

The IonPac AS16 is a high-capacity, hydroxide-selective, anion-exchange column optimized for the determination of polarizable anions including thiosulfate, iodide, thiocyanate, and perchlorate in a variety of sample matrices. Using an isocratic sodium or potassium hydroxide eluent, polarizable anions can be determined in less than 20 min. The AS16 is ideal for the determination of trace perchlorate in drinking water and ground water matrices. With an isocratic hydroxide eluent, perchlorate can be determined in 10 min. The AS16 column is the column specified in U.S. EPA Method 314.0 and Method 314.1 (Primary Method) for the determination of trace perchlorate in drinking water. The Cryptand C1 Concentrator Column is the specified concentrator column for sample preconcentration in U.S. EPA Method 314.1.

### The Superior Performance IonPac AS16 Anion-Exchange Column

- Optimized hydrophilic resin for the isocratic separation of polarizable anions.
- Recommended for testing drinking water and groundwater matrices for perchlorate.
- Specified column in U.S. EPA Method 314.0 and Method 314.1 (Primary Method).
- Use the Cryptand C1 Concentrator Column for sample preconcentration.
- Use with eluent generator (EG) for simplified Reagent-Free™ Ion Chromatography (RFIC™) system operation. Requires only a deionized water source to produce sodium or potassium hydroxide eluent.
- Either sodium or potassium hydroxide EG can be used with Method 314.0. Method 314.1 requires the use of sodium hydroxide EG.
- Eluent suppression using the ASRS-ULTRA II provides RFIC system operation with low backgrounds and enhanced analyte sensitivity.
- Ideal for analysis of polyphosphates and polycarboxylates.
- High capacity: 170 µeq per column (4 × 250 mm column).
- Large-loop injection for easy ppb level determinations (e.g., perchlorate in drinking and ground water).
- Compatible with organic solvents to enhance analyte solubility, modify column selectivity, and for effective column cleanup.

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## High Efficiency Particle Structure

The IonPac AS16 packing is a unique structure composed of a highly cross-linked core and a MicroBead™ anion-exchange layer attached to the surface as illustrated in Figure 1. The substrate for the IonPac AS16 column is a 9- $\mu\text{m}$ -diameter macroporous resin bead, consisting of ethylvinylbenzene cross-linked with 55% divinylbenzene.

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

## Isocratic Separation of Polarizable Anions

The IonPac AS16 column has been optimized for the fast, isocratic determination of polarizable anions such as thiosulfate, iodide, thiocyanate, and perchlorate. Figure 2 shows the isocratic separation of the polarizable anions using a 35 mM sodium hydroxide eluent.

Typical applications for the AS16 column include trace perchlorate in environmental samples, such as drinking and groundwater. The AS16 is also optimized for the determination of thiosulfate, iodide, and thiocyanate in chemical samples, including scrubber solutions, process streams, and brines. Figure 3 shows the determination of trace perchlorate in a drinking water sample, using a large loop injection, with an isocratic hydroxide eluent coupled with suppressed conductivity detection. Low  $\mu\text{g/L}$  (ppb) levels of perchlorate can easily be quantified using a 1.0-mL injection loop on a 4-mm AS16 column.

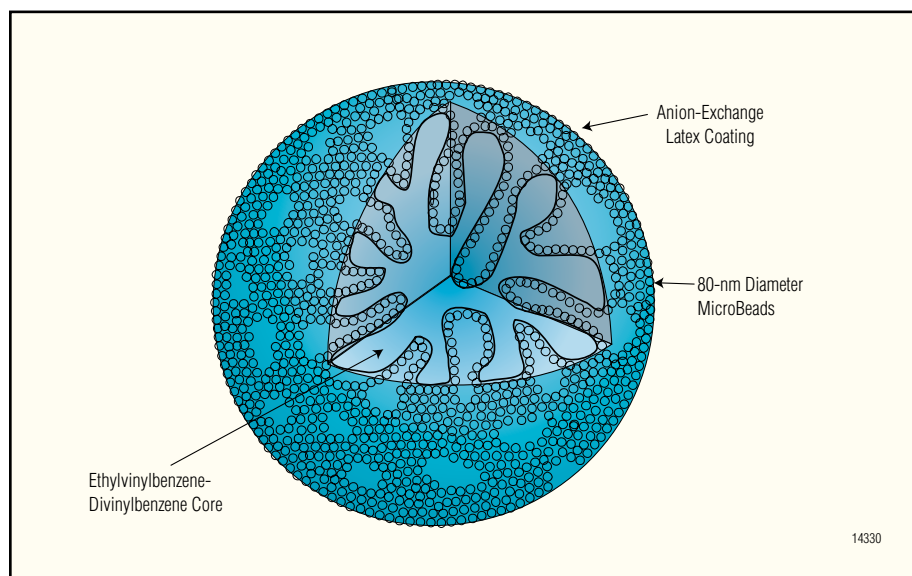


Figure 1. Macroporous resin with anion-exchange functionalized latex layer.

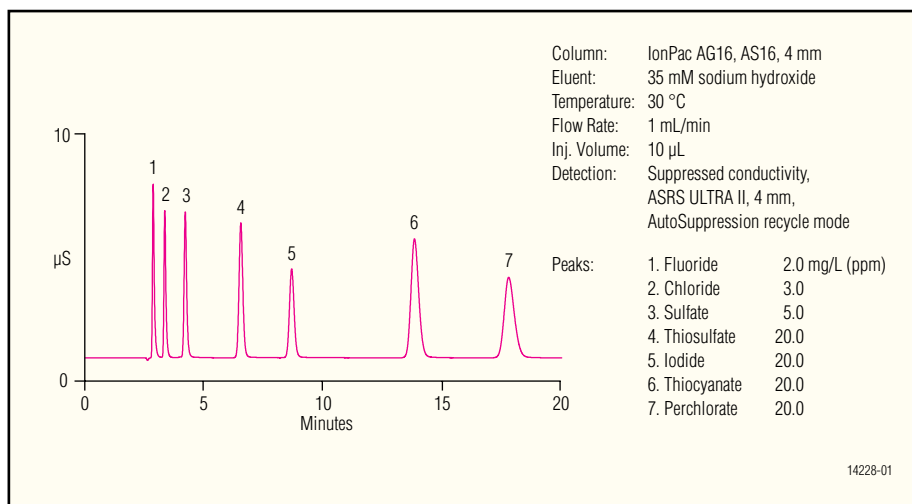


Figure 2. Isocratic separation of polarizable anions and inorganic anions using a sodium hydroxide eluent on the 4-mm IonPac AS16 column.

## Determination of Trace Perchlorate in Drinking Water and Ground Water Matrices

Perchlorate (initially as ammonium perchlorate), which is widely used in the manufacture of rocket propellants, munitions, fireworks, and road flares has been found in drinking water in areas where aerospace materials and munitions have been manufactured and tested. Perchlorate is a potential health concern, because it may interfere with the production of thyroid hormones. A simple, isocratic method has been developed using the high-capacity IonPac AS16 column to determine trace levels of perchlorate in drinking water matrices.

Figure 3 shows the determination of trace perchlorate in a drinking water sample, using a large-loop injection, with an isocratic hydroxide eluent coupled with suppressed conductivity detection. Low- $\mu\text{g/L}$  (ppb) levels of perchlorate can easily be quantified using a 1.0-mL injection loop on a 4-mm AS16 column.

A new U.S. EPA Method has been developed for the determination of trace perchlorate in drinking water matrices. U.S. EPA Method 314.1 (Primary Method) specifies the IonPac AS16 column and the Cryptand C1 Concentrator Column. Figure 4 shows the determination of trace perchlorate in a drinking water sample using sample preconcentration with the Cryptand C1 Concentrator Column with a sodium hydroxide eluent coupled with suppressed conductivity detection. The Cryptand C1 Concentrator Column is used with sodium hydroxide eluent to allow optimum concentrator capacity control. At high concentrations of sodium, the Cryptand C1 has high capacity but at lower concentrations the capacity decreases and the analytes can be eluted. Figure 5 illustrates the system flow path for the determination of trace perchlorate according to U.S. EPA Method 314.1.

Low  $\mu\text{g/L}$  (ppb) levels of perchlorate can easily be quantified using the AS16 Column and a 2 mL sample preconcentration as shown in Figure 4.

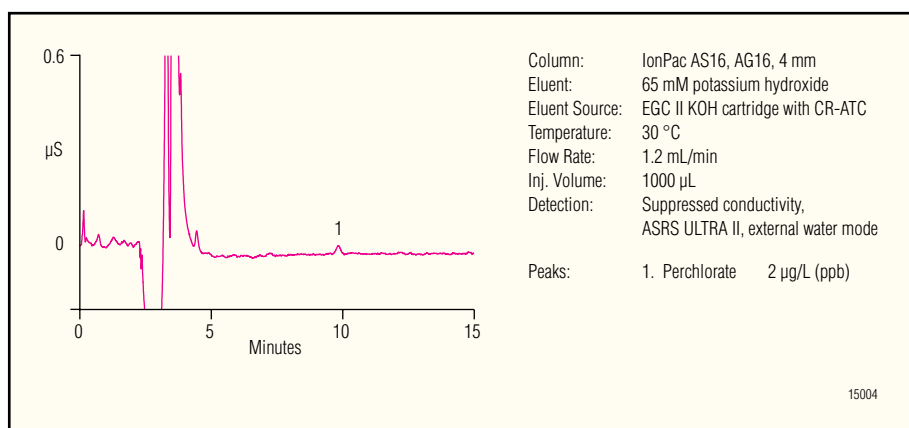


Figure 3. Determination of trace perchlorate in drinking water using a large loop injection with 65 mM KOH on a 4-mm IonPac AS16 column as described in U.S. EPA Method 314.0. Using this specialized method for perchlorate, other anions in the sample are eluted quickly (peaks 1–4) and do not interfere with the perchlorate peak.

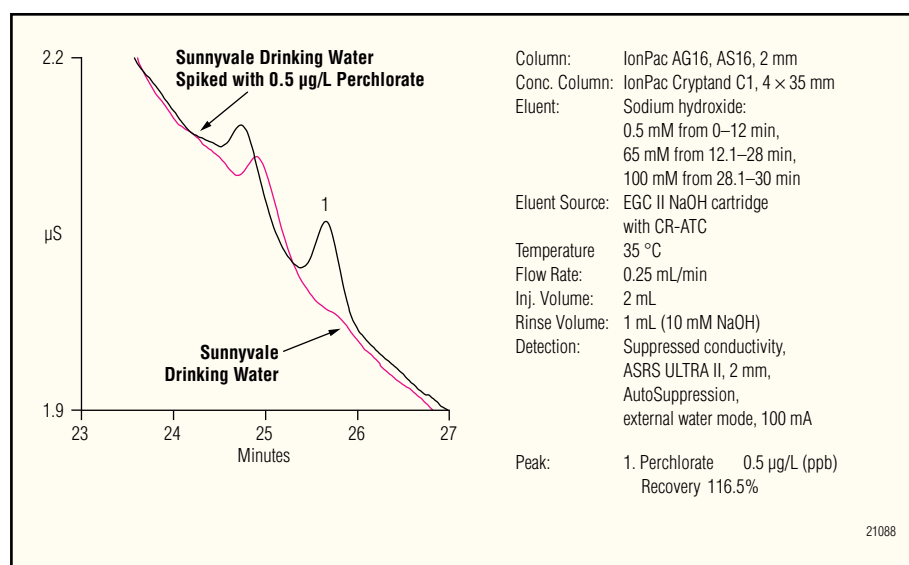


Figure 4. Determination of trace perchlorate in drinking water using the AS16 column following concentration on a Cryptand C1 concentrator column as described in U.S. EPA Method 314.1.

## Gradient Separation of Polarizable Anions and Inorganic Anions

The AS16 column was designed for the determination of polarizable anions including thiosulfate, iodide, thiocyanate, and perchlorate. However, the AS16 column also provides excellent separation of a wide variety of other anions as shown in Figure 6. With a potassium hydroxide gradient, 20 inorganic anions and polarizable anions are easily separated in approximately 25 min. Peak shape and efficiency are greatly improved for the polarizable anions on the AS16 column. Note that bromide and nitrate coelute on the AS16 column. For applications where bromide and nitrate are analytes, please refer to the AS20 data sheet.

## Gradient Separations as Simple as Isocratic Runs with the Eluent Generator

The Eluent Generator produces high purity potassium or sodium hydroxide eluent electrolytically from water, eliminating the need for eluent preparation. The hydroxide eluent produced is free of carbonate contamination. The use of carbonate-free hydroxide eluents results in minimal baseline shifts during hydroxide gradients yielding lower background conductivities and lower detection limits for target analytes as shown in Figure 6.

## IonPac AS16 for Polyphosphates Using Gradient Elution

Polyphosphates are widely used in a variety of industries. They are used for pharmaceutical and detergent formulations, water treatment applications to decrease water hardness, and in cleansers and fertilizers. Polyphosphates are also commonly used as food additives to control pH, to sequester metal ions, and to increase the ionic strength of solutions. Using a potassium hydroxide gradient on the IonPac AS16 column,

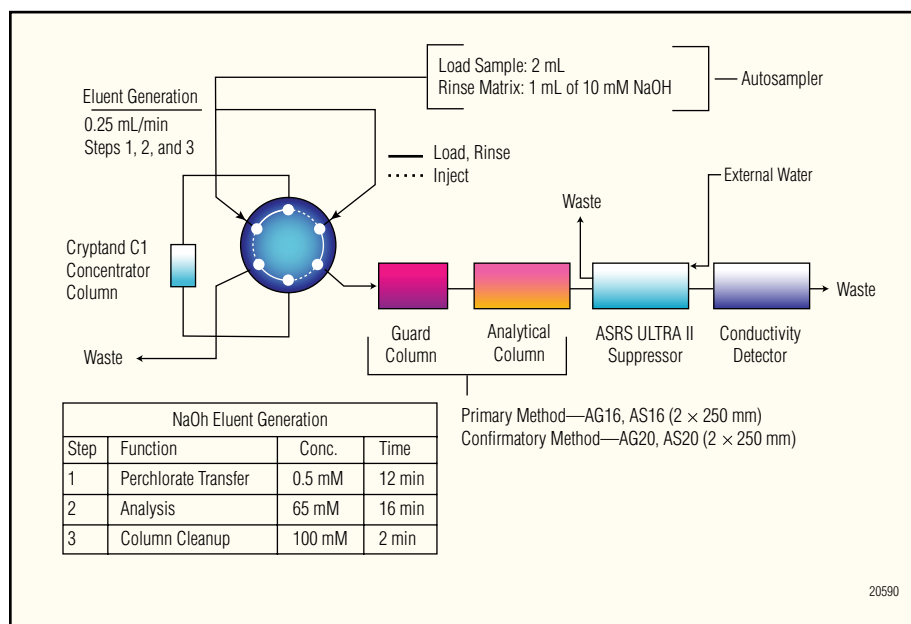


Figure 5. System flow path for trace perchlorate in drinking water.

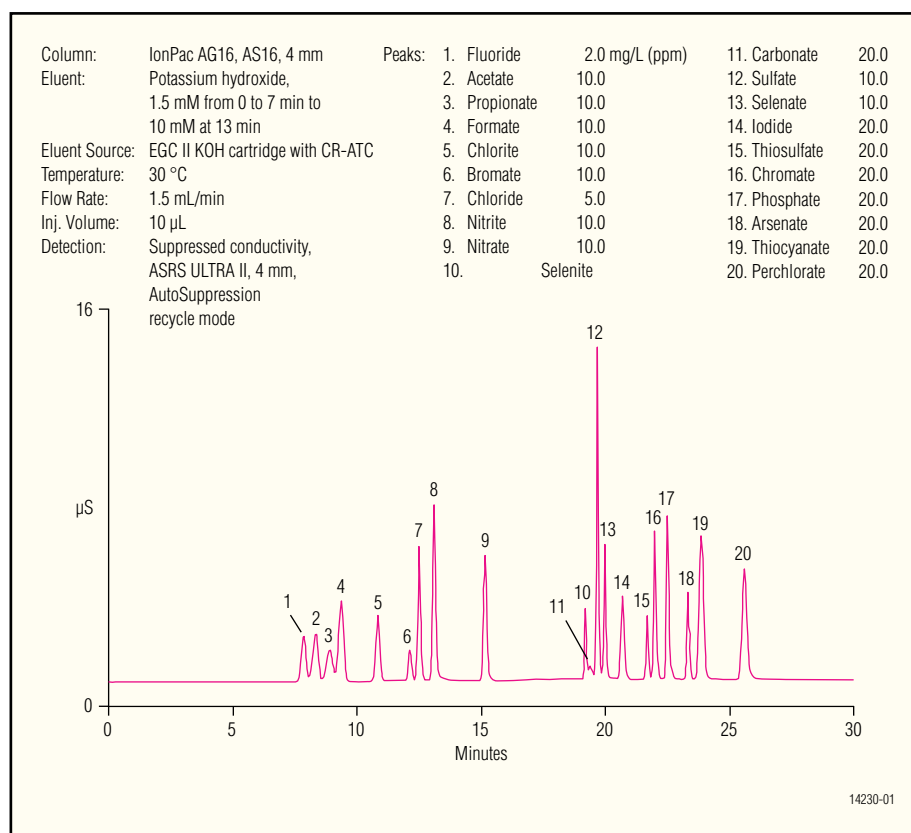


Figure 6. Determination of polarizable anions and inorganic anions using a potassium hydroxide gradient delivered with an Eluent Generator using the 4-mm IonPac AS16 column.

low molecular weight polyphosphates can be separated in less than 10 min. Figure 7 shows the use of the AS16 column for the separation of polyphosphates in a detergent sample.

### IonPac AS16 for Highly Charged Anions Using Gradient Elution

The separation of highly charged anions such as polycarboxylates is possible using gradient elution on a 2- or 4-mm IonPac AS16 column. The high hydroxide selectivity on the AS16 resin permits elution of these highly charged anions at lower hydroxide concentrations than on other anion-exchange columns.

### System Requirements and Recommendations

#### System Requirements for EGC-NaOH Eluent Generation

For NaOH eluents generated using the EGC-NaOH cartridge, use with ICS-2000, ICS-2500, or ICS-3000 IC Systems equipped with an Eluent Generator. The Eluent Generator is used to automatically produce sodium hydroxide gradients from deionized water. The EGC-NaOH cartridge can only be controlled using Chromeleon® 6.7 and subsequent Chromeleon releases.

#### System Requirements for EGC-KOH Eluent Generation

For KOH eluents generated using the EGC-KOH cartridge, use the ICS-2000, ICS-2500, or ICS-3000 IC Systems equipped with an Eluent Generator. The AS16 can be used with older Dionex IC Systems equipped with an EG40 Eluent Generator or an RFC-30 Reagent Free Controller. The Eluent Generator is used to automatically produce potassium hydroxide gradients from deionized water. The EGC-KOH cartridge can be controlled using Chromeleon 6.0 and higher.

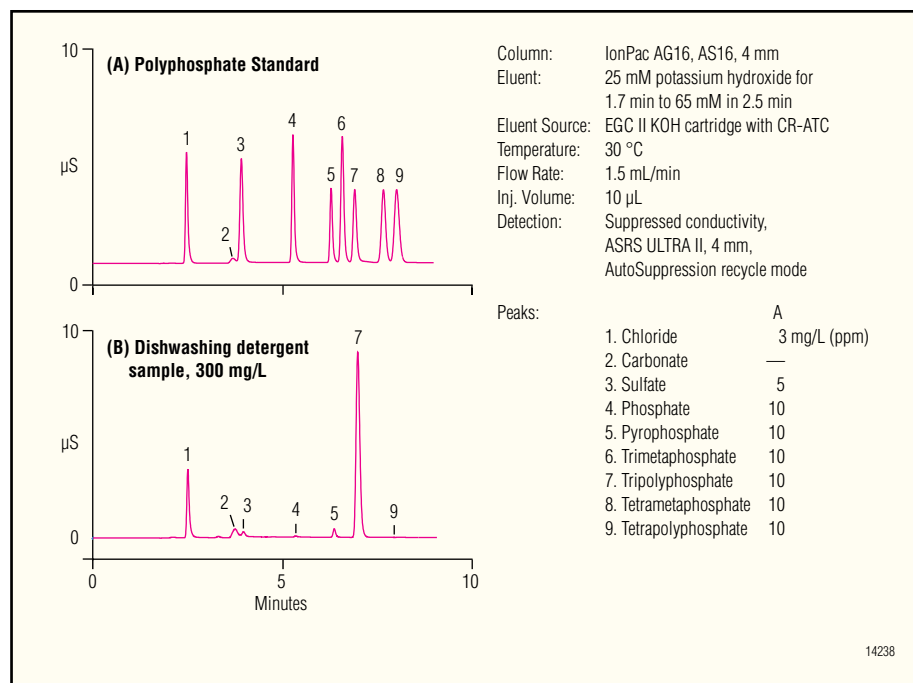


Figure 7. Separation of polyphosphates on the 4-mm IonPac AS16 column using a potassium hydroxide gradient delivered with an Eluent Generator.

### Suppressor Recommendations

For optimum ease-of-use and economy, the IonPac AS16 column should be used with the ASRS Anion Self-Regenerating Suppressor, ASRS-ULTRA II. It is recommended to operate the IonPac AS16 column at an elevated temperature (30 °C) to ensure reproducible retention times. When using hydroxide eluent generation for Method 314.0 and 314.1, external water mode is required.

### Anion Trap Columns

When using the Eluent Generator for eluent delivery, a CR-ATC Continuously Regenerated Anion Trap Column should be installed between the Elu-Gen cartridge and the Eluent Generator degas module. As an alternative, an ATC-HC column can be installed between the pump outlet and inlet of the EluGen Cartridge in the Eluent Generator Module.

Alternatively, when performing hydroxide gradient anion exchange applications on the AS16, using hand-prepared bottled eluents, the 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 trace perchlorate concentrator work, use the Cryptand C1 Concentrator Column when the sample is delivered with a syringe or with an autosampler. Use the TAC-LP1 or TAC-ULP1 Anion Concentrator Column for other anion applications when the sample is delivered with a syringe or with an autosampler. Use the IonPac AS16 guard column for other anion applications, when the sample is delivered with a single-piston pump such as the DQP or DXP.

## SPECIFICATIONS

### Dimensions:

IonPac AS16 Analytical Column:  
2 x 250 mm and 4 x 250 mm

IonPac AG16 Guard Column:  
2 x 50 mm and 4 x 50 mm

### Maximum Operating Pressure:

4000 psi

### Mobile Phase Compatibility:

pH 0–14; 0–100% HPLC solvents

### Substrate Characteristics:

#### Analytical Column:

Supermacroporous resin  
Bead Diameter ( $\mu\text{m}$ ): 9.0  
Pore Size: 2000 Å  
Cross-Linking (%DVB): 55%

#### Guard Column:

Microporous resin  
Bead Diameter ( $\mu\text{m}$ ): 13.0  
Pore Size: <10 Å  
Cross-Linking (%DVB): 55%

### Latex Characteristics:

Functional Group: Alkanol quaternary ammonium ion

Latex Cross-linking: 1%

Latex Diameter: 80 nm

Hydrophobicity: Ultralow

### Capacity:

42.5  $\mu\text{eq}$   
(2 x 250 mm analytical column)

0.875  $\mu\text{eq}^*$   
(2 x 50 mm guard column)

170  $\mu\text{eq}$   
(4 x 250 mm analytical column)

3.5  $\mu\text{eq}^*$   
(4 x 50 mm guard column)

### Column Construction:

PEEK with 10–32 threaded ferrule-style end fittings.

All components are nonmetallic.

\* Guards are packed with a low-capacity microporous resin.

## ORDERING INFORMATION

To order in the U.S., call (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.

IonPac AS16 Analytical Column  
(4 x 250 mm) ..... P/N 055376

IonPac AG16 Guard Column  
(4 x 50 mm) ..... P/N 055377

IonPac AS16 Analytical Column  
(2 x 250 mm) ..... P/N 055378

IonPac AG16 Guard Column  
(2 x 50 mm) ..... P/N 055379

CR-ATC Continuously Regenerated Anion Trap Column  
P/N 060477

(For use with the EG50 with built-in CR-TC control, the EG40 with EG40 CR-TC Add-on Kit or the RFC-30 Reagent Free Controller).

ATC-3 Anion Trap Column  
(9 x 24 mm) ..... P/N 059660  
(for use with 4-mm columns)

ATC-3 Anion Trap Column  
(4 x 35 mm) ..... P/N 079932  
(for use with 2-mm columns)

ATC-HC Anion Trap Column  
P/N 059604  
(for use with the EG40 or EG50)

Cryptand C1 Concentrator Column  
(4 x 35 mm) ..... P/N 062893

TAC-LP1 Trace Anion Concentrator  
(4 x 35 mm) ..... P/N 046026

TAC-ULP1 Trace Anion Concentrator  
(5 x 23 mm) ..... P/N 061400

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### Dionex Corporation

1228 Titan Way  
P.O. Box 3603  
Sunnyvale, CA  
94088-3603  
(408) 737-0700

### North America

U.S. (847) 295-7500  
Canada (905) 844-9650

### South America

Brazil (55) 11 3731 5140

### Europe

Austria (43) 1 616 51 25 Benelux (31) 20 683 9768; (32) 3 353 4294  
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### Asia Pacific

Australia (61) 2 9420 5233 China (852) 2428 3282 India (91) 22 2764 2735  
Japan (81) 6 6885 1213 Korea (82) 2 2653 2580 Singapore (65) 6289 1190  
Taiwan (886) 2 8751 6655

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