

## IonPac CS16 Cation-Exchange Column



*The IonPac® CS16 cation-exchange column is designed for the determination of disparate concentration ratios of sodium and ammonium (up to 10,000:1) in diverse sample matrices using an isocratic acid eluent and elevated temperature. Other important applications include the determination of short-chained alkylamines and alkanolamines in the presence of lithium, sodium, ammonium, potassium, magnesium, and calcium in complex sample matrices. The IonPac CS16 column is recommended for most IonPac CS15 applications. The column selectivity is optimized for a 40 °C operating temperature for maximum peak efficiencies. Solvent compatibility permits easy column clean-up after the analysis of complex matrices. Formats available include 0.5 mm, 3 mm, and 5 mm, allowing use of Capillary to analytical flow rates and supporting advanced IC × IC applications.*

**Superior Chromatographic Performance**

- Universal column for disparate concentration ratios of ammonium and sodium in complex sample matrices
- CS16 Capillary column offers reduced eluent consumption and reduced operating costs
- Trace level ammonium in high concentrations of sodium; trace level sodium in high concentrations of ammonium or amines
- Determine amines, including alkylamines and alkanolamines in diverse sample matrices
- Designed to be used in most IonPac CS15 applications with a larger linear working range
- Improved low sample pH tolerance
- High capacity: 8400 µeq per column (5 × 250 mm column)
- Fourfold and 100-fold increase in mass sensitivity, respectively, with 3 mm i.d. microbore and 0.5 mm i.d. capillary formats
- Column selectivity optimized for a 40 °C operating temperature for maximum peak efficiencies
- Simplified operation provided by the Eluent Generator, which requires only a deionized water source to produce methanesulfonic acid (MSA) eluent
- Compatible with organic solvents to enhance analyte solubility, to modify column selectivity, or for effective column clean-up

**Passion. Power. Productivity.**

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Thermo Scientific brand

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- Sample matrices include environmental waters and soil extracts; power plant waters treated with ammonium, morpholine, or ethanolamine; chemical additives; chemical process solutions; scrubber solutions; plating baths; and solvents

### Unique Carboxylate Cation Exchanger

The IonPac CS16 column is a unique hydrophilic, high capacity carboxylate functionalized cation exchanger that provides excellent peak shape for alkali and alkaline earth metals and amines. The IonPac CS16 column packing is a 5- $\mu\text{m}$  diameter macroporous particle consisting of ethylvinylbenzene crosslinked with 55% divinylbenzene as shown in Figure 1. The substrate is functionalized with a hydrophilic carboxylic acid layer that permits the elution of mono- and divalent cations using a dilute hydronium ion eluent, such as MSA or sulfuric acid. The CS16 packing is a new advancement in Dionex resin technology. The use of a smaller resin particle size (5  $\mu\text{m}$ ) provides the advantage of improved peak efficiencies, while the new grafting technology allows higher capacity through the incorporation of a much larger number of carboxylic acid cation-exchange sites.

### Improved Resolution

The IonPac CS16 column provides improved resolution among the analyte peaks due to its higher cation-exchange capacity. It was designed specifically for high-to-low ratios of sodium and ammonium in diverse sample matrices. Ratios of up to 10,000:1 can be resolved using a simple isocratic acidic eluent at an elevated temperature (40 °C) coupled with suppressed conductivity detection. The common inorganic cations and ammonium can be resolved in 20 minutes using 30 mM MSA as shown in Figure 2.

The MSA or sulfuric acid concentration can be optimized for the fast determination of Group I and II cations using 48 mM MSA, also illustrated in Figure 2.

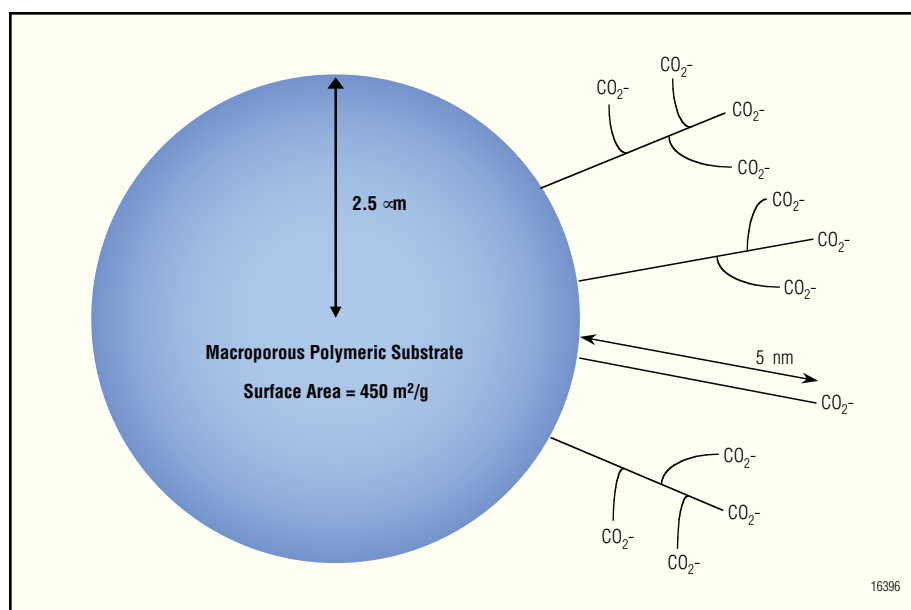


Figure 1. Structure of an IonPac CS16-5 $\mu\text{m}$  packing particle.

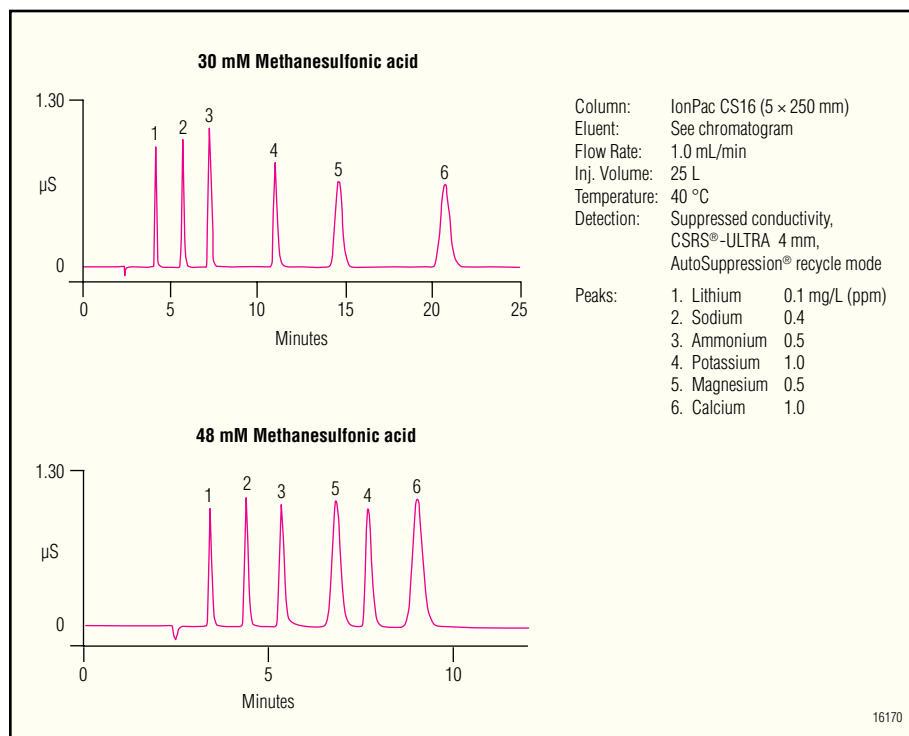


Figure 2. Isocratic separation of common inorganic cations and ammonium.

## CS16 Capillary Format

The CS16 Capillary column (0.5 × 250 mm) is packed with the same material as the equivalent analytical scale version, thus producing the same performance as a 5 mm column, but requires only 1/100th the eluent flow rate. The capillary format offers the advantage of less eluent consumption providing reduced operating costs. Figure 3 illustrates the separation of the common inorganic cations using the CS16 Capillary Column. Excellent retention time reproducibility can be achieved with the capillary format.

## High Loading Capacity for Trace Level Ammonium in High Sodium Samples

The IonPac CS16 is a high capacity cation-exchange column that replaces the CS15 column for disparate concentration ratios of ammonium and sodium in diverse sample matrices. The CS16 is ideal for the determination of low concentrations of ammonium in environmental waters. It provides improved resolution of sodium from ammonium and alkanolamines, even for samples high in ionic strength. Figure 4A illustrates the determination of trace level ammonium in the presence of high sodium at ratios up to 10,000:1 using an isocratic MSA eluent on the CS16 5 mm column. Ratios up to 20,000:1 can be resolved using a MSA gradient with the CS16 3 mm column as illustrated in Figure 4B.

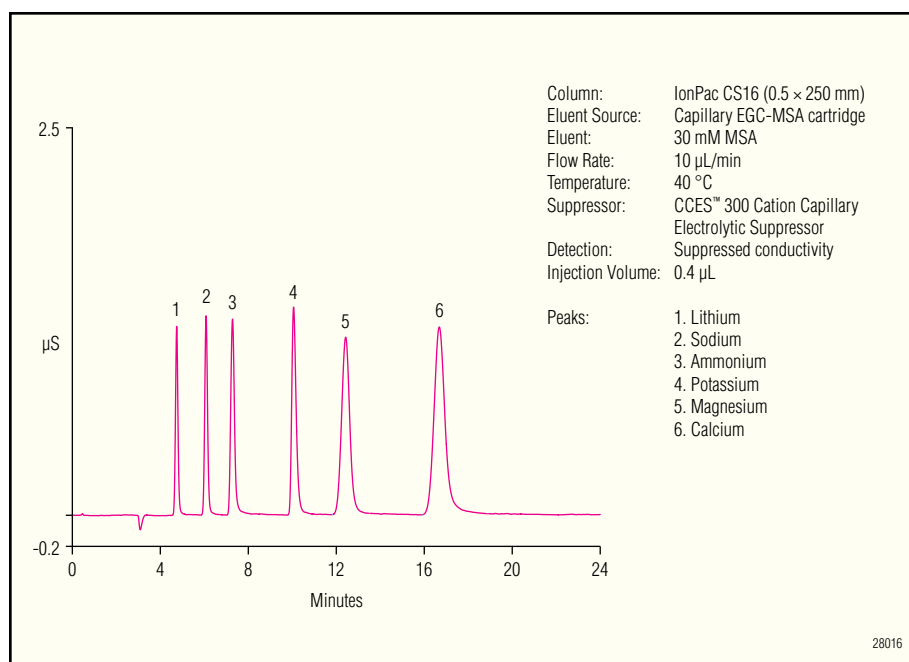


Figure 3. Separation of six cations on a capillary CS16 column.

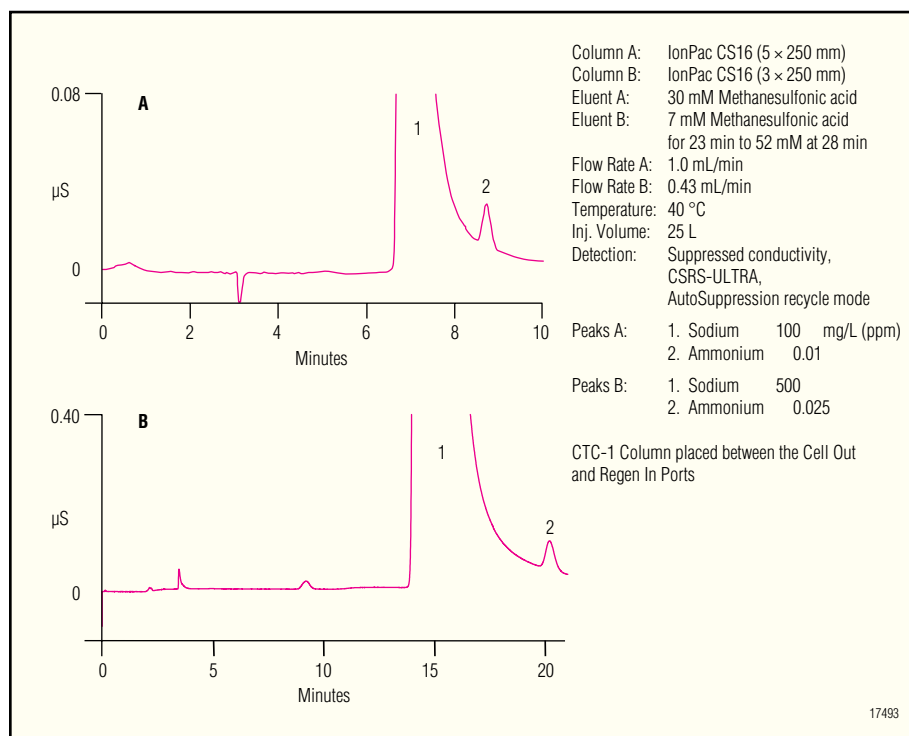


Figure 4. Determination of trace level ammonium in a high sodium sample.

**High Loading Capacity for Trace Level Sodium in High Ammonium Samples**

The IonPac CS16 column is also ideal for the determination of trace level sodium at ng/L (ppt) concentrations in ammonium and amine-treated cooling waters. The high capacity and unique selectivity of the CS16 column allow the resolution of trace sodium in the presence of high levels of ammonium and alkanolamines. Figures 5 and 6 illustrate the determination of trace concentrations of sodium in the presence of high levels of ammonium or amines.

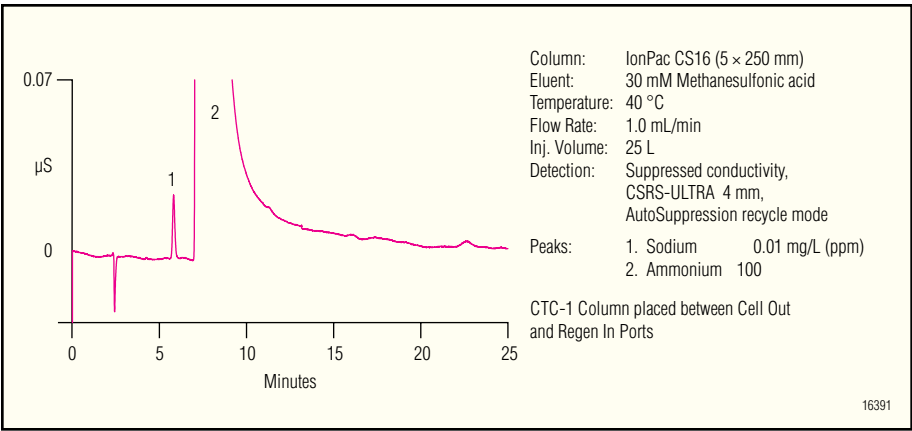


Figure 5. Determination of trace level sodium in a high ammonium sample.

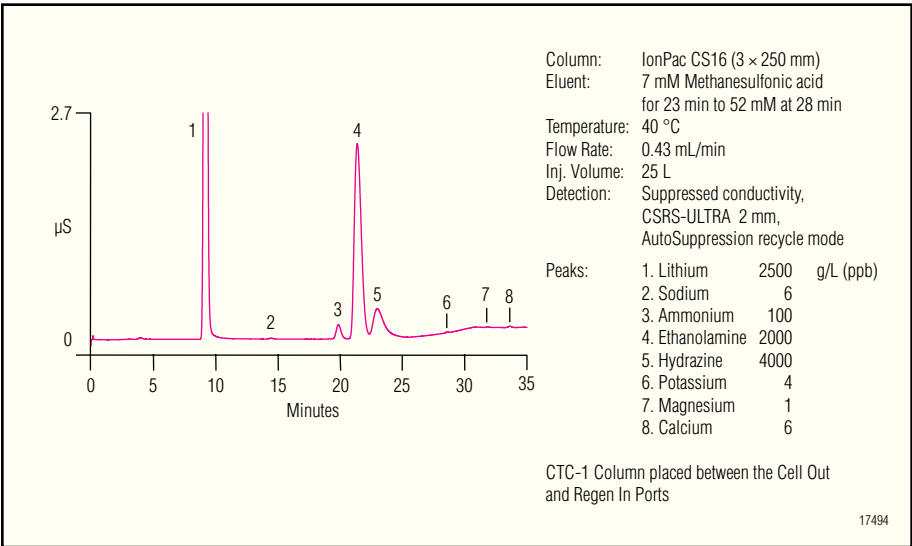


Figure 6. Determination of trace level sodium in a high amine sample.

## Determination of Amines in Complex Matrices

The IonPac CS16 column can be used to monitor the amine content in the quality control of chemical additives, process solutions, plating baths, and scrubber solutions. The CS16 column is ideal for the determination of amines in a variety of sample matrices. Figures 7 and 8 illustrate the separation of short-chained hydrophilic methylamines and alkanolamines and Group I and II cations in a single run. For specific amine applications, the eluent conditions can be optimized to resolve the amines of interest and the common inorganic cations.

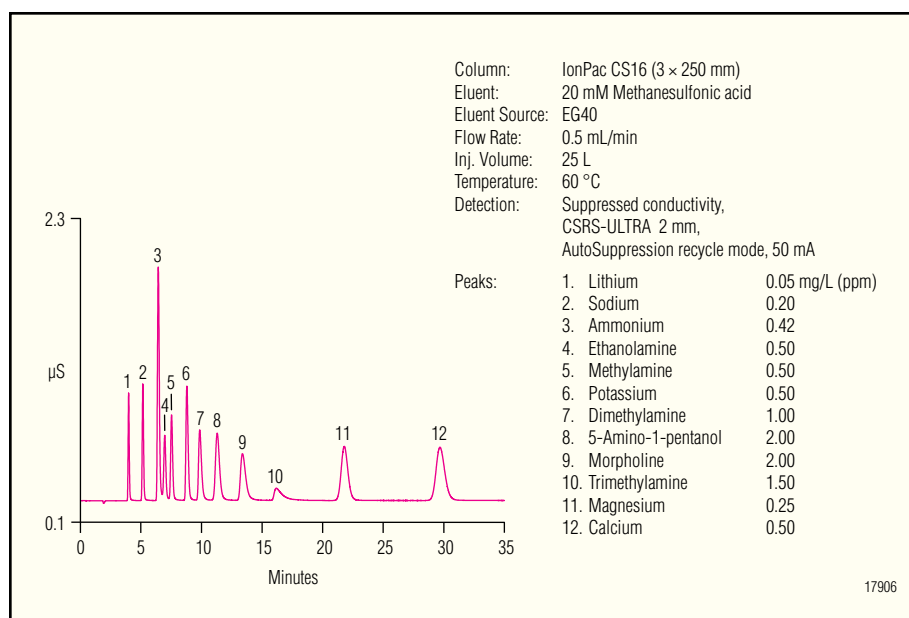


Figure 7. Determination of methyl amines and the Group I and II cations using the IonPac CS16 column. The CSRS-ULTRA was operated outside the heated column compartment.

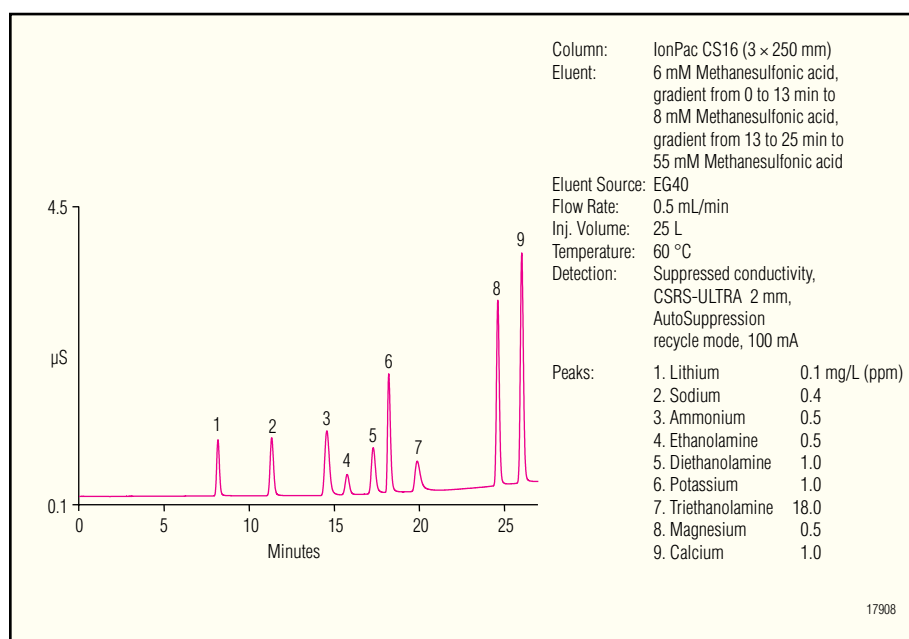


Figure 8. Determination of alkanolamines and the Group I and II cations using the IonPac CS16 column. The CSRS-ULTRA was operated outside the heated column compartment.

## Long-Term Durability

The IonPac CS16 packing ensures long-term column stability and trouble-free operation. The column is compatible with acidic eluents and samples. Performance of the high-capacity CS16 column does not deteriorate with the injection of acidic samples up to approximately 100 mN hydronium ion as illustrated in Figure 9. Acid digests or preserved samples can be injected without pH adjustment.

## Solvent-Compatible Packing

The IonPac CS16 column is 100% solvent-compatible. Adding acetonitrile to the eluent modifies column selectivity and enables the elution of nonpolar analytes or contaminants from the column. Acetonitrile can be used to enhance sample solubility, reduce retention times, 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.

## System Recommendations

The CS16 column in the suppressed conductivity mode is recommended for use with the ICS-2100 or ICS-5000 IC Systems equipped with an Eluent Generator (EG). The CS16 can be used with older Dionex IC Systems equipped with an EG or an RFC-30 Reagent Free Controller. The Eluent Generator is used to automatically produce methanesulfonic acid gradients from deionized water.

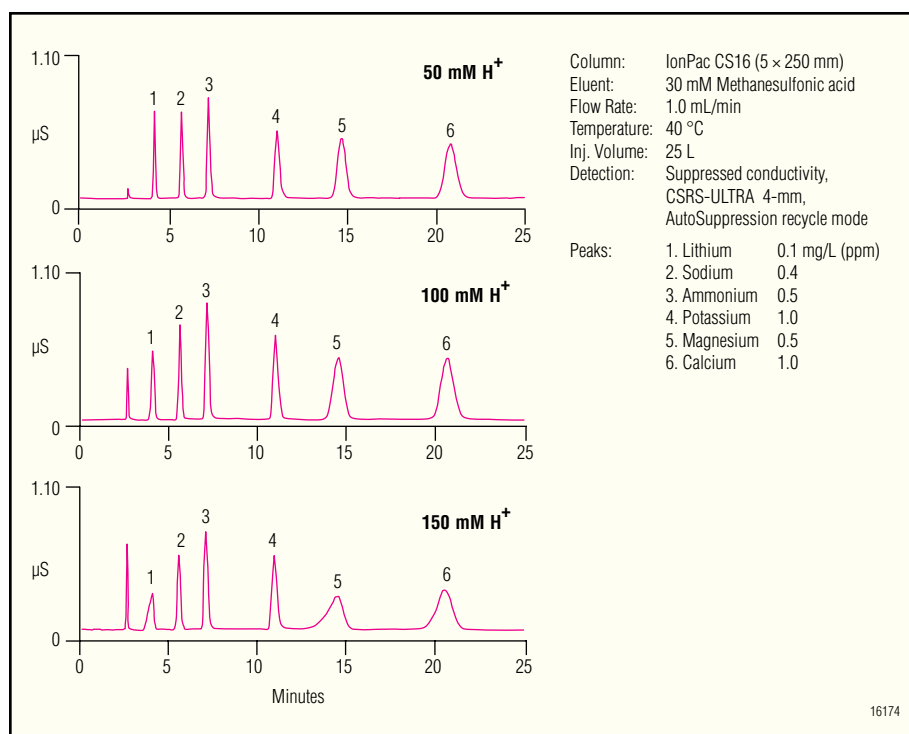


Figure 9. The IonPac CS16 packing permits the injection of acidic samples without pH adjustment.

## Suppressors

For optimum ease of use and performance, the CS16 column can be used with the CSRS 300 Anion Suppressor or the CCES™ 300 Cation Capillary Electrolytic Suppressor.

## Cation Trap Columns

When using the Eluent Generator for eluent delivery, a CR-CTC Continuously Regenerated Cation Trap Column should be installed between the Eluent Generator cartridge and the Eluent Generator degas module. Alternatively, a CTC Cation Trap Column can be installed between the gradient pump and the injection valve to remove cationic contaminants from the eluent.

## Concentrator Columns

For trace analysis work, use the IonPac CG16 guard column when a single piston pump such as the AXP pump is used for sample delivery. Use the TCC-LP1, TCC-ULP1, or the 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 CG16 capillary guard column or the MCC-100 concentrator column. For two-dimensional Ion Chromatography methods to determine trace ammonium and amines, use the MCC-200 concentrator column.

## ORDERING INFORMATION

In the U.S., call 1-800-346-6390 or contact the Dionex regional office nearest you. Outside the U.S., order through your local Dionex office or distributor. Refer to the following part numbers.

| Description                                                                                                    | Part Number |
|----------------------------------------------------------------------------------------------------------------|-------------|
| <b>IonPac CS16 Columns</b>                                                                                     |             |
| IonPac CS16 Capillary Column<br>(0.5 × 250 mm) .....                                                           | 075401      |
| IonPac CG16 Capillary Guard Column<br>(0.5 × 50 mm) .....                                                      | 075402      |
| IonPac CS16 Analytical Column<br>(5 × 250 mm) .....                                                            | 079805      |
| IonPac CG16 Guard Column<br>(5 × 50 mm) .....                                                                  | 057574      |
| IonPac CS16 Analytical Column<br>(3 × 250 mm) .....                                                            | 059596      |
| IonPac CG16 Guard Column<br>(3 × 50 mm) .....                                                                  | 079931      |
| <b>Trap Columns</b>                                                                                            |             |
| CR-CTC II Continuously Regenerated Cation Trap Column .....                                                    | 066262      |
| CR-CTC Continuously Regenerated Cation Trap Column (Capillary)<br>(For use with Capillary Cation Columns)..... | 072079      |
| CTC-1 Cation Trap Column<br>(9 × 24 mm) for use with the 5 mm columns .....                                    | 040192      |
| CTC Cation Trap Column<br>(4 × 35 mm) for use with the 3 mm columns .....                                      | 043132      |
| <b>Cation Concentrator Columns</b>                                                                             |             |
| TCC-LP1 Low Pressure Trace Cation Concentrator<br>(4 × 35 mm) for use with the 3 mm and 5 mm columns .....     | 046027      |
| TCC-ULP1 Ultra Trace Cation Concentrator-Ultra Low Pressure<br>(5 × 23 mm) .....                               | 063783      |
| TCC-XLP1 Ultra Trace Cation Concentrator-Extremely Low Pressure<br>(6 × 16 mm) .....                           | 063889      |
| MCC-100 Monolith Cation Concentrator Column<br>(0.5 × 80 mm) .....                                             | 075462      |
| MCC-200 Monolith Cation Concentrator Column<br>(0.75 × 80 mm) .....                                            | 075463      |

## SPECIFICATIONS

### Dimensions:

IonPac CS16 Capillary Column:  
0.5 × 250 mm

IonPac CG16 Capillary Guard  
Column: 0.5 × 50 mm

CS16 Analytical Column:  
5 × 250 mm and 3 × 250 mm

CG16 Guard Column: 5 × 50 mm  
and 3 × 50 mm

### Maximum Operating Pressure:

4000 psi (Standard and Microbore)  
5000 psi (Capillary)

### Mobile Phase Compatibility:

Acidic eluents, 100% HPLC acetonitrile.  
**Alcohols should be avoided.**

### Substrate Characteristics:

Bead Diameter: 5 µm  
Crosslinking (%DVB): 55%

### Ion-Exchange Group:

Grafted carboxylic acid

### Functional Group Characteristics:

Medium hydrophobic

### Capacity (µeq/column):

84 µeq/column (0.5 × 250 mm)  
17 µeq/column (0.5 × 50 mm)  
8400 µeq/column (5 × 250 mm)  
1700 µeq/column (5 × 50 mm)  
3000 µeq/column (3 × 250 mm)  
600 µeq/column (3 × 50 mm)

### Column Construction:

PEEK™ with 10-32 threaded ferrule-  
style end fittings. All components are  
non-metallic.

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