Thermo Scientific Dionex Eluent Suppressors for Ion Chromatography

Suppression was introduced in 1975, thereby bringing ion chromatography (IC) to the forefront of modern analytical techniques for inorganic analysis. Suppression greatly enhances signal-to-noise ratio in two ways by:

- Decreasing background eluent conductivity and noise
- Increasing analyte conductivity

We currently offer five suppressors for continuous suppression of the eluent in a broad range of IC applications. Suppressor choice depends on the eluent used, whether organic solvents are used, analyte and matrix concentration, and the type of chromatography being practiced:

- The Thermo Scientific™ Dionex™ ERS™ 500 Electrolytically Regenerated Suppressor is used for electrolytically regenerated suppression of IC applications requiring high-capacity, low noise, high backpressure resiliency and fast startup. The Dionex ERS 500 suppressor is recommended for isocratic use with carbonate, hydroxide, methanesulfonic acid or sulfuric acid eluents, as well as gradient use with hydroxide, methanesulfonic acid or sulfuric acid eluents, in both the standard bore (4 mm) and microbore (2 mm) format of operation. This suppressor is a fundamental component of a Reagent-Free™ IC (RFIC™) system.
- Thermo Scientific™ Dionex™ CES™ 300 Capillary Electrolytic Suppressor is used for electrolytically regenerated suppression of IC applications at a capillary scale (5–30 µL/min). The Dionex CES 300 suppressor is recommended for isocratic use with carbonate, hydroxide or methanesulfonic acid eluents, as well as gradient use with hydroxide or methanesulfonic acid eluents, in the capillary (0.4 mm) format of operation. This suppressor is a fundamental part of a RFIC systems with Eluent Generation (RFIC-EG) capillary system.
- The Thermo Scientific™ Dionex™ CRS™ 500 Chemically Regenerated Suppressor is used for chemically regenerated suppression of IC eluents requiring high-capacity, solvents, and/or very low noise.
- The Thermo Scientific™ Dionex™ ACRS-ICE 500 Anion Chemically Regenerated Suppressor is used for chemically regenerated suppression of ion-exclusion chromatography. (ICE), and is available in both the standard bore (9 mm) and microbore (4 mm) format of operation.

Thermo SCIENTIFIC

IC Separation Technology

A typical ion chromatograph consists of several components as shown in Figure 1. The eluent, which is conductive, is delivered to the system using a high-pressure pump. The sample is introduced, then flows through the guard, and into the analytical ion-exchange columns where the ion-exchange separation occurs. After separation, the suppressor reduces the conductivity of the eluent and typically increases the conductivity of the analytes so they are delivered to the conductivity cell in a form that increases response. A computer and software are used to control the system, acquire and process the data.

We have continuously worked to improve suppressor technology to provide better sensitivity and consistency for the analysis of a wide variety of compounds.

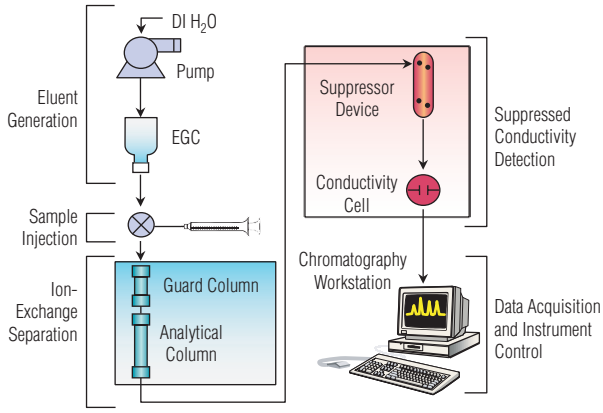


Figure 1. Ion chromatograph using suppressed conductivity detection.

The Suppressor Advantage

Figure 2 shows an example of suppression used for anion chromatography. Thermo Scientific™ Dionex™ AERS™ 500 Anion Electrolytically Regenerated Suppressor, Thermo Scientific™ Dionex™ AAES™ Anion Atlas Electrolytic Suppressor, or the Thermo Scientific™ Dionex™ ACES™ 300 Anion Capillary Electrolytic Suppressor removes potassium or sodium ions (and other sample cations) from the eluent and replaces them with hydronium ions formed by electrolysis of the water regenerant. These hydronium ions combine with the hydroxyl or carbonate ions from the eluent to form water or carbonic acid, which have very low conductivity and associated noise compared with the hydroxide or carbonate eluent. Analyte conductivity is generally enhanced because the analyte anions associate with the highly conductive hydronium ions. Overall improved detection limits are feasible due to the net gain in signal-to-noise ratio using suppressed IC relative to non-suppressed IC.

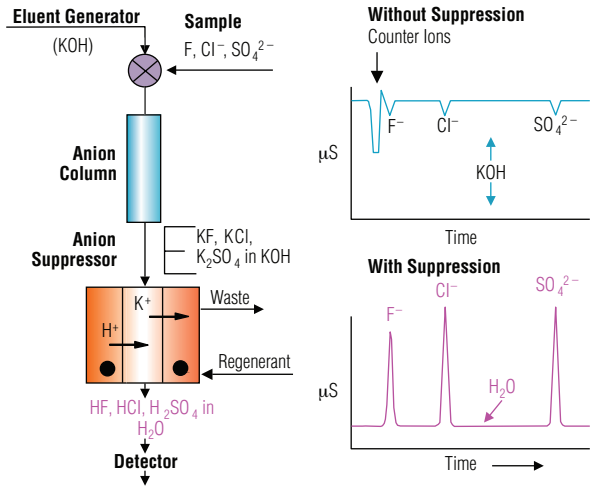


Figure 2. Diagram of eluent suppression for anion chromatography.

Performance Comparison

The Dionex ERS 500 and Dionex CRS 500 suppressors are high-capacity, continuously regenerated suppressors capable of suppressing eluents for all IC separations, including gradients in the standard bore and microbore scale of operation. The Dionex CES 300 suppressor is a capillary scale suppressor capable of suppressing all eluents at a capillary scale.

The Dionex CRS 500 suppressor is recommended for the best long-term performance when using solvent in the eluent. When using the Dionex ERS 500 or Dionex CES 300 suppressors, low levels of oxidizable solvent in the eluent are acceptable only in the external water mode. These suppressors can operate in the recycle mode with a relatively non-oxidizable solvent such as isopropyl alcohol. Higher levels of solvents (> 40%) in the eluent require the Dionex CRS 500 suppressor. The Dionex ERS 500 suppressor is available in three versions. The standard Dionex ERS 500 suppressor is a general purpose suppressor optimized for the majority of applications. The Dionex AERS 500 Carbonate suppressor is a variant of the Dionex ERS 500 suppressor optimized for use with carbonate eluents. The Dionex ERS 500e suppressor is optimized for use with the external water mode of operation and is the preferred solution when borate eluents or eluents containing solvents are used.

The Dionex ERS 500 family of suppressors and Dionex CRS 500 suppressors are available in two formats, 4 mm and 2 mm. The 4 mm suppressors are used with 5 and 4 mm columns. The 2 mm suppressors are used with 1, 2 and 3 mm columns. The Dionex ACRS-ICE 500 suppressors are available in two formats, 9 mm and 4 mm. The 9 mm suppressor is used with 9 mm Dionex IonPac ICE columns. The 4 mm suppressor is used with 4 mm Dionex IonPac ICE columns.

The internal void volume of the suppressor can affect the efficiency of a separation. To maintain maximum peak efficiencies when using 1, 2 or 3 mm columns, the 2 mm Dionex ERS 500 or 2 mm Dionex CRS 500 suppressors should be used.

Suppressor	Regeneration Requirements	Operational Requirements	Suppressor Capacity [mN] × [mL/min]	Benefits	Applications	
					Anions	Cations
Dionex ERS 500 and Dionex ERS 500e 2 and 4 mm formats < 15 and < 50 µL void volume	Electrolytic	All existing systems, except Thermo Scientific Dionex ICS-600 and Thermo Scientific Dionex ICS-900	Anion (Dionex AERS): 4 mm: 200 µeq/min 2 mm: 50 µeq/min Cation (Dionex CSRS): 4 mm: 110 µeq/min 2 mm: 37.5 µeq/min	- High-capacity - Versatility - Ease-of-use - High-pressure operation - Low noise - Electrolytic regeneration - Limited solvent compatibility	- Hydroxide and carbonate/ bicarbonate eluents - Borate eluents (Dionex ERS 500e) - For low-level solvent applications use external water (Dionex AERS 500e) - Columns: all anion-exchange columns	- Methanesulfonic acid and sulfuric acid eluents - For low-level solvent applications, external water (Dionex CERS 500e) - For eluents containing chloride or nitrate use the Dionex CRS 500 suppressor - Columns: all cation-exchange columns except Thermo Scientific™ Dionex™ IonPac™ SCS 1
Dionex AERS 500 Carbonate 2 and 4 mm formats < 15 and < 50 µL void volume	Electrolytic	All existing systems, except Dionex ICS-600 and Dionex ICS-900	4 mm: 30 µeq/min, 2 mm: 7.5 µeq/min	- Optimized for carbonate eluents - Lowest noise with carbonate eluents and electrolytic suppression	Carbonate/bicarbonate eluents	
Dionex CES 300 < 1.5 µL void volume	Electrolytic	Requires Capillary IC system (Thermo Scientific Dionex ICS-5000⁺ system)	Anion (Dionex ACES: 2 µeq/min Cation (Dionex CCES): 1.5 µeq/min	- Compatible with capillary flow rates - Versatility - Ease-of-use - Low noise - Electrolytic regeneration - Limited solvent compatibility	- Hydroxide and carbonate/ bicarbonate eluents - For low-level solvent applications use external water or chemical regeneration - All capillary anion-exchange columns - Ioscratic and gradient eluents	
Dionex CRS 500 2 and 4 mm formats < 15 and < 50 µL void volume	Chemical	All existing systems Required for the Dionex ICS-900 system	Anion (Dionex ACRS): 4 mm: 150 µeq/min 2 mm: 37.5 µeq/min Cation (Dionex CCRS): 4 mm: 150 µeq/min 2 mm: 37.5 µeq/min	- Solvent compatibility - Lowest noise - Fastest startup	- Carbonate/ bicarbonate and hydroxide eluents and eluents containing solvents - Columns: all anion-exchange columns	- Methanesulfonic acid and sulfuric acid eluents and eluents containing solvents, chloride, or nitrate - Columns: all cation-exchange columns
Dionex ACRS-ICE-500 4 and 9 mm formats < 15 and < 50 µL void volume	Chemical	All existing systems		- Recommended for ion-exclusion chromatography	- Any Dionex IonPac ICE column set with suppressed conductivity detection - Useful for IC of weak acids	

CHEMICAL SPECIFICATIONS

Suppressor	Temperature Range[1]	Recommended Backpressure	Maximum Eluent Flow Rate	Eluent Solvent Restrictions[2]	Maximum Regenerant EWM[3] Flow Rate	Modes of Operation Supported	Maximum Current
Dionex AERS 500	15–40 °C	30–100 psi	3 mL/min (4 mm), 1 mL/min (2 mm)	Not Recommended[7]	5 mL/min (4 mm) 2 mL/min (2 mm)	Recycle, EWM[3,7]	500 mA for 4 mm (recommended for usewith Chromeleon CDS) 150 mA for 2 mm
Dionex CERS 500	15–40 °C	30–100 psi	3 mL/min (4 mm), 0.75 mL/min (2 mm)	Not Recommended[7]	5 mL/min (4 mm) 2 mL/min (2 mm)	Recycle, EWM[3,7]	300 mA for 4 mm, (recommended for usewith Chromeleon CDS) 110 mA for 2 mm
Dionex AERS 500 Carbonate	15–40 °C	40–100 psi	3 mL/min (4 mm), 1 mL/min (2 mm)	< 40% oxidizable	5 mL/min (4 mm) 2 mL/min (2 mm)	Recycle, EWM[3]	125 mA for 4 mm, 30 mA for 2 mm
Dionex AERS 500e	15–40 °C	30–100 psi	3 mL/min (4 mm), 1 mL/min (2 mm)	< 40% oxidizable solvents in EWM[3]	5 mL/min (4 mm) 2 mL/min (2 mm	Recycle, EWM[3]	500 mA for 4 mm, 150 mA for 2 mm
Dionex CERS 500e	15–40 °C	30–100 psi	3 mL/min (4 mm), 0.75 mL/min (2 mm)	< 40% oxidizable solvents in EWM[3]	5 mL/min (4 mm), 2 mL/min (2 mm)	Recycle, EWM[3]	300 mA for 4 mm, 110 mA for 2 mm
Dionex ACES 300	15 °C	20–100 psi	0.30 mL/min	< 40% solvent in EWM[3]	0.100 mL/min	Recycle, EWM[3]	20 mA
Dionex CCES 300	15 °C	20–100 psi	0.30 mL/min	< 40% solvent in EWM[3]	0.100 mL/min	Recycle, EWM[3] (recycle recommended)	20 mA
Dionex CCRS 500	15–40 °C	30–60 psi	3 mL/min (4 mm), 0.75 mL/min (2 mm)	100% solvent compatible	10 mL/min (4 mm) 5 mL/min 2 mm	Chemical, DCR mode	na
Dionex ACRS 500	15–40 °C	30–60 psi	3 mL/min (4 mm), 0.75 mL/min (2 mm)	100% solvent compatible	10 mL/min (4 mm) 5 mL/min 2 mm	Chemical, DCR mode	na
ACRS-ICE 500	15–40 °C	40 psi	3 mL/min	90% solvent	10 mL/min compatible	Chemical, DCR mode	na

[1] When installed outside the heated column enclosure, all suppressors excluding Dionex CES 300 suppressor can support applications up to 60 °C.
[2] Solvents for anion eluents include methanol. Solvents for cation eluents include acetonitrile and dioxane.
[3] EWM = external water mode; for eluents containing > 40% solvent, use the chemical regeneration mode.
[4] Recycle recommended for aqueous applications without solvent.
[5] Do not use THF solvent in the eluent.
[6] Dionex ACES 300 and Dionex CCES 300 suppressors require 15 °C for recycled eluent mode of operation.
[7] Dionex ERS 500 can be used in External Water Mode, however the Dionex AERS 500e is recommended if borate eluent or eluents containing oxidizable solvents such as methanol are used.

Noise Comparison

The Dionex ERS 500 suppressor offers very low noise for hydroxide, and MSA eluents, whereas the Dionex AERS 500 Carbonate suppressor provides the lowest noise for carbonate eluent suppression. The Dionex CRS 500 suppressor produces the lowest overall noise because it uses non-electrolytic chemical regeneration. The Dionex ERS 500 Carbonate suppressor provides very low noise for carbonate eluents when used in conjunction with the Dionex CRD 300 Carbonate Removal Device. Low noise levels translate into lower method detection limits.

The Dionex CES 300 suppressor offers similar noise levels as the Dionex ERS 500 suppressor.

Electrolytically Regenerated Suppressor (Dionex ERS 500) for IC Analysis

The Dionex ERS 500 family of suppressors enhances analyte conductivity while suppressing eluent conductivity. The Thermo Scientific™ Dionex™ AutoSuppression™ devices provides significant improvement in analyte detection limits. The ions required for eluent suppression are generated by the continuous electrolysis of water. Therefore, the Dionex ERS 500 family of suppressors deliver low backgrounds and low noise levels without the need for manually prepared regenerant solutions or off-line regeneration of the suppressor.

Dionex ERS 500 Versatility

The Dionex ERS 500 family of suppressors are is designed to operate with the entire line of Thermo Scientific Dionex IC equipment and a very broad range of applications, including anion-exchange, cation-exchange, anion ion-pairing and ion suppression, or cation ion-pairing and ion suppression. The combination of a revolutionary eluent generator and the Dionex ERS 500 family of suppressors is the basis of a RFIC-EG system technology. The combination of Dionex ERS 500 eluent regeneration with eluent purification columns is the basis of RFC systems with Eluent Regeneration (RFIC-ER) system technology.

PHYSICAL SPECIFICATIONS

Suppressor	Dimensions	Void Volume	Weight
Dionex ERS 500 Dionex ERS 500 Carbonate Dionex ERS 500e	12.1 × 4.5 × 4.8 cm (4.25 × 1.8 × 1.9 in)	4 mm: < 50 µL 2 mm: < 15 µL	295 g (0.65 lb)
Dionex CRS 500	14.0 × 4.5 × 4.8 cm (5.5 × 1.8 × 1.9 in.)	4 mm: < 50 µL 2 mm: < 15 µL	370 g (0.82 lb)
Dionex ACRS-ICE 500	14.0 × 4.5 × 4.8 cm (5.5 × 1.8 × 1.9 in.) (1.9 × 1.8 × 4.0 in.)	9 mm: < 50 µL 4 mm: < 15 µL	370 g (0.82 lb)
Dionex CES 300	10.3 × 3.1 × 10.3 cm	< 1.5 µL	150 g (0.3 lb)

Table 1. Dionex ERS 500 suppressor modes of operation.

Mode	Benefit	Application
Recycle	Easy-to-use	Aqueous eluents, limited solvents
Gas-Assisted Recycle*	Easy-to-use, low noise	Aqueous eluents, limited solvents, low level analysis
External Water	Low noise, solvent compatible	Eluents containing < 40% solvent trace-level analysis, interface with MS and postcolumn reactions
Gas-Assisted External Water*	Low noise, solvent compatible, reduces water requirement	Eluents containing < 40% solvent, trace-level analysis
Thermo Scientific™ Dionex™ MPIC™ Mobile Phase IC	Low noise	Anion ion-pairing and ion suppression Cation ion-pairing and ion suppression

*Requires P/N 056886.

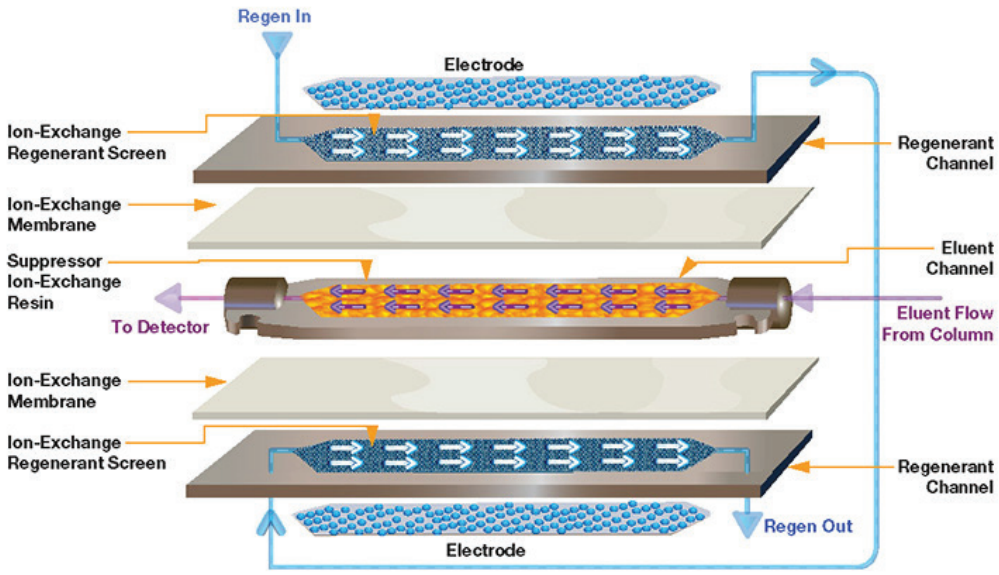


Figure 3. Internal construction of the Dionex ERS 500 suppressor. The Dionex ERS 500e and Dionex ERS 500 Carbonate have a similar construction. The Dionex ERS 500e uses a pair of tees to direct the regenerant flow to the regenerant channels in parallel, similar to the Dionex CRS 500, see Figure 10. The Dionex ERS 500 Carbonate also uses a parallel regenerant flow configuration as well as using a divided electrode as the anode.

Dionex ERS 500 System Control

The software and hardware control options for the Dionex ERS 500 suppressor allow use of the optimum current for specific applications, extending suppressor life and improving recoveries of certain analytes, such as magnesium.

The Thermo Scientific Dionex ICS-1000, Thermo Scientific Dionex ICS-1100, Thermo Scientific Dionex ICS-1500, Thermo Scientific Dionex ICS-1600, Thermo Scientific Dionex ICS-2000, Thermo Scientific Dionex ICS-2100, Thermo Scientific Dionex ICS-2500, Thermo Scientific Dionex ICS-3000, Thermo Scientific Dionex ICS-5000 and Thermo Scientific Dionex ICS-5000+ series systems include software and hardware to control the Dionex ERS 500 suppressor.

For other systems, the Thermo Scientific Dionex ED50A Electrochemical Detector or Thermo Scientific Dionex CD25A Conductivity Detector with Chromeleon CDS software, version 6.2 or higher can control the current to the Dionex ERS 500 suppressor in 1 mA increments. For older units, the Dionex RFC-10 Reagent-Free Controller can also control the current to the Dionex ERS 500 suppressor in 1 mA increments. (See Table 2). The Dionex ERS 500 Suppressors Current Controller, Dionex SCC-10 can be used in conjunction with the older current controllers provide a current output of twelve settings.

Dionex ERS 500 for Maximum Flexibility

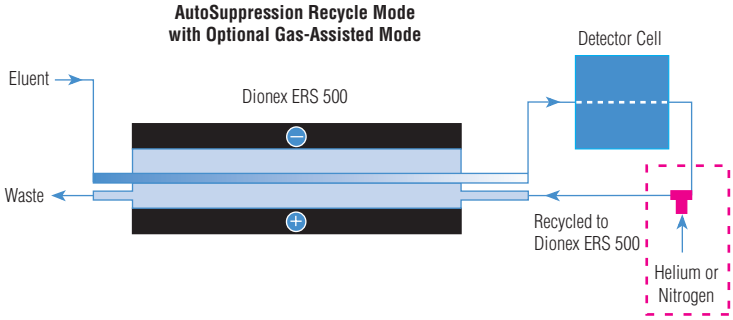
The Dionex ERS 500 family of suppressors are designed for maximum flexibility. The Dionex ERS 500 suppressors do not restrict the user to one or two columns and eluents. These suppressors are compatible with the full range of ion-exchange columns and isocratic or gradient eluents.

Most applications for anion or cation-exchange use the economical and easy-to-use AutoSuppression recycle mode (Figure 4). The AutoSuppression recycle mode can be enhanced with the use of the Gas-Assisted Regeneration Kit. This optional mode reduces the noise for trace-level analysis without the need for external water regenerant. In this mode, gas is added to the conductivity cell effluent before it enters the “Regen In” port of the Dionex ERS 500 suppressor.

Table 2. System control of Dionex ERS 500 elecrolytic suppressors.

IC System	ERS Hardware Control Requirements	ERS Software Control Requirements
Dionex ICS-1000, Dionex ICS-1100, Dionex ICS-1500, Dionex ICS-1600, Dionex ICS-2000, Dionex ICS-2100, Dionex ICS-2500, Dionex ICS-3000, Dionex ICS-5000, and Dionex ICS-5000+	Integrated, no additional hardware required	Thermo Scientific™ Dionex™ Chromeleon™ Chromatography Data System (CDS) Software, version 6.2 or higher Dionex Chromeleon Software 7.2 SR3 MUa or higher for Dionex AERS 500 Carbonate suppressor control[1]
Dionex DX-600 or BioLC with ED50A or CD25A detector	Integrated, no additional hardware required	Chromeleon CDS, version 6.2 or higher
Dionex DX-320 with IC25A detector	Integrated, no additional hardware required	Chromeleon CDS, version 6.2 or higher
Dionex DX-600 or BioLC with ED50	Dionex RFC-10 or Dionex RFC-30 Reagent-Free Controller[1] or Dionex SSC-10	No software required for Dionex RFC[2] control
Dionex DX-500 with ED40/50 or CD20/25 detector	Dionex RFC-10 or Dionex RFC-30 Reagent-Free Controller[1] or Dionex SSC-10	No software required for Dionex RFC[2] control

[1]Dionex AERS 500 Carbonate suppressors can be controlled with Dionex Chromeleon 6.2 or higher, but manual optimum current calculation is required.



Dionex AERS 500 Eluents: hydroxide, carbonate/bicarbonate.
Dionex AERS 500 Carbonate Eluents: carbonate/bicarbonate.
Dionex CERS 500 Eluents: methanesulfonic acid (MSA), sulfuric acid, and < 20 mM DAP·HCl.

Figure 4. Eluent flow in the AutoSuppression recycle mode with optional gas-assisted mode. In AutoSuppression recycle mode, after the eluent passes through the detector flow cell, it is recycled back to the suppressor to be used as regenerant. With the optional gas-assisted mode, gas is added to the conductivity cell effluent before it flows into the “Regen In” port of the Dionex ERS 500 suppressor. The gas-assisted mode significantly reduces noise, allowing trace-level analysis.

Eluents or samples containing up to 40% oxidizable organic solvent can be suppressed using the AutoSuppression external water mode. In external water mode, the water for electrolysis is supplied from an external source (see Figure 5). This mode also can be enhanced with the use of the gas-assisted mode, which reduces the regenerant consumption and lowers noise. Although all Dionex ERS 500 suppressors can be operated in external water mode, the Dionex ERS 500e suppressor has been specifically optimized for this mode and the preferred solution. When using eluents containing solvent (up to 40%) or borate, the Dionex ERS 500e gives longer lifetime and lower noise.

Installation kits are available for each of these modes of operation, see the Ordering Information section.

The Dionex ERS 500 family of suppressors should not be used with eluents or samples containing more than 40% organic solvent. The Dionex CRS 500 suppressor is recommended for eluents and samples containing high levels of organic solvents.

The Dionex ERS 500e suppressor can also be used to suppress eluents for Dionex MPIC Mobile Phase IC when the organic solvent content of the eluent remains below 40%.

Finally, the Dionex AERS 500 Carbonate suppressor is designed for optimal performance when using carbonate or carbonate/bicarbonate eluents. The patented design of the Dionex AERS 500 Carbonate suppressor results in significantly lower noise levels than the standard Dionex AERS 500 suppressor when used with carbonate or carbonate/bicarbonate eluents. For routine analysis, the peak response and efficiencies are equivalent to the performance of a Dionex ERS 500 suppressor, but with lower noise.

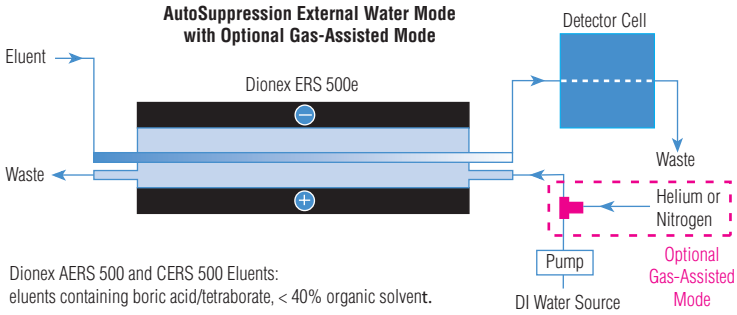
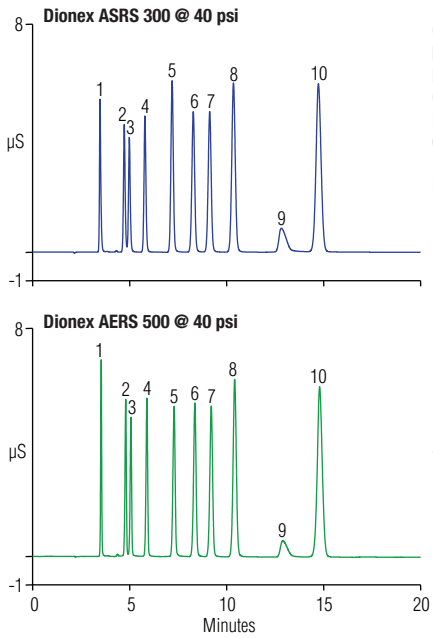


Figure 5. Eluent flow in the AutoSuppression external water mode with optional gas-assisted mode. The deionized water used for the electrolysis process is supplied from a constant pressure source or pump. This mode is ideal for operation with eluents and samples containing up to 40% organic solvent. With the optional gas-assisted mode, gas is added to the external water, which is pumped through the Dionex ERS 500 suppressor at a consistent flow rate between 1–2 mL/min. This mode decreases the amount of water required for the external water mode.

Dionex AERS 500 Suppressor for Anion-Exchange Chromatography



Column: Dionex IonPac AS19 4µm, 4 mm
Eluent: 20.0 mM Hydroxide (EG)
Flow rate: 1.0 mL/min
Current: 50 mA (Recycle)
Loop size: 10 µL
Oven: 30 °C

Peaks:	Dionex ASRS 300 @ 40 psi	Dionex AERS 500 @ 40 psi
1. Fluoride	13930	16132
2. Chlorite	15259	16886
3. Bromate	15536	17088
4. Chloride	16529	18821
5. Nitrite	15599	15213
6. Chlorate	15442	15704
7. Bromide	16233	17109
8. Nitrate	15328	15708
9. Carbonate	5751	6077
10. Sulfate	15086	15961

Figure 6. Comparison of the Dionex AERS 500 suppressor to the Dionex ASRS 300 suppressor using an inorganic anion standard. The Dionex AERS 500 suppressor outperforms the Dionex ASRS 300 suppressor as shown by the peak efficiency.

Dionex CERS 500 Suppressor for Cation-Exchange Chromatography

Column: Dionex Ion Pac CS15, 4 mm
Eluent: 10 mN H_2SO_4/ 9% Acetonitrile
Flow Rate: 1.2 mL/min
Inj. Volume: 25 µL
Detection: Suppressed conductivity Dionex CERS 500 suppressor, 4 mm, external water mode
Oven Temp: 40 °C

Peaks: 1. Sodium 100 mg/L (ppm)
2. Ammonium 0.025
3. Magnesium —
4. Calcium —

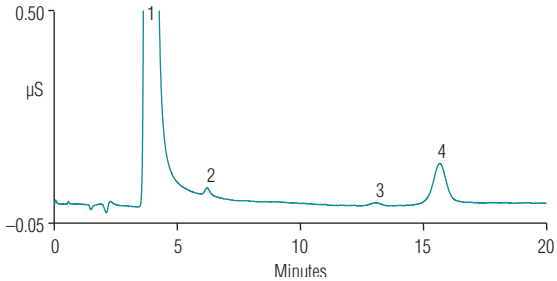
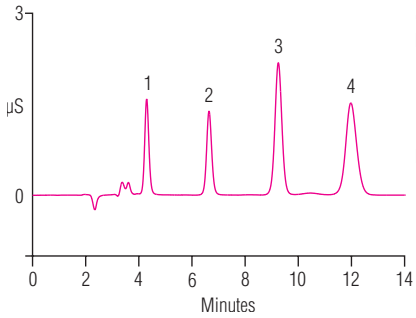


Figure 7. The Dionex CERS is used in external water mode to suppress an eluent containing < 40% organic solvent. This separation permits the determination of trace-level ammonium in a wastewater sample containing a high concentration of sodium.

Dionex ERS 500 for Mobile Phase Ion Chromatography



Column: Dionex IonPac NS1-10µm, 4 mm
Eluent: 3 mM tetrabutylammonium hydroxide, 28% acetonitrile
Flow Rate: 1.0 mL/min
Inj. Volume: 10 µL
Detection: Suppressed conductivity, Dionex ASRS Suppressor, 4 mm, Dionex MPIC suppression mode
Regenerant: 10 mM sulfuric acid

Peaks:
1. Propanesulfonate 15 mg/L (ppm)
2. Iodide 15
3. Thiocyanate 15
4. Hexanesulfonate 50

Figure 8. The Dionex ASRS, Dionex CSRS, Dionex AERS 500e or Dionex CERS 500e suppressors can suppress eluents used for Dionex MPIC Mobile Phase IC. In this example, the anion Dionex MPIC Mobile Phase IC suppression mode uses electrolysis augmented by sulfuric acid regenerant to supply the hydronium ions for suppression. Similarly, the Dionex CSRS or Dionex CERS 500e suppressor can be used for cation Dionex MPIC Mobile Phase IC ion-pairing separations.

Dionex CRS 500 Chemically Regenerated Suppressor for Chemically Regenerated Eluent Suppression

The Dionex CRS 500 suppressor uses continuous chemical suppression to enhance analyte conductivities while decreasing eluent conductivity. While using continuous chemical regeneration, the Dionex CRS 500 suppressor enables direct conductivity detection with ion-exchange applications using isocratic or gradient elution over wide concentration ranges (Figure 9).

The Dionex CRS 500 suppressor membranes are optimized for low background and noise. The eluent screens employed in the Dionex MMS 300 suppressor were replaced with a planar bed of ion exchange resin in the Dionex CRS 500 suppressor, improving eluent flow characteristics and increasing static capacity. Thus improved peak shapes are achieved with the Dionex CRS 500 making it compatible with the new columns based on 4 um particle beads. Figure 10 illustrates the internal design of the Dionex CRS 500 suppressor.

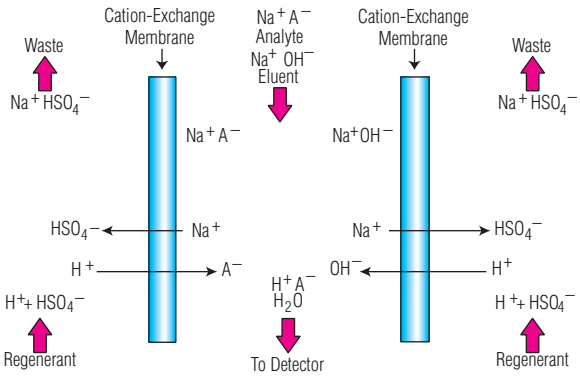


Figure 9. The Dionex CRS 500 suppressor enables direct conductivity detection with ion-exchange applications using isocratic or gradient elution over wide concentration ranges.

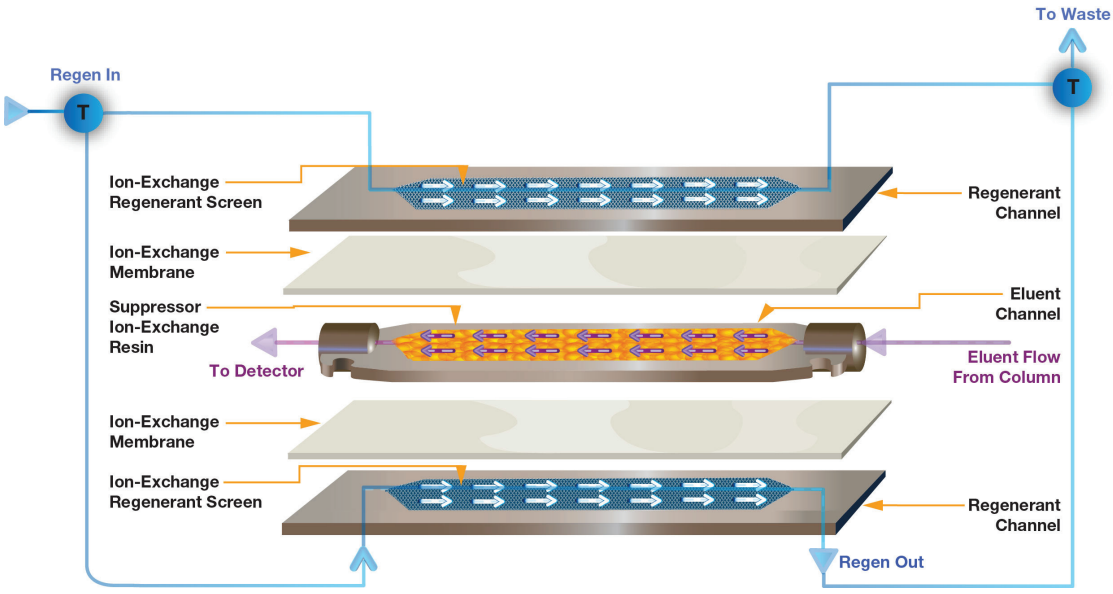


Figure 10. Internal construction of the Dionex CRS 500 suppressor. The Dionex CRS 500 suppressor is a high-capacity suppressor. The Dionex ERS 500e and Dionex ERS 500 Carbonate use a similar regenerant flow design, but share the ERS 500 electrode configuration.

Table 3. Dionex CRS 500 suppressor modes of operation.

Mode	Benefit	Application
Displacement chemical regeneration (DCR)	Low noise and ease-of-use with extended unattended operation	Chemical regeneration with Displacement Chemical Regeneration Kit
Pressurized bottle	Lowest noise	Chemical regeneration with External Regeneration Kit
Peristaltic Pump	Low noise and ease-of-use	Peristaltic Pump Kit

Table 4. Dionex CRS 500 suppressor.

Anions	Cations
Use with carbonate/bicarbonate and hydroxide eluents and for eluents containing solvents Columns: All anion-exchange columns	Use with methanesulfonic acid and sulfuric acid eluents and eluents containing solvents, chloride, or nitrate Columns: All cation-exchange columns except for the Dionex IonPac SCS-1 column

Dionex CRS 500 Suppressor for Sensitive Ion-Exchange Chromatography

When compared to non-suppressed IC, chemical suppression increases the linear working range of analytes by several orders of magnitude and improves detection limits for analytes 20–100 times. The Dionex CRS 500 suppressor is designed with minimal internal dead volume to provide high suppression capacity with minimal peak dispersion. The net result of chemical suppression is a dramatic improvement in signal-to-noise compared to non-suppressed applications.

Dionex CRS 500 Operational Modes

The Dionex CRS 500 suppressor can be used in the conventional pressurized bottle mode, the displacement chemical regeneration (DCR) mode, or the peristaltic pump mode. Convenient concentrated regenerant solutions are available for each mode of operation.

The DCR mode is a convenient and economical mode of operation for chemical suppressors in which the regenerant is displaced by using conductivity cell effluent, delivering regenerant to the suppressor at a flow rate equal to the eluent flow rate (Figure 11). In this mode, the regenerant bottle is completely filled with regenerant upon start-up. As the cell effluent is pumped into the regenerant bottle, the regenerant is forced out into the suppressor regen chambers. No additional pump or pressure is required. Eluent and regenerant bottles are of equivalent volumes and new regenerant is prepared when new eluent is installed. The low regenerant flow rate minimizes waste and allows unattended operation, offering an economical option to the AutoRegen or pressurized bottle mode.

The conventional pressurized bottle mode uses a pressurized reservoir to deliver the chemical regenerant to the Dionex CRS 500 suppressor (Figure 12). The pressure is set at 3–10 psi, which delivers the regenerant to the Dionex CRS 500 suppressor at approximately 5–10 mL/min for 4 mm (3–8 mL/min for 2 mm). The spent regenerant is then diverted to waste.

The new peristaltic pump mode uses a peristaltic pump to deliver the regenerant to the Dionex CRS 500 suppressor at a controlled flow rate. A two-channel pump is available, and can be used to deliver Dionex CRS 500 regenerant and Thermo Scientific Dionex CRD 300 Carbonate Removal Device regenerant simultaneously.

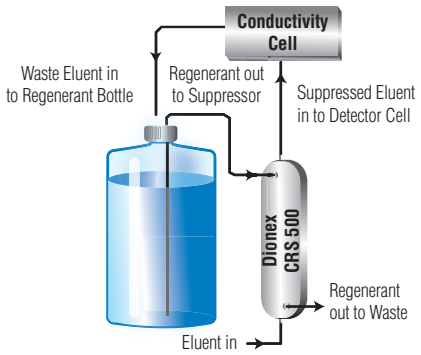


Figure 11. In the DCR mode, the regenerant is displaced by the eluent flow into the regenerant bottle. The regenerant flow is directed to the suppressor's Regen In port. This mode of operation is convenient and economical because the regenerant flow rate is reduced to and controlled by the eluent flow rate.

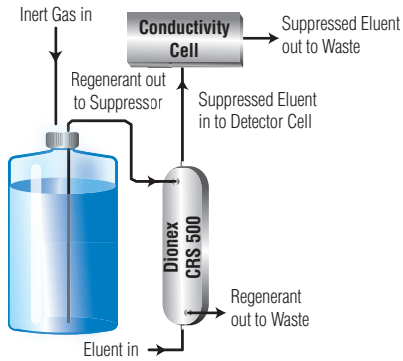


Figure 12. In pressurized bottle mode, the regenerant reservoir is pressurized to deliver the regenerant to the suppressor. The spent regenerant is then collected as waste.

High Efficiency

The Dionex CRS 500 suppressor is available in both standard bore (5 and 4 mm) and microbore (2 and 3 mm) formats. The standard bore suppressors have a low void volume of less than 50 µL to maintain the efficiency of ion-exchange separations using 4 or 5 mm columns. The microbore Dionex CRS 500 suppressor format is optimized to maintain the efficiency of ion-exchange separations when using either 2 or 3 mm columns (Figures 14 and 15).

High Suppression Capacity

The Dionex CRS 500 suppressor is a direct replacement for older chemical suppressor devices, including the Dionex MMS 300, Dionex MMS III, Dionex MMS II, Dionex MMS I, and packed-bed suppressors. The Dionex CRS 500 suppressor accommodates both isocratic elution and rapidly increasing gradients to high eluent concentrations (above 100 mM hydroxide for the Dionex ACRS 500 4 mm suppressor) while maintaining low background conductance.

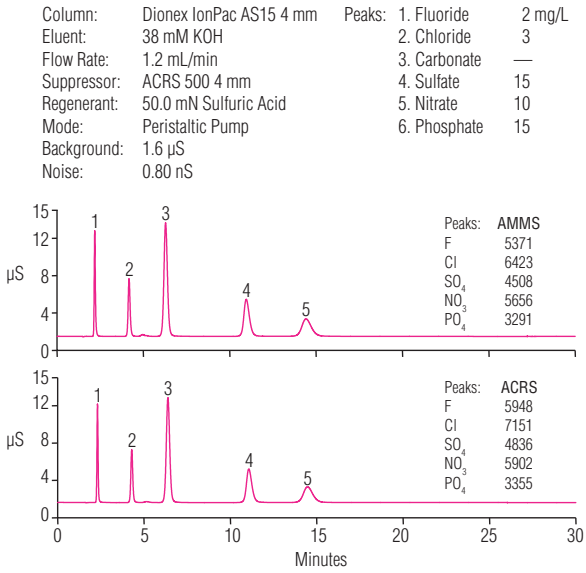


Figure 14. Comparison of the Dionex ACRS 500 suppressor to the Dionex AMMS 300 suppressor using an RFIC generated hydroxide eluent. The Dionex ACRS 500 suppressor outperforms the Dionex AMMS 300 suppressor as shown by the peak efficiency.

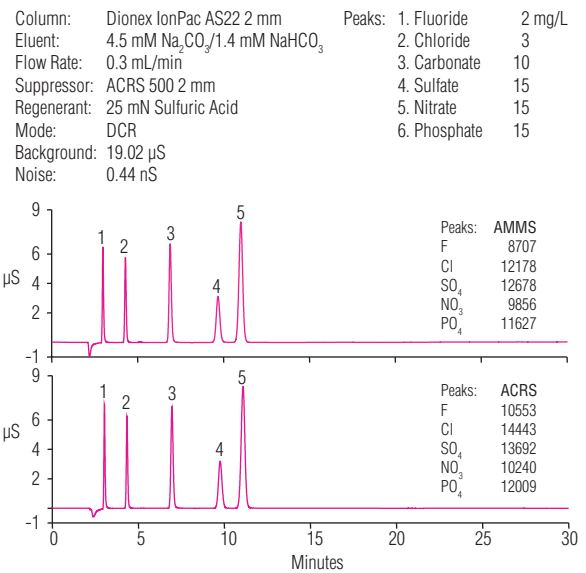


Figure 15. Comparison of the Dionex ACRS 500 suppressor to the Dionex AMMS 300 suppressor using a manually prepared carbonate eluent. The Dionex ACRS 500 suppressor outperforms the Dionex AMMS 300 suppressor as shown by the peak efficiency.

Compatible with HPLC Solvents

The Dionex CRS 500 suppressor is compatible with typical HPLC solvents and are recommended for both anion and cation separations when solvents are used in the eluents (Figures 16 and 17). Solvent compatibility allows flexibility when optimizing eluent conditions for more demanding separations.

Dionex ACRS-ICE 500 Chemically Regenerated Suppressor for Chemically Regenerated Eluent Suppression of ICE Eluents

The Dionex ACRS-ICE 500 is a high-capacity, low-void volume, membrane-based eluent suppressor designed for use with the ion-exclusion and ion-suppression separation modes of IC. The Dionex ACRS-ICE 500 uses chemical suppression to increase analyte ionization and therefore conductivity while decreasing eluent conductivity. The result is a significant improvement in analyte detection limits.

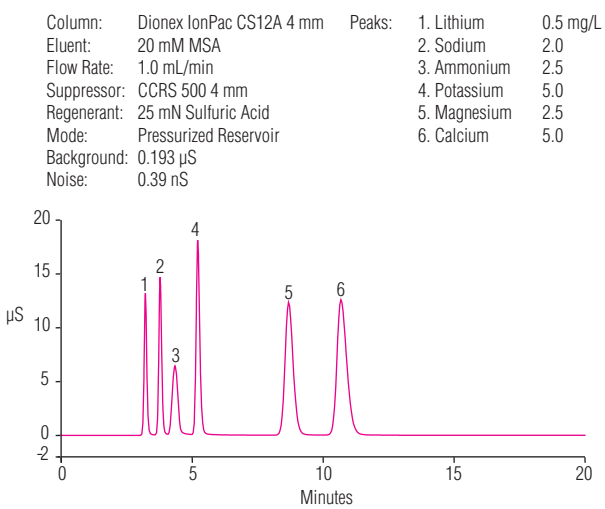


Figure 16. Cation separation using the Dionex IonPac CS12A (4 mm) column and the Dionex CCRS 500 (4 mm) suppressor in pressurized bottle mode.

Increased Sensitivity with Suppressed Conductivity Detection

The Dionex ACRS-ICE 500 suppressor is used in chemical suppression mode with a tetrabutylammonium hydroxide (TBAOH) regenerant. The Dionex ACRS-ICE 500 suppressor decreases background eluent conductivity by displacing the highly conductive hydronium ions from the eluent into the regenerant chambers, followed by a neutralization step in the regenerant chambers. The resulting TBA+ OSA– pair has low conductance. Figure 18 illustrates the suppression process for the Dionex ACRS-ICE 500 suppressor. The cation-exchange membrane in the Dionex ACRS-ICE 500 suppressor allows the hydronium ions from the eluent to pass into the regenerant chambers where they are neutralized by hydroxide ions from the TBAOH regenerant.

Analyte conductivity is increased by forming the TBA salt of the weak acid analyte, which is more conductive than the partially ionized acid form of the analyte.

Optimized for Ion-Exclusion Chromatography and Ion-Suppression Chromatography

The Dionex ACRS-ICE 500 suppressor has been improved to allow use at temperatures up to 40 °C with eluents containing HPLC solvents. Elevated temperatures or solvents can be used to increase peak efficiency or alter column selectivity in ion-exclusion and ion-suppression separations. The suppressor can be placed outside a chromatography oven for operation at elevated temperatures above 40 °C.

The Dionex ACRS-ICE 500 suppressor is designed for use with either the ion-exclusion or ion-suppression separation modes of IC. Both modes use dilute eluents containing acids with low pKa values. Ion-exclusion chromatography uses a cation-exchange phase, typically in the hydronium form, to selectively exclude weak acids on the basis of differences in pKa (see Figures 19 and 20). In contrast, ion-suppression chromatography uses an acidic eluent that suppresses ionization of analytes, thus allowing the separation of weak acids using a hydrophobic reversed-phase column such as the Dionex IonPac NS1.

Dionex ACRS-ICE 500 Applications

The Dionex ACRS-ICE 500 suppressor is ideally suited to ion-exclusion chromatography of:

- Organic acids and alcohols in complex or high-ionic-strength samples, including food and beverage products, biological samples, fermentation processes, industrial process liquors, and treated wastewaters.
- Organic acids in high-ionic-strength matrices.

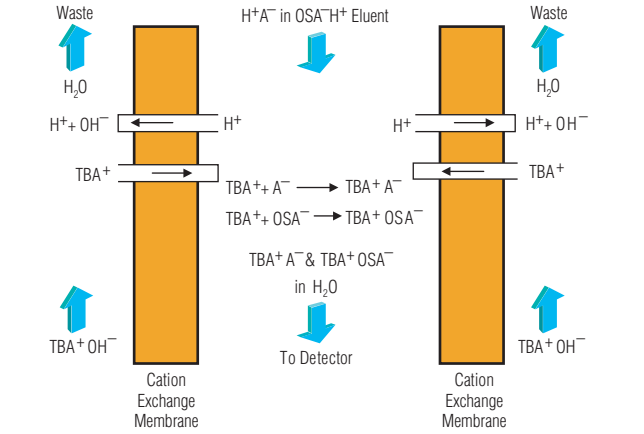


Figure 17. Dionex ACRS-ICE 500 suppression process for ion-exclusion chromatography.

Column:	Dionex IonPac ICE-AS1, see chromatogram	Peaks:	1. Nitrate	50.0 mg/L (ppm)
Eluent:	10 mM heptafluorobutyric acid		2. Malate	20.0
Flow Rate:	0.8 mL/min, 9 mm		3. Glycolate	40.0
	0.16 mL/min, 4 mm		4. Formate	20.0
Inj. Volume:	50 µL		5. Acetate	40.0
Detection:	Suppressed conductivity, Dionex ACRS-ICE 500 Suppressor, see chromatogram		6. Propionate	60.0
Sample:	0.25% sulfuric acid			

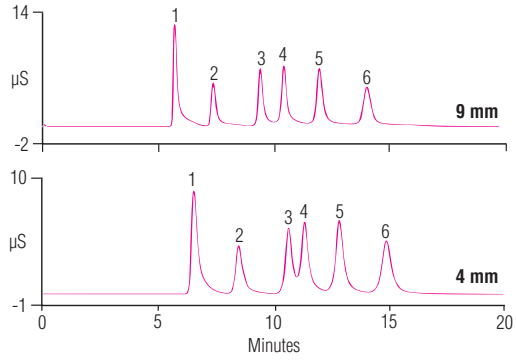


Figure 18. Comparison of Dionex ACRS-ICE 500 (9 mm) and (4 mm) on a Dionex IonPac ICE-AS1. The Dionex ACRS-ICE 500 (4 mm) gives similar suppression results to the Dionex ACRS-ICE 500 (9 mm), but with 1/4 eluent consumption.

Column:	Dionex IonPac ICE-AS6, 9 mm	Peaks:	1. Nitrate	5.0	mg/L (ppm)
Eluent:	1 mM heptafluorobutyric acid		2. Malate	10.0	
Flow Rate:	0.8 mL/min		3. Glycolate	15.0	
Inj. Volume:	50 µL		4. Formate	20.0	
Detection:	Suppressed conductivity, Dionex ACRS-ICE 500 Suppressor, 9 mm		5. Acetate	10.0	
			6. Propionate	10.0	
Sample:	0.25% sulfuric acid				

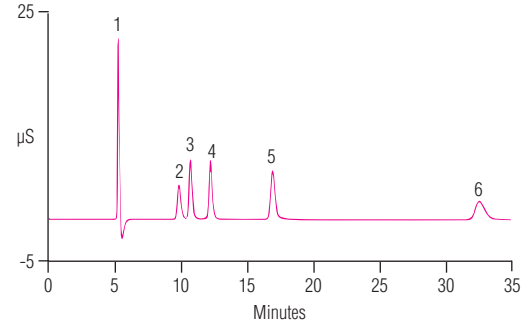


Figure 19. Determination of aliphatic acids in an acidic matrix using ion-exclustion.

Capillary Electrolytic Suppressor (Dionex CES 300) for Capillary IC Analysis

The Dionex CES 300 suppressors are optimized for eluent flow rates typically seen in capillary systems (5–30 µL/min). When used for anion analysis, the Dionex ACES 300 suppressor converts highly conductive hydroxide-based eluents into pure water, thus reducing the baseline on a conductivity detector. While suppressing the eluent, the Dionex ACES 300 suppressor also converts the analytes into their more conductive hydronium (acid) form, thus increasing their sensitivity under conductivity detection. Likewise, when used for cation analysis, the Dionex CCES 300 suppressor converts highly conductive methanesulfonic acid (MSA) eluents into pure water; simultaneously, the analytes are converted to their more conductive hydroxide form, increasing their sensitivity.

Dionex CES Suppressor Technology

The Dionex CES 300 suppressor uses a three-chamber design to minimize dead volume while maximizing suppression capacity and reducing noise.

The eluent chamber is comprised of an ion-exchange capillary membrane that facilitates the efficient exchange of the eluent counterions for regenerant ions.

The regenerant chambers are divided into the ion-exchange chamber and the electrode chambers. The regenerant first passes through the ion-exchange chamber, which is filled with a bed of ion-exchange resin; the ion-exchange capillary membrane is coiled in this bed. The regenerant bed is an ion-exchange resin in the opposite form as the eluent. It is this bed of resin that provides the regenerant ions for the capillary membrane eluent chamber.

There are two electrode chambers that are separated from the ion-exchange chamber by a pair of ion-exchange membranes. The regenerant, after passing through the ion-exchange chamber, passes through the cathode and anode chambers serially. When current is passed through the electrodes, the regenerant ions are generated in the first electrode chamber; these ions are pushed into the ion-exchange chamber via an electric field, maintaining the ion-exchange chamber in the regenerant form. After co-ions exchange from the eluent ion-exchange capillary membrane, the co-ions are pushed out of the ion-exchange chamber via the electric field into the second electrode chamber. Finally, these co-ions are neutralized by the ions generated in the second electrode chamber.

Dionex CES 300 System Control

The unique design of the Dionex CES 300 suppressor simplifies software and hardware control options. For most applications, the Dionex CES 300 suppressor can be set to a single current setting of 10 mA. For applications requiring very high eluent concentrations, the Dionex CES 300 suppressor must be set to 20 mA. The Dionex ICS-5000$^+$ system includes software and hardware to control the Dionex CES 300 suppressor. Chromeleon CDS software, version 6.8 or 7.0 is required.

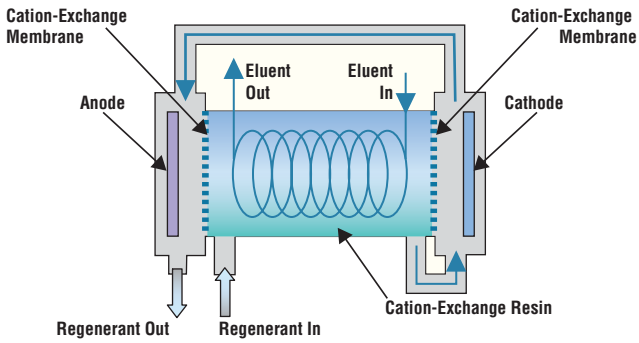


Figure 20. Anion Capillary Electrolytic Suppressor (Dionex ACES 300).

Column:	Dionex IonPac CS12A (0.4 × 250 mm)	Peaks:	1. Lithium	0.5 mg/L
Eluent:	20 mM Methanseulfonic acid		2. Sodium	2.0
Eluent Source:	Thermo Scientific Dionex EGC-MSA (Capillary) Cartridge		3. Ammonium	2.5
			4. Potassium	5.0
Temperature:	30 °C		5. Magnesium	2.5
Flow Rate:	10 µL/min		6. Calcium	5.0
Inj. Volume:	0.4 µL			
Detection:	Suppressed conductivity, Dionex CCES 300 Suppressor, Dionex AutoSuppression device, recycle mode			

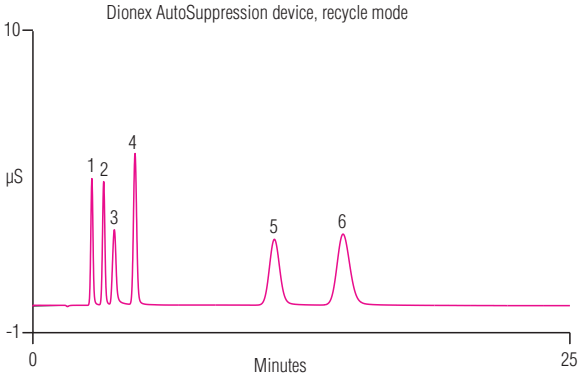


Figure 21. Separation of six common cations using a Dionex IonPac CS12A capillary column.

Column:	Dionex IonPac AS19 (0.4 mm × 250 mm)	Peaks:	1. Fluoride	12. Malonate
Eluent:	10 mM KOH (0 to 10 min), 10 to 52 mM KOH (10 to 42 min), 52 to 70 mM (42 to 45 min), 10 mM (45 to 50 min)		2. Acetate	13. Selenate
			3. Formate	14. Oxalate
			4. Chlorite	15. Iodide
			5. Bromate	16. Thiosulfate
Eluent Source:	Dionex EGC-KOH (Capillary) Cartridge		6. Chloride	17. Chromate
			7. Nitrite	18. Chromate
Temperature:	30 °C		8. Chlorate	19. Fumarate
Flow Rate:	10 µL/min		9. Bromide	20. Arsenate
Inj. Volume:	0.4 µL		10. Nitrate	21. Thiocyanate
Detection:	Suppressed conductivity, Dionex ACES 300 Suppressor recyle mode		11. Sulfate	22. Perchlorate

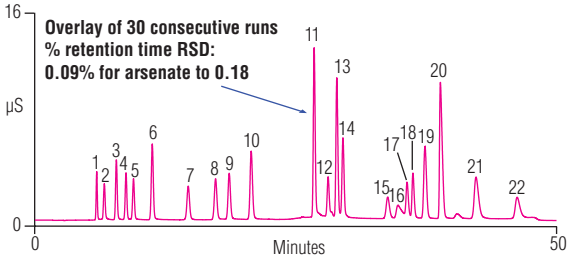
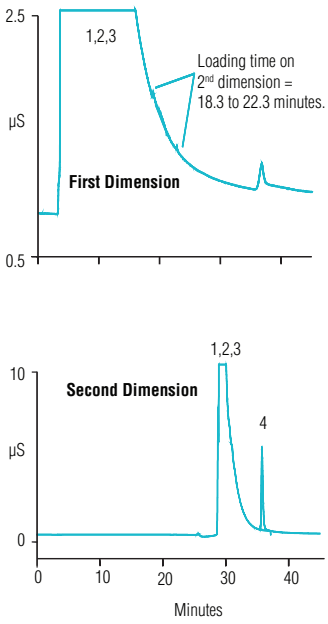


Figure 22. Separation of 22 anions on a Dionex IonPac AS19 capillary column.



First Dimension

Column:	Dionex IonPac AG20/AS20 (2 × 250 mm)		
Eluent Source:	Dionex EGC III KOH Cartridge		
Eluent:	Potassium hydroxide 0-30 min, 35 mM 30-40 min, 60 mM 40-45 min, 35 mM		
Flow Rate:	0.25 mL/min		
Inj. Volume:	500 mL		
Temperature:	30 °C		
Detection:	Suppressed conductivity, Dionex ASRS 300 suppressor, external water mode		
Peaks:	1. Chloride	1000	mg/L (ppm)
	2. Carbonate	1000	
	3. Sulfate	1000	
	4. Perchlorate	—	

Second Dimension

Column:	Dionex IonPac AG16/AS16 (0.4 × 250 mm)		
Eluent Source:	Dionex EGC KOH (Capillary) Cartridge		
Eluent:	Potassium hydroxide 65 mM		
Flow Rate:	0.010 mL/min		
Inj. Volume:	1000 mL		
Temperature:	30 °C		
Concentrator:	Thermo Scientific™ Dionex™ IonSwift™ MAC-200		
Detection:	Suppressed conductivity, Dionex ACES 300 suppressor, external water mode		
Peaks:	1. Chloride	—	mg/L (ppm)
	2. Carbonate	—	
	3. Sulfate	—	
	4. Perchlorate	0.2	

Figure 23. 2D-IC Analysis of Trace Perchlorate Using the Dionex IonPac AS20 microbore column and the Dionex IonPac AS16 capillary column.

Ordering Information

In the U.S., call (800) 346-6390 or contact the Thermo Fisher Scientific Regional Office nearest you. Outside the U.S., order through your local Thermo Fisher Scientific office or distributor. Refer to the following part numbers.

Dionex ERS 500 Suppressors

Dionex ERS 500 Electrolytically Regenerated Suppressors	Part Number
Dionex AERS 500 (2 mm) Anion Electrolytically Regenerated Suppressor For use with 2 and 3 mm microbore anion-exchange columns. Replaces the Dionex ASRS 300 (P/N 064555), ASRS ULTRA II (P/N 061562), ASRS ULTRA (P/N 053947), ASRS I (P/N 043187), and the ASRS II (P/N 046078) suppressors.	082541
Dionex AERS 500 (4 mm) Anion Electrolytically Regenerated Suppressor For use with 4 and 5 mm anion-exchange columns. Replaces the Dionex ASRS 300 (P/N 064554), ASRS ULTRA II (P/N 061561), ASRS (P/N 053946), ASRS I (P/N 043189), and the ASRS II (P/N 046081) suppressors.	082540
Dionex CERS 500 (2 mm) Cation Electrolytically Regenerated Suppressor For use with 2 and 3 mm microbore cation-exchange columns. Replaces the Dionex CSRS 300 (P/N 046557), CSRS ULTRA II (P/N 061564), CSRS ULTRA (P/N 053949), CSRS I (P/N 043188), and the CSRS II (P/N 046080) suppressors.	082543
Dionex CERS 500 (4 mm) Cation Electrolytically Regenerated Suppressor For use with 4 mm cation-exchange columns. Replaces the Dionex CSRS 300 (P/N 064556), CSRS ULTRA II (P/N 061563), CSRS ULTRA (P/N 053948), CSRS I (P/N 043190), and the CSRS II (P/N 046079) suppressors.	082542
Dionex AERS 500 Carbonate (4 mm) Anion Electrolytically Regenerated Suppressor for Carbonate Eluents For use with 4 and 5 mm anion-exchange columns and carbonate or carbonate/bicarbonate eluents.	085029
Dionex AERS 500 Carbonate (2 mm) Anion Electrolytically Regenerated Suppressor for Carbonate Eluents For use with 2 and 3 mm anion-exchange columns and carbonate or carbonate/bicarbonate eluents.	085028
Dionex AERS 500e (4 mm) Anion Electrolytically Regenerated Suppressor for External Water Mode For use with 4 and 5 mm anion-exchange columns when external water mode is used.	SP6952
Dionex AERS 500e (2 mm) Anion Electrolytically Regenerated Suppressor for External Water Mode For use with 2 and 3 mm anion-exchange columns when external water mode is used.	SP6953
Dionex CERS 500e (4 mm) Cation Electrolytically Regenerated Suppressor for External Water Mode For use with 4 and 5 mm cation-exchange columns when external water mode is used.	SP6954
Dionex AERS 500e (2 mm) Cation Electrolytically Regenerated Suppressor for External Water Mode For use with 2 and 3 mm cation-exchange columns when external water mode is used.	SP6955
Dionex ERS 500 Suppressors for Mobile Phase Ion Chromatography (MPIC) For Anion MPIC (NS1 ion-pairing suppressor): Order the Dionex AERS 500 suppressor. Note: The ACRS-ICE 500 Chemically Regenerated Anion MicroMembrane Suppressor cannot be used for anion Dionex MPIC Mobile Phase IC. For Cation MPIC (NS1 ion-pairing suppressor): Order the Dionex CERS 500 suppressor.	

Dionex ERS 500 Suppressor Spare Parts	Part Number
Backpressure loop, 1 each	
For 5 and 4 mm columns	045877
For 2 and 3 mm columns	045878
Syringe, 1.0 mL, disposable For flushing the Dionex ERS 500 suppressor at startup.	016388
Syringe adapter, female Luer lock,	
1/4-28 threads (for regenerant chamber)	024305
10–32 threads (for eluent chamber)	046888

Optional Kits	Part Number
External Regenerant Installation Kit For Dionex ERS 500 suppressor operation in the external water mode, chemical regeneration mode, and MPIC chemical regeneration mode. Kit contains a 4 L bottle, one pressure regulator (0–30 psi/0–210 kPa), and appropriate tubing and fittings for installation of one Dionex ERS 500 suppressor with pneumatic delivery of regenerant.	038018
Dionex ERS Gas-Assisted Regeneration Kit Required for the initial installation of the gas-assisted recycle mode or the gas-assisted external water mode. Contains one pressure regulator (0–30 psi/0–210 kPa), 1/4-28 mixing tee, one check valve, and all tubing and fittings required to install the Dionex ERS 500 suppressor for operation in these modes.	056886
Dionex SRD-10 Suppressor Regenerant Detector The Dionex SRD-10 is a stand-alone device that monitors liquid flow to a suppressor's regenerant chambers and automatically disables the eluent pump if flow is disrupted.	074395
Dionex SCC-10 Suppressor Current Controller The Dionex SCC-10 is an external adapter designed for use with legacy instruments that only offer four settings for current. The Dionex SCC-10 is powered from the existing suppressor current supply, and can output 12 discreet current settings from 10 mA to 250 mA.	074053

Dionex CRS 500 Chemically Regenerated Suppressors	Part Number
Dionex ACRS 500 (2 mm) Chemically Regenerated Suppressor For use with 2 and 3 mm anion-exchange columns. Replaces the 2 mm Dionex AMMS 300 (P/N 064559) and the AMMS III (P/N 056751) Suppressors.	085091
Dionex ACRS 500 (4 mm) Chemically Regenerated Suppressor For use with 4 and 5 mm anion-exchange columns. Replaces the 4 mm Dionex AMMS 300 (P/N 064558), and the AMMS III (P/N 056750) Suppressors.	085090
Dionex CCRS 500 (2 mm) Cation Chemically Regenerated Suppressor For use with 2 and 3 mm cation-exchange columns. Replaces the 2 mm Dionex CMMS 300 (P/N 064561), and the CMMS III (P/N 056753) Suppressors.	085093
Dionex CCRS 500 (4 mm) Cation Chemically Regenerated Suppressor For use with 4 and 5 mm cation-exchange columns. Replaces the 4 mm Dionex CMMS (P/N 064560) and the CMMS III (P/N 056752) Suppressors.	085092

Chemical Regeneration Dionex CRS 500 Kits for Displacement	Part Number
Installation Kit for Displacement Chemical Regeneration Operation	
2 L DCR Kit	056882
4 L DCR Kit Includes one regenerant reservoir, cap, and all tubing and fittings to install the Dionex CRS 500 in the DCR mode. Order the size that matches the system's eluent bottle size.	056884
2 L Eluent Bottle	044129
4 L Eluent Bottle	039164
Anion Regenerant Concentrate (75 mL of 2.0 N H_2SO_4)	057559
Anion Regenerant Concentrate, 4-pack (Four each of P/N 057559)	057555
Cation Regenerant Concentrate (100 mL of 2.06 M TBAOH)	057561
Cation Regenerant Concentrate, 4-pack (Four each of P/N 057561)	057556

Chemical Regenerant Kits and Regenerant Concentrates	Part Number
External Regenerant Installation Kit For Dionex CRS 500 operation in the chemical suppression mode. Includes one 4 L pressurizable regenerant reservoir, one pressure regulator (0–30 psi/0–210 kPa), and all tubing and fittings required to install the Dionex CRS 500 for operation in this mode.	038018
Anion Regenerant Concentrate (50 mL of 0.25 N H_2SO_4)	039601
Anion Regenerant Concentrate, 4-pack (Four each of P/N 039601)	037164
Cation Regenerant Concentrate (500 mL of 0.10 N TBAOH)	039602

Dionex CRS 500 Suppressor Spare Parts	Part Number
Backpressure loop, 1 each	
For 4 and 5 mm system	045877
For 2 and 3 mm systems	045878
Syringe, 1.0 mL, disposable For flushing the Dionex CRS 500 suppressor at startup.	016388
Syringe Adapter, female Luer lock, 1/4-28 threads	024305

Dionex CES 300 Suppressors

Dionex CES 300 Capillary Electrolytic Suppressors	Part Number
Dionex ACES 300 Anion Capillary Electrolytic Suppressor For use with anion-exchange capillary columns.	072052
Dionex CCES 300 Cation Capillary Electrolytic Suppressor For use with cation-exchange capillary columns.	072053

Optional Kits	Part Number
Cation Regenerant Concentrate (100 mL of 2.06 M TBAOH)	057561
Cation Regenerant Concentrate, 4-pack (Four each of P/N 057561)	057556

Chemical Regenerant Kits and Regenerant Concentrates	Part Number
External Regenerant Installation Kit For Dionex CES 300 suppressor operation in the external water mode. Kit contains a 4 L bottle, one pressure regulator (0–30 psi/0–210 kPa), and appropriate tubing and fittings for installation of one Dionex CES 300 suppressor with pneumatic delivery of external water.	038018

Dionex AES Atlas Suppressors

Dionex AES Atlas Electrolytic Suppressors	Part Number
Dionex AAES Atlas Anions Electrolytic Suppressor The Dionex AAES Atlas anion suppressor can be used for carbonate/bicarbonate eluents up to 25 mN at 1.0 mL/min. One dimension for 5, 4, 3, and 2 mm columns. Requires Chromeleon CDS, version 6.2 or higher with an ED50A, CD25A, or IC25A for direct control. Older systems (Dionex DX-500 with ED50 or CD25; DX-320 with IC25; and DX-120) require a Dionex RFC-10 or RFC-30 Reagent-Free Controller. The Dionex DX-120 also requires an DX-120 Adapter Cable listed below.	056116
Dionex CAES Atlas Cation Electrolytic Suppressor The Dionex CAES Atlas cation suppressor can be used for methanesulfonic acid or sulfuric acid eluents up to 25 mN at 1.0 mL/min. One dimension for 5, 4, 3, and 2 mm columns. Requires Chromeleon CDS, version 6.2 or higher with an ED50A, CD25A, or IC25A for direct control. Older systems (Dionex DX-500 with ED50 or CD25; DX-320 with IC25; and DX-120) require a Dionex RFC-10 or RFC-30 Reagent-Free Controller. The Dionex DX-120 also requires an Dionex DX-120 Adapter Cable listed below.	056118

Dionex RFC-10, RFC-30 Suppressor Controllers	Part Number
Dionex RFC-30 Reagent-Free Controller with Dionex EGC II KOH Cartridge and Dionex CR-ATC Continuously Regenerated Anion Trap Column	060667
Dionex RFC-30 Reagent-Free Controller with Dionex EGC II MSA Cartridge and Dionex CR-CTC II Continuously Regenerated Cation Trap Column	060668
Dionex RFC-10 Suppressor Controller	060335
Dionex DX-120 Adapter Cable for RFC-10 or RFC-30 This adapter cable is required to interface the Dionex RFC-10 or RFC-30 to the Dionex DX-120.	057861

Dionex AES Atlas Suppressor Spare Parts	Part Number
Backpressure loop, I ea. For 5 and 4 mm systems For 3 and 2 mm systems	 045877 045878
Syringe, 1.0 mL, disposable For flushing the Dionex AES Atlas suppressor at startup.	016388
Syringe adapter, female Luer lock, 1/4-28 threads (for regenerant chamber)	024305
Syringe adapter, female Luer lock, 10–32 threads (for eluent chamber)	046888

Optional Kits	Part Number
External Regenerant Installation Kit For Dionex AES Atlas suppressor operation in the external water mode. Kit contains a 4 L bottle, one pressure regulator (0–30 psi/0–210 kPa), and appropriate tubing and fittings for installation of one Dionex AES Atlas Suppressor with pneumatic delivery of regenerant.	038018
Trap Column and Suppressor Regeneration Kit The Trap Column and Suppressor Regeneration Kit allow off-line regeneration of trap columns and cleanup of suppressors. The kit includes a 1 L plastic bottle, pressure regulator, 2-way valve, and all of the fittings and tubing required for operation.	059659

Dionex ACRS-ICE 500 Suppressor

Dionex ACRS-ICE 500 Suppressor	Part Number
ACRS-ICE 500 (9 mm) Anion Chemically Regenerated Suppressor for ICE Eluents. Replaces the Dionex AMMS-ICE 300 (P/N 067527) suppressor.	084715
ACRS-ICE 500 (4 mm) Anion Chemically Regenerated Suppressor for ICE Eluents	084714

Regenerant Kits and Reagent	Part Number
External Regenerant Installation Kit Required for first time installation. Includes one 4 L pressurizable regenerant reservoir, one pressure regulator (0–30 psi/0–210 kPa), and all tubing and fittings required to install regenerant delivery to the Dionex AMMS-ICE 300 suppressor.	038018
Dionex ACRS-ICE 500 Cation Regenerant Solution 500 mL of 0.1 M tetrabutylammonium hydroxide (TBAOH)	039602

Dionex ACRS-ICE 500 Suppressor Spare Parts	Part Number
Backpressure loop, 1 each for 4 mm system	045877
Syringe, 1.0 mL, disposable For flushing the Dionex ACRS-ICE 500 suppressor at startup.	016388

Dionex ERS 500 Suppressor Controller

Dionex ERS 500 Suppressor Controllers	Part Number
Dionex RFC-30 Reagent-Free Controller with Dionex EGC III KOH Cartridge and Dionex CR-ATC 500 Continuously Regenerated Anion Trap Column	060667
Dionex RFC-30 Reagent-Free Controller with Dionex EGC III MSA Cartridge and Dionex CR-CTC 500 Continuously Regenerated Cation Trap	060668
Dionex RFC-10 Suppressor Controller	060335
Dionex DX-120 Adapter Cable Note: Earlier Dionex systems can accommodate Dionex ERS 500 or Dionex AES Atlas suppressor operation with Dionex SCR-1 and SC-20 stand-alone controller modules. These modules are now discontinued and replaced by the Dionex RFC-10 or Dionex RFC-30.	057861

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