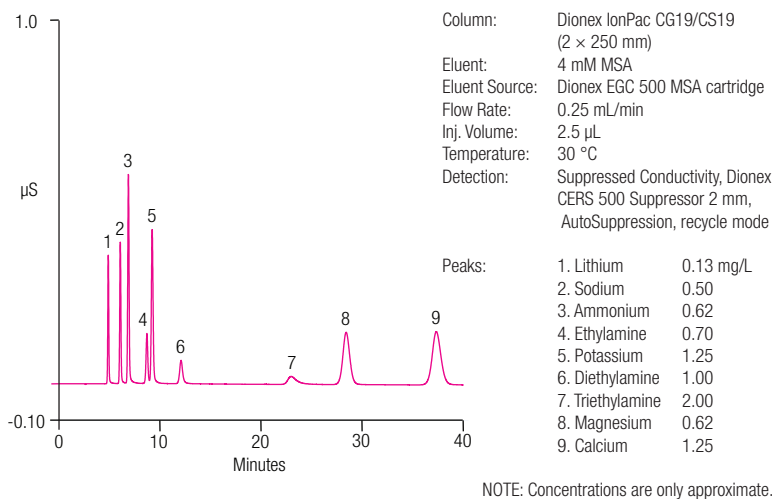
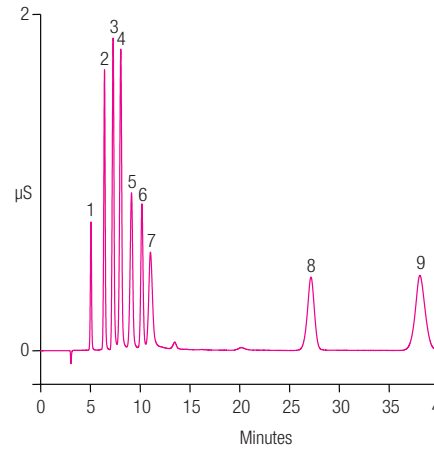


Figure 3. Isocratic elution of the six common cations plus ethylamines using the Dionex IonPac CG19/CS19 column (2 mm).

Determination of Alkanolamines and the Common Inorganic Cations

Alkanolamines, including monoethanolamine, diethanolamine, and triethanolamine, are most commonly used individually, but are also used in combination to optimize scrubber treatment efficiency for specific chemical processes. In large plants, different alkanolamines may be used in adjacent units to accommodate different scrubbing requirements. The Dionex IonPac CS19 column has unique selectivity for alkanolamines and therefore can resolve mixtures of these priority scrubber amines using a 4 mM MSA isocratic eluent with suppressed conductivity detection, as illustrated in Figure 4. .



Column: Dionex CG19/CS19 (2 mm)
 Eluent Source: Dionex EGC II MSA cartridge
 Eluent: 4 mM MSA
 Flow Rate: 0.25 mL/min
 Injection Vol.: 5 µL
 Temperature: 30 °C
 Detection: Suppressed Conductivity,
 Dionex CSRS 300 Suppressor,
 AutoSuppression, recycle mode

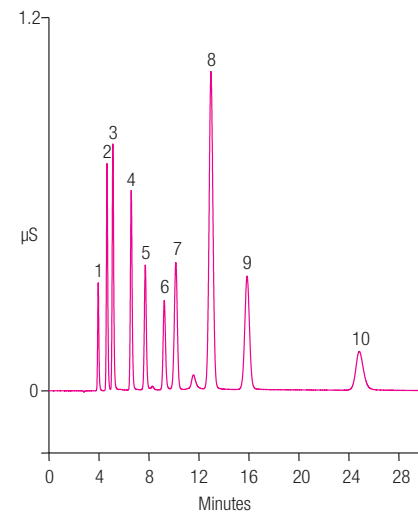
Peaks:	1. Lithium	0.125 mg/L
	2. Sodium	0.5
	3. Ammonium	0.62
	4. Ethanolamine	5.0
	5. Diethanolmine	10.0
	6. Potassium	1.25
	7. Triethanolamine	45.0
	8. Magnesium	0.62
	9. Calcium	1.25

NOTE: Concentrations are only approximate.
 The peaks between peak #7 and #8 are unknown.

29018

Determination of Ammonium and the Group I and II Cations

The Dionex IonPac CS19 column is the recommended column for the determination of ammonium and the common inorganic cations in diverse sample matrices, including scrubber solutions, process streams, and wastewater. Ammonium and the Group I and II cations are separated and elute with excellent peak efficiencies and symmetries when the column is run with a simple isocratic eluent, as illustrated in Figure 5.



Columns: Dionex IonPac CG19/CS19 (2 mm)
 Eluent Source: Dionex EGC II MSA cartridge
 Eluent: 7 mM MSA
 Flow Rate: 0.25 mL/min
 Injection Vol.: 5 µL
 Temperature: 30 °C
 Detection: Suppressed Conductivity,
 Dionex CSRS 300 Suppressor,
 AutoSuppression, recycle mode

Peaks:	1. Lithium	0.15 mg/L
	2. Sodium	0.60
	3. Ammonium	0.75
	4. Potassium	1.5
	5. Rubidium	1.2
	6. Cesium	1.4
	7. Magnesium	0.75
	8. Calcium	1.5
	9. Strontium	1.4
	10. Barium	1.4

NOTE: Concentrations are only approximate.
 The peak between peak #7 and #8 is an unknown.

29019

Figure 5. Separation of ammonium and the Group I and Group II inorganic cations on the Dionex IonPac CG19/CS19 column.

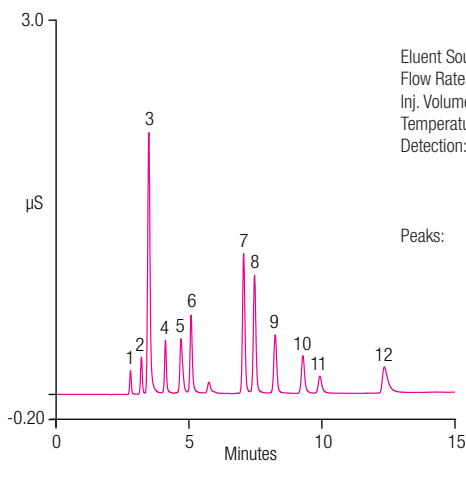
Determination of Biogenic Amines and the Group I and II Cations

Biogenic amines including putrescine, cadaverine, histamine, spermine, and spermidine are important to monitor in foods because they are indicators of spoilage. As shown in Figure 6, the Dionex IonPac CS19 column can easily separate the common cations and biogenic amines using an aqueous eluent without the need for organic solvent. Using the optimized gradient and increased flow rate shown in Figure 6, the biogenic amines and cations elute with good peak efficiencies and symmetries in less than 12 min.

Using the Dionex IonPac CS19 column and suppressed conductivity detection, these biogenic amines can easily be determined in complex food matrices. Amperometric detection can also be used to detect biogenic amines. This detection mode provides the advantage of specificity for oxidizable amines including the biogenic amines. Inorganic cations present in the sample are not detected using amperometric detection.

Solvent-Compatible Packing

The Dionex IonPac CS19 column is compatible with up to 10% organic solvents, such as acetonitrile and acetone. Alcohols can only be used at very low flow rates to avoid high pressure on the column. Thus, alcohols can be present as the matrix in samples or can be used for washing the column at 1/5 of the standard flow rate for the column format. Adding acetonitrile to the eluent modifies column selectivity and enables the elution of nonpolar analytes, hydrophobic analytes, or contaminants from the column. Acetonitrile can be used to enhance sample solubility, reduce retention times due to hydrophobic interactions, and improve the peak shapes of hydrophobic amines. Time and expense can be saved by eliminating time-consuming sample preparation steps. This feature allows complex sample matrices to be analyzed with minimal sample preparation.



Columns: Dionex IonPac CG19/CS19 (2 × 250 mm)
 Eluent: 9 mM MSA, gradient to 65 mM MSA from 0.1 to 10.7 min, isocratic to 12.8 min, back to 9 mM MSA at 12.9 min
 Eluent Source: Dionex EGC 500 MSA cartridge
 Flow Rate: 0.325 mL/min
 Inj. Volume: 2.5 µL
 Temperature: 30 °C
 Detection: Suppressed Conductivity, Dionex CERS 500 2 mm, AutoSuppression, recycle mode

Peaks:	1. Lithium	0.05 mg/L
	2. Sodium	0.20
	3. Ammonium	0.25
	4. Potassium	0.50
	5. Magnesium	0.25
	6. Calcium	0.50
	7. Putrescine	7.50
	8. Cadaverine	4.50
	9. Histamine	6.50
	10. Agmatine	5.00
	11. Spermidine	1.50
	12. Spermine	3.00

NOTE: Concentrations are only approximate.

Figure 6. Fast gradient elution of six common cations plus biogenic amines using the Dionex IonPac CG19/CS19 column (2 mm).

System Requirements

The Dionex IonPac CS19 column operated in the suppressed conductivity mode is recommended for use with the Thermo Scientific Dionex ICS-2100 system or Thermo Scientific™ Dionex™ ICS-5000+ Reagent-Free™ HPIC™ systems equipped with an eluent generator. Capillary columns (0.4 mm) require the use of a capillary system such as the Dionex ICS-5000+ capillary IC system or the Thermo Scientific Dionex ICS-4000 Capillary HPIC system. The Dionex IonPac CS19 analytical column can be used with older Dionex IC systems equipped with an eluent generator or a Thermo Scientific Dionex RFC-30 Reagent-Free Controller. The eluent generator automatically produces methanesulfonic acid gradients from deionized water.

Suppressor Recommendations

For optimum ease of use and performance, the Dionex IonPac CS19 analytical column should be used with the Dionex CERS 500 Cation Electrolytically Regenerated Suppressor or the Dionex CCES 300 Cation Capillary Electrolytic Suppressor for the Dionex IonPac CS19 capillary column. We recommend operating the Dionex IonPac CS19 column at a slightly elevated temperature (30 °C) to ensure reproducible retention times in all environmental conditions.

Cation Trap Columns

When using the eluent generator for eluent delivery and to achieve an almost flat baseline when using gradient elution, we recommend installing a Dionex CR-CTC II Continuously Regenerated Cation Trap Column to remove cationic contaminants from the eluent. The Dionex CR-CTC trap column should be installed between the Thermo Scientific Dionex EGC Eluent Generator Cartridge and the eluent generator degas module. For capillary applications, the Thermo Scientific Dionex CR-CTC II Continuously Regenerated Cation Trap Column (Capillary) is used to reduce the background conductivity during gradient separations.

Alternatively, a Thermo Scientific Dionex CTC Cation Trap Column can be used with 2 mm and 4 mm columns, and is installed between the gradient pump and the injection valve to remove cationic contaminants from the eluent.

Concentrator Columns

For trace analysis work, use the Thermo Scientific Dionex IonPac TCC-LP1, Dionex IonPac TCC-UPL1, or Dionex IonPac TCC-XLP1 Cation Concentrator Column when the sample is delivered with a syringe or with an autosampler.

For concentrator work with a 0.4 mm capillary column, use the Thermo Scientific™ Dionex™ IonSwift™ MCC-100 concentrator column.

SPECIFICATIONS

Dimensions:	Dionex IonPac CS19 Analytical Column: 2 × 250 mm and 4 × 250 mm
	Dionex IonPac CG19 Guard Column: 2 × 50 and 4 × 50 mm
	Dionex IonPac CS19 Capillary Column: 0.4 × 250 mm
	Dionex IonPac CG19 Capillary Guard Column: 0.4 × 50 mm
Maximum Operating Pressure:	3000 psi (standard, microbore, and capillary)
Mobile Phase Compatibility:	Acidic eluents (pH 0–7), 10% HPLC solvents, alcohols should be avoided.
Substrate Characteristics:	2 × 250 mm, 4 × 250 mm, 0.4 × 250 mm Supermacroporous Resin Particle Diameter: 4 µm Pore Size: 2000 Å Crosslinking (%DVB): 55%
	2 × 50 mm, 4 × 50 mm, 0.4 × 50 mm Microporous Resin Particle Diameter: 8 µm Pore Size: < 1 Å Crosslinking (%DVB): 55%
Ion-Exchange Group:	Grafted carboxylic acid
Functional Group Characteristics:	Medium hydrophobic
Capacity (µeq/column):	2410 µeq/column (4 × 250 mm)
	46 µeq/column (4 × 50 mm)
	600 µeq/column (2 × 250 mm)
	11 µeq/column (2 × 50 mm)
	24 µeq/column (0.4 × 250 mm)
	0.5 µeq/column (0.4 × 50 mm)
Column Construction:	PEEK™ with 10-32 threaded ferrule-style end fittings. All components are nonmetallic.

Ordering Information

Analytical and Guard Columns	Part Number
Dionex IonPac CS19 Capillary Column (0.4 × 250 mm)	076024
Dionex IonPac CG19 Capillary Guard Column (0.4 × 50 mm)	076025
Dionex IonPac CS19 Analytical Column (4 × 250 mm)	076026
Dionex IonPac CG19 Guard Column (4 × 50 mm)	076027
Dionex IonPac CS19 Analytical Column (2 × 250 mm)	076028
Dionex IonPac CG19 Guard Column (2 × 50 mm)	076029
Trap Columns	Part Number
Dionex CR-CTC II Continuously Regenerated Cation Trap Column	066262
Dionex CR-CTC Continuously Regenerated Cation Trap Column (Capillary) (for use with Capillary Cation Columns)	072079
Dionex CTC-1 Cation Trap Column (9 × 24 mm) (for use with 4 mm columns)	040192
Dionex CTC Cation Trap Column (4 × 35 mm) (for use with 2 mm columns)	043132
Trace Cation Concentrator Columns	Part Number
Dionex TCC-LP1 Trace Cation Concentrator Low Pressure (4 × 35 mm)	046027
Dionex TCC-ULP1 Trace Cation Concentrator Ultralow Pressure (5 × 23 mm)	063783
Dionex TCC-XLP1 Trace Cation Concentrator Extremely Low Pressure (6 × 16 mm)	063889
Dionex MCC-100 Monolith Cation Concentrator Column (0.5 × 80 mm)	075462

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