

IonPac® and IonSwift™ concentrator columns for anion, cation, and chelation ion chromatography are used to concentrate analytes, allowing determinations at µg/L (ppb) and sub-µg/L levels.

IonPac trap columns for anion and cation determinations prevent eluent contaminants from causing interfering peaks during gradient ion chromatography.

Now sold under the
Thermo Scientific brand

Thermo
SCIENTIFIC

Concentrator Columns

IonPac Concentrator Columns are designed primarily for high-purity water analysis. The columns retain ions from a measured volume of aqueous sample matrix, thereby concentrating the analyte species and lowering detection limits. The advantage of using concentrator columns is the ability to perform routine analysis for ions at µg/L (ppb) to ng/L (ppt) levels.

Figure 1 illustrates a typical IC trace-enrichment system configuration using a concentrator column. The sample is pumped across the concentrator column, as shown in Figure 1A.

After the analytes from the sample are concentrated, the valve is switched. The concentrated analytes are then swept by the eluent from the concentrator column onto the analytical column, as shown in Figure 1B.

Figure 2 illustrates the configuration of a 2D-IC System using a capillary concentrator column. The concentrator column is placed between the first and second dimension of the 2D System set-up; a cut volume then is focused on the capillary concentration column, then eluted onto a second dimension column.

Figures 3–12 illustrate the use of this system configuration for trace-level anion determinations. This concentrator system can also be used for the determination of trace cations and transition metals, as shown in Figures 13 and 14.

Ordering Information

Monolith Anion Concentrator (MAC-100)

(0.5 × 80 mm).....P/N 074702

The MAC-100 Monolith Anion Concentrator Column is designed primarily for high-purity water analysis. The MAC-100 is a general purpose, ultralow pressure anion concentrator designed for use with IonPac anion capillary columns and IonSwift anion columns. The MAC-100 strips ions from a measured volume of aqueous sample, concentrating the analyte species and thereby lowering detection limits. The MAC-100 is available in a 0.5 × 80 mm format for ultralow pressure applications using a pressurized bottle, syringes, AS autosampler and a single piston sample delivery pump (AXP pump) for sample loading. The MAC-100 has a capacity of 0.17 µeq/column and a void volume of approximately 10 µL.

Monolith Anion Concentrator (MAC-200)

(0.75 × 80 mm).....P/N 075461

The MAC-200 Monolith Anion Concentrator Column is designed primarily for 2D-IC capillary applications including trace bromate or perchlorate in drinking water matrices. The MAC-200 Concentrator Column can also be used to preconcentrate trace anions in high purity water matrices. The MAC-200 is available in a 0.75 × 80 mm format designed specifically for concentrating trace anions such as bromate or perchlorate. The MAC-200 is placed between the first and second dimension of the 2D-IC system set-up and a cut volume is focused on the MAC-200, then eluted onto a second dimension column such as an IonPac AS19 or AS20 capillary column. The MAC-200 has a capacity of 0.24 µeq/column and a void volume of approximately 23 µL.

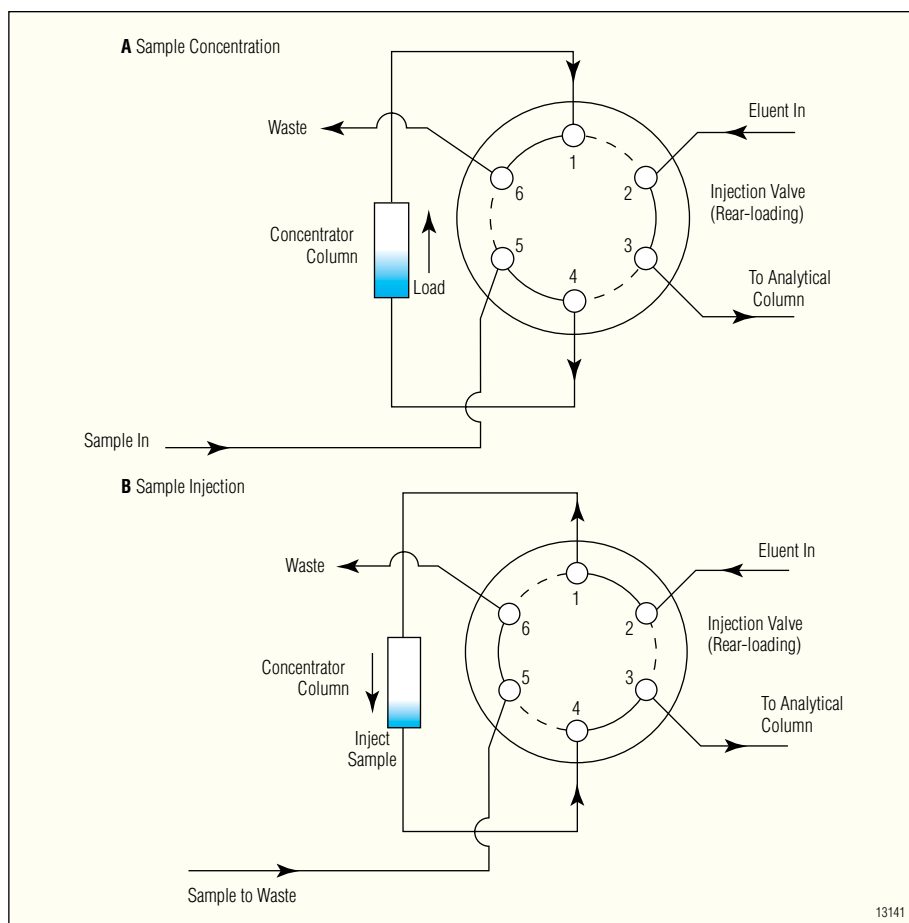


Figure 1. Process for ion chromatography trace enrichment: (A) sample concentration step and (B) sample injection step.

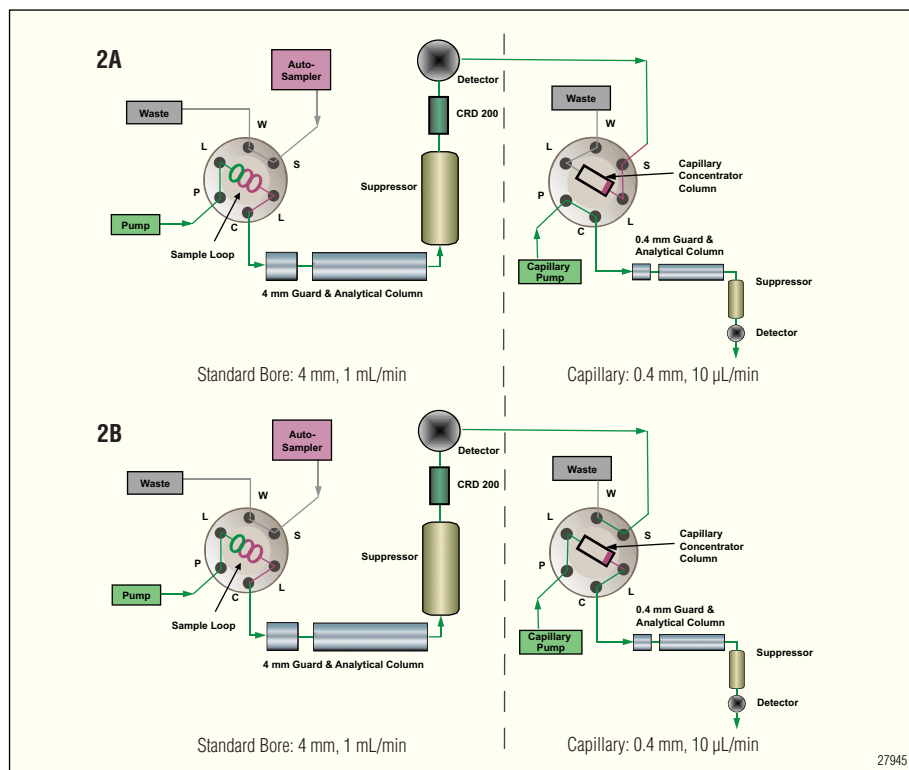


Figure 2. Configuration of a 2D-IC System using a capillary concentrator column.

Anion Concentrators

Anion MicroConcentrator (AMC-1) (2 × 15 mm)P/N 051760

The AMC-1 is a low void-volume microconcentrator column designed for the concentration of inorganic and low-molecular-weight organic anions from ultrapure water. The novel solvent compatible resin technology ensures a low sulfate background during the concentration step. The AMC-1 can be loaded with either a loop or sample loading pump. The low column void volume (approximately 15 μL) allows improved determination of early-eluting anions such as fluoride, glycolate, acetate, and formate. This low void volume is ideal for 2 mm concentration methods, reduces the “system dip”, and improves anion determinations for trace anion determinations in the power generation and semiconductor industries. The AMC-1 has a capacity of 3.0 $\mu\text{eq/}$ column and can be used in 2 mm or 4 mm i.d. anion-exchange systems with carbonate/bicarbonate or borate eluents.

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

The TAC-LP1 Low-Pressure Trace Anion Concentrator Column is designed primarily for high-purity water analysis. The TAC-LP1 strips ions from a measured volume of aqueous sample matrix, concentrating the analyte species and thereby lowering detection limits. The TAC-LP1 is a general purpose, low-pressure concentrator for use with syringe or autosampler loading (AS-DV Autosampler). It can be used in anion-exchange systems using hydroxide, carbonate/bicarbonate, or borate eluent systems. The TAC-LP1 has a capacity of 25.0 $\mu\text{eq/}$ column and a void volume of approximately 145 μL .

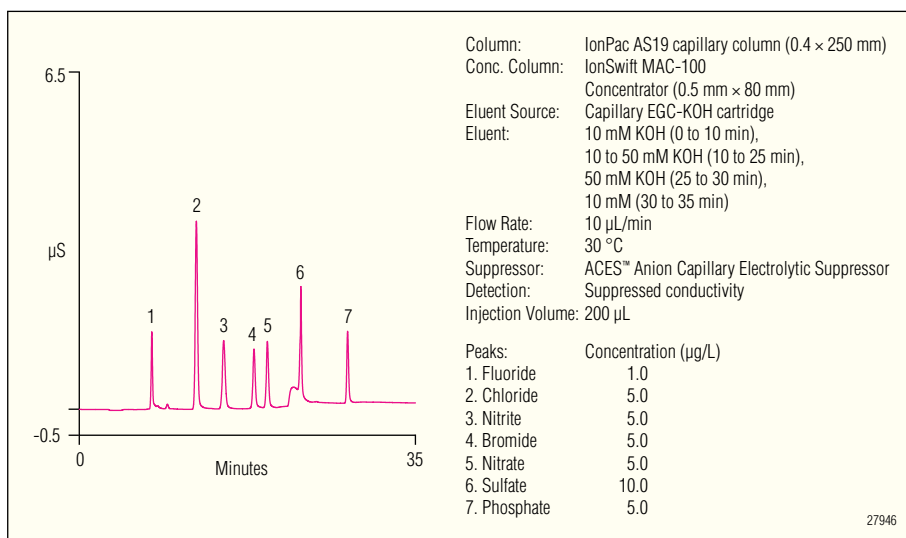


Figure 3. Separation of inorganic anions at trace concentrations on a IonPac AS19 capillary column with 200 μL injection.

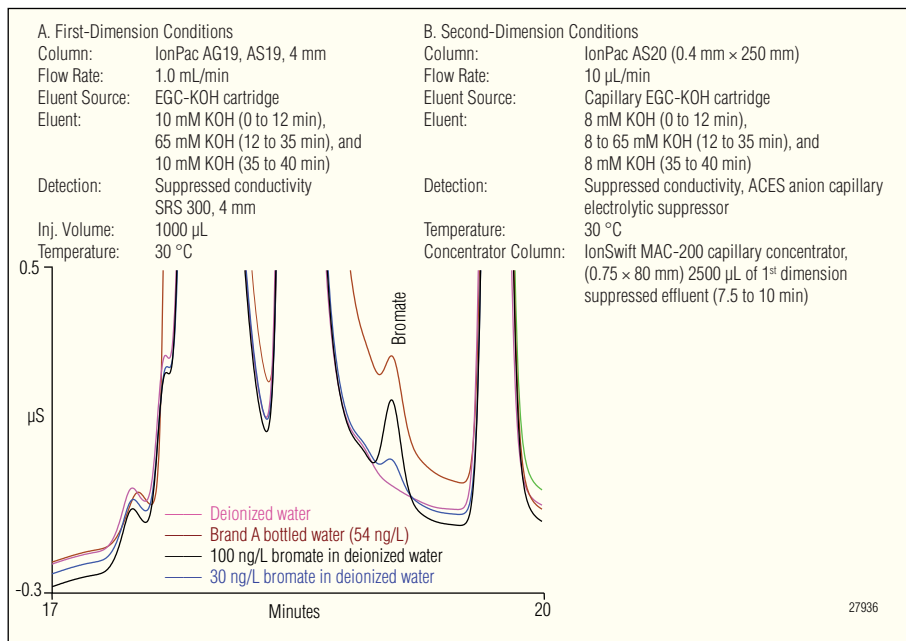


Figure 4. Determination of trace concentrations of bromate using the IonPac AS20 column with two-dimensional ion chromatography.

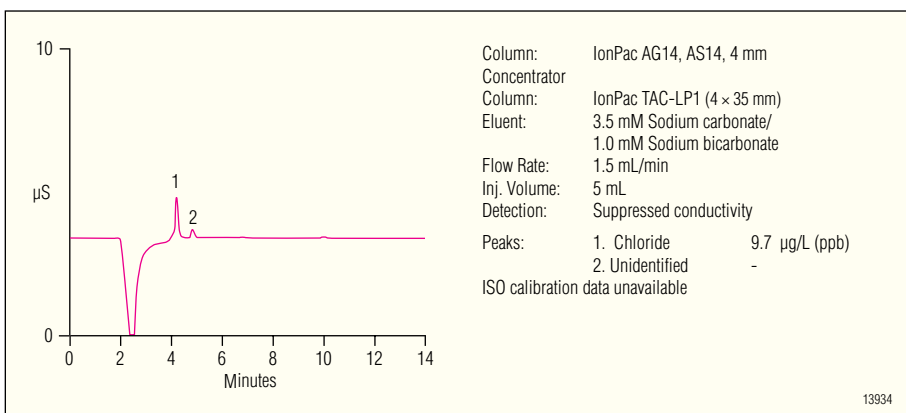


Figure 5. Determination of trace-level chloride using a TAC-LP1 concentrator column.

Ultra-Low-Pressure Trace Anion Concentrator (TAC-ULP1)
 (5 × 23 mm) P/N 061400

The TAC-ULP1 Ultra-Low-Pressure Trace Anion Concentrator Column is designed primarily for high-purity water analysis. The TAC-ULP1 strips ions from a measured volume of aqueous sample matrix, concentrating the analyte species and thereby lowering detection limits. The TAC-ULP1 is a general purpose, ultra-low-pressure concentrator for use with syringe or autosampler loading (AS-DV and AS Autosamplers). The TAC-ULP1 (5 × 23 mm) can be used with single-piston sample delivery pumps, including the AXP pump. The TAC-ULP1 can be used with carbonate/bicarbonate, borate, or hydroxide eluents. The TAC-ULP1 has a capacity of 25.0 μeq /column and a void volume of approximately 145 μL .

Ultratrace Anion Concentrator Low Pressure (UTAC-LP1)
 (4 × 35 mm) P/N 063079

The UTAC-LP1 (4 × 35 mm) Ultratrace Anion Concentrator Column is designed primarily for high purity water analysis. The UTAC-LP1 is an ultraclean (low sulfate) concentrator column. The UTAC-LP1 strips ions from a measured volume of aqueous sample matrix, concentrating the analyte species thereby lowering detection limits. The UTAC-LP1 is a general purpose, low pressure anion concentrator column for use with syringe or autosampler loading (AS-DV). The UTAC-LP1 can be used with carbonate/bicarbonate, borate, or hydroxide eluents. The UTAC-LP1 has a capacity of 25.0 μeq /column and a void volume of approximately 145 μL .

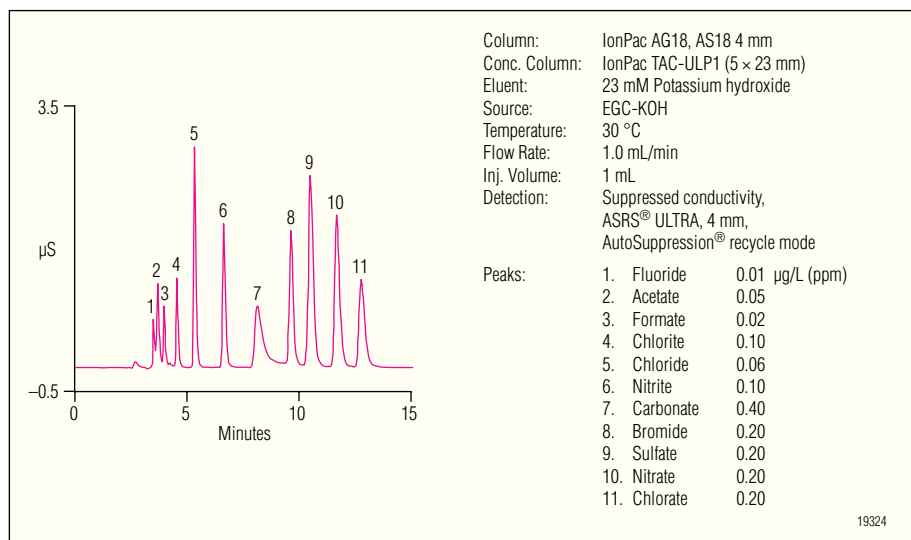


Figure 6. Determination of trace anions using a TAC-ULP1 concentrator column.

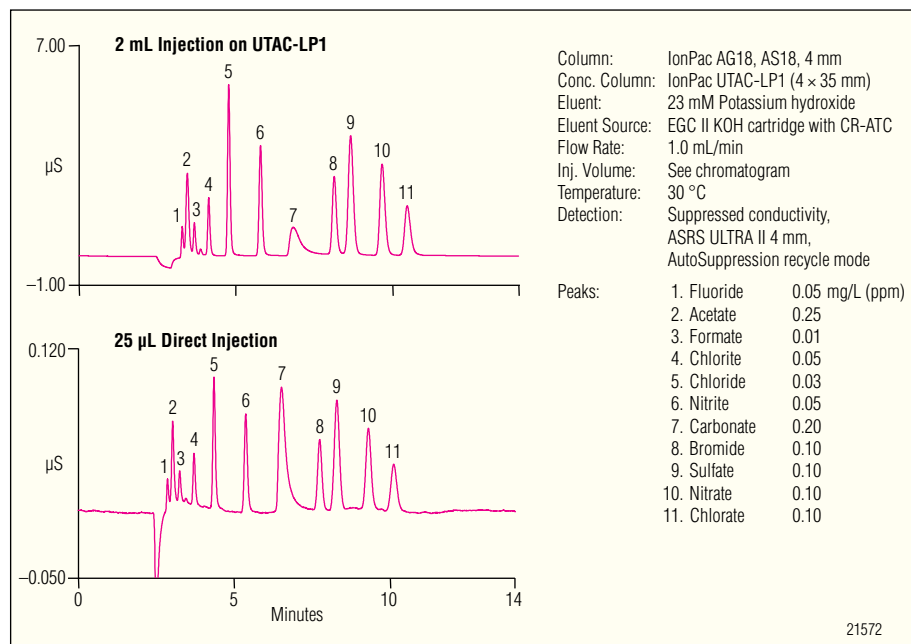


Figure 7. Comparison of direct injection and preconcentration using the UTAC-LP1 concentrator column for the determination of trace anions.

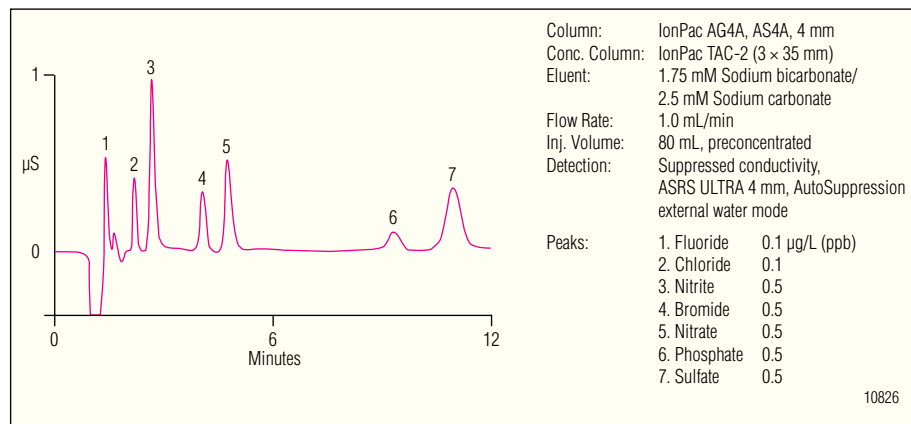


Figure 8. Trace-level anion determination using a TAC-2 concentrator column.

Ultratrace Anion Concentrator Low Pressure 2 (UTAC-LP2)
(4 × 35 mm).....P/N 072779

The UTAC-LP2 (4 × 35 mm) Ultratrace Anion Concentrator Column is designed primarily for high-purity water analysis. The UTAC-LP2 is a general purpose, low-pressure anion concentrator column with similar features to the UTAC-LP1, but back-pressure resilience has been improved to eliminate the need for a pulse damper on the loading pump, and matrix resilience has been improved to allow direct injection of samples containing poly-acrylic acid additives used in the power industry. The UTAC-LP2 is available in a 4 × 35 mm format for low-pressure applications including loading pump, syringe or AS-DV autosampler loading. The UTAC-LP2 has a capacity of 25.0 µeq/column and a void volume of approximately 145 µL.

Ultratrace Anion Concentrator-Ultra Low Pressure (UTAC-ULP1)
(5 × 23 mm) P/N 063475

The UTAC-ULP1 (5 × 23 mm) Ultratrace Anion Concentrator Column is designed primarily for high purity water analysis. The UTAC-ULP1 is an ultra clean (low sulfate) concentrator column. The UTAC-ULP1 strips ions from a measured volume of aqueous sample matrix, concentrating the analyte species thereby lowering detection limits. The UTAC-ULP1 is a general purpose, ultra low-pressure concentrator for use with syringe or autosampler loading (AS-DV and AS Autosamplers). The UTAC-ULP1 can be used with single piston sample delivery pumps including the AXP pump. The UTAC-ULP1 can be used with carbonate/bicarbonate, borate, or hydroxide eluents. The UTAC-ULP1 has a capacity of 25.0 µeq/column and a void volume of approximately 145 µL.

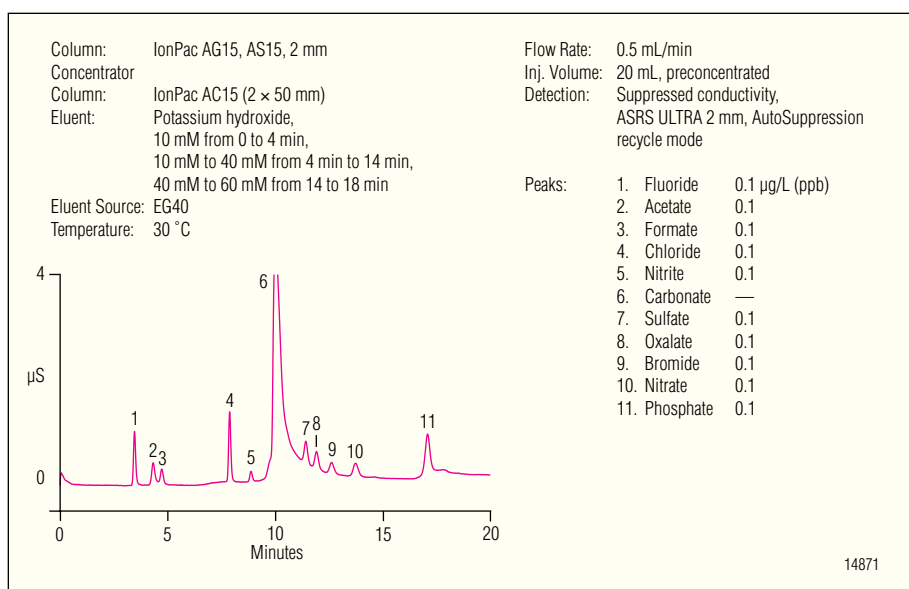


Figure 9. Determination of inorganic anions and low molecular weight organic acids with sample preconcentration using a 2 mm AC15 column.

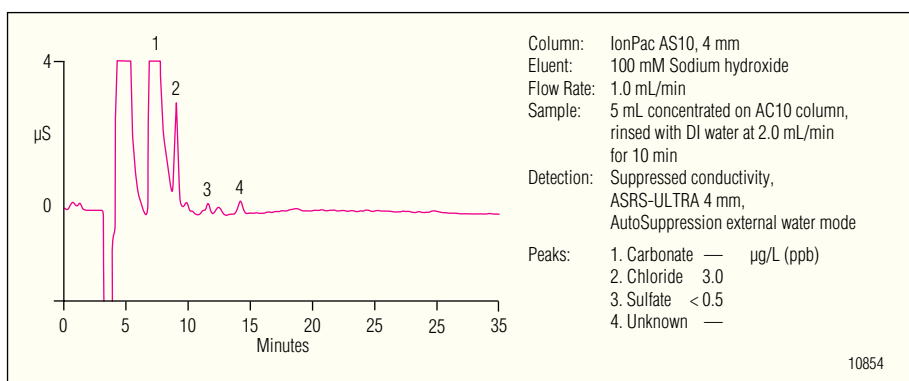


Figure 10. Determination of anions in semiconductor-grade isopropyl alcohol using an AC10 concentrator column.

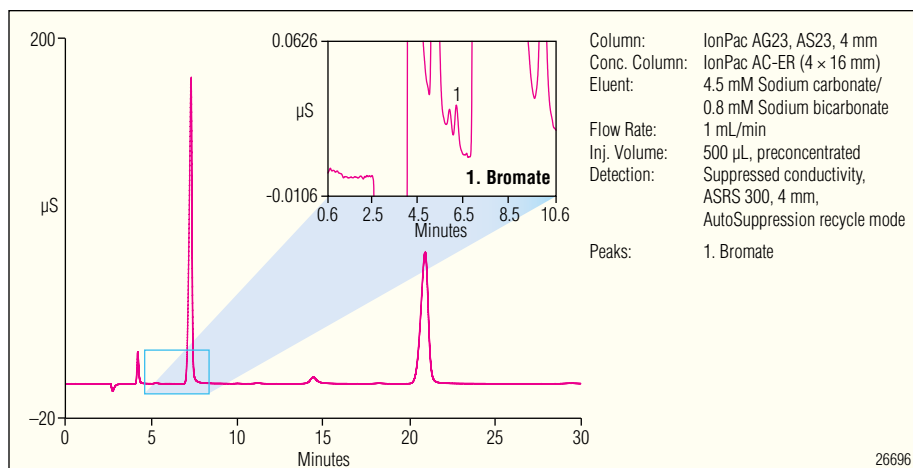


Figure 11. Determination of bromate in a municipal water sample using a Reagent-Free™ IC system with eluent regeneration and an AC-ER concentrator column.

Ultratrace Anion Concentrator Ultra Low Pressure 2 (UTAC-LP2)
(5 × 23 mm).....P/N 072780

The UTAC-ULP2 (5 × 23 mm) Ultratrace Anion Concentrator Column is designed primarily for high-purity water analysis. The UTAC-ULP2 is a general purpose, ultralow pressure anion concentrator column with similar features to the UTAC-ULP1, but back-pressure resilience has been improved to eliminate the need for a pulse damper on the loading pump, and matrix resilience has been improved to allow direct injection of samples containing polyacrylic acid additives. UTAC-ULP2 is available in a 5 × 23 mm format for ultralow pressure applications including loading pump, syringe, and AS-DV or AS autosampler loading. The UTAC-ULP2 has a capacity of 25.0 μeq/column and a void volume of approximately 145 μL.

Ultratrace Anion Concentrator-Extremely Low Pressure (UTAC-XLP1)
(6 × 16 mm) P/N 063459

The UTAC-XLP1 (6 × 16 mm) Ultratrace Anion Concentrator Column is designed primarily for high purity water analysis. The UTAC-XLP1 is an ultraclean (low sulfate) concentrator column. The UTAC-XLP1 strips ions from a measured volume of aqueous sample matrix, concentrating the analyte species thereby lowering detection limits. The UTAC-XLP1 is a general purpose, extremely low-pressure concentrator for use with syringe or autosampler loading (AS-DV and AS Autosamplers). The UTAC-XLP1 can be used with single piston sample delivery pumps including the AXP pump. The UTAC-XLP1 can be used with carbonate/bicarbonate, borate, or hydroxide eluents. The UTAC-XLP1 has a capacity of 25.0 μeq/column and a void volume of approximately 145μL.

Ultratrace Anion Concentrator Extremely Low Pressure 2 (UTAC-LP2)
(6 × 16 mm).....P/N 072781

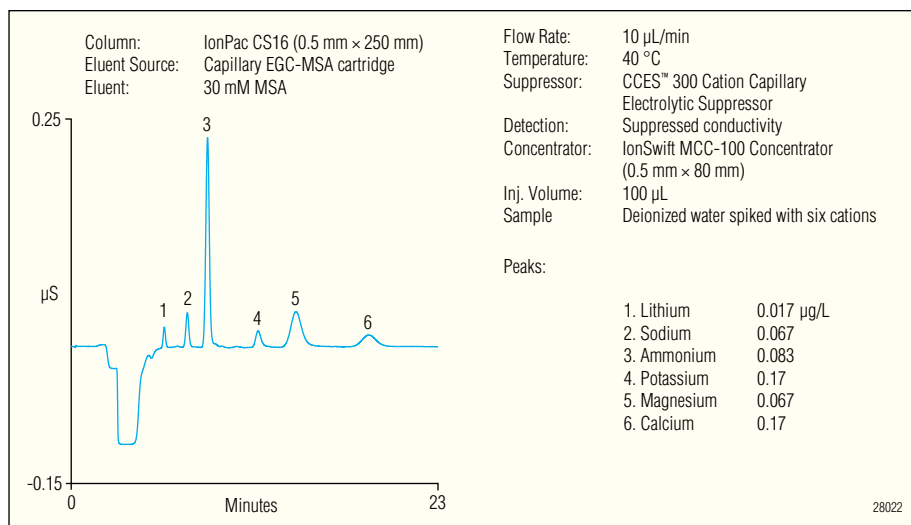


Figure 12. Separation of inorganic cations at trace concentrations using an IonPac CS16 capillary column and IonSwift MCC-100 concentrator column with 100 μL injection.

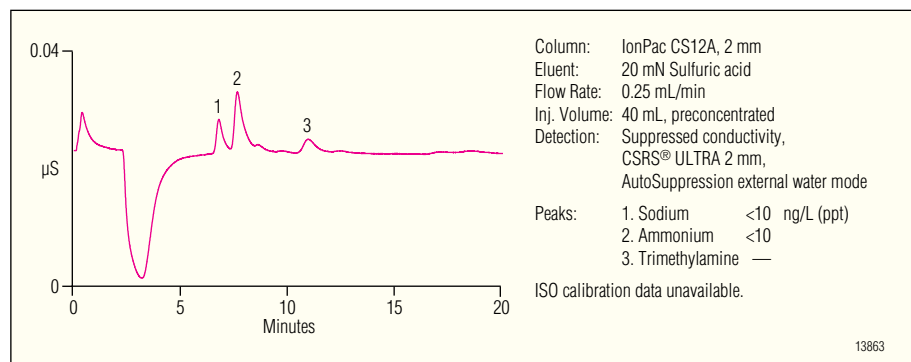


Figure 13. Determination of trace cations using sample pre-concentration.

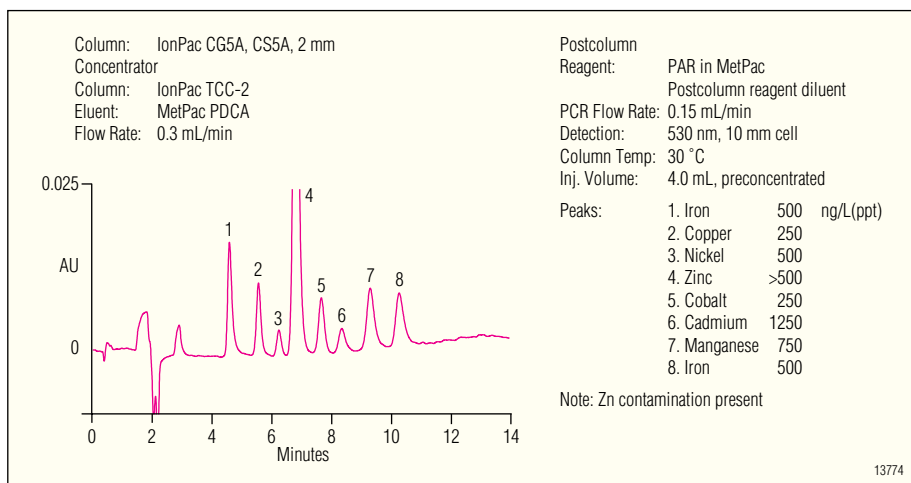


Figure 14. Determination of trace transition metals using sample pre-concentration.

The UTAC-XLP2 (6 × 16 mm) Ultratrace Anion Concentrator Column is designed primarily for high purity water analysis. The UTAC-XLP2 is a general purpose, extremely low-pressure anion concentrator column with similar features to the UTAC-XLP1, but backpressure resilience has been improved to eliminate the need for a pulse damper on the loading pump, and matrix resilience has been improved to allow direct injection of samples containing polyacrylic acid additives used in the power industry. The UTAC-XLP2 is available in a 6 × 16 mm format for extremely low-pressure applications including AS-DV and AS autosampler loading. The UTAC-ULP2 has a capacity of 25.0 $\mu\text{eq}/\text{column}$ and a void volume of approximately 145 μL .

Trace Anion Concentrator (TAC-2)
(3 × 35 mm)P/N 043101
(pkg. of 4)P/N 043102

The TAC-2 is a pellicular anion-exchange concentrator column with a capacity of 3.4 $\mu\text{eq}/\text{column}$ and a moderately low void volume (approximately 50 μL). The TAC-2 can be used in anion-exchange systems using carbonate/bicarbonate or borate eluent systems. Note that the TAC-2 should not be used with solvents.

IonPac AC10 Concentrator
(4 × 35 mm)P/N 043133

For use with IonPac AS10 4 mm anion-exchange columns; The AC10 Concentrator has a void volume of approximately 207 μL and a capacity of approximately 4 $\mu\text{eq}/\text{column}$.

IonPac AC10 Concentrator
(2 × 35 mm)P/N 043134

For use with IonPac AS10 2 mm anion-exchange columns; the capacity is approximately 0.8 $\mu\text{eq}/\text{column}$. The void volume is approximately 52 μL .

IonPac AC15 Concentrator
(4 × 50 mm)P/N 055694

For use with IonPac AS15 4 mm anion-exchange columns; the capacity is approximately 9 $\mu\text{eq}/\text{column}$. The void volume is approximately 210 μL .

IonPac AC15 Concentrator
(2 × 50 mm)P/N 055695

For use with IonPac AS15 2 mm and 3 mm anion-exchange columns; the capacity is approximately 2.2 $\mu\text{eq}/\text{column}$. The void volume is approximately 53 μL .

IonPac Anion Concentrator for Eluent Regeneration (AC-ER)
(4 × 16 mm).....P/N 072778

The AC-ER (4 × 16 mm) Anion Concentrator Column is a general purpose, low-dead volume, extremely low pressure anion concentrator column with similar features to the UTAC 2 concentrators, but with reduced dead volume and capacity. The AC-ER is available in a 4 × 16 mm format for very low-dead volume to maximize the number of injections that can be made on an RFIC system with eluent regeneration (ER) between eluent exchanges. The AC-ER has a capacity of 12.0 $\mu\text{eq}/\text{column}$ and a void volume of approximately 70 μL .

With an AC-ER column installed in an RFIC-ER system, each injection only adds 75 μL of sample matrix into the eluent regardless of the sample volume (70 μL + 5 μL for connecting tubing). Therefore, approximately 266 injections can be performed before the eluent needs to be replaced, regardless of the actual amount of sample loaded onto the concentrator. And by using a matrix elimination step with the AC-ER in place, solvents can be directly injected onto the AC-ER then flushed off before injection into the RFIC-ER system. The new AC-ER concentrator brings a host of new applications within range of RFIC-ER systems, including analysis of bromate to 5 ppb in drinking water, and analysis of common anions in ethanol.

Cation Concentrators
Monolith Cation Concentrator (MCC-100)
(0.5 × 80 mm).....P/N 075462

The MCC-100 Monolith Cation Concentrator Column is designed primarily for high-purity water analysis. The MCC-100 is a general purpose, ultralow pressure Cation concentrator designed for use with IonPac cation capillary columns. The MCC-100 strips ions from a measured volume of aqueous sample, concentrating the analyte species and thereby lowering detection limits. The MCC-100 is available in a 0.5 × 80 mm format for ultralow pressure applications using a pressurized bottle, syringes, AS autosampler and a single piston sample delivery pump (AXP pump) for sample loading. The MCC-100 has a capacity of 0.72 $\mu\text{eq}/\text{column}$ and a void volume of approximately 10 μL .

Monolith Cation Concentrator (MCC-200)
(0.75 × 80 mm).....P/N 075463

The MAC-200 Monolith Cation Concentrator Column is designed primarily for 2D-IC capillary applications including trace ammonium and amines in high salt matrices. The MCC-200 Concentrator Column can also be used to preconcentrate trace cations in high purity water matrices. The MCC-200 is available in a 0.75 × 80 mm format designed specifically for concentrating trace cations such as ammonium or amines. The MCC-200 is placed between the first and second dimension of the 2D-IC system set-up and a cut volume is focused on the MCC-200, then eluted onto a second dimension column such as an IonPac CS16 or CS17 capillary column. The MCC-200 has a capacity of 1.57 $\mu\text{eq}/\text{column}$ and a void volume of approximately 23 μL .

Trace Cation Concentrator (TCC-LP1)
(4 × 35 mm)P/N 046027

The TCC-LP1 (4 × 35 mm) Low Pressure Trace Cation Concentrator Column is designed primarily for high purity water analysis. The TCC-LP1 strips ions from a measured volume of aqueous sample matrix, concentrating the analyte species thereby lowering detection limits.

The TCC-LP1 is a general purpose, low-pressure concentrator for use with syringe or autosampler loading (AS-DV). It is designed for use with carboxylated cation-exchange systems such as the IonPac CS12, CS12A, CS14, CS15, CS16, CS17 or CS18 with monovalent eluents (sulfuric acid, methanesulfonic acid, or hydrochloric acid). The TCC-LP1 has a capacity of 260 $\mu\text{eq}/\text{column}$ and a void volume of approximately 145 μL .

Ultralow Pressure Trace Cation Concentrator (TCC-ULP1)
(5 × 23 mm) P/N 063783

The TCC-ULP1 (5 × 23 mm) Ultralow Pressure Trace Cation Concentrator Column is designed primarily for high purity water analysis. The TCC-ULP1 strips ions from a measured volume of aqueous sample matrix, concentrating the analyte species thereby lowering detection limits. The TCC-ULP1 is a general purpose, ultralow-pressure concentrator for use with syringe or autosampler loading (AS-DV or AS Autosamplers). The TCC-ULP1 can also be used with single-piston sample delivery pumps including the AXP pump. It is recommended for use with carboxylated columns such as the IonPac CS12, CS12A, CS14, CS15, CS16, CS17 and CS18 columns. The TCC-ULP1 can be used with sulfuric acid, methanesulfonic acid, and hydrochloric acid eluents. The TCC-ULP1 has a capacity of 260 $\mu\text{eq}/\text{column}$ and a void volume of approximately 145 μL .

Extremely Low Pressure Trace Cation Concentrator (TCC-XLP1)
(6 × 16 mm) P/N 063889

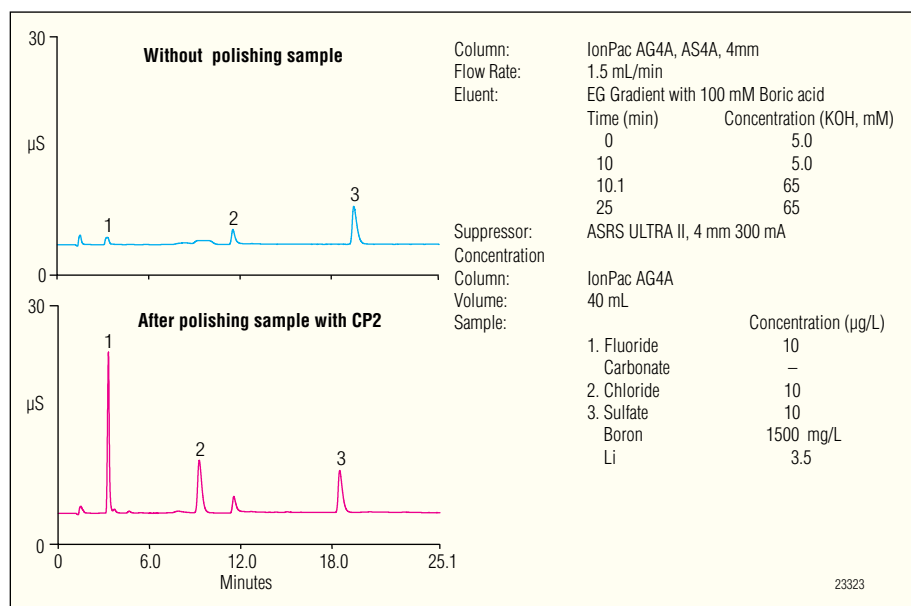


Figure 15. This example compares a simulated borated water sample consisting of trace anions and lithium. The polishing step ensured complete recovery of both response and peak shapes for all ions. Cation Polisher CP2 is placed between the sampling pump and the injection valve.

The TCC-XLP1 (6 × 16 mm) Extremely Low Pressure Trace Cation Concentrator Column is designed primarily for high purity water analysis. The TCC-XLP1 strips ions from a measured volume of aqueous sample matrix, concentrating the analyte species thereby lowering detection limits. The TCC-XLP1 is a general purpose, extremely low-pressure concentrator for use with syringe or autosampler loading (AS-DV or AS Autosamplers). The TCC-XLP1 can also be used with single-piston sample delivery pumps including the AXP pump. It is recommended for use with carboxylated columns such as the CS12, CS12A, CS14, CS15, CS16, CS17 and CS18 columns. The TCC-XLP1 can be used with sulfuric acid, methanesulfonic acid, and hydrochloric acid eluents. The TCC-XLP1 has a capacity of 260 $\mu\text{eq}/\text{column}$ and a void volume of approximately 145 μL .

Trace Cation Concentrator (TCC-2)
(3 × 35 mm)P/N 043103
(pkg. of 4)P/N 043104

The TCC-2 is a surface-sulfonated cation-exchange concentrator column with a capacity of approximately 10 $\mu\text{eq}/\text{column}$ and a low void volume of approximately 50 μL . It is ideal for use with sulfonated cation-exchange columns such as the IonPac CS3, CS10, and CS11. The TCC-2 can also be used as concentrator column for transition metals.

Chelation Ion Chromatography Concentrators
MetPac™ CC-1 Concentrator
(4 × 50 mm)
(pkg. of 2) P/N 042156

A chelating column ideal for concentration of cationic transition metals from high ionic strength matrices. The capacity is 0.4 meq/column.

TMC-1 Concentrator
(3 × 25 mm) P/N 049000

A high-capacity cation-concentration column used for coupling the MetPac CC-1 to the IonPac CS5 or IonPac CS5A analytical columns when performing chelation IC. The capacity is 0.3 meq/column.

Trap Columns

IonPac Trap columns contain high-capacity, low-efficiency, ion-exchange resin. The column strips trace contaminants from the eluent, preventing concentration on the guard and analytical columns. The trap column is installed in the eluent line prior to the injection valve to prevent spurious peaks during gradient chromatography.

Metal-Free Trap Column

Metal-Free Column (MFC-1)

(3 × 27 mm) P/N 037017

The MFC-1 is packed with a special chelating resin and is used in the eluent line prior to the injection valve to remove transition metals from high-pH eluents. The capacity is 170 $\mu\text{eq}/\text{column}$.

Continuously Regenerated Trap Columns (CR-TC)

CR-TC trap columns are high-pressure, electrolytically regenerated devices that remove ionic contaminants from the eluent without the need for off-line chemical regeneration. The product is available in two versions, the CR-ATC for anion applications and CR-CTC II for cation applications. The CR-TC is compatible with all Dionex Eluent Generators including the RFC-30, ICS-2100 and ICS-5000 EG. EG40 customers must first order the CR-TC Add-on Kit (P/N 060476). A single format is used with 2, 3, 4, and 5 mm i.d. separator column applications, while a second format is available for capillary column applications.

CR-ATC Continuously Regenerated Anion Trap Column..... P/N 060477
CR-ATC (Capillary)..... P/N 072078

When plumbed after the EluGen cartridge, the CR-ATC removes all anionic contaminants, for example carbonate, from the deionized feed water and provides low drift during gradient operations.

CR-CTC II Continuously Regenerated Cation Trap Column..... P/N 066262
CR-CTC (Capillary) P/N 072079

When plumbed after the EluGen cartridge, the CR-CTC removes cationic contaminants, for example ammonium and sodium, from deionized feed water and provides low drift during gradient operations.

Anion Trap Columns

The ATC is a high-capacity anion-exchange column used to remove trace anion contamination from eluents.

ATC-3 (9 × 24 mm)..... P/N 059660

For use with 4 mm anion-exchange columns.

ATC-3 (4 × 35 mm)..... P/N 059661

For use with 2 mm and 3 mm anion-exchange columns.

ATC-HC (9 × 75 mm) P/N 059604

For use with the EGC-KOH, EGC-NaOH, EGC-LiOH or EGC-K₂CO₃ cartridges in the EG40 or EG50 Eluent Generator.

ATC-HC Borate Form

(9 × 75 mm) P/N 064755

For use with the EG generated borate eluents or with manually prepared borate eluents.

Cation Trap Columns

The CTC is a high-capacity cation-exchange column packed with sulfonated resin. The CTC is used to remove trace cation contamination from the eluent.

CTC-1 (9 × 24 mm) P/N 040192

For use with 4 mm and 5 mm cation-exchange columns.

CTC (2 mm)

(4 × 35 mm) P/N 043132

For use with 2 mm and 3 mm cation-exchange columns.

Cation Polisher Columns

Cation Polisher CP1 and CP2 columns are designed for removal of metallic contaminants and other cations such as calcium and magnesium from the sample stream while performing anion analysis. The columns improve the performance of ion chromatography systems, particularly with phosphate analysis in the presence of metallic contaminants.

Samples that contain high levels of metals or cations can be deposited on the guard/analytical columns or the suppressor, which can lead to performance issues such as poor peak shapes or poor recoveries for some anions such as phosphate. These contaminants can adversely affect the operation of the guard/analytical columns or suppressor. Cation Polisher columns address the potential precipitation issue of these contaminants and aid in extending the column and suppressor lifetimes when pursuing anion analysis and when the matrix ions contain multivalent cations.

In some cases the Cation Polisher columns aid removal of matrix cations when pursuing anion analysis with sample preconcentration. The matrix cations can elute species of interest from the concentrator column and lead to poor peak shapes and recovery. Removing the matrix cations using Cation Polisher columns helps ensure good chromatographic performance.

The CP1 (6 × 16 mm) column is a cation-exchange column in the sodium form and packed in a low pressure format and is specifically designed for autosampler operation. The void volume of this column is approximately 250 μL . The CP2 (9 × 24 mm) column is a higher capacity version in the hydronium form and has a void volume of approximately 825 μL . The CP2 Polisher Column is recommended for large volume sample preconcentration applications using an external pump. Both columns can be regenerated off-line approximately every 2–3 months (depending on the level of contamination and usage).

Cation Polisher CP1 Na⁺ Form

(6 × 16 mm) P/N 064930

Cation Polisher CP2 H⁺ Form

(9 × 24 mm) P/N 064931

CONCENTRATOR COLUMN SELECTION TABLE

Column	Capacity (µeq/column)	Void Volume (µL)	Recommended Applications	Recommended Sample Delivery Method
Anion				
MAC-100	0.17	10	Hydroxide, carbonate/bicarbonate and borate eluents	Pressurized bottle, syringes, AS autosampler, and single piston sample delivery pump (AXP pump)
MAC-200	0.24	23	Hydroxide, carbonate/bicarbonate and borate eluents	Pressurized bottle, syringes, AS autosampler, and single piston sample delivery pump (AXP pump)
AMC-1	3.0	15.0	Carbonate/bicarbonate and borate eluents	AXP pump*
TAC-LP1	25.0	145.0	Hydroxide, carbonate/bicarbonate and borate eluents	Pressurized bottles, syringes, low-pressure autosamplers (AS-DV), SP10 AutoNeutralization Module
TAC-ULP1	25.0	145.0	Hydroxide, carbonate/bicarbonate and borate eluents	Pressurized bottles, syringes, autosamplers (AS-DV and AS) single-piston sample delivery pumps (AXP pump).
UTAC-LP1	25.0	145.0	Hydroxide, carbonate/bicarbonate	Pressurized bottles, syringes, low-pressure autosamplers (AS-DV and AS-HV)
UTAC-LP2	25.0	145.0	Hydroxide, carbonate/bicarbonate and borate eluents	Pressurized bottles, syringes, low-pressure autosamplers (AS-DV and AS-HV)
UTAC-ULP1	25.0	145.0	Hydroxide, carbonate/bicarbonate and borate eluents	Pressurized bottles, syringes, autosamplers (AS-DV and AS and AS-HV), single-piston sample delivery pumps (AXP pump)
UTAC-ULP2	25.0	145.0	Hydroxide, carbonate/bicarbonate and borate eluents	Pressurized bottles, syringes, autosamplers (AS-DV and AS and AS-HV), single-piston sample delivery pumps (AXP pump)
UTAC-XLP1	25.0	145.0	Hydroxide, carbonate/bicarbonate and borate eluents	Pressurized bottles, syringes, low-pressure autosamplers (AS-DV, AS and AS-HV), single piston delivery pumps (AXP pump)
UTAC-XLP2	25.0	145.0	Hydroxide, carbonate/bicarbonate and borate eluents	Pressurized bottles, syringes, low pressure autosamplers (AS-DV, AS and AS-HV) single-piston delivery pumps (AXP pump)
TAC-2	3.4	50.0	Carbonate/bicarbonate and	AXP pump*
AC10 (4 mm)	4.0	207.0	Hydroxide and borate eluents	AXP pump*
AC10 (2 mm)	0.8	52.0	Hydroxide and borate eluents	AXP pump*
AC15 (4 mm)	9.0	210.0	Hydroxide and borate eluents	AXP pump*
AC15 (2 mm)	2.2	53.0	Hydroxide and borate eluents	AXP pump*
AC-ER	12.0	70	Carbonate/bicarbonate eluent with RFIC-ER systems	Syringes, low-pressure autosamplers (AS-DV and AS)

* AXP pumps should use a pressurized sample source.

CONCENTRATOR COLUMN SELECTION TABLE

Column	Capacity (µeq/column)	Void Volume (µL)	Recommended Applications	Recommended Sample Delivery Method
Cation				
MCC-100	0.72	10	Use with carboxylated columns; MSA and sulfuric acid eluents	Pressurized bottle, syringes, AS autosampler, and single piston sample delivery pump (AXP pump)
MCC-200	1.57	23	Use with carboxylated columns; MSA and sulfuric acid eluents	Pressurized bottle, syringes, AS autosampler, and single piston sample delivery pump (AXP pump)
TCC-LP1	260.0	145.0	Use with carboxylated columns; MSA and sulfuric acid eluents	Pressurized bottles, syringes, low-pressure autosamplers, (AS-DV) SP10 AutoNeutralization Module
TCC-ULP1	260.0	145.0	Use with carboxylated columns; MSA and sulfuric acid eluents	Pressurized bottles, syringes, autosamplers (AS-DV and AS Autosamplers), single-piston sample deliver pumps (AXP pump).
TCC-XLP1	260.0	145.0	Use with carboxylated columns; MSA and sulfuric acid eluents	Pressurized bottles, syringes, autosamplers (AS-DV and AS Auotsamplers), single-piston sample deliver pumps AXP pump).
TCC-2	10.0	50.0	Use with sulfonated columns; HCl/DAP•HCl eluents	AXP pump*

* AXP pumps should use a pressurized sample source.

CONCENTRATOR AND TRAP COLUMN SPECIFICATIONS

Column	Particle Diameter	Substrate X-linking	Latex Diameter	Latex X-linking	Capacity (per column)	Functional Group	Hydrophobicity
Concentrator							
MAC-100	Monolithic backbone	55%	85 nm	6%	0.17 μ eq	Alkanol quaternary ammonium	Very low
MAC-200	Monolithic backbone	55%	85 nm	6%	0.24 μ eq	Alkanol quaternary ammonium	Very low
AMC-1	10 μ m	55%	Nonea	NA	3.0 μ eq	Alkyl quaternary ammonium	Medium
TAC-LP1	18 μ m	55%	85 nm	6%	25.0 μ eq	Alkanol quaternary ammonium	Very low
TAC-ULP1	18 μ m	55%	85 nm	6%	25.0 μ eq	Alkanol quaternary ammonium	Very low
UTAC-LP1	17 μ m	55%	85 nm	6%	25 μ eq	Alkanol quaternary ammonium	Very low
UTAC-LP2	20 μ m	55%	N/A	N/A	25 μ eq	Alkanol quaternary ammonium	Very low
UTAC-ULP1	17 μ m	55%	85 nm	6%	25 μ eq	Alkanol quaternary ammonium	Very low
UTAC-ULP2	20 μ m	55%	N/A	N/A	25 μ eq	Alkanol quaternary ammonium	Very low
UTAC-XLP1	17 μ m	55%	85 nm	6%	25 μ eq	Alkanol quaternary ammonium	Very low
UTAC-XLP2	20 μ m	55%	N/A	N/A	25 μ eq	Alkanol quaternary ammonium	Very low
TAC-2	30 μ m	2%	250 nm	5%	3.4 μ eq	Alkyl quaternary ammonium	Medium
AC10 (4 mm)	13 μ m	55%	160 nm	5%	4.0 μ eq	Alkanol quaternary ammonium	Low
AC10 (2 mm)	13 μ m	55%	160 nm	5%	0.8 μ eq	Alkanol quaternary ammonium	Low
AC15 (4 mm)	13 μ m	55%	85 nm	6%	9.0 μ eq	Alkanol quaternary ammonium	Very low
AC15 (2 mm)	13 μ m	55%	85 nm	6%	2.2 μ eq	Alkanol quaternary ammonium	Very low
AC-ER	20 μ m	55%	N/A	N/A	12 μ eq	Alkanol quaternary ammonium	Very low
AC15 (2 mm)	13 μ m	55%	85 nm	6%	2.2 μ eq	Alkanol quaternary ammonium	Very low
MCC-100	Monolithic backbone	55%	85 nm	6%	0.17 μ eq	Fully functionalized with carboxylic acid	Very low
MCC-200	Monolithic backbone	55%	85 nm	6%	0.24 μ eq	Fully functionalized with carboxylic acid	Very low
TCC-LP1	20 μ m	55%	None ^a	NA	260.0 μ eq	Fully functionalized with carboxylic acid	Very low
TCC-ULP1	20 μ m	55%	None ^a	NA	260.0 μ eq	Fully functionalized with carboxylic acid	Very low
TCC-XLP1	20 μ m	55%	None ^a	NA	260.0 μ eq	Fully functionalized with carboxylic acid	Very Low
TCC-2	30 μ m	2%	None ^a	NA	10.0 μ eq	Sulfonic acid	High

^a Surface-functionalized resin.

^b Fully-functionalized resin.

CONCENTRATOR AND TRAP COLUMN SPECIFICATIONS

Column	Particle Diameter	Substrate X-linking	Latex Diameter	Latex X-linking	Capacity (per column)	Functional Group	Hydrophobicity
Trap							
ATC-3 (4 mm)	55 μm	8%	None ^b	NA	1.5 meq	Quaternary ammonium	Low
ATC-3 (2 mm)	55 μm	8%	None ^b	NA	0.35 meq	Quaternary ammonium	Low
ATC-HC (9 × 75 mm)	750 μm	8%	None ^b	NA	4.0 meq	Quaternary ammonium	Low
ATC-HC Borate Form (9 × 75 mm)	750 μm	8%	None ^b	NA	4.0 meq	Quaternary ammonium	Low
CTC (4 mm)	500 μm	8%	None ^b	NA	3.0 meq	Sulfonic acid	Low
CTC (2 mm)	500 μm	8%	None ^b	NA	0.8 meq	Sulfonic acid	Low
MFC-1	200 μm	20%	None ^b	NA	170.0 μeq	Iminodiacetate	Medium
Transition Metal							
MetPac CC-1	18 μm	20%	None ^b	NA	0.4 meq	Iminodiacetate	Medium
TMC-1	17 μm	8%	None ^b	NA	0.3 meq	Sulfonic acid	Medium
Cation Polisher							
CP1 Na ⁺ Form (6 × 16 mm)	20 μm	55%	None ^b	NA	170.0 meq	Carboxylic acid	Very low
CP2 H ⁺ Form (19 × 24 mm)	20 μm	55%	None ^b	NA	575.0 meq	Carboxylic acid	Very low

^a Surface-functionalized resin.

^b Fully-functionalized resin.

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