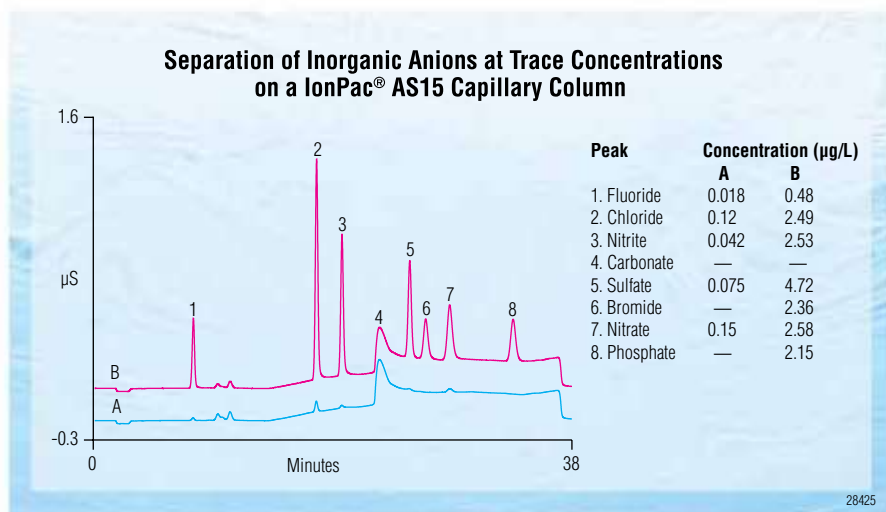


IonPac AS15 Anion-Exchange Column



The IonPac® AS15 is a high-capacity, hydroxide-selective anion-exchange column designed for the determination of trace-level concentrations of inorganic anions and low molecular weight organic acids, including fluoride, glycolate, acetate, formate, chloride, nitrite, carbonate, sulfate, oxalate, bromide, nitrate, and phosphate in high-purity water matrices encountered in the semiconductor and power generation industries. The IonPac AS15 column offers excellent retention of fluoride from the water dip and uses a simple hydroxide eluent easily supplied by the Eluent Generator (EG).

The IonPac AS15 column is available in formats from 0.4 to 4 mm, allowing use of capillary to analytical flow rates, and supporting advanced IC × IC applications.

Superior Chromatographic Performance

- Universal column for trace-level concentrations of inorganic anions and low molecular weight organic acids in high-purity water matrices.
- The IonPac AS15-5μm (3 × 150 mm) column is recommended for fast separation of common inorganic anions and monovalent organic acids in 15 minutes.
- IonPac AS15-9μm (0.4 × 250, 2 × 250 and 4 × 250 mm) columns are recommended for higher capacity applications (25 minute analysis time).
- The AS15 Capillary column (0.4 × 250 mm) offers reduced eluent consumption, reduced operating costs, and excellent reproducibility.
- Column selectivity optimized for a 30 °C operating temperature to ensure reproducible retention times.
- Large-loop injections for ppb-level analysis.
- Sample preconcentration for ultra-trace (ppt-level) analysis using optimized AC15 concentrator column.
- Superior retention and resolution of early-eluting anions, including fluoride, glycolate, acetate, and formate.
- Simplified operation is provided by the EG, which requires only a deionized water source to produce potassium hydroxide eluent.
- Hydroxide eluent suppresses to a very low background for trace-level determinations.
- Compatible with organic solvents to enhance analyte solubility, to modify column selectivity, or for effective column cleanup.
- Direct transfer of 4 mm applications to the 0.4 mm, 3 mm, and 2 mm column formats for more economical operation, reduced eluent consumption, and increased mass sensitivity.

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Thermo Scientific brand

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High-Efficiency Particle Structure

The IonPac AS15 packing is a unique structure composed of a highly crosslinked core and an anion-exchange layer grafted to the surface, as shown in Figure 1. The AS15 column substrate is composed of a macroporous resin bead (5 μm diameter for the 3 mm column and 9 μm for the 0.4 mm, 4 mm, and 2 mm columns) consisting of ethylvinylbenzene crosslinked with 55% divinylbenzene.

The anion-exchange layer is functionalized with alkanol quaternary ammonium groups and has a controlled thickness, which results in excellent mass transfer characteristics and consequently, highly efficient peaks.

Versatile Capability

The IonPac AS15 column is ideal for the isocratic separation of fluoride, chloride, carbonate, nitrite, sulfate, bromide, nitrate, and phosphate in high purity water matrices using a simple hydroxide eluent and suppressed conductivity detection. Fluoride is well resolved from the water dip with elution of highly retained analytes such as phosphate in 15 min using the 3 $\times$ 150 mm column and < 25 min using the 0.4 $\times$ 250 mm or 4 $\times$ 250 mm columns, as illustrated in Figure 2.

The IonPac AS15-5 μm (3 $\times$ 150 mm) column uses the same alkanol ammonium functional groups as the AS15-9 μm (4 $\times$ 250 mm) column, but differs in column format and resin particle size. As a result, the 3 mm column provides the advantages of faster analysis time for the common inorganic anions, reduced eluent consumption, and improved minimum detection limits compared to the 4 mm column. The AS15-5 μm (3 $\times$ 150 mm) column is recommended for the fast separation of the common inorganic anions and low molecular weight organic acids.

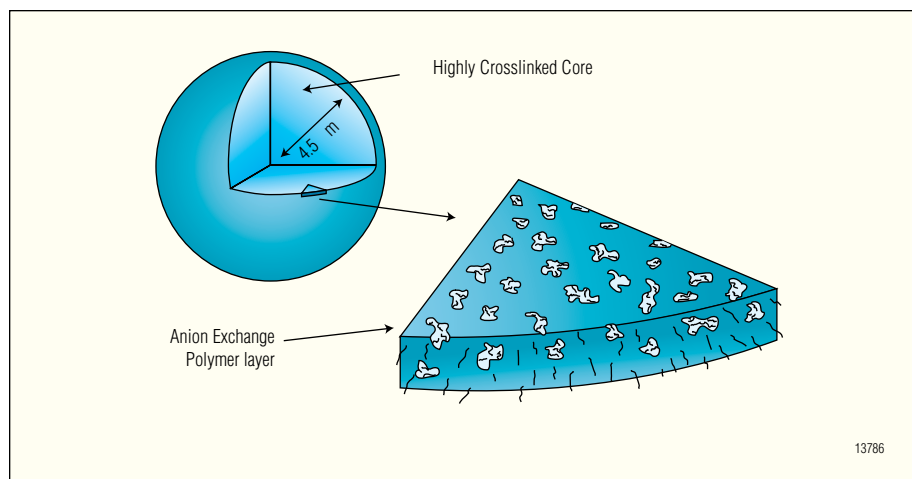


Figure 1. Structure of an IonPac AS15-9 μm packing particle.

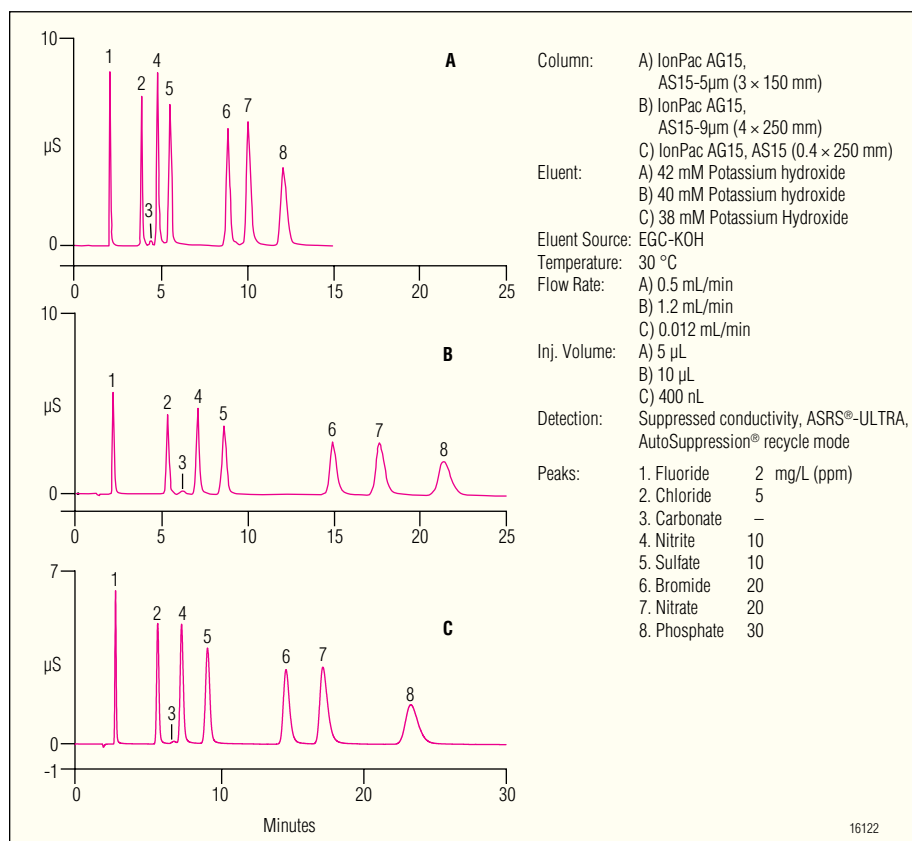


Figure 2. Comparison of the IonPac AS15-5 μm (3 $\times$ 150 mm), AS15-9 μm (4 $\times$ 250 mm), and AS15-9 μm (0.4 $\times$ 250 mm) columns for separation of inorganic anions.

The high-capacity IonPac AS15-9 μm 0.4 $\times$ 250 mm, 4 $\times$ 250 mm and 2 $\times$ 250 mm columns are recommended for higher capacity applications and provide maximum resolution of trace components in the presence of high concentrations of other anions.

AS15 Capillary Format

The IonPac AS15 Capillary column (0.4×250 mm) is packed with the same material as the equivalent standard bore version (producing the same performance as a 4 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 trace level inorganic anions using the IonPac AS15 capillary column after concentration on the IonSwift® MAC-100 Concentrator column. Excellent retention time reproducibility can be achieved with the capillary format.

Large Loop Injections for $\mu\text{g/L}$ (ppb) Level Analysis

The IonPac AS15 column selectivity and high capacity allow the determination of trace levels of inorganic anions and low molecular weight organic acids in high-purity water matrices using a large-loop injection. Figure 4 illustrates the separation of inorganic anions and low molecular weight organic acids in a high-purity water sample using this technique. Separation was achieved using a potassium hydroxide gradient with suppressed conductivity detection at a temperature of 30 °C. Low $\mu\text{g/L}$ (ppb) levels of these analytes can easily be quantified using a 1 mL injection on an IonPac AS15-5 μm (3×150 mm) column. The conductivity of the hydroxide eluent can be suppressed to a very low background, facilitating trace-level analysis.

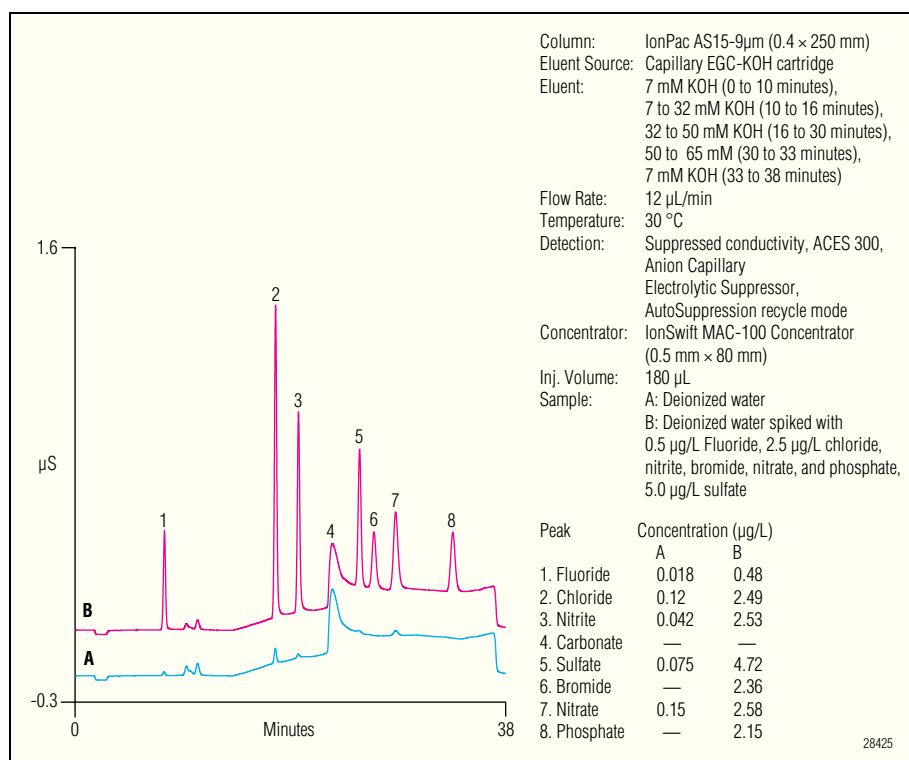


Figure 3. Separation of inorganic anions at trace concentrations using the IonPac AS15 Capillary column and the IonSwift MAC-100 Concentrator column.

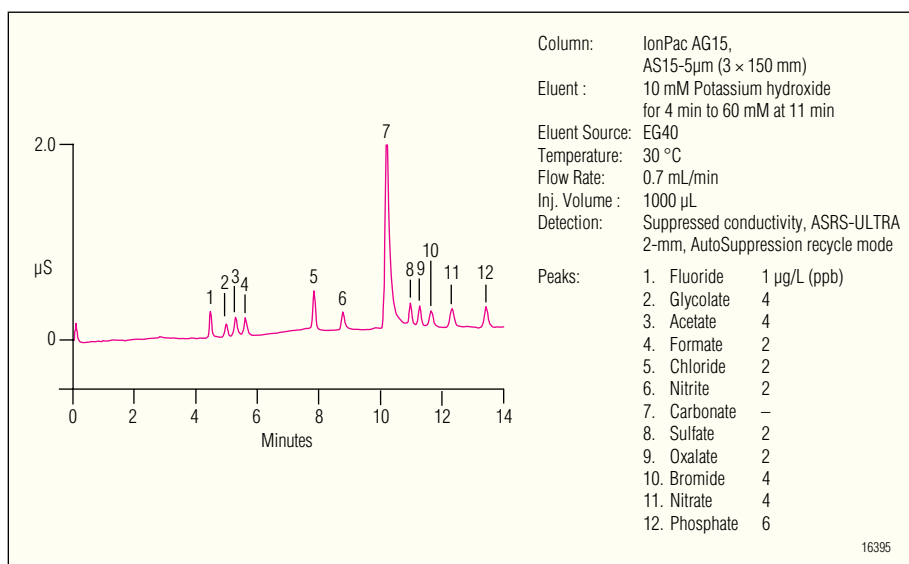


Figure 4. Determination of inorganic anions and low molecular weight organic acids in high-purity water using a large-loop injection and a potassium hydroxide gradient on an IonPac AS15-5 μm (3×150 mm) column.

AC15 Concentrator Column for Preconcentration for Ultratrace (ng/L) Analysis

Monitoring anionic contaminants at low ng/L (ppt) levels in ultrapure water is a critical issue in the semiconductor and power generation industries. Using preconcentration techniques, low-ppt levels of inorganic anions and low molecular weight organic acids can be determined easily. Figure 5 illustrates this technique using an IonPac AC15 concentrator column, which is designed for reproducible recoveries of trace anions such as chloride and sulfate from high-purity water. Using sample preconcentration, low-ppt levels of inorganic anions and low molecular weight organic acids can be routinely measured in power plant and semiconductor pure water.

Trace Analysis is Easier with the Eluent Generator

Combining the IonPac AS15 column with the EG makes trace anion analysis even easier. The EG makes potassium hydroxide eluent electrolytically from water. The use of this ultrapure hydroxide as an eluent results in a low background and stable baseline. Routine ppb-level analysis of inorganic anions and low molecular weight organic acids by direct injection is possible with the IonPac AS15 column using the EG, as illustrated in Figures 4 and 5.

Trace Analysis of Inorganic Anions and Low Molecular Weight Organic Acids in High Ionic Strength Matrices

High capacity columns allow large loop injections while maintaining the peak shapes of trace components, even in the presence of high concentrations of other anions (e.g. carbonate) that may be present in the high-purity water matrices encountered in the semiconductor and power generation industries.

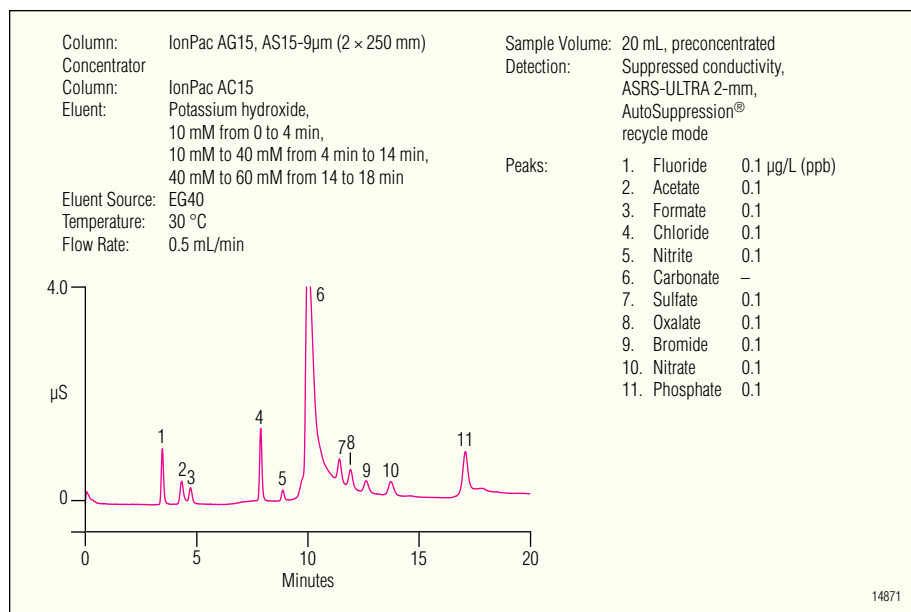


Figure 5. Determination of inorganic anions and low molecular weight organic acids from a 20-mL sample volume of high-purity water using the IonPac AS15-9 μ m (2 $\times$ 250 mm) column.

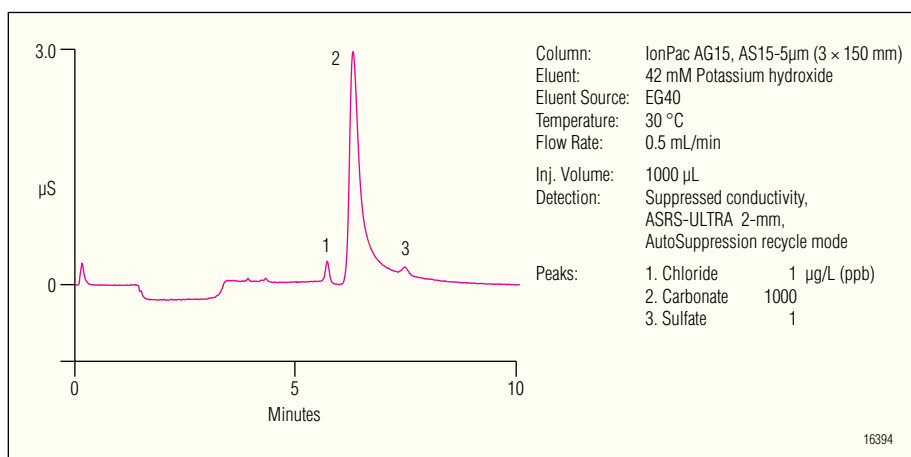


Figure 6. Determination of trace levels of chloride and sulfate in high purity water using a large loop injection on the IonPac AS15-5 μ m (3 $\times$ 150 mm) column.

Figure 6 shows the use of the IonPac AS15-5 μ m (3 $\times$ 150 mm) column for trace chloride and sulfate in a high-purity water matrix containing high concentrations of carbonate. Using an isocratic potassium hydroxide eluent, carbonate is well resolved from chloride and sulfate and does not interfere with quantification. For high-purity water applications that require determination of a few specific analytes, a fast run using the AS15-5 μ m (3 $\times$ 150 mm) column is recommended.

For applications requiring higher capacity, the AS15-9 μ m columns are recommended. The 0.4 mm, 4 mm, and 2 mm IonPac AS15-9 μ m columns have very high capacities, providing excellent resolution of inorganic anions in complex sample matrices. Figure 7 compares the separation of inorganic anions in a wastewater sample on the IonPac AS15-5 μ m (3 $\times$ 150 mm) and AS15-9 μ m (4 $\times$ 250 mm) columns.

Determination of Inorganic Anions and Low Molecular Weight Organic Acids

Low molecular weight organic acids and mono- and divalent inorganic anions commonly encountered in the chemical, semiconductor, and power generation industries can be determined in a single run using the IonPac AS15-5 μ m (3 $\times$ 150 mm) column. Figure 8 illustrates the separation of weakly retained anions such as acetate, formate, propionate, and butyrate in a simulated industrial chemical sample using a hydroxide gradient at a controlled temperature of 30 $^{\circ}$ C.

System Recommendations

The IonPac AS15 column is recommended for use with Dionex ICS-2100 or ICS-5000 IC systems equipped with an EG. The AS15 column can also be used with older Dionex IC systems equipped with an EG or an RFC-30 Reagent-Free[®] Controller. The EG is used to automatically produce potassium hydroxide gradients from deionized water.

Suppressor Recommendations

For optimum ease of use and economy, use the IonPac AS15 column with the ASRS[®] 300 Anion Self-Regenerating Suppressor[®] or ACES[™] Anion Capillary Electrolytic Suppressor 300. Operate the AS15 at an elevated temperature (30 $^{\circ}$ C) to ensure reproducible retention times.

Anion Trap Columns

When using the EG for eluent delivery, a CR-ATC column should be installed between the EG cartridge and the EG degas module. Alternately, 4 mm, 3 mm, and 2 mm systems can use the ATC-HC column, installed between the pump outlet and inlet of the EluGen cartridge in the EG module. When performing sodium hydroxide-gradient applications on the IonPac AS15 column using hand-prepared bottled eluents, the ATC-3 should be installed between the gradient pump and the injection valve to remove anionic contaminants from the eluent.

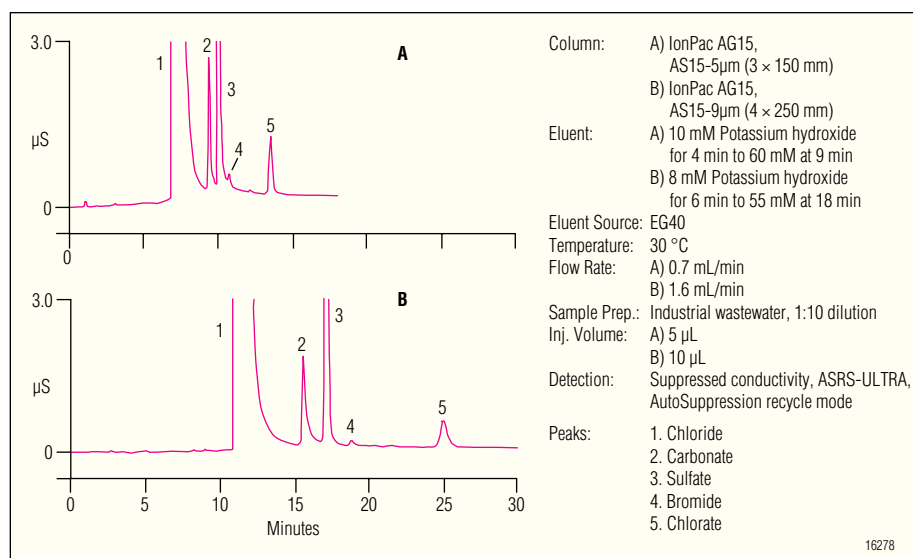


Figure 7. Analysis of an industrial wastewater sample on the IonPac AS15-5 μ m (3 $\times$ 150 mm) and AS15-9 μ m (4 $\times$ 250 mm) columns.

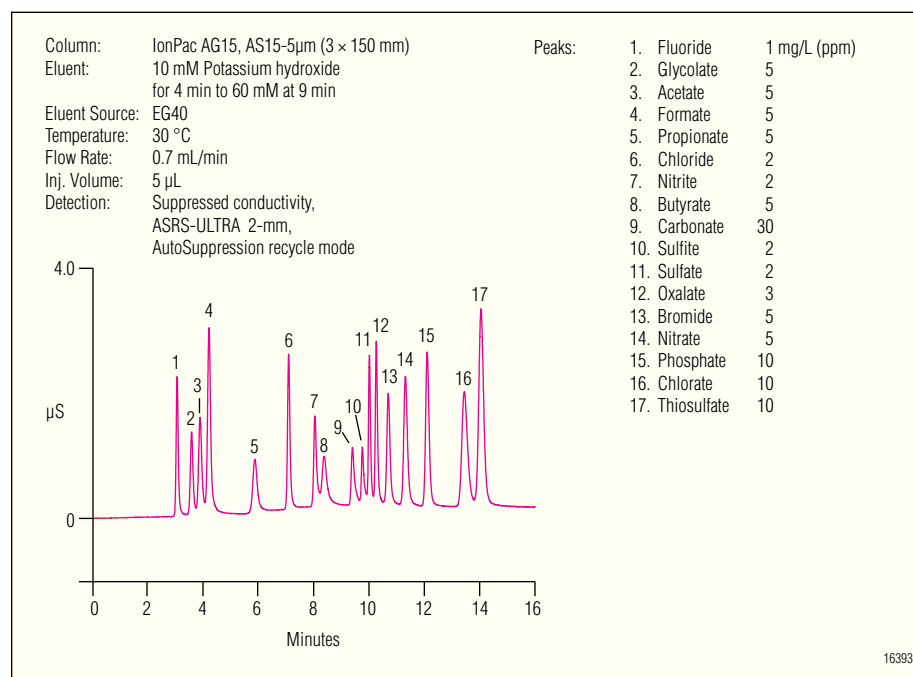


Figure 8. Separation of weakly retained organic acids using a potassium hydroxide gradient on the IonPac AS15-5 μ m (3 $\times$ 150 mm) column.

Concentrator Columns

For concentrator work, when a single piston pump such as the AXP pump (pulse damper required) is used for sample delivery, use the IonPac AG15 Guard column, ultratrace anion concentrator columns (UTAC-LP1, UTAC-ULP1, UTAC-XLP1, UTAC-LP2, UTAC-ULP2, or UTAC-XLP2), or the trace anion concentrator columns

(TAC-ULP1 or TAC-2). Use the UTAC-LP1, UTAC-LP2 or the TAC-LP1 when the sample is delivered with a syringe or with a low-pressure autosampler such as the AS-DV.

For concentrator work with a 0.4 mm capillary column, use the IonPac AG15 Capillary Guard column or the IonSwift MAC-100 Concentrator column.

SPECIFICATIONS

Dimensions:

IonPac AS15 Capillary Column:
0.4 × 250 mm

IonPac AG15 Capillary Guard Column:
0.4 × 50 mm

IonPac AS15 Analytical Column:
2 × 250, 3 × 150, and 4 × 250 mm

IonPac AG15 Guard Column:
2 × 50, 3 × 30, and 4 × 50 mm

IonPac AC15 Concentrator Column:
2 × 50 and 4 × 50 mm

Maximum Operating Pressure:

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

Mobile Phase Compatibility:

pH 0–14; 0–100% HPLC solvents

Substrate Characteristics:

Bead Diameter:
5 µm (3 × 150 mm)
9 µm (0.4 × 250, 2 × 250 and
4 × 250 mm)
13 µm (AC15)

Pore Size:
100 Å (AS15, AG15)
Microporous, < 10 Å (AC15)
Crosslinking (%DVB): 55%

Latex Characteristics (AC15):

Latex Crosslinking: 6%
Latex Diameter: 85 nm

Ion-Exchange Group:

Surface-functionalized with alkanol
quaternary ammonium ion (AS15,
AG15) Latex-functionalized with
alkanol quaternary ammonium ion
(AC15)

Functional Group Characteristics:

Medium–high hydrophobicity (AS15, AG15)
Very low hydrophobicity (AC15)

Capacity:

2.25 µeq (0.4 × 250 mm capillary column)
0.45 µeq (0.4 × 50 mm capillary guard column)
56.25 µeq (2 × 250 mm analytical column)
11.25 µeq (2 × 50 mm guard column)
2.2 µeq (2 × 50 mm concentrator column)
70 µeq (3 × 150 mm analytical column)
14 µeq (3 × 30 mm guard column)
225 µeq (4 × 250 mm analytical column)
45 µeq (4 × 50 mm guard column)
9 µeq (4 × 50 mm concentrator column)

AC15 Void Volume:

9 µL (2 × 50 mm)
210 µL (4 × 50 mm)

Column Construction:

PEEK® with 10–32 threaded ferrule-style end
fittings. All components are nonmetallic.

ORDERING INFORMATION

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 the following part numbers:

AS15 Analytical and Guard Columns	Part Number
IonPac AS15-9µm Capillary Column (0.4 × 250 mm).....	075662
IonPac AG15-9µm Guard Column (0.4 × 50 mm).....	075663
IonPac AS15-9µm Analytical Column (4 × 250 mm).....	053940
IonPac AG15-9µm Guard Column (4 × 50 mm).....	053942
IonPac AS15-5µm Analytical Column (3 × 150 mm).....	057594
IonPac AG15-5µm Guard Column (3 × 30 mm).....	057597
IonPac AS15-9µm Analytical Column (2 × 250 mm).....	053941
IonPac AG15-9µm Guard Column (2 × 50 mm).....	053943

Trap Columns

CR-ATC Continuously Regenerated Anion Trap Column (for use with systems equipped with an eluent generator or RFC-30 Reagent-Free Controller).....	060477
CR-ATC Continuously Regenerated Anion Trap Column (Capillary) (for use with Capillary Anion Columns).....	072078
ATC-3 Anion Trap Column (9 × 24 mm) (for use with 4 mm columns).....	059660
ATC-3 Anion Trap Column (4 × 35 mm) (for use with 2 mm columns).....	059661
ATC-HC Anion Trap Column (for use with the EG).....	059604

Trace Anion Concentrator Columns

IonPac AC15 Concentrator Column (2 × 50 mm; for use with 2-mm and 3-mm columns).....	055695
IonPac AC15 Concentrator Column (4 × 50 mm).....	055694
IonSwift MAC-100 Monolith Anion Concentrator Column (0.5 × 80 mm).....	074702
TAC-LP1 Trace Anion Concentrator (4 × 35 mm).....	046026
TAC-ULP1 Trace Anion Concentrator (5 × 23 mm).....	061400
UTAC-LP1 Ultra Trace Anion Concentrator Low Pressure (4 × 35 mm).....	063079
UTAC-ULP1 Ultra Trace Anion Concentrator Ultra Low Pressure (5 × 23 mm).....	063475
UTAC-XLP1 Ultra Trace Anion Concentrator Extremely Low Pressure (6 × 16 mm).....	063459
UTAC-LP2 Ultra Trace Anion Concentrator Low Pressure (4 × 35 mm).....	072779
UTAC-ULP2 Ultra Trace Anion Concentrator Ultra Low Pressure (5 × 23 mm).....	072780
UTAC-XLP2 Ultra Trace Anion Concentrator Extremely Low Pressure (6 × 16 mm).....	072781

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LPN 1000-05 PDF 3/11
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