Dionex IonPac AS30 Columns

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Product Manual

for

Dionex IonPac AS30 Analytical Column

Analytical Column, 2 × 250 mm (Item # 303161)
Analytical Column, 4 × 250 mm (Item # 303159)

Dionex IonPac AG30 Guard Column

Guard Column, 2 × 50 mm (Item # 303162)
Guard Column, 4 × 50 mm (Item # 303160)

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Safety and Special Notices

Make sure you follow the precautionary statements presented in this guide. The safety and other special notices appear in boxes.

Safety and special notices include the following:

 **SAFETY**	***Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.***
 **WARNING**	***Indicates a potentially hazardous situation which, if not avoided, could result in damage to equipment.***
 **CAUTION**	***Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury. Also used to identify a situation or practice that may seriously damage the instrument but will not cause injury.***
 **NOTE**	***Indicates information of general interest.***
IMPORTANT	***Highlights information necessary to prevent damage to software, loss of data, or invalid test results; or might contain information that is critical for optimal performance of the system.***
Tip	***Highlights helpful information that can make a task easier.***

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1. Introduction

Thermo Scientific™ Dionex™ IonPac™ AS30 Analytical and Dionex IonPac AG30 Guard Columns are hydroxide-selective anion-exchange columns designed to separate inorganic anions and oxyhalides including fluoride, chlorite, bromate, chloride, carbonate, sulfate, nitrite, bromide, chlorate, nitrate, and phosphate using a hydroxide eluent delivered with an Eluent Generator. The selectivity of Dionex IonPac AG30/AS30 columns has been designed to elute fluoride away from the water dip (injection void) and to separate oxyhalides and common anions using a hydroxide gradient. Column selectivity has been optimized to facilitate quantitation of trace levels of bromate in drinking water containing up to 50 ppm ethylenediamine (EDA). Ethylenediamine is sometimes added to drinking water samples as a preservative and can react with carbonate to produce artifacts that interfere with early eluting analytes such as fluoride. The Dionex IonPac AS30 column minimizes this interference by increasing the separation between fluoride and the EDA carbamate artifact, allowing better integration of the fluoride peak.

In comparison to the Dionex IonPac AS19 and IonPac AS27 columns, the Dionex IonPac AS30 column has unique selectivity and much higher column capacity to enable separation of fluoride from the EDA carbamate artifact as well as separation of carbonate and sulfate for better quantification of sulfate. The Dionex IonPac AS30 is a recommended column for use in Dionex High Pressure IC (HPIC) systems analyzing samples preserved with EDA. Using an isocratic or gradient hydroxide eluent, common inorganic anions can easily be separated in a variety of sample matrices including drinking water, ground water, wastewater, process streams, and scrubber solutions.

The Dionex IonPac AS30 is compatible with pH 0-14 eluents and samples, and it can be used with eluents containing 0-100% organic solvents such as acetonitrile. The Dionex IonPac AS30 can be used with any suppressible ionic eluent that does not exceed the capacity of the suppressor. The Dionex IonPac AS30 has nominal efficiency of at least 7000 plates/column for bromide using Quality Assurance test conditions.

1.1 Dionex IonPac AS30/Dionex IonPac AG30 Column Packing Specifications

Resin Characteristics:

Nominal Particle Size:	5.5 µm (Analytical Column*)
Nominal Particle Size:	11 µm (Guard Column**)
Particle Cross-linking:	55%
Ion exchange capacity:	477 µeq per 4 × 250 mm column
	119 µeq per 2 × 250 mm column
	6 µeq per 4 × 50 mm column
	1.5 µeq per 2 × 50 mm column

Functional Characteristics:

Functional Group:	Alkanol quaternary ammonium ion
Hydrophobicity:	Medium-low

*Analytical Column resin composition: supermacroporous ethylvinylbenzene polymer cross-linked with divinylbenzene.
**Guard Column resin composition: microporous ethylvinylbenzene polymer cross-linked with divinylbenzene.

Table 1 Dionex IonPac AS30/Dionex IonPac AG30 Operating Parameters

Column(s)	Typical Back Pressure psi (MPa[a]), 30°C[b]	Standard Flow Rate mL/min	Maximum Flow Rate mL/min[c]
Dionex IonPac AS30 2 mm Analytical column	~ 3000 (20.68)	0.38	0.5
Dionex IonPac AG30 2 mm Guard column	~ 300 (2.07)	0.38	0.5
Dionex IonPac AG30 and AS30 2 mm column set	~ 3300 (22.75)	0.38	0.5
Dionex IonPac AS30 4 mm Analytical column	~ 3000 (20.68)	1.50	2.0
Dionex IonPac AG30 4 mm Guard column	~ 300 (2.07)	1.50	2.0
Dionex IonPac AG30 and AS30 4 mm column set	~ 3300 (22.75)	1.50	2.0

[a] Note: 1MPa = 145.04 psi

[b] Total backpressure at standard flow rates

[c] In all cases, flow rate should not result in pressures over 5,000 psi

NOTE

For assistance, visit Unity Lab Services online at www.unitylabservices.com.
From the U.S., call the Customer Care Center for Dionex Products at 1-800-346-6390.
Outside the U.S., call the nearest Thermo Fisher Scientific office.

2. Installation

NOTE

Read the instrument manuals. This manual assumes that you are using Thermo Scientific Dionex instrumentation and are familiar with the installation and operation of the Thermo Scientific Dionex Ion Chromatograph (IC). If you do not understand the operation of the system, take the time to familiarize yourself with the various system components before beginning an analysis.

The proper configuration of an Ion Chromatography System (ICS) is dependent on the column format. Although they can typically use the same system, the use of a 2 mm or 4 mm column requires different set up to ensure optimum performance. The selected format and analysis type will affect the type of pump recommended. A gradient pump is designed to blend and pump isocratic, linear, or gradient mixtures of up to four mobile phase components at precisely controlled flow rates. An isocratic pump is for applications not requiring gradient or multi-eluent proportioning capabilities. For high pressure applications (over 3000 psi), the use of high-pressure consumables, components, and fittings is required.

2.1 Thermo Scientific Dionex High Pressure Ion Chromatography Systems

A minimum of a Dionex High Pressure Ion Chromatography (HPIC) System is recommended when running Dionex IonPac AS30 columns due to the higher backpressures generated at typical operational flow rates. Systems should have the capability to operate up to at least 5000 psi. Standard IC systems, with an upper limit of 3000 psi, are insufficient for proper column operation.

All systems should allow 100% metal-free operation to prevent column damage. This includes pump heads and all flow paths.

WARNING

Care should always be taken not to exceed the maximum operating pressure of the system components. IC systems with lower backpressure capabilities are not recommended as reduced flow rates may result in loss of performance.

NOTE

Contact your local representative for information on how to customize your system to your application needs.

2.2 System Requirements

Dionex IonPac Columns are designed to run on Dionex Ion Chromatographs equipped with suppressed conductivity detection. We recommend the use of ferrules and fittings rated with a pressure of >5000 psi. The use of Thermo Scientific Dionex IC PEEK Viper™ fittings is recommended to achieve consistent low dead volume connections and ensure optimum chromatographic performance. Dionex IC PEEK Viper fittings are available in convenient kits for Dionex ICS-5000$^+$ and ICS-6000 systems with conductivity detectors (Item # 088803), and for Dionex Integrion RFIC systems with conductivity detectors (Item # 088798).

2.2.1 System Void Volume

When using 2 mm columns, it is particularly important to minimize system void volume. The system void volume should be scaled down to at least 1/4 of the system volume in a standard 4 mm system. For best performance, all tubing installed between the injection valve and detector should be 0.005" i.d. PEEK tubing. In order to reduce system backpressure at higher flow rates, 0.007" i.d. PEEK tubing may be used for connections *before* the injection valve, but peak efficiency will be compromised if used for post injector connections, which may also result in decreased peak resolution. Minimize the lengths of all connecting tubing and remove all unnecessary switching valves and couplers.

2.3 Column Start-Up

The column is shipped using sodium tetraborate as the storage solution.

Prepare the eluent shown on the Quality Assurance Report. To remove the storage solution, flush the column to waste with the 80 mM KOH eluent for at least 45 minutes and then 15 minutes with QAR eluent before attaching the column outlet to the suppressor. Install the column in the column module and test the column performance under the conditions described in the QAR. Continue making injections of the test standard until consecutive injections of the standard give reproducible retention times. Equilibration is complete when consecutive injections of the standard give reproducible retention times.

IMPORTANT ***When making any tubing connections, first turn off the pump. This will avoid any slippage of the ferrule under high pressure conditions.***

2.4 Eluents

2.4.1 Eluent Generation

It is recommended that Dionex IonPac columns are used with Dionex HPIC Systems equipped with a Thermo Scientific Dionex Eluent Generator (EG). The use of eluent generation provides a more stable baseline, improved performance, and increased reproducibility over the use of manually prepared eluents.

The Dionex Eluent Generator is used to automatically produce eluents either isocratically or as gradients from deionized water. Please refer to the Dionex EG manual for information on the operation of the Dionex eluent generators.

CAUTION

Only Dionex Eluent Generator Cartridges (EGCs) rated for 5,000 psi or higher should be used when running Dionex IonPac AS30 column due to the higher backpressures generated at typical operational flow rates.

2.5 Dionex IonPac Guard Columns

A Dionex IonPac AG30 Guard Column is normally used with the Dionex IonPac AS30 Analytical Column. A guard is placed in front of the analytical column to prevent sample contaminants from damaging the analytical column. It is easier to clean or replace the guard column than it is the analytical column. Placing a guard column in front of the analytical column will cause retention times to increase by approximately 0.7% under isocratic test conditions. Replacing the guard column at the first sign of peak efficiency loss or decreased retention time will prolong the life of the analytical column.

2.6 Trap Columns

For gradient operation a trap column is installed between the gradient pump and the injection valve and takes the place of the gradient mixer if present. The trap column is filled with high capacity ion exchange resin which helps to minimize the baseline shift caused by increasing ionic contaminants as the eluent ionic strength increases over the course of gradient analysis.

2.6.1 Continuously Regenerated Anion Trap Columns for Use with Eluent Generator Cartridges

For applications using eluent generation on a Dionex ICS-5000$^+$ HPIC system, a Dionex CR-ATC 500 Continuously Regenerated Anion Trap Column (Item # 075550) should be installed at the Dionex EGC 500 eluent outlet to remove trace level ionic contaminants from the carrier deionized water. For applications using eluent generation on a Dionex ICS-6000 or Dionex Integrion HPIC system, use a Dionex CR-ATC 600 (Item # 088662). See the Dionex Continuously Regenerated Trap Column Product Manual (Document No. 079684) for instructions.

As an alternative to a Dionex CR-ATC 500, a Thermo Scientific Dionex ATC 500 Trap Column (Item # 079018) can be installed between the pump outlet and the inlet of the Dionex EGC 500 to remove anionic contaminants from the carrier deionized water. Note that use of the Dionex ATC 500 will require off-line regeneration. See the Dionex Anion Trap Columns Product Manual (Document No. 032697) for instructions.

CAUTION

Only trap columns rated for 5,000 psi pressure should be used when running Dionex IonPac AS30 columns due to the higher backpressures generated at typical operational flow rates.

2.7 Sample Concentrators

The function of a concentrator column is to strip ions of interest from a measured volume of a relatively clean aqueous sample matrix. This process "concentrates" the desired analyte species onto the concentrator column, lowering detection limits by 2-5 orders of magnitude. The concentrator column is used in lieu of the sample loop at the start of the analysis.

Dionex Concentrator columns or the Dionex IonPac Guard Column can be used for trace anion concentration work with Dionex IonPac columns. A pump is used to load the sample onto the concentrator column in the OPPOSITE direction of the eluent flow. Once concentration is complete the eluent flow is then directed through the concentrator to the analytical column. When using concentration techniques, care should be taken not to overload the concentrator column by concentrating an excessive amount of sample. If an excessive amount of sample is used, inaccurate results may be obtained. It is possible during the concentration step for the stronger binding polyvalent ions to elute the weakly retained ions from the concentrator column. For more detailed information on sample concentration techniques for high sensitivity work and a detailed discussion of concentration techniques refer to the appropriate concentrator manual for your application.

CAUTION

Dionex IonPac Concentrator Columns are designed for use with specific eluent systems. Use only concentrator columns designed for the eluent system you are using.

3. Operation

3.1 General Operating Conditions

The following conditions should be used as a starting point towards method development.

Injection Volume:	2 mm: 2.5 µL
	4 mm: 10 µL
Column:	2 mm: Dionex IonPac AG30 2 mm Guard Column + Dionex IonPac AS30 2 mm Analytical Column
	4 mm: Dionex IonPac AG30 4 mm Guard Column + Dionex IonPac AS30 4 mm Analytical Column
Eluent:	18 mM KOH
Eluent Source:	Dionex EGC 500 KOH cartridge with Dionex CR-ATC 600 (Dionex ICS-6000 or Integrion) or Dionex CR-ATC 500 (Dionex ICS-5000$^+$)
Eluent Flow Rate:	2 mm: 0.38 mL/min
	4 mm: 1.5 mL/min
Temperature:	30 °C
Suppressor:	Dionex ADRS 600 Anion Dynamically Regenerated Suppressor, AutoSuppression, Recycle Mode
Expected Background Conductivity:	< 1 µS
Long-term Storage Solution	(> 1 week): 100 mM sodium tetraborate
Short-term Storage Solution	(< 1 week): Eluent

NOTE

For assistance, visit Unity Lab Services online at www.unitylabservices.com.
From the U.S., call the Customer Care Center for Dionex Products at 1-800-346-6390.
Outside the U.S., call the nearest Thermo Fisher Scientific office.

3.2 General Operational Precautions

The following precautions should always be adhered to when using Dionex IonPac columns.

- Samples and manually prepared eluents should always be filtered and degassed to protect the system and column from particulates and ensure a stable background.
- Eluents and samples used should be used within the allowable limits for the column.
- Do not exceed the operational pressure of the system.
- Take care not to exceed the maximum operational flow rate and pressure of the column. If the pressure approached the maximum allowed pressure, reduce the operational flow rate.

Table 2 Operational Limits for the Dionex IonPac AS30 Column

Eluent pH	Between 0 and 14
Sample pH	Between 0 and 14
Maximum Flow Rate for 2 mm columns	0.5 mL/min
Maximum Flow Rate for 4 mm columns	2.0 mL/min
Maximum Operating Pressure	5,000 psi (34.47MPa)

3.3 Quality Assurance Reports

Each column is qualified to ensure it meets specifications. Example copies of these Quality Assurance Reports (QARs) can be found in Section 7. The QAR supplied with the column should be used as a guide to ensure system performance.

3.4 Chemical Requirements and Solvent Compatibility

Chemical purity can influence separation performance. Only chemicals of the highest purity should be used. Refer to Section 6.4, Chemical Purity Requirements for more details.

Some solvents may be used for cleaning or eluent modification.

NOTE

Adding solvent to the aqueous eluent can reduce the peak response by up to half due to increased eluent viscosity, decreased ionization of organic acids, and lower peak efficiencies. Therefore, only use solvent in the eluent when needed for improved resolution of analytes of interest.

Table 3 Typical HPLC Solvents for Cleaning and Use with Dionex IonPac Columns

Solvent	Maximum Operating Concentration
Acetonitrile	100%
Methanol	100%
2-Propanol	100%
Tetrahydrofuran	20%*

*Higher concentrations may only be used for limited duration applications such as column clean-up at pressures < 4000 psi.

CAUTION

The Dionex ADRS 600 must be operated in the AutoSuppression External Water Mode when using eluents containing organic solvents. Refer to the Suppressor Product Manual (Document No. 031956) for operation limitations in the electrolytic mode (power on).

3.5 Eluent Preparation

A Dionex Eluent Generator (EG) is recommended for use with Dionex IonPac columns.

When preparing eluents manually, ensure all chemicals and water are of the highest purity.

3.5.1 Manually Prepared Eluents

Eluents should be stored in plastic bottles under a helium atmosphere to ensure contamination free operation and proper pump performance (nitrogen can be used if eluents do not contain solvents). Contamination from carbon dioxide when basic eluents are exposed to the air can cause performance variability such as retention time shifts.

3.5.2 Making Eluents that Contain Solvents

Mixing solvents with water should be done on a volume to volume basis. For example, if a procedure requires an eluent of 40% acetonitrile, prepare the eluent by adding 400 mL of acetonitrile to an eluent reservoir. Then add 600 mL of deionized water or eluent concentrate to the acetonitrile in the reservoir. Using this procedure to mix solvents with water will ensure that a consistent true volume/volume eluent is obtained. Premixing water with solvent will minimize the possibility of outgassing.

NOTE

When purging or degassing eluents containing solvents, do not purge or degas the eluent excessively since it is possible that a volatile solvent will evaporate or be "boiled" off from the solution under reduced pressure.

NOTE

Always degas and store all eluents in plastic eluent bottles pressurized with helium. Only helium can be used to purge and degas ionic eluents containing solvents, since nitrogen is soluble in solvent containing eluents.

NOTE

Acetonitrile (ACN) hydrolyzes to ammonia and acetate when exposed to basic solutions. To prevent eluent contamination from acetonitrile hydrolysis, always add acetonitrile to basic aqueous eluents by proportioning the acetonitrile into the basic eluent with the gradient pump. Keep the acetonitrile in a separate eluent bottle containing only acetonitrile and water.

SAFETY

Never add the acetonitrile directly to the basic carbonate or hydroxide eluent solutions.

3.6 Regenerant Preparation for the Thermo Scientific Dionex Chemically Regenerated Suppressor (Dionex CRS 500)

The Dionex Chemically Regenerated Suppressor requires the use of a regenerant solution. Refer to the product manual (Document No. 031727) for operating instructions.

3.7 Recommendations for Method Development

The Dionex IonPac AS30 is designed for the determination of inorganic anions and oxyhalides in approximately 35 minutes using a hydroxide gradient eluent delivered by a Dionex Eluent Generator. In any type of gradient elution system, it is important to use eluents that produce a minimum shift in baseline conductivity during the run as well as a fast equilibration time from one run to the next. Potassium hydroxide is converted to water in the suppressor, making it the preferred source of eluent. As long as the capacity of the suppressor is not exceeded, the eluent hydroxide concentration has little effect on background conductivity. For example, a gradient run could begin at 1 mM KOH and end at 60 mM KOH, with a resulting total baseline change of 1 to 2 µS.

Ensure that adequate equilibration time is allowed between runs. If a downward shift in the baseline is observed during the isocratic section of the chromatogram, increase the equilibration time.

You can increase the sensitivity of your system by using sample concentration techniques (see Section 2.7, “Sample Concentrators”).

CAUTION

Carbon dioxide readily dissolves in dilute basic solutions, forming carbonate. Carbonate contamination of eluents can affect the retention times of the anions being analyzed. Eluents should be maintained under an inert helium atmosphere to avoid carbonate contamination.

4. Example Applications

4.1 Recommendations for Optimum System Performance

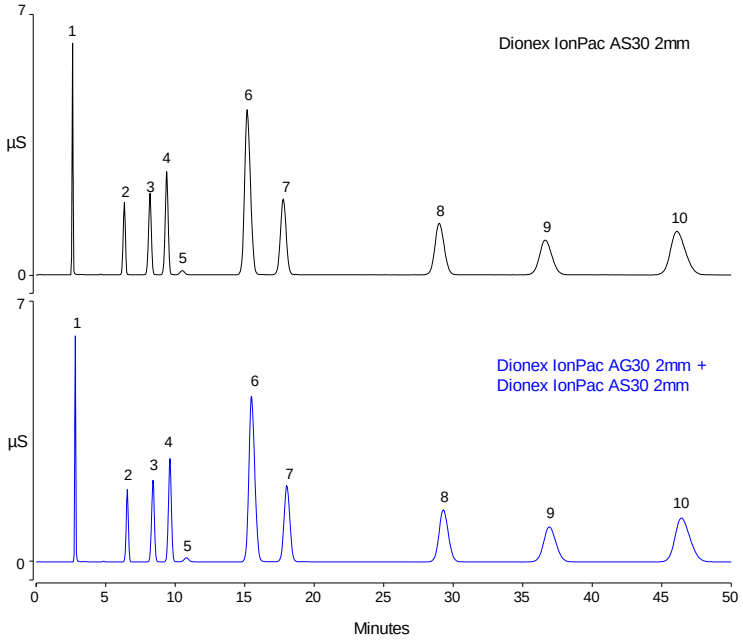
The chromatograms in this section were obtained using columns that reproduced the Quality Assurance Report on optimized Ion Chromatographs. Different systems will differ slightly in performance due to slight differences in column sets, system void volumes, liquid sweep-out times of different components, and laboratory temperatures.

Carbon dioxide readily dissolves in dilute basic solutions forming carbonate. Carbonate contamination of eluents can affect the retention times of the anions being analyzed. Eluents should be maintained under an inert helium atmosphere to avoid carbonate contamination. Each application shown can be run on either 2 mm or 4 mm columns. The eluent linear velocity should be maintained by increasing or reducing the flow rate appropriately. For example, a 4 mm application run at 1.5 mL/min and a 2 mm application run at 0.38 mL/min.

4.2 Isocratic Separation of Common Anions and Oxyhalides

Isocratic elution of inorganic anions on the Dionex IonPac AS30 column has been optimized utilizing a hydroxide eluent. By using this eluent, common inorganic anions can be used to test the performance (QAR) of the Dionex IonPac AS30 column. The Dionex IonPac AS30 analytical column should always be used with the Dionex IonPac AG30 guard column. An operating temperature of 30 °C is used to ensure reproducible resolution and retention. Note that the Dionex IonPac AG30 guard column is packed with a microporous resin of proportionally lower capacity and contributes to an approximately 0.7% increase in retention time when placed in-line prior to the analytical column under isocratic test conditions as shown in Figures 1 and 2.

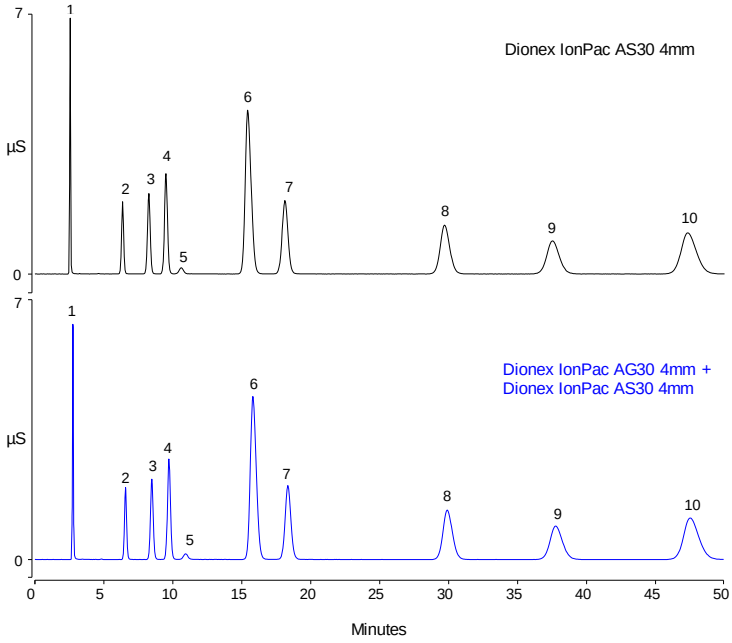
Figure 1 Isocratic Separation of Common Anions and Oxyhalides using Dionex IonPac AS30 2mm column



Column:	See chromatogram
Eluent:	18 mM KOH
Eluent Source:	Dionex EGC 500 KOH cartridge
Flow Rate:	0.38 mL/min
Inj. Volume:	2.5 µL
Temperature:	30˚C
Detection:	Suppressed Conductivity, Dionex ADRS 600 2mm AutoSuppression, recycle mode

Peaks:	mg/L
1. Fluoride	3.0
2. Chlorite	10.0
3. Bromate	20.0
4. Chloride	6.0
5. Carbonate	-----
6. Sulfate	30.0
7. Nitrite	15.0
8. Bromide	25.0
9. Chlorate	25.0
10. Nitrate	25.0

Figure 2 Isocratic Separation of Common Anions and Oxyhalides using Dionex IonPac AS30 4mm column



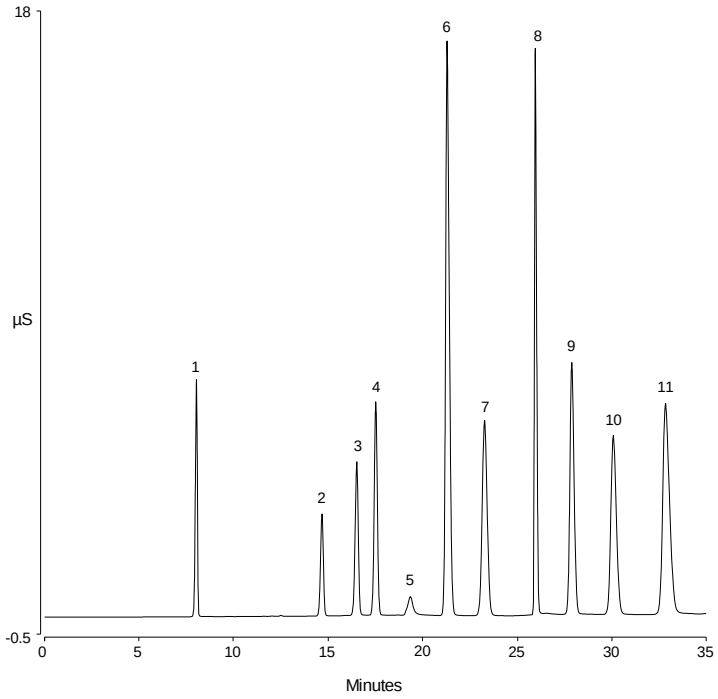
Column:	See chromatogram
Eluent:	18 mM KOH
Eluent Source:	Dionex EGC 500 KOH cartridge
Flow Rate:	1.5 mL/min
Inj. Volume:	10 µL
Temperature:	30˚C
Detection:	Suppressed Conductivity, Dionex ADRS 600 4mm AutoSuppression, recycle mode

Peaks:	mg/L
1. Fluoride	3.0
2. Chlorite	10.0
3. Bromate	20.0
4. Chloride	6.0
5. Carbonate	-----
6. Sulfate	30.0
7. Nitrite	15.0
8. Bromide	25.0
9. Chlorate	25.0
10. Nitrate	25.0

4.3 Separation of Oxyhalides and Inorganic Anions Using a Hydroxide Gradient

The following chromatograms demonstrate the separation of oxyhalides and inorganic anions using a hydroxide gradient. As illustrated in Figures 3 and 4, a simple hydroxide gradient will provide good separation of all common inorganic anions and oxyhalides in less than 35 minutes.

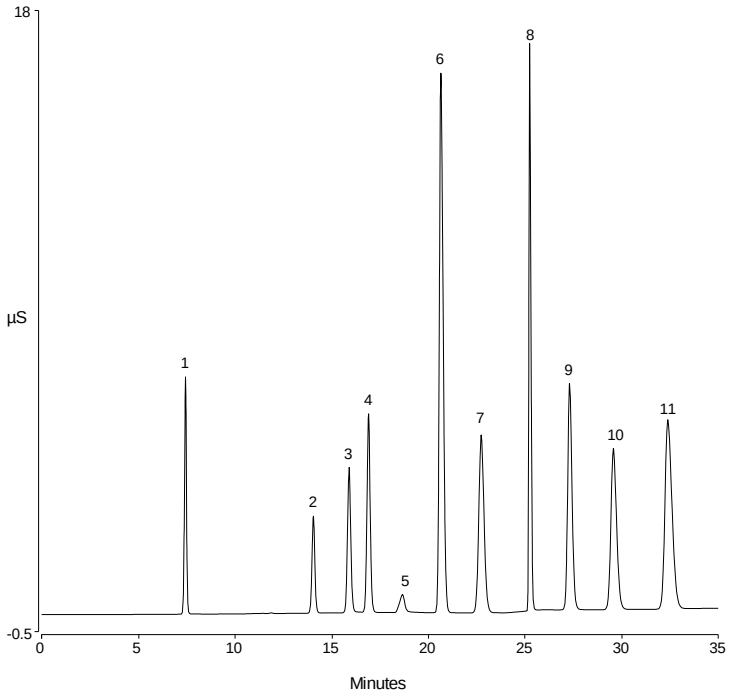
Figure 3 Separation of Oxyhalides and the Inorganic Anions Using a Hydroxide Gradient with the Dionex IonPac AS30 2mm Column



Column:	Dionex IonPac AG30/AS30, 2mm
Eluent:	Equilibration: 7 minutes At 0 min: 1 mM KOH At 8 min: 8 mM KOH At 16 min: 25 mM KOH At 22 min: 30 mM KOH At 24 min: 60 mM KOH At 35 min: 60 mM KOH (end of run)
Eluent Source:	Dionex EGC 500 KOH cartridge
Flow Rate:	0.38 mL/min
Inj. Volume:	2.5 µL
Temperature:	30˚C
Detection:	Suppressed Conductivity, Dionex ADRS 600 2mm AutoSuppression, recycle mode

Peaks:	mg/L
1. Fluoride	3.0
2. Chlorite	10.0
3. Bromate	20.0
4. Chloride	6.0
5. Carbonate	-----
6. Sulfate	30.0
7. Nitrite	15.0
8. Phosphate	40.0
9. Bromide	25.0
10. Chlorate	25.0
11. Nitrate	25.0

Figure 4 Separation of Oxyhalides and the Inorganic Anions Using a Hydroxide Gradient with the Dionex IonPac AS30 4mm Column



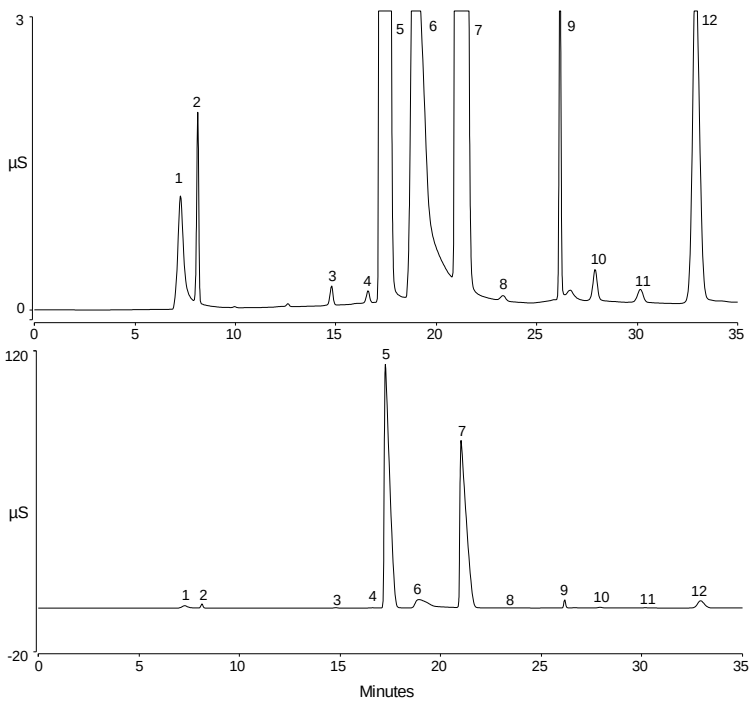
Column:	Dionex IonPac AG30/AS30, 4mm
Eluent:	Equilibration: 7 minutes At 0 min: 1 mM KOH At 8 min: 8 mM KOH At 16 min: 25 mM KOH At 22 min: 30 mM KOH At 24 min: 60 mM KOH At 35 min: 60 mM KOH (end of run)
Eluent Source:	Dionex EGC 500 KOH cartridge
Flow Rate:	1.5 mL/min
Inj. Volume:	10 µL
Temperature:	30˚C
Detection:	Suppressed Conductivity, Dionex ADRS 600 4mm AutoSuppression, recycle mode

Peaks:	mg/L
1. Fluoride	3.0
2. Chlorite	10.0
3. Bromate	20.0
4. Chloride	6.0
5. Carbonate	-----
6. Sulfate	30.0
7. Nitrite	15.0
8. Phosphate	40.0
9. Bromide	25.0
10. Chlorate	25.0
11. Nitrate	25.0

4.4 Gradient Separation of Simulated Drinking Water Spiked with 50 ppm Ethylenediamine

The following chromatograms show the analysis of a simulated drinking water sample spiked with 50 ppm ethylenediamine (EDA) using the Dionex IonPac AS30 column. EDA is primarily used to preserve some analytes commonly present in drinking water, such as chlorite, bromate and chlorate. However, EDA in the presence of carbonate is converted to EDA carbamate, which can interfere with early eluting peaks such as fluoride. The Dionex IonPac AS30 column minimizes this interference by increasing the separation between EDA carbamate and fluoride, allowing better integration of the fluoride peak as demonstrated in Figures 5 and 6. The Dionex IonPac AS30 column also provides better resolution of carbonate and sulfate.

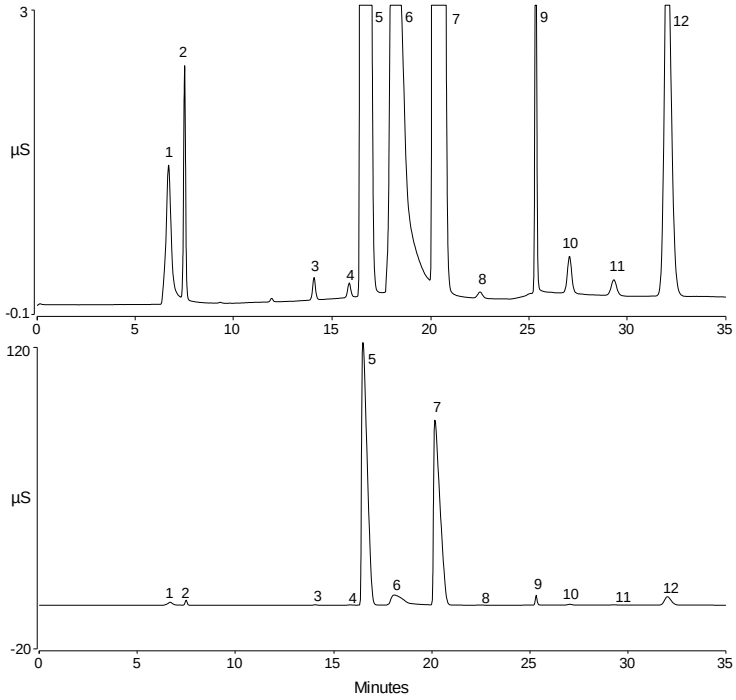
Figure 5 Gradient Separation of Simulated Drinking Water Spiked with 50ppm Ethylenediamine Using Large Loop Injection and Dionex IonPac AS30 2mm Column



Column:	Dionex IonPac AG30/AS30, 2mm
Eluent:	Equilibration: 7 minutes At 0 min: 1 mM KOH At 8 min: 8 mM KOH At 16 min: 25 mM KOH At 22 min: 30 mM KOH At 24 min: 60 mM KOH At 35 min: 60 mM KOH (end of run)
Eluent Source:	Dionex EGC 500 KOH cartridge
Flow Rate:	0.38 mL/min
Inj. Volume:	50 µL
Temperature:	30˚C
Detection:	Suppressed Conductivity, Dionex ADRS 600 2mm AutoSuppression, recycle mode

Peaks:	mg/L
1. EDA Carbamate	50
2. Fluoride	0.08
3. Chlorite	0.06
4. Bromate	0.06
5. Chloride	20.0
6. Carbonate	20.0
7. Sulfate	20.0
8. Nitrite	0.004
9. Phosphate	1.0
10. Bromide	0.10
11. Chlorate	0.06
12. Nitrate	1.0

Figure 6 Gradient Separation of Simulated Drinking Water Spiked with 50ppm Ethylenediamine Using Large Loop Injection and Dionex IonPac AS30 4mm Column



Column:	Dionex IonPac AG30/AS30, 4mm
Eluent:	Equilibration: 7 minutes At 0 min: 1 mM KOH At 8 min: 8 mM KOH At 16 min: 25 mM KOH At 22 min: 30 mM KOH At 24 min: 60 mM KOH At 35 min: 60 mM KOH (end of run)
Eluent Source:	Dionex EGC 500 KOH cartridge
Flow Rate:	1.5 mL/min
Inj. Volume:	200 µL
Temperature:	30˚C
Detection:	Suppressed Conductivity, Dionex ADRS 600 4mm AutoSuppression, recycle mode

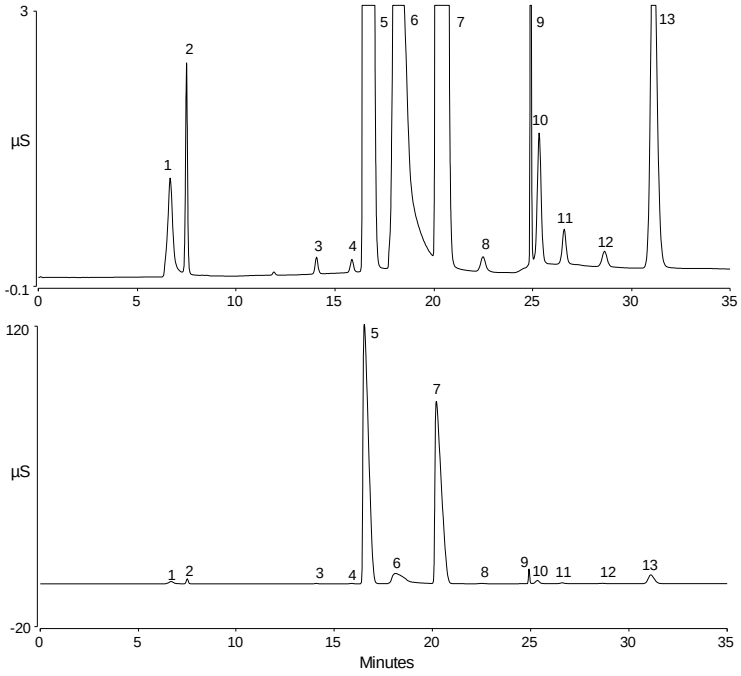
Peaks:	mg/L
1. EDA Carbamate	50
2. Fluoride	0.08
3. Chlorite	0.06
4. Bromate	0.06
5. Chloride	20.0
6. Carbonate	20.0
7. Sulfate	20.0
8. Nitrite	0.004
9. Phosphate	1.0
10. Bromide	0.10
11. Chlorate	0.06
12. Nitrate	1.0

4.5 Gradient Separation of Drinking Water Spiked with a Surrogate Anion

The following chromatograms, figure 7-9 show the analysis of a simulated drinking water sample spiked with 50 ppm ethylenediamine (EDA) and 0.5 ppm of dichloroacetate (DCA) using Dionex IonPac AS30 column. If increased resolution of phosphate and dichloroacetate is desired, a modified gradient can be used as shown in Figure 9.

In cases where drinking water samples have high concentrations of oxalate and phosphate and DCA resolution is not optimum, it is recommended to use another surrogate anion. We recommend using butyrate as an alternate surrogate anion (in place of DCA) as shown in Figures 10 and 11.

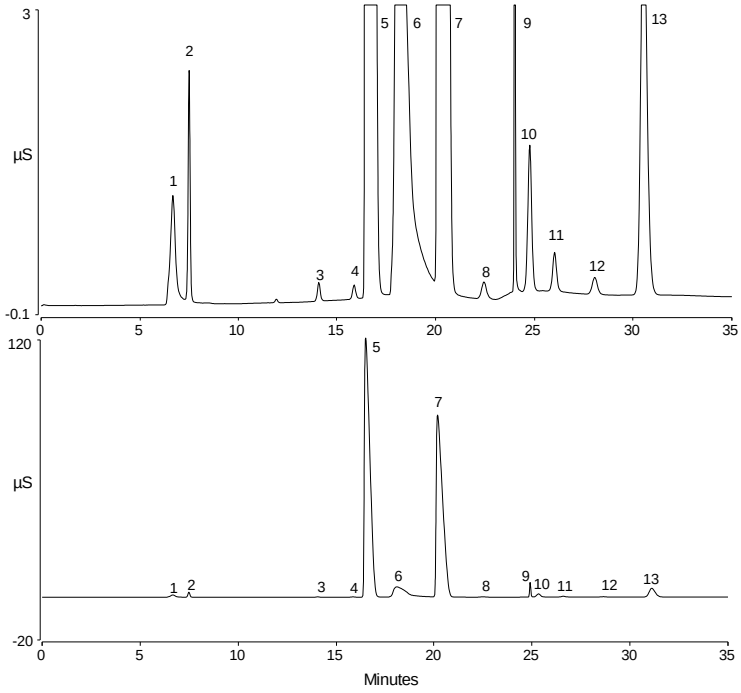
Figure 7 Gradient Separation of Simulated Drinking Water Spiked with 0.5ppm Dichloroacetate Using Hydroxide Gradient and Dionex IonPac AS30 2mm Column



Column:	Dionex IonPac AG30/AS30, 2mm
Eluent:	Equilibration: 7 minutes At 0 min: 1 mM KOH At 8 min: 8 mM KOH At 16 min: 25 mM KOH At 21 min: 30 mM KOH At 22 min: 66 mM KOH At 35 min: 66 mM KOH (end of run)
Eluent Source:	Dionex EGC 500 KOH cartridge
Flow Rate:	0.38 mL/min
Inj. Volume:	50 µL
Temperature:	30˚C
Detection:	Suppressed Conductivity, Dionex ADRS 600 2mm AutoSuppression, recycle mode

Peaks:	mg/L
1. EDA Carbamate	50
2. Fluoride	0.08
3. Chlorite	0.06
4. Bromate	0.06
5. Chloride	20.0
6. Carbonate	20.0
7. Sulfate	20.0
8. Nitrite	0.004
9. Phosphate	1.0
10. Dichloroacetate	0.5
11. Bromide	0.10
12. Chlorate	0.06
13. Nitrate	1.0

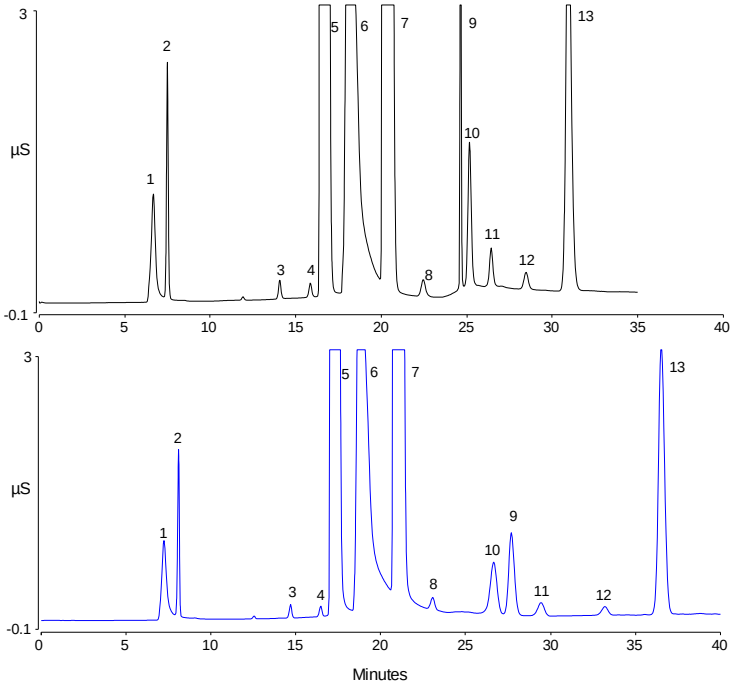
Figure 8 Gradient Separation of Simulated Drinking Water Spiked with 0.5ppm Dichloroacetate Using Hydroxide Gradient and Dionex IonPac AS30 4mm Column



Column:	Dionex IonPac AG30/AS30, 4mm
Eluent:	Equilibration: 7 minutes At 0 min: 1 mM KOH At 8 min: 8 mM KOH At 16 min: 25 mM KOH At 21 min: 30 mM KOH At 22 min: 66 mM KOH At 35 min: 66 mM KOH (end of run)
Eluent Source:	Dionex EGC 500 KOH cartridge
Flow Rate:	1.5 mL/min
Inj. Volume:	200 µL
Temperature:	30˚C
Detection:	Suppressed Conductivity, Dionex ADRS 600 4mm AutoSuppression, recycle mode

Peaks:	mg/L
1. EDA Carbamate	50
2. Fluoride	0.08
3. Chlorite	0.06
4. Bromate	0.06
5. Chloride	20.0
6. Carbonate	20.0
7. Sulfate	20.0
8. Nitrite	0.004
9. Phosphate	1.0
10. Dichloroacetate	0.5
11. Bromide	0.10
12. Chlorate	0.06
13. Nitrate	1.0

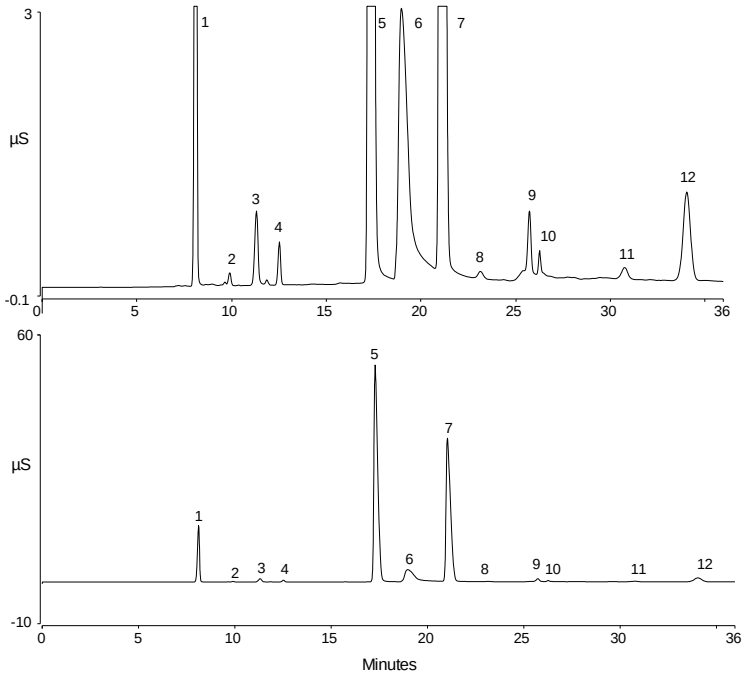
Figure 9 Gradient Separation of Simulated Drinking Water Spiked with 0.5ppm Dichloroacetate Using Two Different Hydroxide Gradients and Dionex IonPac AS30 2mm Column



Column:	Dionex IonPac AG30/AS30, 2mm
Eluent A:	Equilibration: 7 minutes At 0 min: 1 mM KOH At 8 min: 8 mM KOH At 16 min: 25 mM KOH At 21 min: 30 mM KOH At 22 min: 66 mM KOH At 35 min: 66 mM KOH (end of run)
Eluent B:	Equilibration: 7 minutes At 0 min: 1 mM KOH At 8 min: 8 mM KOH At 16 min: 25 mM KOH At 21 min: 30 mM KOH At 27 min: 30 mM KOH At 35 min: 60 mM KOH At 40 min: 60 mM KOH (end of run)
Eluent Source:	Dionex EGC 500 KOH cartridge
Flow Rate:	0.38 mL/min
Inj. Volume:	50 µL
Temperature:	30˚C
Detection:	Suppressed Conductivity, Dionex ADRS 600 2mm AutoSuppression, recycle mode

Peaks:	mg/L
1. EDA Carbamate	50
2. Fluoride	0.08
3. Chlorite	0.06
4. Bromate	0.06
5. Chloride	20.0
6. Carbonate	20.0
7. Sulfate	20.0
8. Nitrite	0.004
9. Phosphate	1.0
10. Dichloroacetate	0.5
11. Bromide	0.10
12. Chlorate	0.06
13. Nitrate	1.0

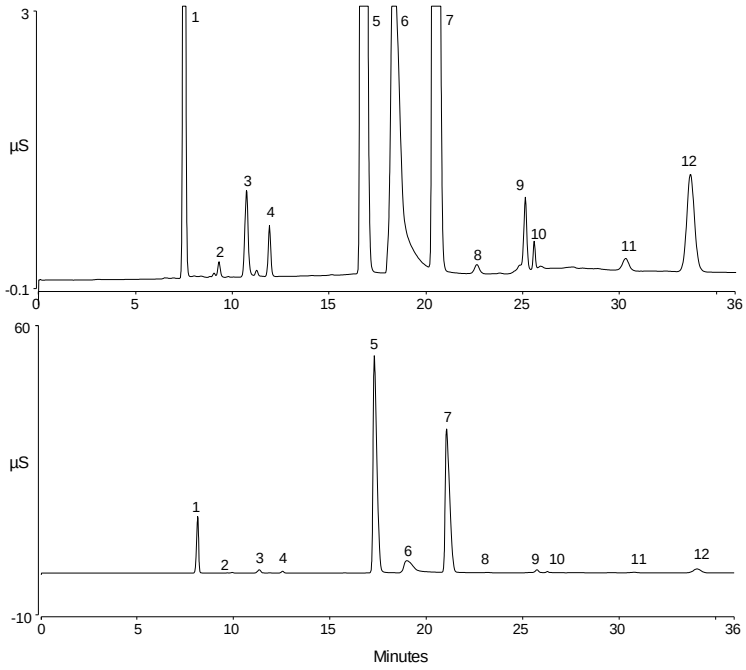
Figure 10 Gradient Separation of Municipal Drinking Water Spiked with 0.5ppm Butyrate Using Hydroxide Gradient and Dionex IonPac AS30 2mm Column



Column:	Dionex IonPac AG30/AS30, 2mm
Eluent:	Equilibration: 7 minutes At 0 min: 1 mM KOH At 8 min: 8 mM KOH At 16 min: 25 mM KOH At 22 min: 30 mM KOH At 24 min: 50 mM KOH At 36 min: 50 mM KOH (end of run)
Eluent Source:	Dionex EGC 500 KOH cartridge
Flow Rate:	0.38 mL/min
Inj. Volume:	50 µL
Temperature:	30˚C
Detection:	Suppressed Conductivity, Dionex ADRS 600 2mm AutoSuppression, recycle mode

Peaks:	mg/L
1. Fluoride	0.59
2. Acetate	NQ
3. Butyrate	0.50
4. Formate	NQ
5. Chloride	6.9
6. Carbonate	11.8
7. Sulfate	6.5
8. Nitrite	0.007
9. Oxalate	NQ
10. Phosphate	0.093
11. Chlorate	0.113
12. Nitrate	0.019

Figure 11 Gradient Separation of Municipal Drinking Water Spiked with 0.5ppm Butyrate Using Hydroxide Gradient and Dionex IonPac AS30 4mm Column



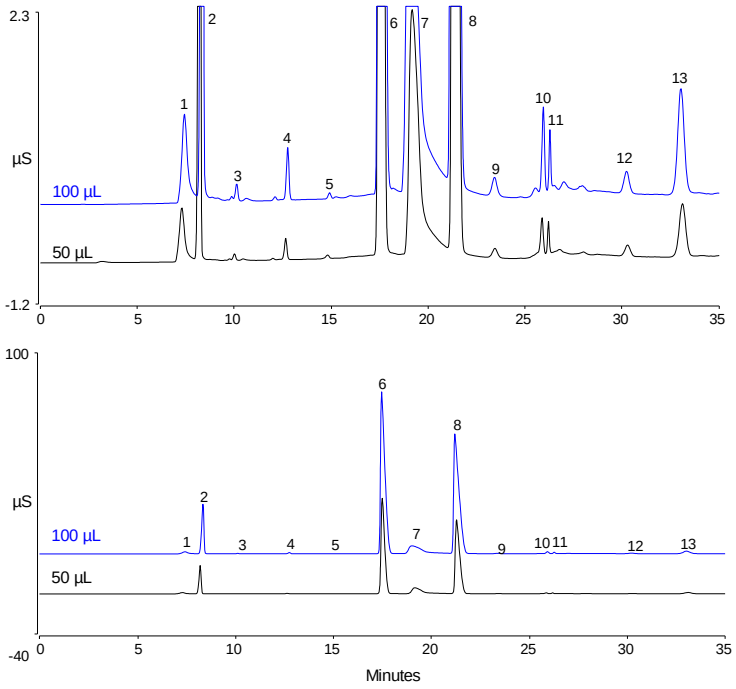
Column:	Dionex IonPac AG30/AS30, 4mm
Eluent:	Equilibration: 7 minutes At 0 min: 1 mM KOH At 8 min: 8 mM KOH At 16 min: 25 mM KOH At 22 min: 30 mM KOH At 24 min: 50 mM KOH At 36 min: 50 mM KOH (end of run)
Eluent Source:	Dionex EGC 500 KOH cartridge
Flow Rate:	1.5 mL/min
Inj. Volume:	200 µL
Temperature:	30˚C
Detection:	Suppressed Conductivity, Dionex ADRS 600 4mm AutoSuppression, recycle mode

Peaks:	mg/L
1. Fluoride	0.52
2. Acetate	NQ
3. Butyrate	0.50
4. Formate	NQ
5. Chloride	6.9
6. Carbonate	11.1
7. Sulfate	6.7
8. Nitrite	0.004
9. Oxalate	NQ
10. Phosphate	0.087
11. Chlorate	0.118
12. Nitrate	0.021

4.6 Gradient Separation of Municipal Drinking Water Using Two Different Injection Volumes

The following chromatograms show the analysis of a municipal drinking water sample spiked with 50 ppm ethylenediamine (EDA) using two different injection volumes on the Dionex IonPac AS30 column. Figure 12 demonstrates that peak response can be increased by increasing the injection volume.

Figure 12 Gradient Separation of Municipal Drinking Water Spiked with 50ppm Ethylenediamine Using Two Different Injection Volumes on Dionex IonPac AS30 2mm Column



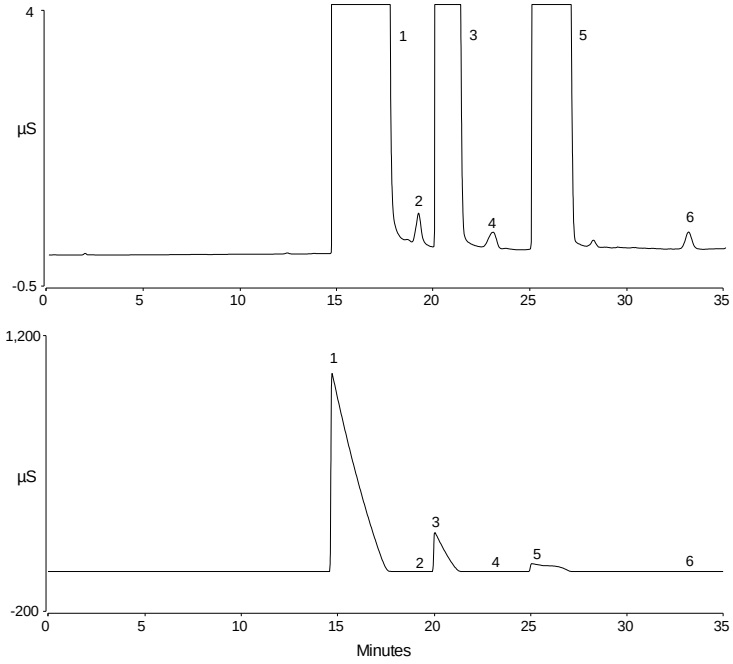
Column:	Dionex IonPac AG30/AS30, 2mm
Eluent:	Equilibration: 7 minutes At 0 min: 1 mM KOH At 8 min: 8 mM KOH At 16 min: 25 mM KOH At 22 min: 30 mM KOH At 24 min: 60 mM KOH At 35 min: 60 mM KOH (end of run)
Eluent Source:	Dionex EGC 500 KOH cartridge
Flow Rate:	0.38 mL/min
Inj. Volume:	50 µL / 100 µL
Temperature:	30˚C
Detection:	Suppressed Conductivity, Dionex ADRS 600 2mm AutoSuppression, recycle mode

Peaks:
1. EDA Carbamate
2. Fluoride
3. Acetate
4. Formate
5. Chlorite
6. Chloride
7. Carbonate
8. Sulfate
9. Nitrite
10. Oxalate
11. Phosphate
12. Chlorate
13. Nitrate

4.7 Determination of Trace Nitrite and Nitrate in a High Ionic Strength Matrix Using Hydroxide Gradient

The following chromatograms demonstrate the analysis of trace nitrite and nitrate in high ionic strength matrices. Notice the excellent separation of nitrite and nitrate without any interference from the higher concentration analytes. Also, carbonate is well separated from chloride and sulfate despite their high concentrations.

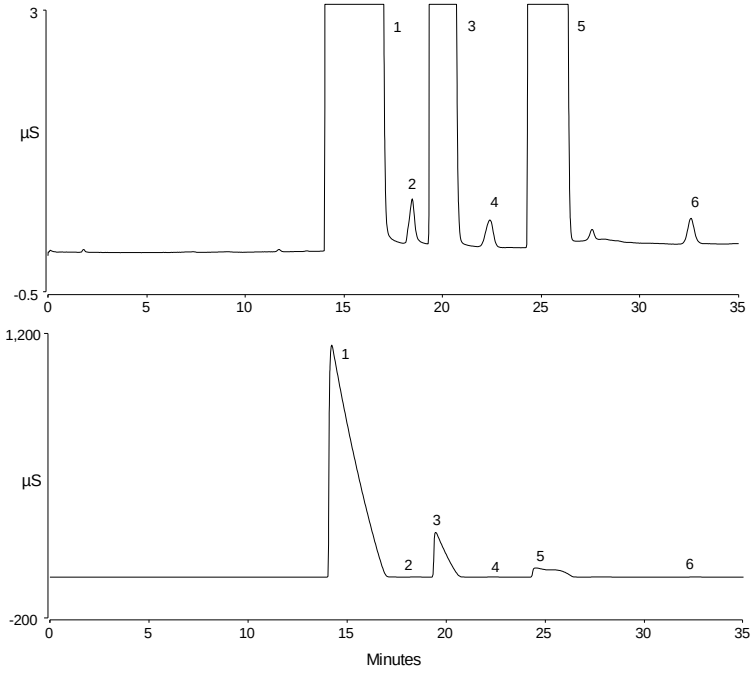
Figure 13 Determination of Trace Nitrite and Nitrate in a High Ionic Strength Matrix Using Hydroxide Gradient and the Dionex IonPac AS30 2mm Column



Column:	Dionex IonPac AG30/AS30, 2mm
Eluent:	Equilibration: 7 minutes At 0 min: 1 mM KOH At 8 min: 8 mM KOH At 16 min: 25 mM KOH At 23 min: 30 mM KOH At 26 min: 60 mM KOH At 35 min: 60 mM KOH (end of run)
Eluent Source:	Dionex EGC 500 KOH cartridge
Flow Rate:	0.38 mL/min
Inj. Volume:	50 µL
Temperature:	30˚C
Detection:	Suppressed Conductivity, Dionex ADRS 600 2mm AutoSuppression, recycle mode

Peaks:	mg/L
1. Chloride	800
2. Carbonate	-----
3. Sulfate	100
4. Nitrite	0.1
5. Phosphate	100
6. Nitrate	0.1

Figure 14 Determination of Trace Nitrite and Nitrate in a High Ionic Strength Matrix Using Hydroxide Gradient and the Dionex IonPac AS30 4mm Column



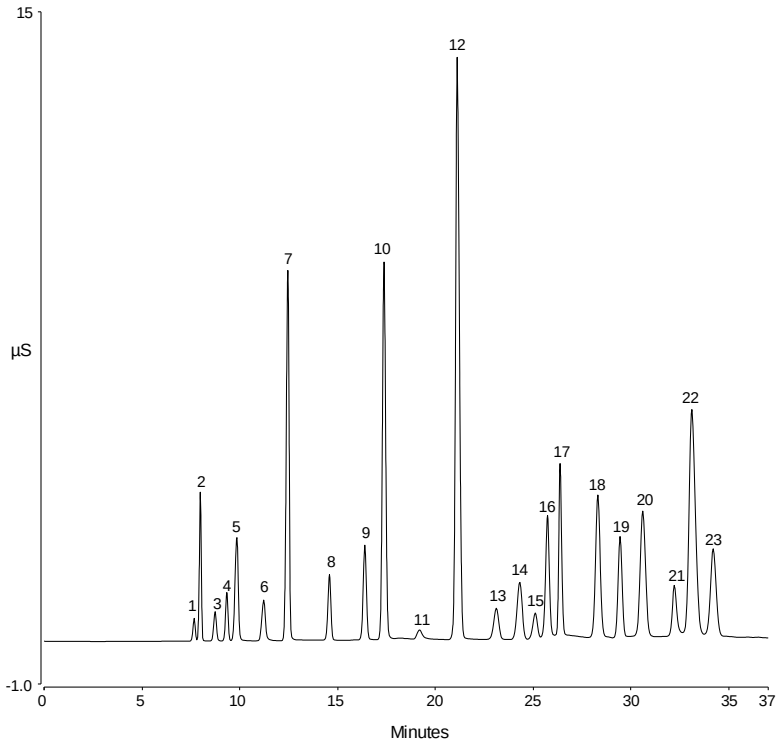
Column:	Dionex IonPac AG30/AS30, 4mm
Eluent:	Equilibration: 7 minutes At 0 min: 1 mM KOH At 8 min: 8 mM KOH At 16 min: 25 mM KOH At 23 min: 30 mM KOH At 26 min: 60 mM KOH At 35 min: 60 mM KOH (end of run)
Eluent Source:	Dionex EGC 500 KOH cartridge
Flow Rate:	1.5 mL/min
Inj. Volume:	200 µL
Temperature:	30˚C
Detection:	Suppressed Conductivity, Dionex ADRS 600 4mm AutoSuppression, recycle mode

Peaks:	mg/L
1. Chloride	800
2. Carbonate	-----
3. Sulfate	100
4. Nitrite	0.1
5. Phosphate	100
6. Nitrate	0.1

4.8 Analysis of Twenty-Three Environmental Anions

The Dionex IonPac AS30 column provides excellent separation of a variety of environmental anions including inorganic anions, oxyhalides, oxyanions, and organic acids. IonPac AS30 has excellent resolution for various organic acid anions as shown for peak 14 and 15,

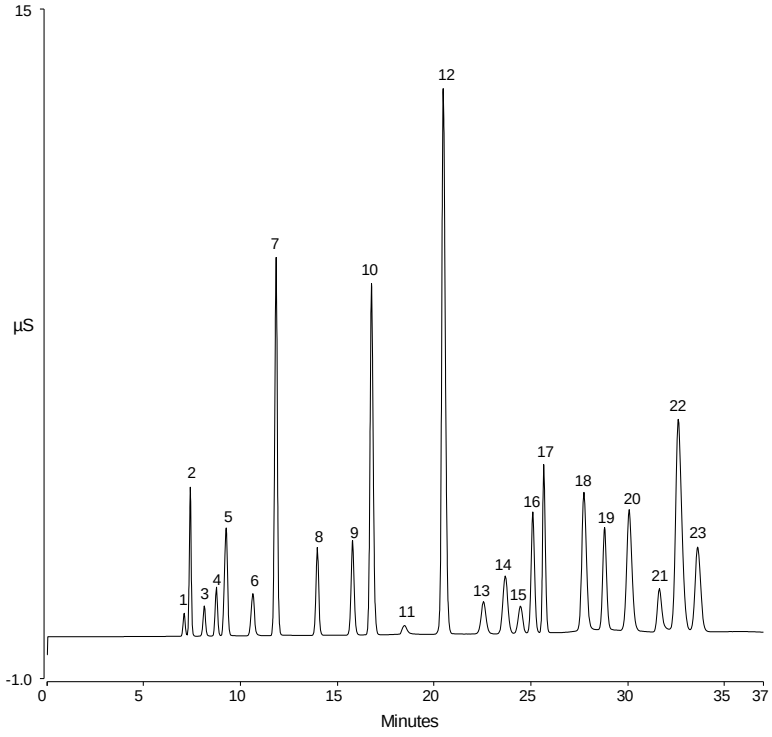
Figure 15 Analysis of Twenty-three Environmental Anions Using Dionex IonPac AS30 2mm Column



Column:	Dionex IonPac AG30/AS30, 2mm
Eluent:	Equilibration: 7 minutes At 0 min: 1 mM KOH At 8 min: 8 mM KOH At 16 min: 25 mM KOH At 22 min: 30 mM KOH At 25 min: 50 mM KOH At 29 min: 65 mM KOH At 37 min: 65 mM KOH (end of run)
Eluent Source:	Dionex EGC 500 KOH cartridge
Flow Rate:	0.38 mL/min
Inj. Volume:	2.5 µL
Temperature:	30˚C
Detection:	Suppressed Conductivity, Dionex ADRS 600 2mm AutoSuppression, recycle mode

Peaks:	mg/L
1. Quinate	5.0
2. Fluoride	3.0
3. Shikimate	10.0
4. Lactate	5.0
5. Acetate	10.0
6. Butyrate	10.0
7. Formate	10.0
8. Chlorite	10.0
9. Bromate	20.0
10. Chloride	6.0
11. Carbonate	-----
12. Sulfate	30.0
13. Nitrite	15.0
14. Malic	10.0
15. Succinic	10.0
16. Oxalate	25.0
17. Phosphate	20.0
18. Bromide	25.0
19. Phthalate	20.0
20. Chlorate	25.0
21. Thiosulfate	20.0
22. Nitrate	25.0
23. Fumarate	20.0

Figure 16 Analysis of Twenty-three Environmental Anions Using the Dionex IonPac AS30 4mm Column



Column:	Dionex IonPac AG30/AS30, 4mm
Eluent:	Equilibration: 7 minutes At 0 min: 1 mM KOH At 8 min: 8 mM KOH At 16 min: 25 mM KOH At 22 min: 30 mM KOH At 25 min: 50 mM KOH At 29 min: 65 mM KOH At 37 min: 65 mM KOH (end of run)
Eluent Source:	Dionex EGC 500 KOH cartridge
Flow Rate:	1.5 mL/min
Inj. Volume:	10 µL
Temperature:	30˚C
Detection:	Suppressed Conductivity, Dionex ADRS 600 4mm AutoSuppression, recycle mode

Peaks:	mg/L
1. Quinate	5.0
2. Fluoride	3.0
3. Shikimate	10.0
4. Lactate	5.0
5. Acetate	10.0
6. Butyrate	10.0
7. Formate	10.0
8. Chlorite	10.0
9. Bromate	20.0
10. Chloride	6.0
11. Carbonate	-----
12. Sulfate	30.0
13. Nitrite	15.0
14. Malic	10.0
15. Succinic	10.0
16. Oxalate	25.0
17. Phosphate	20.0
18. Bromide	25.0
19. Phthalate	20.0
20. Chlorate	25.0
21. Thiosulfate	20.0
22. Nitrate	25.0
23. Fumarate	20.0

5. Troubleshooting

The purpose of the Troubleshooting Guide is to help you solve operating problems that may arise while using Dionex IonPac columns. For more information on problems that originate with the Ion Chromatograph (IC) or other consumables such as the suppressor, trap or concentrator columns, refer to the Troubleshooting Guide in the appropriate operator's manual.

NOTE

For assistance, visit Unity Lab Services online at www.unitylabservices.com
Or call the Customer Care Center for Dionex Products at 1-800-346-6390
Outside the U.S., call the nearest Thermo Fisher Scientific office.

Table 4 Troubleshooting Summary

Observation	Cause	Action	Reference Section
High Back Pressure	Unknown	Isolate Blocked Component	5.1.1
	Plugged Column Bed Supports	Replace Bed Supports, Filter Eluents, and Filter Samples	5.1.2, 5.1.3, 5.1.4
	Other System Components	Unplug, Replace, Filter Eluents and Samples	Component Manual
High Background Conductivity	Contaminated Eluents	Remake Eluents	5.2.1
	Contaminated Trap Column	Clean or Replace Trap Column	5.2.2,5.2.3
	Contaminated Guard or Analytical Column	Clean or Replace Guard and Analytical Column	5.2.4
	Contaminated Suppressor	Clean or Replace Suppressor	5.2.6, Component Manual
	Contaminated Hardware	Clean Component	5.2.5, Component Manual
Poor Resolution	Gradient method not optimized	Optimize method	5.4
Poor Efficiency	Large System Void Volumes	Replumb System	Component Manual, 5.4.1B
	Column Headspace	Replace Column	5.1.2, 5.4.1A
	Improper connections	Replumb system	5.4.1B, 5.4.1C
	Leaks in the system	Check for leaks, Replumb system	5.4.1D, 5.4.1C
	Contaminated Suppressor	Clean or Replace Suppressor	5.4.1E, Component Manual
Short Retention Times	Flow Rate Too fast	Check Flow Rate, Recalibrate Pump	5.4.3B
	Conc. Incorrect Eluents	Remake Eluents	5.2.1, 5.4.3C
	Column Contamination	Clean Column	5.2.4
	Insufficient Equilibration	Extend Equilibration Time at the Start of the Gradient Run	5.4.3A

Retention Time Drift	Contaminated sample or eluent, Poorly mixed eluent	Remake Sample/Eluents	5.2.1, 5.3.1A, E, 5.3.2A
	Temperature variability	Use a thermostatted oven, check oven operation	5.3.1C,D, 5.3.2D, Component Manual
	Poor pump priming or loss of prime	Prime Pump	5.3.1B, 5.3.2B, Component Manual
	Inconsistent flow due to leaking pump	Repair pump	5.3.2C,Component Manual
Oscillating Retention Time	Pump Problems	Recalibrate/Repair Pump	5.3.3A, Component Manual
	Temperature variability	Use a thermostatted oven, check oven operation	5.3.3B, Component Manual
	Sluggish Injection valve	Service Valve	5.3.3C, Component Manual
Poor Front End Resolution	Conc. Incorrect Eluents	Remake Eluents	5.2.1, 5.4.4A
	Column Overloading	Reduce Sample Size	5.4.4B
	Large System Void Volumes	Replumb System	Component Manual, 5.4.4C
Spurious Peaks	Sample Contaminated	Pretreat Samples	5.5A
	Sluggish Injection Valve	Service Valve	5.5B, Component Manual
Analyte Specific Efficiency Loss	Column Contamination from sample or system	Purge contamination, employ a trap or guard column, clean or replace column	5.4.2

5.1 High Back Pressure

5.1.1 Finding the Source of High System Pressure

Total pressure for the Dionex IonPac AG30 Guard Column plus the Dionex IonPac AS30 Analytical Column when using the test chromatogram conditions should be less than 3600 psi. If the system pressure at the standard flow rate is higher than the maximum operational pressure for the system, it is advisable to determine the cause of the high system pressure.

A. Make sure that the pump is set to the correct eluent flow rate. Higher than recommended eluent flow rates will cause higher pressure. Measure the pump flow rate if necessary, with a stopwatch and graduated cylinder to confirm flow rate is correct. Pre-weigh the graduated cylinder and calculate the weight of eluent collected to obtain a more accurate measure of flow.

B. Determine which part of the system is causing the high pressure. High pressure could be due to plugged tubing or tubing with collapsed walls, an injection valve with a clogged port, a guard or separator column with particulates clogging the bed support, a clogged High-Pressure In-Line Filter, the suppressor, or the detector cell.

C. To determine which part of the chromatographic system is causing the problem, disconnect the pump eluent line from the injection valve and turn the pump on. Watch the pressure; it should be at its lowest (< 50 psi) with everything disconnected. The pressure with the eluent generator connected should be < 200 psi. Continue adding system components (injection valve, column(s), suppressor, and detector) one by one, while monitoring the system pressure. The pressure should increase up to a maximum when the Guard and Analytical columns are connected.

D. Measure the system back pressure by attaching a short piece of new 0.010” tubing in place of the column.

E. The Dionex Dynamically Regenerated Suppressor with backpressure loops may add up to 100 psi (0.69 MPa). No other components should add more than 100 psi (0.69 MPa) of pressure. Refer to the appropriate manual for cleanup or replacement of the problem component.

F. A Dionex High-Pressure In-Line Filter positioned between the Pump and Eluent Generator (or injection valve if an EG is not installed) should be installed to prevent particulates from blocking the system.

5.1.2 Replacing Column Bed Support Assemblies

If the column or guard inlet bed support is determined to be the cause of the high back pressure, it should be replaced. To change the inlet bed support assembly, refer to the following instructions, using one of the two spare inlet bed support assemblies included in the Ship Kit.

CAUTION

If the column tube end is not clean when inserted into the end fitting, particulate matter may obstruct a proper seal between the end of the column tube and the bed support assembly. If this is the case, additional tightening may not seal the column but instead damage the column tube or the end fitting.

NOTE

Replacement of the column outlet bed support is not recommended.

A. Disconnect the column from the system.

B. Carefully unscrew the inlet (top) column fitting. Use two open-end wrenches.

C. Remove the bed support. Turn the end fitting over and tap it against a bench top or other hard, flat surface to remove the bed support and seal assembly. If the bed support must be pried out of the end fitting, use a sharp pointed object such as a pair of tweezers, but be careful that you do not scratch the walls of the end fitting. Discard the old bed support assembly.

D. Place a new bed support assembly into the end fitting. Make sure that the end of the column tube is clean and free of any particulate matter so that it will properly seal against the bed support assembly. Use the end of the column to carefully start the bed support assembly into the end fitting.

E. Screw the end fitting back onto the column. Tighten it finger-tight, then an additional 1/4 turn (25 in x lb). Tighten further only if leaks are observed.

F. Reconnect the column to the system and resume operation.

Table 5 Dionex IonPac AG30/AS30 Column Spare Parts

Product	Dionex IonPac AG30/AS30 2 mm columns	Dionex IonPac AG30/AS30 4 mm columns
Analytical Column	303161	303159
Guard Column	303162	303160
Bed Support Assembly	044689	042955
End Fitting	043278	052809

5.1.3 Filter Eluent

Eluents containing particulate material or bacteria may clog the column inlet bed support. Filter water used for eluents through a 0.45 µm filter.

5.1.4 Filter Samples

Samples containing particulate material may clog the column inlet bed support. Filter samples through a 0.45 µm filter prior to injection.

5.2 High Background

In a properly working system, the background conductivity level for the standard eluent system is shown below.

Table 6 Typical Background Conductivity for Anion Columns

Eluent	Expected Background Conductivity
1 mM KOH	0.5 – 0.8 µS
66 mM KOH	0.8 – 1.5 µS
66 mM KOH/15% Methanol	1-3 µS

5.2.1 Preparation of Eluents

A. Make sure that any manually prepared eluents and regenerant are made correctly.

B. Make sure that eluents are made from chemicals with the recommended purity.

C. Make sure that deionized water used to prepare the reagents has a specific resistance of 18.2 megohm-cm.

5.2.2 A Contaminated Trap Column

Please refer to the Product Manual for the Trap column in use.

5.2.3 Contaminated Dionex CR-ATC 500 or CR-ATC 600 Trap Column

A. A Dionex CR-ATC 500 or CR-ATC 600 Trap Column should be installed if using a Dionex Eluent Generator Cartridge.

B. If there is high baseline shift during gradient, the Dionex CR-ATC 500 or CR-ATC 600 may be contaminated or too old; please replace the Dionex CR-ATC 500 or CR-ATC 600 and/or refer to the Clean-Up Procedure, in the Dionex CR-TC Product Manual (Document No. 079684).

NOTE

It is recommended to replace Dionex CR-ATC 500 or CR-ATC 600 trap columns each time the eluent generator cartridge is replaced or after one year of use.

5.2.4 A Contaminated Guard or Analytical Column

A. Remove the Dionex IonPac Guard and Dionex IonPac Analytical Columns from the system.

B. Install a backpressure coil that generates approximately 1500 psi and continue to pump eluent. If the background conductivity decreases, the column(s) is (are) the cause of the high background conductivity.

C. To eliminate downtime caused by fouling, a guard column should be used. Clean or replace the Dionex IonPac Guard Column at the first sign of column performance degradation. The columns can be cleaned as instructed in Section 6.5.2, “Column Cleanup Procedure”.

5.2.5 Contaminated Hardware

Eliminate the hardware as the source of the high background conductivity.

A. Bypass the columns and the suppressor.

B. Install a backpressure coil that generates approximately 1,500 psi.

C. Pump deionized water with a specific resistance of 18.2 megohm-cm through the system.

D. The background conductivity should be less than 2 µS. If it is not, check the detector/conductivity cell calibration by injecting deionized water directly into it. See the appropriate manual for details.

5.2.6 A Contaminated Suppressor

If the above items have been checked and the problem persists, the suppressor is probably causing the problem. For details on Dionex Dynamically Regenerated Suppressor operation, refer to the Product Manual (Document No. 031956). For details on Dionex Chemically Regenerated Suppressor operation, refer to the Product Manual (Document No. 031727).

a. Check the suppressor settings in the instrument method and look for any suppressor-related errors in the audit trail.
b. Check the regenerant flow rate at the REGEN OUT port of the suppressor if operating in the Auto Suppression External Water Mode.
c. Check the eluent flow rate.
d. Replace the regenerant water.

5.3 Inconsistent Retention Times

Inconsistent or shifting retention times could be due to one or several different factors. These should be checked to determine the cause and address the issue.

5.3.1 Drifting to Shorter Retention Time

A. Contamination of the sample or eluent. Poorly mixed eluent. Remake sample and/or eluent.

B. Insufficient pump priming. Prime the pump. Refer to the Operator's Manual for correct pump operation.

C. Changes in temperature will also cause peaks to drift. Place the column in a thermally controlled column compartment. Check the temperature control of the column compartment and calibrate/service as needed. Refer to the Operator's Manual for correct operation of the column compartment.

D. Excessive temperatures may cause column degradation. Check the temperature of the column compartment. Reduce the operational temperature. Refer to the Operator's Manual for correct operation of the column compartment. Replace the column.

E. Oxidizing eluent may cause hydrolysis or degradation of the column resulting in decreased analyte retention. Remove oxidizing agent, remake eluents, and replace the column.

5.3.2 Drifting to Longer Retention Time

A. Pump flow rate is too high. Pump flow rate impacts the eluent concentration generated by the EG. Verify the pump flow rate and have the pump repaired if pump flow rate is an issue.

B. If eluents are prepared manually, poorly mixed eluent can cause longer retention time. Remake eluent.

C. A pump losing prime will cause retention time drift. Prime the pump. Refer to the Operator's Manual for correct pump operation.

D. A leaking pump will cause longer retention times. Check the pump flow. Refer to the Operator's Manual for correct pump operation.

E. Changes in temperature will also cause peaks to drift. Place the column in a thermally controlled column compartment. Check the temperature control of the column compartment and calibrate/service as needed. Refer to the Operator's Manual for correct operation of the column compartment.

5.3.3 Oscillating Retention Times

A. Pump problems can cause retention time to shift to longer and shorter time, run to run. Check the pump flow rate and prime the pump. Refer to the Operator's Manual for correct pump operation.

B. Temperature fluctuation will also cause peaks to shift. Place the column in a thermally controlled column compartment. Check the temperature control of the column compartment and calibrate/service as needed. Refer to the Operator's Manual for correct operation of the column compartment.

C. A sluggish injection valve will cause peaks to shift if the injection time varies. The injection valve may need maintenance. When an injection valve is actuated, the timing is critical for consistent retention times. This will occur when the injection valve needs to be cleaned or serviced. Refer to the Operator's Manual for troubleshooting and service procedures.

5.4 Poor Peak Resolution

When carrying out separations using gradient analysis the column must be sufficiently equilibrated with the eluent concentration used at the start of the analysis. The actual equilibration time depends on the ratio of the strongest eluent concentration to the weakest eluent concentration. Typically, equilibration takes place in 3-5 column volumes of eluent. Depending on flow rate and concentration change, equilibration times range from 3 to 10 minutes.

A. If increased separation is needed for the first group of peaks, reduce the concentration of the starting eluent (E1). This part of the chromatogram is run isocratically with E1.

B. Due to different system configurations, the observed gradient profile may not match the gradient shown in the example. The gradient conditions can be adjusted to improve resolution or to adjust retention times either by changing the gradient timing or by changing the gradient eluent proportions.

C. Keep the concentrations of E1 and E2 (final eluent concentration) constant and adjust the gradient time. This is the simplest way to compensate for total system differences if resolution is the problem.

D. Change the proportions of E1 and E2 and adjust the gradient time. This approach requires more time to develop and more knowledge in methods development work. The advantage is that it allows a method to be tailored for a particular application where selectivity, resolution, and total run time are optimized. Be aware that poor peak resolution can be due to any or all of the following factors.

5.4.1 Loss of Column Efficiency

When chromatographic efficiency is lost, peak resolution may decrease to an unacceptable level as the peaks broaden.

A. Check to see if headspace has developed in the guard or analytical column. This is usually due to improper use of the column such as exposing it to high pressures. Remove the column's inlet end fitting according to Section 5.1.2, "Replacing Column Bed Support Assemblies". If the resin does not fill the column body all the way to the top, it means that the resin bed has collapsed, creating a headspace. The column must be replaced.

B. Extra-column effects can result in sample band dispersion, making the elution of the peaks broader resulting in reduced efficiency. Make sure connections are made correctly with PEEK tubing with an ID of no greater than 0.010" for 4 mm systems or no greater than 0.005" for 2 mm systems. Cut the tubing lengths as short as possible, checking to ensure a smooth, 90° cut.

C. If tubing is not connected properly at the column inlet and outlet, it can cause dispersion resulting in low efficiency numbers.

    a. When installing the columns, it is recommended to turn off the pump while making connections. This will avoid any slippage of the ferrule under high pressure conditions which can result in a void in the fitting. Dispersion results in chromatograms with tailing peaks as shown in Figure 17 below.

    b. Before connecting the fittings, it is recommended to inject water into the cavities of the fluidic system using a syringe or a micropipette while the flow

is off. This will result in faster equilibration by preventing air from entering the system.

c. When making connections, make sure the ferrule and fitting bolt are at least 2 mm (0.1 inch) from the end of the tubing before you insert the tubing into the port. Do not place the ferrule and fitting bolt flush with the end of the tubing. Figure 18 illustrates the correct and incorrect placement of the ferrule and fitting bolt on the tubing.

Figure 17 Tailing Peaks Caused by Incorrectly Installed Tubing Fittings

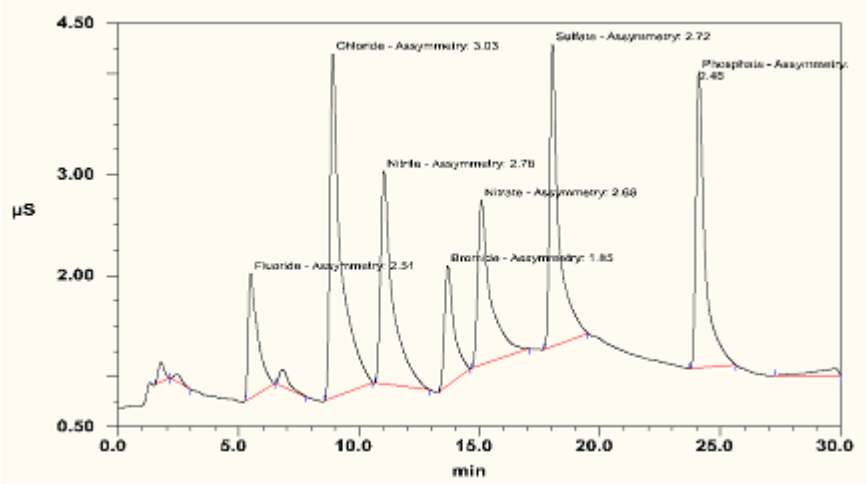
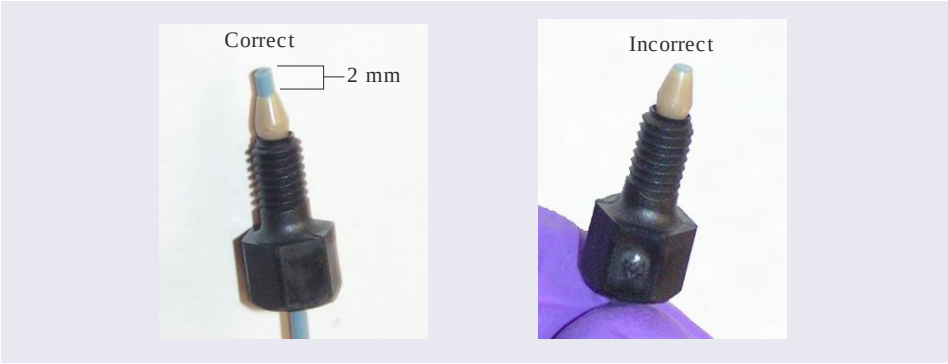


Figure 18 Correct and Incorrect Ferrule and Fitting Bolt Placement for Tubing Connections



D. Check for leaks. This can be done by visual inspection at elevated flow rates. Use of a paper towel or Kimwipe™ touched to connection will show noticeable wetness even with micro liter volume leaks.

E. Suppressor contamination may be the cause of efficiency loss. Typically, such contamination is analyte-dependent so if all analytes are equally affected, it is most likely due to one of the causes above. Refer to the Suppressor Product Manual for cleaning protocols.

5.4.2 Analyte Specific Efficiency Loss

If a specific analyte exhibits an efficiency problem this could be due to contamination. For example, iron oxide causes sulfate and phosphate to tail; aluminum causes poor recovery and peak shape for phosphate; magnesium and calcium hydroxide precipitation in the suppressor cause poor recovery and peak shape for magnesium and calcium (refer to the Product Manual for the suppressor for product specific troubleshooting); nonionic surfactants can cause sulfate to tail.

A. Purge system of suspected contamination. Refer to the Operator's Manual for the system for details.

B. Check sample as source of contamination.

C. Employ the use of an appropriate guard or trap column to remove contaminants. Contact your local representative for current product specific information.

5.4.3 Shortened Retention Times

Shortened retention times will cause peaks to elute closer together and may be due to one or more factors. Fast eluent flow will cause quicker elution of analytes. Higher eluent concentration or a contaminated column (which results in loss of capacity) will reduce the analyte retention causing peaks to elute early.

NOTE

Even with adequate system and column efficiency, resolution of peaks will be compromised if analytes elute too fast due to elevated flow rate or eluent concentration.

A. During gradient analysis the column must be equilibrated with the starting eluent prior to analysis. The time required is dependent on the difference in concentration between the start and the end of the gradient. If the ion concentration on the column is higher than the starting eluent concentration, then peaks may elute early or with inconsistent retention time. Typically, 3-5 column volumes of eluent are suggested for equilibration. Increase the length of time the column is in the starting eluent prior to injection to ensure adequate equilibration.

B. Check the flow rate. Ensure the eluent flow rate is equivalent to the flow rate specified by the analytical protocol. Confirm the eluent flow rate after the column using a stopwatch and graduated cylinder.

C. Ensure the eluent compositions and concentrations are correct. An eluent that is too concentrated will cause the peaks to elute sooner. Prepare fresh eluent.

D. Diluting the eluent will improve peak resolution but will also increase the analytes' retention times. If a 10% dilution of the eluent is not sufficient to obtain the desired peak resolution, or if the resulting increase in retention times is unacceptable, clean the column (see, Section 6, "Column Care").

NOTE

If you are using a gradient pump to proportion the eluent, components from two or three different eluent reservoirs, the resulting eluent composition may not be accurate enough for the application. Use one reservoir containing the correct eluent composition to see if this resolves the problem. There may be a problem when one of the proportioned eluents is less than 5%.

E. Column contamination can lead to a loss of column capacity. This is because all the ion exchange sites will no longer be available for the sample ions. For example, polyvalent ions or metals from the sample may concentrate on the column. Refer to Section 6.5 "Column Cleanup Procedure" for recommended column cleanup procedures.

NOTE

Possible sources of column contamination are impurities in chemicals and in the deionized water used for eluents or components of the sample matrix. Be especially careful to make sure that the recommended chemicals are used. The deionized water should have a specific resistance of 18.2 megohm-cm.

F. After cleaning the column, reinstall it in the system and let it equilibrate with eluent for about 30 minutes. The column is sufficiently equilibrated when consecutive injections of the standard give reproducible retention times. The original column capacity should be restored by this treatment, since the contaminants should be eluted from the column.

5.4.4 Loss of Front-End Resolution

If poor resolution or efficiency is observed for the peaks eluting near the system void volume compared to the later eluting peaks, check the following:

A. Eluent concentration: Incorrect eluent concentration may be the problem. Remake the eluent as required for your application. Ensure that the water and chemicals used are of the required purity. The eluent concentration maybe incorrect if the flow delivered to the eluent generator cartridge is incorrect. Check pump flow rate.

B. Sample concentration and injection volume: Column overloading may be the problem. Reduce the amount of sample ions being injected onto the analytical column by either diluting the sample or injecting a smaller volume onto the column.

C. System plumbing: Improperly swept out volumes anywhere in the system prior to the guard and analytical columns may be the problem. Reconnect components one at a time in the system prior to the columns, and test for front-end resolution after every system change.

5.5 Spurious Peaks

In a system where peaks are observed where none are expected, both the column and the system should be checked.

A. The columns may be contaminated. If the samples contain an appreciable level of polyvalent ions and the column is used with a weak eluent system, the retention times for the analytes will then decrease and spurious, inefficient (broad) peaks can show up at unexpected times. Clean the column as indicated in Section 7 "Column Cleanup".

B. The injection valve may need maintenance. When an injection valve is actuated, the possibility of creating a baseline disturbance exists. This baseline upset can show up as a peak of varying size and shape. This will occur when the injection valve needs to be cleaned or serviced. Check to see that there are no restrictions in the tubing connected to the valve. Also check the valve port faces for blockage and replace them if necessary. Refer to the valve manual for troubleshooting and service procedures. Small baseline disturbances at the beginning or at the end of the chromatogram can be overlooked so long as they do not interfere with the quantification of the peaks of interest.

6. Column Care

6.1 Recommended Operation Pressures

Operating a column above its recommended pressure limit can cause irreversible loss of column performance. The maximum recommended operating pressure for the Dionex IonPac AS30 Column is listed in Sections **Error! Reference source not found.**, "Introduction" and 3.1, " General Operating Conditions".

6.2 Column Start-Up

The column is shipped using sodium tetraborate as the storage solution.

Prepare the eluent shown on the Quality Assurance Report. To remove the storage solution, flush the column to waste with 80 mM KOH for at least 45 minutes and then 15 minutes with the QAR eluent before attaching the column outlet to the suppressor. Install the column in the column module and test the column performance under the conditions described in the QAR. Continue making injections of the test standard until consecutive injections of the standard give reproducible retention times. Equilibration is complete when consecutive injections of the standard give reproducible retention times.

IMPORTANT ***When making any tubing connections, first turn off the pump. This will avoid any slippage of the ferrule under high pressure conditions.***

6.3 Column Storage

For short-term storage (< 1 week), use eluent; for long-term storage (> 1 week), store in eluent in a refrigerator or use 100 mM sodium tetraborate for the column storage solution when stored at room temperature. With the column outlet directed to waste, flush the column for a minimum of 15 minutes with the storage solution. Cap both ends securely, using the plugs supplied with the column.

6.4 Chemical Purity Requirements

Obtaining reliable, consistent, and accurate results requires eluents that are free of ionic impurities. Chemicals, solvents, and deionized water used to prepare eluents must be of the highest purity available. Low trace impurities and low particle levels in eluents also help to protect your ion exchange columns and system components. Thermo Fisher Scientific cannot guarantee proper column performance when the quality of the chemicals, solvents and water used to prepare eluents has been compromised.

Currently at Thermo Fisher Scientific, we have obtained consistent results using Optima® Solvents by Fisher Scientific. We have found that bottled HPLC-grade water from Burdick & Jackson contains acceptably low levels of impurities.

6.4.1 Inorganic Chemicals

Reagent-grade inorganic chemicals should always be used to prepare ionic eluents. Whenever possible, inorganic chemicals that meet or surpass the latest American Chemical Society standard for purity should be used. These inorganic chemicals will detail the purity by having an actual lot analysis on each label.

6.4.2 Deionized Water

The deionized water used to prepare eluents should be Type I reagent-grade water with a specific resistance of 18.2 megohm-cm. The deionized water should be free of ionized impurities, organics, microorganisms, and particulate matter larger than 0.2 µm. Bottled HPLC-Grade Water (with the exception of Burdick & Jackson) should not be used since most bottled water contains an unacceptable level of ionic impurities.

6.4.3 Solvents

In most cases, unless otherwise noted in Section 3.2 "General Operational Precautions", solvents can be added to the ionic eluents used with Dionex IonPac columns to modify the ion exchange process or improve sample solubility. The solvents used must be free of ionic impurities. However, since most manufacturers of solvents do not test for ionic impurities, it is important that the highest grade of solvents available be used. Currently, several manufacturers are making ultrahigh purity solvents that are compatible for HPLC and spectrophotometric applications. These ultrahigh purity solvents will usually ensure that your chromatography is not affected by ionic impurities in the solvent.

When using a solvent in an ionic eluent, the back pressure generated will depend on the solvent used, concentration of the solvent, the ionic strength of the eluent and the flow rate used. The column back pressure will vary as the composition of water-methanol and water-acetonitrile mixture varies. Do not exceed the maximum operating backpressure of the Dionex IonPac column.

Solvents and water should be premixed in concentrations which allow proper mixing by the gradient pump and to minimize outgassing. Ensure that all of the inorganic chemicals are soluble in the highest solvent concentration to be used during the analysis.

6.5 Column Cleanup

The following column cleanup protocols have been divided into three general isocratic protocols to remove acid-soluble, base-soluble, or organic contaminants. They can be combined into one gradient protocol if desired; however, the following precautions should be observed.

WARNING

- ***Always ensure that the cleanup protocol used does not switch between eluents which may create high pressure eluent interface zones in the column.***
- ***High pressure zones can disrupt the uniformity of the packing of the column bed and irreversibly damage the performance of the column.***
- ***High viscosity mixing zones can be created between two eluents having solvents with a very high energy of mixing.***
- ***High pressure zones in the column can be created by pumping successive eluents through the column that are not miscible, that have eluent components in one eluent that will precipitate out in the other eluent, or by using an acid eluent followed by a base eluent which may create a neutralization pressure band.***
- ***The precipitation of the salts by solvents during column rinses can result in very high-pressure zones.***

When in doubt, always include short column rinse steps to reduce the solvent content of the eluent to < 5% levels and the ionic strength of the eluent to < 50 mM levels to avoid creating high pressure zones in the column that may disrupt the uniformity of the column packing.

6.5.1 Choosing the Appropriate Cleanup Solution

Table 7 Cleaning Solutions for Anion Exchange Columns

Contamination	Anion Solutions
Hydrophilic Contamination of Low Valence	Concentrated hydroxide solutions such as a 10X concentrate of the most concentrated eluent used in the application is sufficient to remove hydrophilic contamination of low valence.
Hydrophilic Contamination of High Valence	Concentrated acid solutions such as 1 to 3 M HCl will remove high valence hydrophilic ions by ion suppression and elution by the chloride ion.
Metal Contamination	Metal contamination often results in asymmetric peak shapes and/or variable analyte recoveries. For example, iron or aluminum contamination often results in tailing of sulfate and phosphate. Aluminum contamination can also result in low phosphate recoveries.
	Concentrated acid solutions such as 1 to 3 M HCl remove a variety of metals. If after acid treatment, the chromatography still suggests metal contamination, treatment with chelating acids such as 0.2 M oxalic acid is recommended.
Ionic and Hydrophobic Contamination	Concentrated acid solutions such as 1 to 3 M HCl can be used with compatible organic solvents to remove contamination that is ionic and hydrophobic. The acid suppresses ionization and ion exchange interactions of the contamination with the resin.
	A frequently used cleanup solution is 200 mM HCl in 80% acetonitrile. This solution must be made immediately before use because the acetonitrile will decompose in the acid solution during long term storage.
Nonionic and Hydrophobic Contamination	Although this is extremely rare, nonionic and hydrophobic contaminants can contaminate an ion exchange column. The symptoms include reduced chromatographic efficiency, elevated pressure or tailing for a subset of analyte ions. Retention is unaffected by this type of contamination. Organic solvents can be used alone if the contamination is nonionic and hydrophobic. The degree of nonpolar character of the solvent should be increased as the degree of hydrophobicity of the contamination within the range of acceptable solvents.

6.5.2 Column Cleanup Procedure

A. Prepare a 500 mL solution of the appropriate cleanup solution using the guidelines in the table above.

B. Disconnect the outlet of the Dionex IonPac column from the suppressor. If your system is configured with both a guard column and an analytical column, reverse the order of the guard and analytical column in the eluent flow path. Double check that the eluent flows in the correct direction as designated on each of the column labels.

CAUTION

When cleaning an analytical column and a guard column in series, ensure that the guard column is placed after the analytical column in the eluent flow path. Contaminants that have accumulated on the guard column can be eluted onto the analytical column and irreversibly damage it. If in doubt, clean each column separately.

C. For aqueous cleaning solutions, set the pump flow rate to 1.0 mL/min for 4 mm analytical/guard columns or 0.25 mL/min for 2 mm analytical/guard columns.

D. For cleaning solutions containing organic solvents, set the pump flow rate to 0.5 mL/min for 4 mm analytical/guard columns or 0.12 mL/min for 2 mm analytical/guard columns.

E. Rinse the column for 10 minutes with deionized water before pumping the chosen cleanup solution over the column or before switching cleanup solutions.

F. Unless otherwise noted, pump the cleanup solution through the column for at least 60 minutes (pump for longer time if column is highly contaminated). A step gradient is used for column cleanup when switching between solutions.

G. Rinse the column for at least 10 minutes with deionized water before pumping eluent over the column.

H. Equilibrate the column(s) with eluent, still directing the effluent to waste, for at least 30 minutes before resuming normal operation.

I. Reconnect the Dionex IonPac analytical column to the suppressor and if your system was originally configured with a guard column, place the guard column in line between the injection valve and the analytical column.

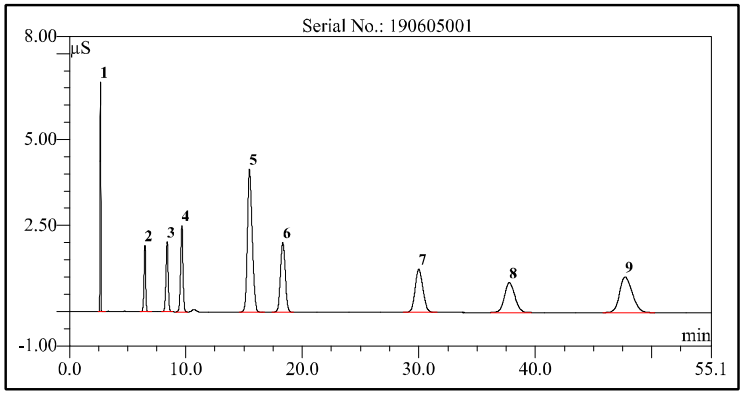
7. Quality Assurance Report

Device Monitoring Enabled
and Viper Fitting Ready

Dionex IonPac™ AS30
Analytical (2 x 250 mm)
Product No. 303161

Date: 04-Jun-19 12:53
Serial No. : 190605001
Lot No. : 01903168

Eluent:	18 mM KOH
Eluent Source:	Dionex EGC-KOH Cartridge
Flow Rate:	0.38 mL/min
Temperature:	30 °C
Detection:	Suppressed Conductivity
Suppressor:	Dionex Anion Dynamically Regenerated Suppressor (Dionex ADRS™ 600 2mm) AutoSuppression™ Recycle Mode
Applied Current:	18 mA
Injection Volume:	2.5 µL
Storage Solution:	100 mM Sodium Tetraborate



No.	Peak Name	Ret.Time (min)	Asymmetry (AIA)	Resolution (EP)	Efficiency (EP)	Concentration (mg/L)
1	Fluoride	2.66	0.9	19.48	8864	3.0
2	Chlorite	6.48	1.0	5.93	8570	10.0
3	Bromate	8.39	1.0	3.35	8378	20.0
4	Chloride	9.65	1.0	10.07	9852	6.0
5	Sulfate	15.46	1.4	3.77	6488	30.0
6	Nitrite	18.32	1.1	11.81	9418	15.0
7	Bromide	29.99	1.2	5.45	9569	25.0
8	Chlorate	37.76	1.2	5.49	8575	25.0
9	Nitrate	47.71	1.4	n.a.	9082	25.0

QA Results:

Analyte	Parameter	Specification	Results
Bromide	Efficiency	>=6300	Passed
Bromide	Asymmetry	1.0-1.7	Passed
Sulfate	Efficiency	>=4050	Passed
Sulfate	Asymmetry	1.0-1.9	Passed
Nitrate	Retention Time	41.6-50.4	Passed
	Pressure	<=3630	2531

Production Reference:
Datasource: QAR
Directory: _RFID\Anion\AS30
Sequence: AS30_2x250
Sample No.: 1

6.70 Build 1820 (Demo-Installation)

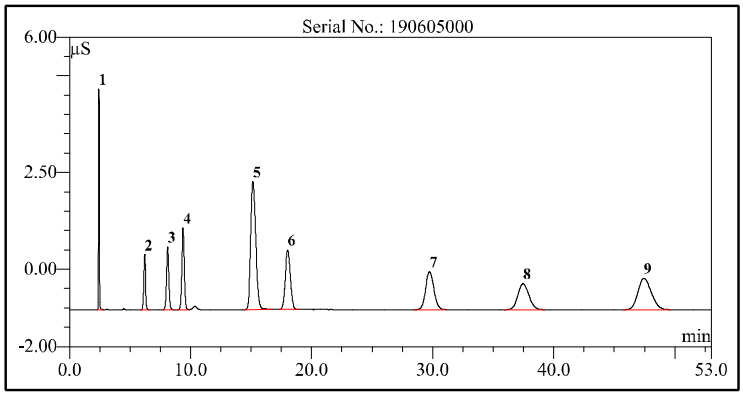
ChromeIcon™ Thermo Fisher Scientific

Device Monitoring Enabled
and Viper Fitting Ready

Dionex IonPac™ AS30
Analytical (4 x 250 mm)
Product No. 303159

Date: 09-Jul-19 12:56
Serial No. : 190605000
Lot No. : 03

Eluent:	18 mM KOH
Eluent Source:	Dionex EGC-KOH Cartridge
Flow Rate:	1.5 mL/min
Temperature:	30 °C
Detection:	Suppressed Conductivity
Suppressor:	Dionex Anion Dynamically Regenerated Suppressor (Dionex ADRS™ 600 4mm) AutoSuppression™ Recycle Mode
Applied Current:	67 mA
Injection Volume:	10 µL
Storage Solution:	100 mM Sodium Tetraborate



No.	Peak Name	Ret.Time (min)	Asymmetry (AIA)	Resolution (EP)	Efficiency (EP)	Concentration (mg/L)
1	Fluoride	2.44	1.0	20.07	8840	3.0
2	Chlorite	6.21	1.0	5.99	8251	10.0
3	Bromate	8.12	1.0	3.40	7995	20.0
4	Chloride	9.39	1.1	10.00	9417	6.0
5	Sulfate	15.15	1.4	3.76	6199	30.0
6	Nitrite	18.03	1.1	11.64	8933	15.0
7	Bromide	29.73	1.2	5.31	9013	25.0
8	Chlorate	37.46	1.2	5.41	8089	25.0
9	Nitrate	47.44	1.3	n.a.	8707	25.0

QA Results:

Analyte	Parameter	Specification	Results
Bromide	Efficiency	>=6300	Passed
Bromide	Asymmetry	1.0-1.7	Passed
Sulfate	Efficiency	>=4050	Passed
Sulfate	Asymmetry	1.0-1.9	Passed
Nitrate	Retention Time	41.6-50.4	Passed
	Pressure	<=3630	2607

Production Reference:
Datasource: QAR
Directory: _RFID\Anion\AS30
Sequence: AS30_4x250
Sample No.: 1

6.70 Build 1820 (Demo-Installation)

Chromeleon™ Thermo Fisher Scientific

8. Additional Information

NOTE

For assistance, visit Unity Lab Services online at www.unitylabservices.com
From the U.S. call the Customer Care Center for Dionex Products at 1-800-346-6390
Outside the U.S., call the nearest Thermo Fisher Scientific office.

8.1 General Information on PEEK™ Tubing

Dionex brand PEEK™ tubing is available. Note that tubing from different suppliers varies with respect to color and i.d. Care should be taken to ensure the correct i.d. is being used to avoid problems caused by sample dispersion.

Table 8 Tubing Back Pressures.

Color	Part Number	I.D. inch	I.D. cm	Volume mL/ft.	Back Pressure, psi/ft. at 1 mL/min	Back Pressure, psi/ft. at 0.25 mL/min	Back Pressure, psi/cm. at 1mL/min
Green	044777	0.030	0.076	0.137	0.086	0.021	0.003
Orange	042855	0.020	0.051	0.061	0.435	0.109	0.015
Blue	049714	0.013	0.033	0.026	2.437	0.609	0.081
Black	042690	0.010	0.025	0.015	6.960	1.740	0.232
Red	044221	0.005	0.013	0.004	111.360	27.840	3.712
Yellow	049715	0.003	0.008	0.001	859.259	214.815	28.642
Light Blue	071870	0.0025	0.006	0.0009	1766.0	441.0	58.0

NOTE

Blue and Light blue are very similar in color. Additionally, tubing from different suppliers may differ to that stated above.