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suppressors

Eluent Suppressors for Ion Chromatography



Dionex introduced suppression 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 compared with nonsuppressed IC*

Now sold under the Thermo Scientific brand

Thermo SCIENTIFIC

Dionex offers 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 Self-Regenerating Suppressor® (SRS® 300) is used for electrolytically regenerated suppression of IC applications requiring high capacity, low noise, and fast startup. SRS 300 suppressors are recommended for isocratic or gradient use with hydroxide eluents or methanesulfonic acid and sulfuric acid eluents. These suppressors are a fundamental component of a Reagent-Free™ IC (RFIC™) system.
- The Capillary Electrolytic Suppressor (CES™ 300) is used for electrolytically regenerated suppression of IC applications at a capillary scale (5–30 µL/min). CES 300 suppressors are recommended for isocratic or gradient use with hydroxide or methanesulfonic acid eluents. These suppressors are a fundamental part of an RFIC-EG™ capillary system.
- MicroMembrane™ Suppressors (MMS™ 300) are used for chemically regenerated suppression of ion chromatography eluents requiring high capacity, solvents, and/or very low noise.
- The Anion Ion-Exclusion Suppressor (AMMS®-ICE 300) is used for chemically regenerated suppression of ion-exclusion chromatography.
- The Atlas® Electrolytic Suppressor (AES®) is recommended for isocratic anion-exchange separations with carbonate eluents, or isocratic cation-exchange separations with low concentrations of methanesulfonic acid or sulfuric acid eluents.

DIONEX

Passion. Power. Productivity.

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 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, and acquire and process the data.

Since the introduction of ion chromatography in 1975, Dionex has worked to improve suppressor technology to provide better sensitivity and consistency for the analysis of a wide variety of compounds. For more detail on the evolution of suppressor technology, see the brochure *Advances in Chemical Suppression* (Dionex LPN 1855), available at www.dionex.com.

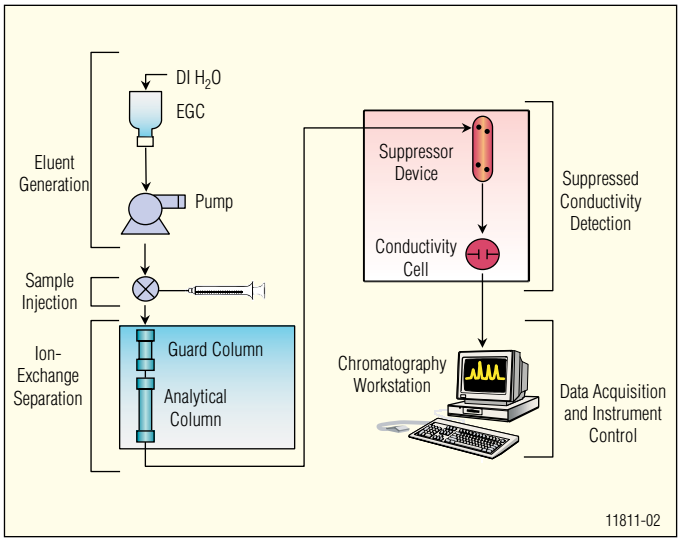


Figure 1. Ion chromatograph using suppressed conductivity detection.

The Suppressor Advantage

Figure 2 shows an example of suppression used for anion chromatography. An Anion Self-Regenerating Suppressor (ASRS® 300), Anion Atlas Electrolytic Suppressor (AAES), or the Anion Capillary Electrolytic Suppressor (ACES™ 300) removes potassium or sodium ions (and other 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 compared with the hydroxide or carbonate eluent. Analyte conductivity is enhanced because the analyte anions associate with the highly conductive hydronium ions.

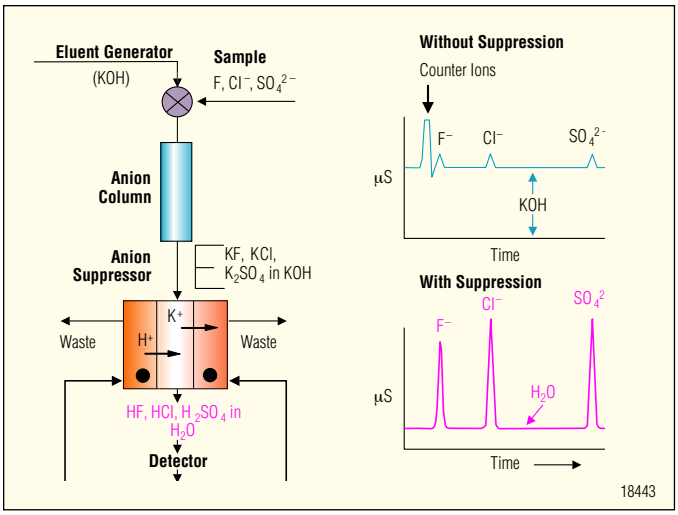


Figure 2. Diagram of eluent suppression for anion chromatography.

Performance Comparison

The SRS and MMS are high-capacity suppressors capable of suppressing eluents for all IC separations, including gradients. The CES is a capillary scale suppressor capable of suppressing all eluents at a capillary scale. The AES provides very low noise for applications using carbonate/bicarbonate eluents for anion exchange, but has a lower suppression capacity. The AES can also be used with low concentrations of methanesulfonic acid and sulfuric acid eluents for cation exchange.

The MMS 300 is recommended for the best long-term performance when using solvent in the eluent. When using the SRS or CES, low levels of solvent in the eluent are acceptable only in the external water mode. Higher levels of solvents (> 40%) in the eluent require the MMS suppressor. The AES suppressors are designed for aqueous eluents only.

The SRS and MMS are available in two formats, 4 and 2 mm. The 4 mm suppressors are used with 5 and 4 mm columns. The 2 mm suppressors are used with 2 and 3 mm columns. The AES suppressor comes in one format that is used for all column formats (5, 4, 3, and 2 mm). The CES 300 suppressor comes in one format that is used for all capillary scale formats (0.2–0.4 mm)

The internal void volume of the suppressor can affect the efficiency of a separation. Although the void volume of the AES suppressor has been reduced to provide excellent peak efficiency for 4 and 3 mm columns, a slight decrease in efficiency, compared to the 2 mm SRS or MMS, may be noticed for early-eluting peaks with 2 mm columns. To maintain maximum peak efficiencies when using 2 mm columns, the 2 mm SRS or 2 mm MMS should be used.

SUPPRESSOR	REGENERATION REQUIREMENTS	OPERATIONAL REQUIREMENTS	SUPPRESSION CAPACITY [mN] × [mL/min]	BENEFITS	APPLICATIONS	
					Anions	**Cations**
SRS 300 2 and 4 mm formats < 15 and < 50 µL void volume	Electrolytic or chemical	All existing systems except ICS-900.	*Anion (ASRS):* 4 mm: 200 µeq/min 2 mm: 50 µeq/min *Cation (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	- Hydroxide and carbonate/bicarbonate eluents - For low-level solvent applications use external water or chemical regeneration - Columns: all anion exchange columns	- Methanesulfonic acid and sulfuric acid eluents - For low-level solvent applications, external water or chemical regeneration - For eluents containing chloride or nitrate, chemical regeneration. - Columns: all cation exchange columns except SCS-1
CES 300 < 1.5 µL void volume	Electrolytic	Requires Capillary IC system (ICS-5000)	*Anion (ACES™):* 2 µeq/min *Cation (CCES™):* 1.5 µeq/min	- Compatible with capillary flow rates - Versatility - Ease of use - Low noise - Electrolytic regeneration	- Hydroxide eluents - For low-level solvent applications use external water or chemical regeneration - All capillary anion-exchange columns - Ioscratic and gradient eluents	- Methanesulfonic acid acid eluents - For low-level solvent applications, use external water or chemical regeneration - All capillary cation-exchange columns - Isocratic and gradient eluents
MMS 300 2 and 4 mm formats < 15 and < 50 µL void volume	Chemical	All existing systems. Required for ICS-900.	*Anion (AMMS®)*: 4 mm: 150 µeq/min 2 mm: 37.5 µeq/min *Cation (*CMMS®): 4 mm: 150 µeq/min 2 mm: 37.5 µeq/min	- Solvent compatiblity - Lowest noise - Fastest start-up	- 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

SUPPRESSOR	REGENERATION REQUIREMENTS	OPERATIONAL REQUIREMENTS	SUPPRESSION CAPACITY [mN] × [mL/min]	BENEFITS	APPLICATIONS	
					Anions	**Cations**
AMMS-ICE 300 2 and 4 mm formats < 15 and < 50 µL void volume	Chemical	All existing systems.		- Recommended for ion-exclusion chromatography	- Any IonPac ICE column set with suppressed conductivity detection - Useful for IC of weak acids	
AES One format for 2, 3, and 4 mm columns < 35 µL void volume	Electrolytic	Requires Chromeleon® 6.2 and above and Series "A" detectors; RFC-10 or RFC-30 Controller for other systems	*Anion:* AAES: 25 µeq/min *Cation:* CAES: 25 µeq/min	- Ease of use - Low noise for carbonate/bicarbonate	- Carbonate/bicarbonate eluents - No solvents - Columns: AS4, AS4A, AS4A-SC, AS9-SC, AS9-HC, AS12A, AS14, AS14A, AS22, AS23	- Use with methanesulfonic acid and sulfuric acid eluents - No solvents - Columns: CS12, CS12A, CS14, CS17, CS18

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**
ASRS 300	15–35 ˚C	30–60 psi	3 mL/min (4 mm), 1 mL/min (2 mm)	< 40% solvents in EWM[3]	5 mL/min (4 mm) 2 mL/min (2 mm)	Recycle, EWM[3], chemical (recycle recommended)[4]	300 mA for 4 mm, 100 mA for 2 mm
CSRS 300	15–40 ˚C	30–60 psi	3 mL/min (4 mm), 0.75 mL/min (2 mm)	< 40% solvents in EWM[3]	5 mL/min (4 mm) 2 mL/min (2 mm)	Recycle, EWM[3], chemical (recycle recommended)[4]	300 mA for 4 mm, 100 mA for 2 mm
ACES 300	15 ˚C[6]	20–100 psi	0.030 mL/min	< 40% solvent in EWM[3]	0.100 mL/min	Recycle, EWM[3] (recycle recommended)[4]	20 mA (10 mA recommended for most applications)
CCES 300	15 ˚C[6]	20–100 psi	0.030 mL/min	< 40% solvent in EWM[3]	0.100 mL/min	Recycle, EWM[3] (recycle recommended)[4]	20 mA (10 mA recommended for most applications)
CMMS 300	15–40 ˚C	40 psi	3 mL/min (4 mm), 0.75 mL/min (2 mm)	100% solvent compatibile	10 mL/min (4 mm) 5 mL/min 2 mm	Chemical, DCR mode	n/a
AMMS 300	15–40 ˚C	40 psi	3 mL/min (4 mm), 0.75 mL/min (2 mm)	100% solvent compatibile	10 mL/min (4 mm) 5 mL/min (2 mm)	Chemical, DCR mode	n/a
AMMS-ICE 300	15–40 ˚C	40 psi	3 mL/min	90% solvent compatibile[5]	10 mL/min	Chemical, DCR mode	n/a
AAES	15–40 ˚C	20–100 psi	3 mL/min	0% solvents (no solvents)	5 mL/min	Recycle and external water	150 mA
CAES	15–40 ˚C	20–100 psi	3 mL/min	0% solvents (no solvents)	5 mL/min	Recycle and external water	150 mA

[1]When installed outside the heated column enclosure, all suppressors excluding CES 300 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]ACES 300 and CCES 300 require 15 ˚C for recycled eluent mode of operation.

Noise Comparison

The SRS 300 offers very low noise for hydroxide, carbonate, and MSA eluents, whereas the anion AES provides the lowest noise for carbonate eluent suppression. The MMS 300 produces the lowest overall noise because it uses non-electrolytic chemical regeneration. Low noise levels translate into lower method detection limits.

The CES 300 suppressors offer similar noise levels as the SRS 300 suppressors.

Self-Regenerating Suppressor (SRS 300) for IC Analysis

The SRS 300 Self-Regenerating Suppressor enhances analyte conductivity while suppressing eluent conductivity. This AutoSuppression® device provides significant improvement in analyte detection limits. The ions required for eluent suppression are generated by the continuous electrolysis of water. Therefore, the SRS 300 delivers low backgrounds and low noise levels without the need for manually prepared regenerant solutions or off-line regeneration of the suppressor.

SRS 300 Versatility

The SRS 300 is designed to operate with the entire line of Dionex ion chromatography 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 SRS 300 is the basis of Reagent-Free™ IC with Eluent Generation (RFIC-EG™) system technology. The combination of SRS 300 eluent regeneration with eluent purification columns is the basis of Reagent-Free IC systems with Eluent Regeneration (RFIC-ER™) system technology.

PHYSICAL SPECIFICATIONS

Suppressor	Dimensions	Void Volume	Weight
SRS 300	16.8 × 4.5 × 5.2 cm (6.6 × 1.8 × 2.1 in.)	4 mm: < 50 µL 2 mm: < 15 µL	630 g (1.4 lb)
MMS 300	16.8 × 4.5 × 5.2 cm (6.6 × 1.8 × 2.1 in.)	4 mm: < 50 µL 2 mm: < 15 µL	630 g (1.4 lb)
AMMS-ICE 300	16.8 × 4.5 × 5.2 cm (6.6 × 1.8 × 2.1 in.)	< 50 µL	630 g (1.4 lb)
AES	4.9 × 4.4 × 10.2 cm (1.9 × 1.8 × 4.0 in.)	< 35 µL	120 g (0.3 lb)
CES 300	10.3 × 3.1 × 10.3 cm	< 1.5 µL	150 g (0.3 lb)

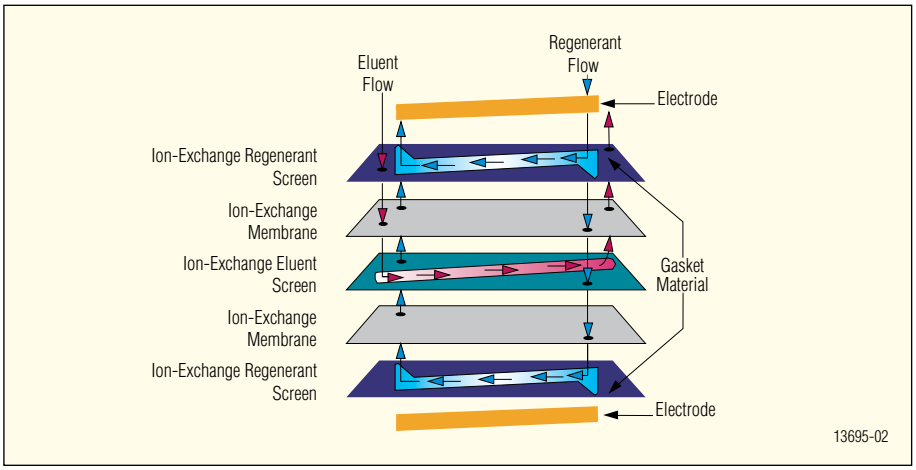


Figure 3. Internal construction of the SRS 300.

SRS MODES OF OPERATION

Mode	Benefit	Application
Recycle	Easy to use	Aqueous eluents
Gas-Assisted Recycle*	Easy to use Low noise	Aqueous eluents 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
Chemical Regeneration	Very low noise Durable	Eluents containing solvents, high chloride, or nitrate
Mobile Phase Ion Chromatography (MPIC®)	Low noise	Anion ion pairing and ion suppression Cation ion pairing and ion suppression

*Requires P/N 056886.

SRS 300 System Control

The software and hardware control options for the SRS 300 allow use of the optimum current for specific applications, extending suppressor life and improving recoveries of certain analytes, such as magnesium.

The ICS-1000, ICS-1100, ICS-1500, ICS-1600, ICS-2000, ICS-2100, ICS-2500, ICS-3000, and ICS-5000 series systems include software and hardware to control the SRS 300 suppressor.

For other systems, the ED50A or CD25A with Chromeleon 6.2 or higher can control the current to the SRS in 1 mA increments. For older units, the RFC-10 Suppressor Controller can also control the current to the SRS in 1 mA increments. (See table at right for system requirements.)

SRS 300 for Maximum Flexibility

The SRS 300 is designed for maximum flexibility. The SRS 300 does not restrict the user to one or two columns and eluents. This suppressor is compatible with the full range of Dionex 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

SYSTEM CONTROL OF SRS ELECTROLYTIC SUPPRESSORS

IC System	SRS Hardware Control Requirements	SRS Software Control Requirements
ICS-1000, 1100, 1500, 1600, 2000, 2100, 2500, 3000, and -5000	Integrated, no additional hardware required	Chromeleon 6.2 or higher
DX-600 or BioLC with ED50A or CD25A detector	Integrated, no additional hardware required	Chromeleon 6.2 or higher
DX-320 with IC25A detector	Integrated, no additional hardware required	Chromeleon 6.2 or higher
DX-600 or BioLC with ED50 or CD20/25 detector	RFC-10 or RFC 30 Reagent-Free Controller[1]	No software required for RFC[2] control
DX-500 with ED40/50 or CD20/25 detector	RFC-10 or RFC 30 Reagent-Free Controller[1]	No software required for RFC[2] control
DX-320 with IC25 detector	RFC-10 or RFC 30 Reagent-Free Controller[1]	No software required for RFC[2] control

[1] Needed for optimal current control in 1-mA increments

[2] Chromeleon can be used to control the DX system.

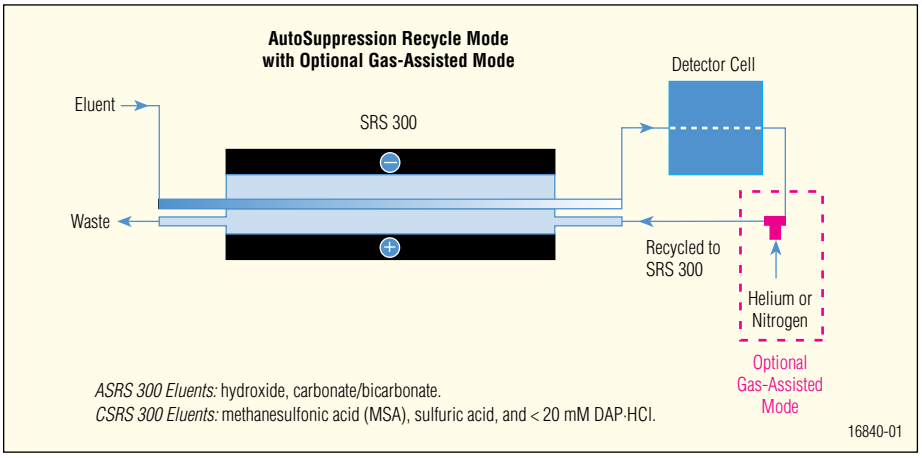


Figure 4. Eluent flow in the AutoSuppression recycle mode with optional gas-assisted mode. In AutoSuppression recycle mode, after the eluent passes through the detector flow cell, it is recycled back to the suppressor to be used as regenerant. With the optional gas-assisted mode, gas is added to the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

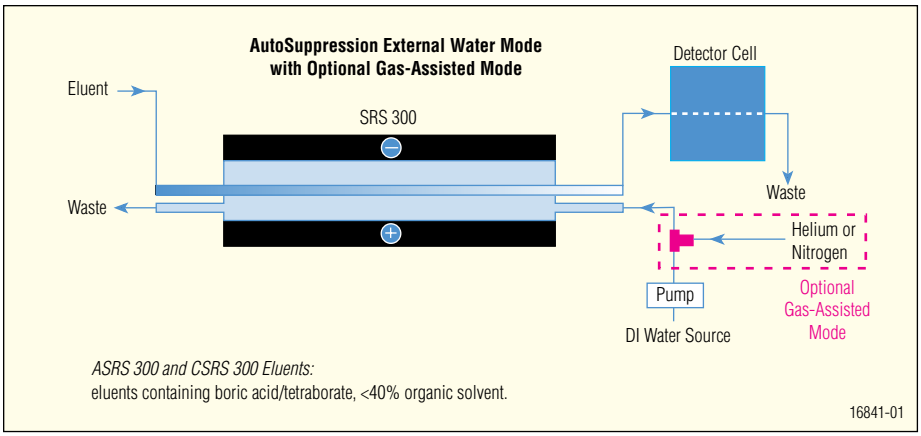


Figure 5. Eluent flow in the AutoSuppression external water mode with optional gas-assisted mode. The deionized water used for the electrolysis process is supplied from a constant pressure source or pump. This mode is ideal for high-sensitivity operation. With the optional gas-assisted mode, gas is added to the external water, which is pumped through the SRS at a consistent flow rate between 2–3 mL/min. This mode decreases the amount of water required for the external water mode.

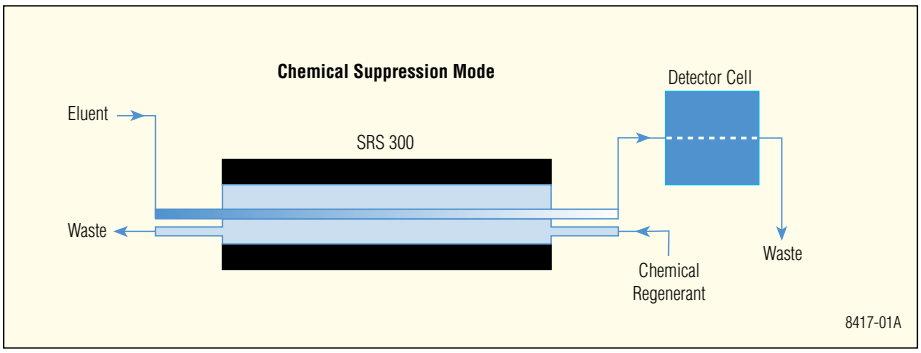


Figure 6. Eluent flow in the chemical suppression mode. The SRS 300 can be operated as a chemical suppressor by using a chemical regenerant. No current is supplied to the SRS. The MPIC suppressor mode uses chemical regeneration for cation ion-pairing and chemical regeneration augmented by electrolytic suppression for anion ion-pairing chromatography.

"Regen In" port of the SRS 300.

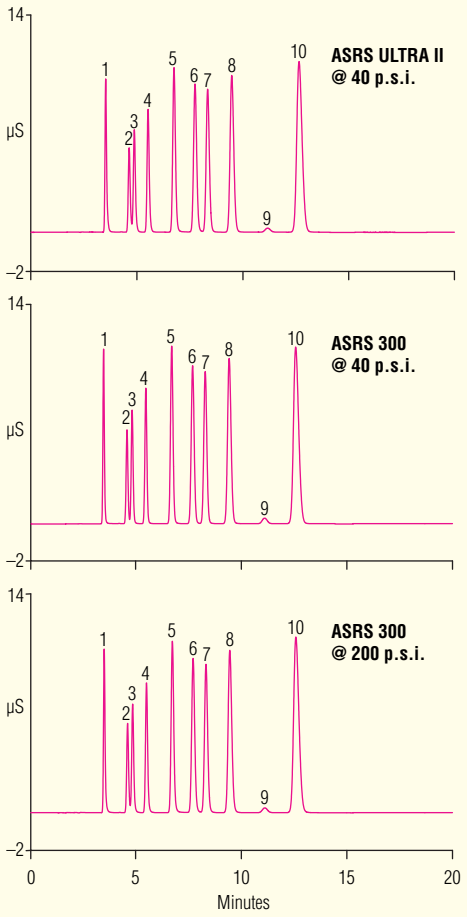
Eluents containing up to 40% organic solvent can be suppressed using the AutoSuppression external water mode. (For best long-term performance when using solvents, use the chemical suppression mode.) In external water mode, the water for electrolysis is supplied from an external source (see Figure 5). This mode also can be enhanced with the use of the gas-assisted mode, which reduces the regenerant flow rate and lowers noise. A peristaltic pump can be used to recirculate water in an infinite loop ensuring the SRS 300 does not go dry and overheat.

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

The SRS 300 should be operated in chemical suppression mode (Figure 6) for eluents containing greater than 40% solvent.

SRS 300 suppressors can also be used to suppress eluents for Mobile Phase Ion Chromatography (MPIC) when the organic solvent content of the

ASRS 300 for Anion-Exchange Chromatography



Column: IonPac AS19 4 mm
Eluent: 20.0 mM KOH
Eluent Source: EGC II KOH
Inj. Volume: 10 µL
Flow Rate: 1 mL/min
Temperature: 30 °C
Detection: Suppressed conductivity, AutoSuppression, recycle mode, 50 mA

Peaks:

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

Peak Efficiency (plates/column)

	SRS ULTRA II at 40 psi	SRS 300 at 40 psi	SRS 300 200 psi
Fluoride	11250	12852	11825
Chlorite	13040	14053	13565
Bromate	13175	14299	13756
Chloride	13817	15487	14562
Nitrite	13204	14512	13721
Chlorate	12987	14167	13464
Bromide	14080	15288	14510
Nitrate	13492	14545	13816
Carbonate	8976	9664	9368
Sulfate	11448	11915	11506

24371

Figure 8. Comparison of the ASRS ULTRA II to the ASRS 300 using an inorganic anion standard. The ASRS 300 out performs the ASRS ULTRA II even at elevated pressures, as shown by the peak efficiency.

CSRS 300 for Cation-Exchange Chromatography

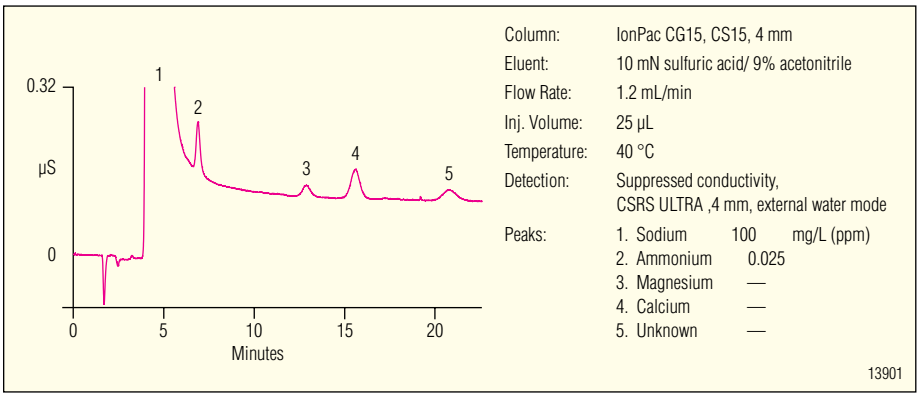


Figure 9. The CSRS ULTRA is used in external water mode to suppress an eluent containing < 40% organic solvent. This separation permits the determination of trace-level ammonium in a wastewater sample containing a high concentration of sodium.

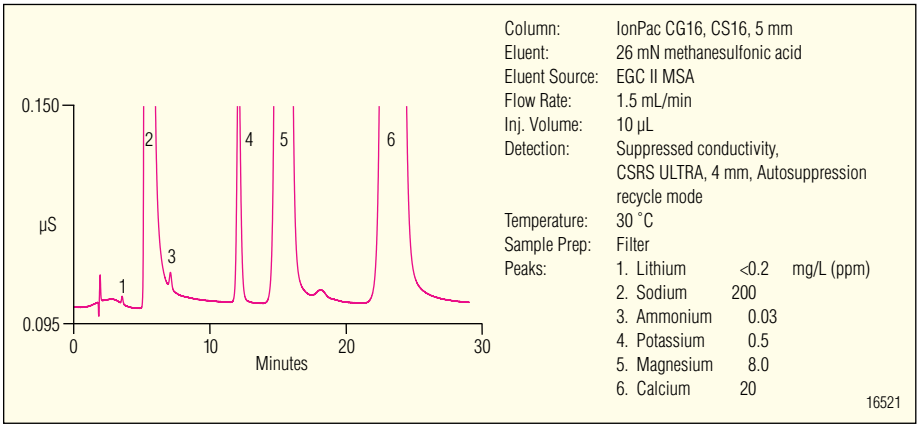


Figure 10. Resolution of trace ammonium from high sodium with the IonPac CS16 column.

SRS 300 for Mobile Phase Ion Chromatography (MPIC)

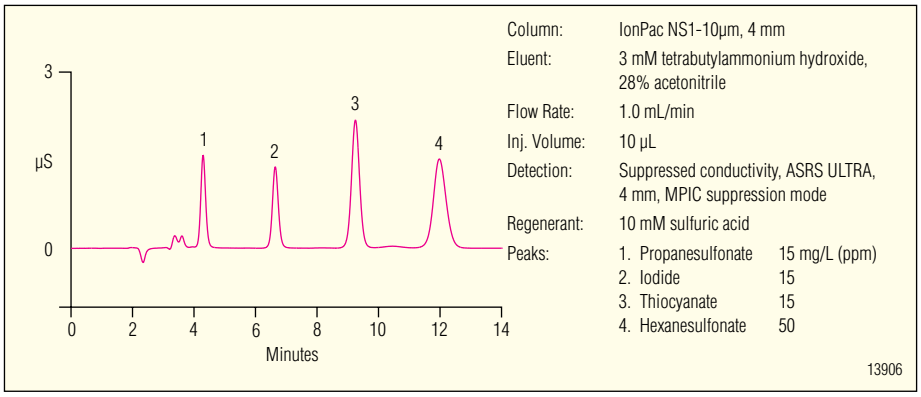


Figure 11. The ASRS ULTRA or CSRS ULTRA can suppress eluents used for MPIC. In this example, the anion MPIC suppression mode uses electrolysis augmented by sulfuric acid regenerant to supply the hydronium ions for suppression. Similarly, the CSRS ULTRA can be used for cation MPIC ion-pairing separations.

MicroMembrane Suppressor (MMS 300) for Chemically Regenerated Eluent Suppression

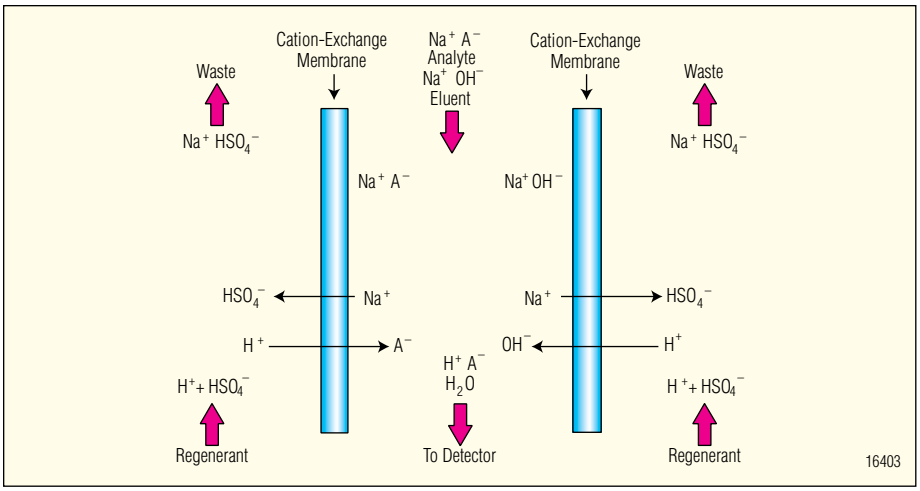
eluent remains below 40%.

MMS 300 suppressors use continuous chemical suppression to enhance analyte conductivities while decreasing eluent conductivity. Using continuous chemical regeneration, the MMS 300 enables direct conductivity detection with ion-exchange applications using isocratic or gradient elution over wide concentration ranges (Figure 12).

MMS suppressor membranes are optimized for low background and noise. New regenerant screens were introduced with the MMS 300, improving regenerant flow, decreasing start-up times, and improving background noise. Figure 13 illustrates the internal design of the MMS 300.

MMS 300 for Sensitive Ion-Exchange Chromatography

When compared to nonsuppressed ion chromatography, chemical suppression increases the linear working range of analytes by several orders of magnitude and improves detection limits for analytes 20–100 times. The MMS 300 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 nonsuppressed applications.



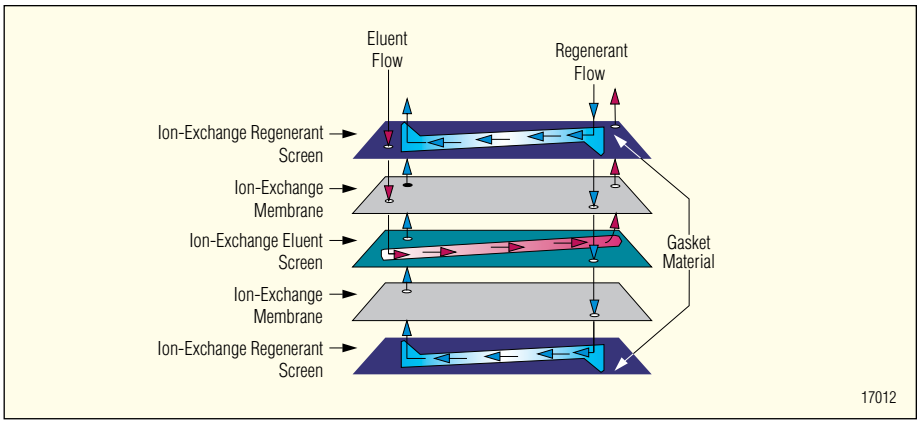


Figure 13. Internal construction of the MMS 300. The MMS 300 is a high-capacity MicroMembrane suppressor.

MMS 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 Regenerant Kit
Peristaltic Pump	Low noise and ease of use	Peristaltic Pump Kit

MMS APPLICATIONS

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 SCS-1

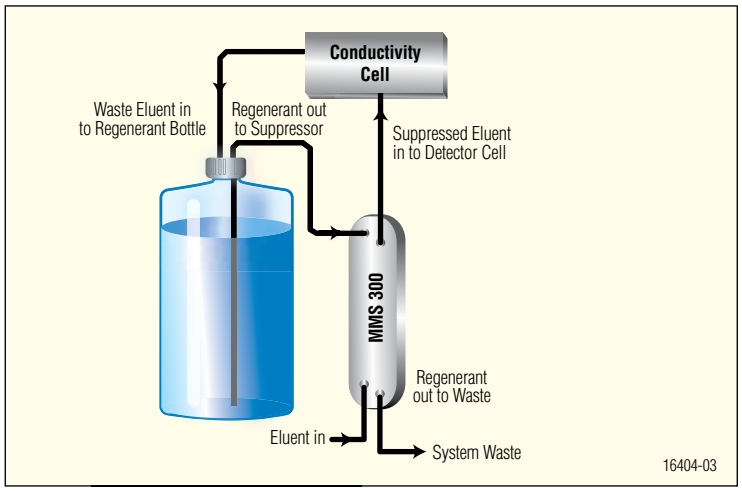


Figure 14. In the DCR mode, the regenerant is displaced by the eluent flow into the regenerant bottle. The regenerant flow is directed to the suppressor's Regen In port. This mode of operation is convenient and economical because the regenerant flow rate is reduced to and controlled by the eluent flow rate.

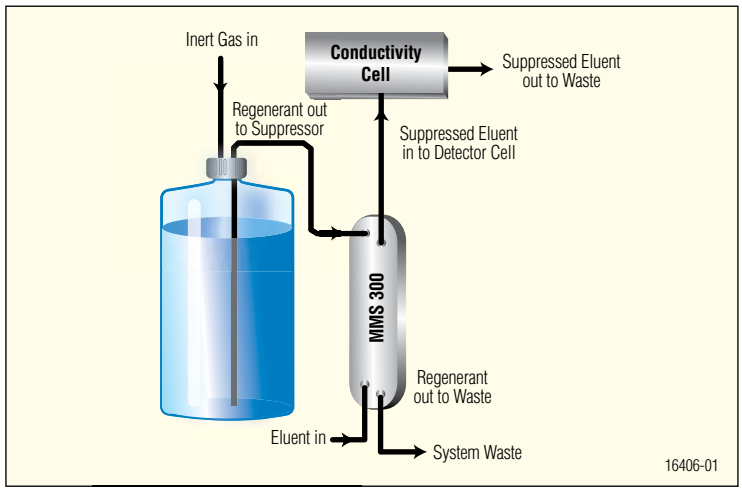


Figure 15. In pressurized bottle mode, the regenerant reservoir is pressurized to deliver the regenerant to the suppressor. The spent regenerant is then collected as waste.

MMS Operational Modes

The MMS 300 can be used in the conventional pressurized bottle mode, the displacement chemical regeneration (DCR) mode, or the new 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 14). 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 MMS 300 suppressor (Figure 15). The pressure is set at 5–10 psi, which delivers the regenerant to the MMS 300 at approximately 5–10 mL/min for 4 mm (5–8 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 MMS 300 at a controlled flow rate. A two-channel pump is available, and can be used to deliver MMS 300 regenerant and CRD 300 regenerant simultaneously.

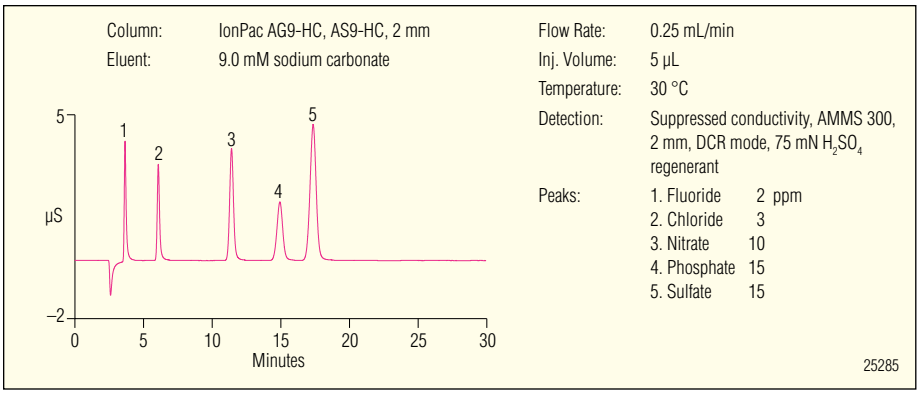


Figure 16. Anion separation using the AS9-HC 2 mm column and the AMMS 300 2 mm suppressor in DCR mode.

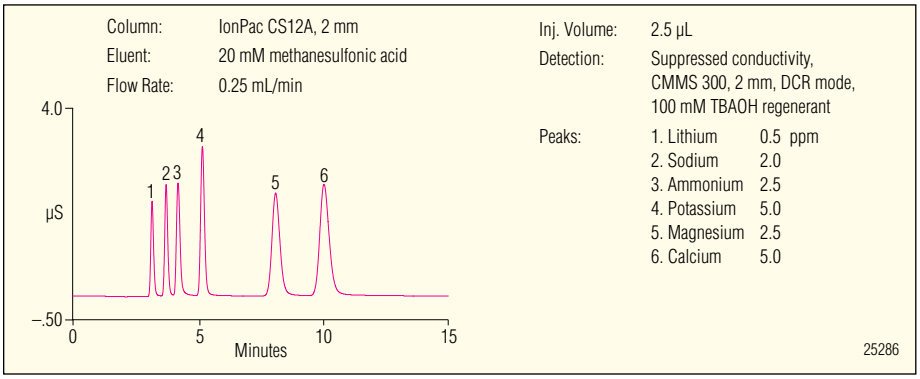


Figure 17. Cation separation using the CS12A 2 mm column and the CMMS 300 2 mm suppressor in DCR mode.

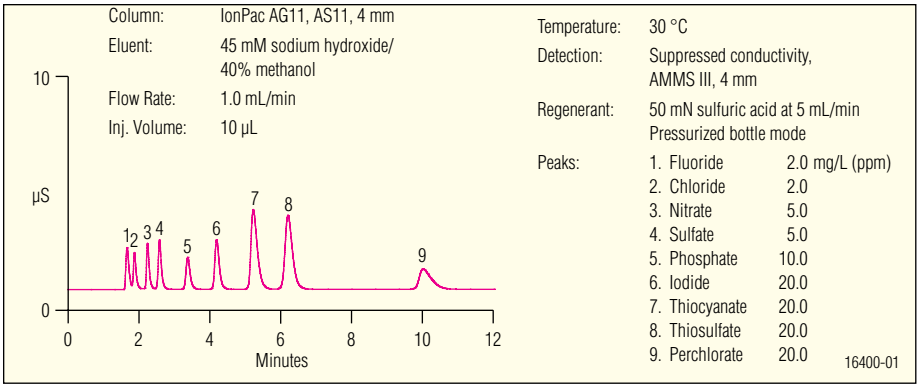


Figure 18. Anion separation with a sodium hydroxide and methanol eluent using the AS11 column and the AMMS III suppressor in pressurized bottle mode.

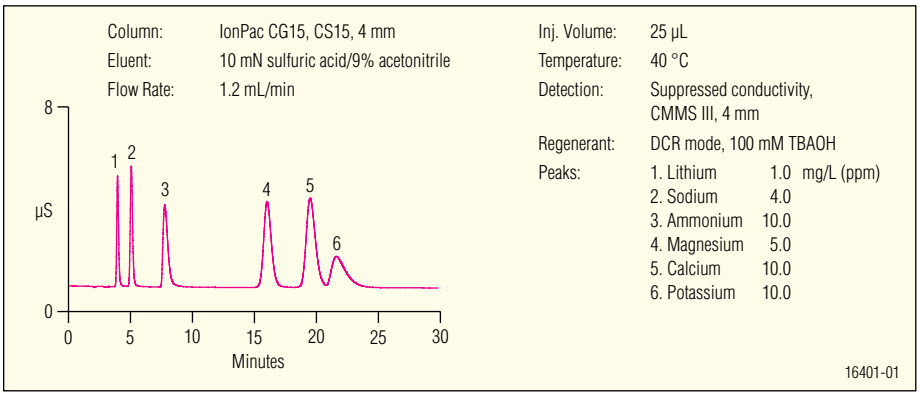


Figure 19. Cation separation with a sulfuric acid and acetonitrile eluent using the CS15 column and the CMMS III suppressor in DCR mode using tetrabutylammonium hydroxide regenerant.

High Efficiency

The MMS 300 is available in both standard-bore (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 MMS 300 format is optimized to maintain the efficiency of ion-exchange separations when using either 2 or 3 mm columns (Figures 16 and 17).

High Suppression Capacity

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

Compatible with HPLC Solvents

The MMS suppressors are compatible with typical HPLC solvents and are recommended for both anion and cation separations when solvents are used in the eluents (Figures 18 and 19). Solvent compatibility allows flexibility when optimizing eluent conditions for more demanding separations.

Anion Ion Exclusion MicroMembrane Suppressor (MMS 300) for Chemically Regenerated Eluent Suppression

The AMMS-ICE 300 is a high-capacity, low-void volume, membrane-based eluent suppressor designed for use with the ion-exclusion and ion-suppression separation modes of ion chromatography. The AMMS-ICE 300 uses chemical suppression to increase analyte ionization and therefore conductivity while decreasing eluent conductivity. The result is a significant improvement in analyte detection limits.

Increased Sensitivity with Suppressed Conductivity Detection

The AMMS-ICE 300 suppressor is used in chemical suppression mode with a tetrabutylammonium hydroxide (TBAOH) regenerant. The AMMS-ICE 300 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 20 illustrates the suppression process for the ICE suppressor. The cation-exchange membrane in the AMMS-ICE 300 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.

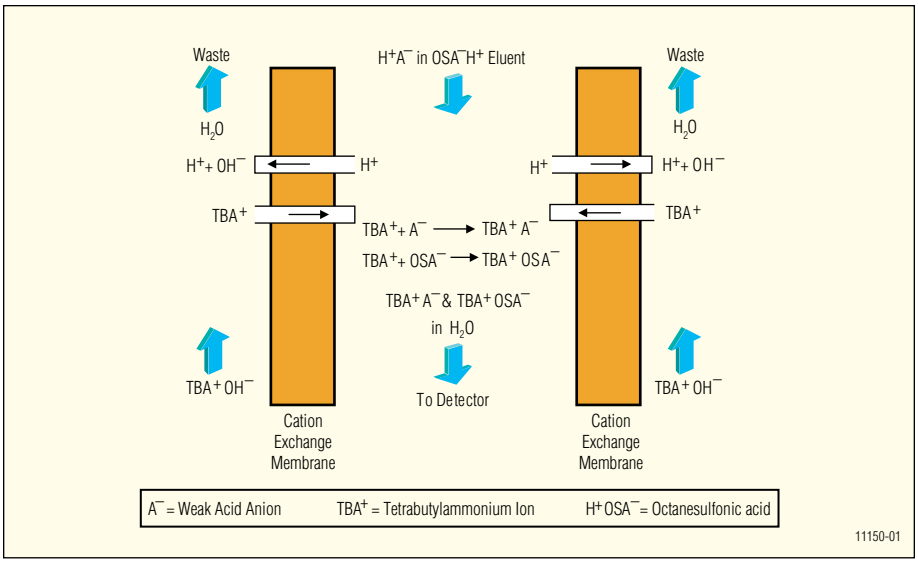


Figure 20. AMMS-ICE suppression process for ion-exclusion chromatography.

Optimized for Ion-Exclusion Chromatography and Ion-Suppression Chromatography

The AMMS-ICE 300 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 AMMS-ICE 300 is designed for use with either the ion-exclusion or ion-suppression separation modes of ion chromatography. Both modes use dilute eluents containing acids with low pK_a 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 pK_a (see Figures 21 and 22). 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 IonPac NS1.

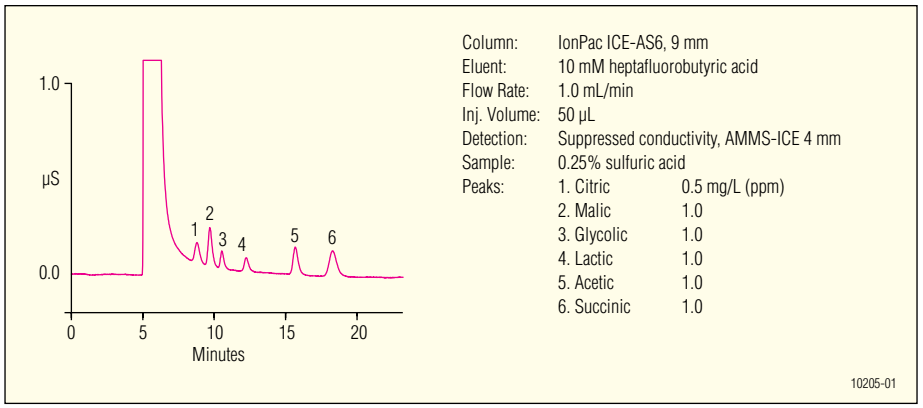


Figure 21. Determination of aliphatic acids in an acidic matrix using ion exclusion.

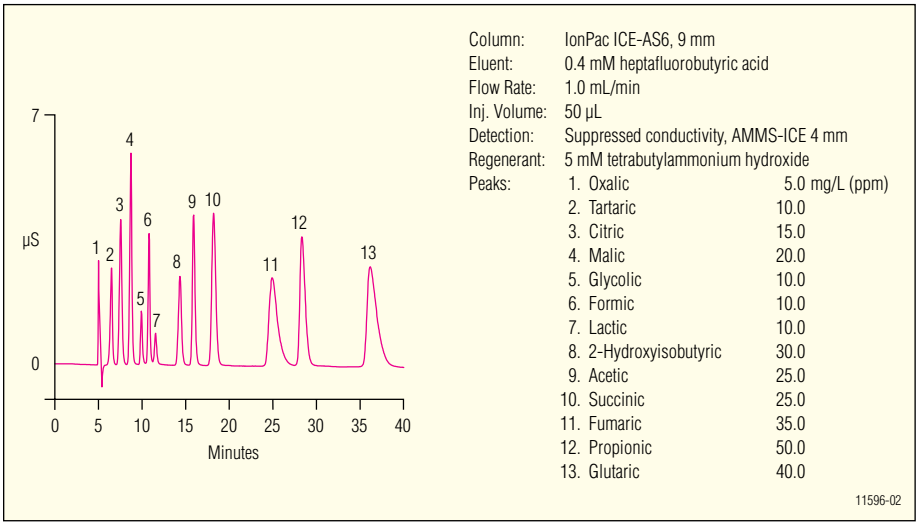


Figure 22. Separation of organic acids using the ICE-AS6 column.

AMMS-ICE 300 Applications

The AMMS-ICE 300 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.

Capillary Electrolytic Suppressor (CES 300) for Capillary IC Analysis

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

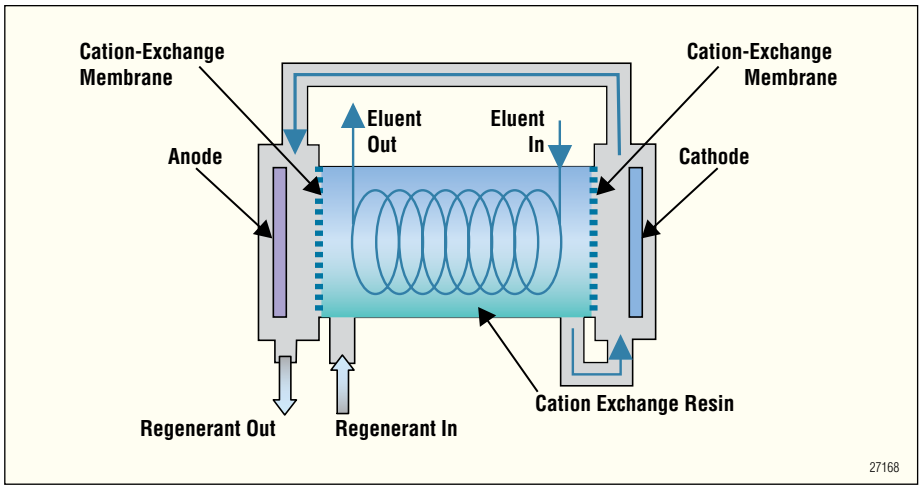


Figure 23. Anion Capillary Electrolytic Suppressor (ACES 300).

CES Technology

The CES 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.

CES 300 System Control

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

Key Applications Using a CES Suppressor

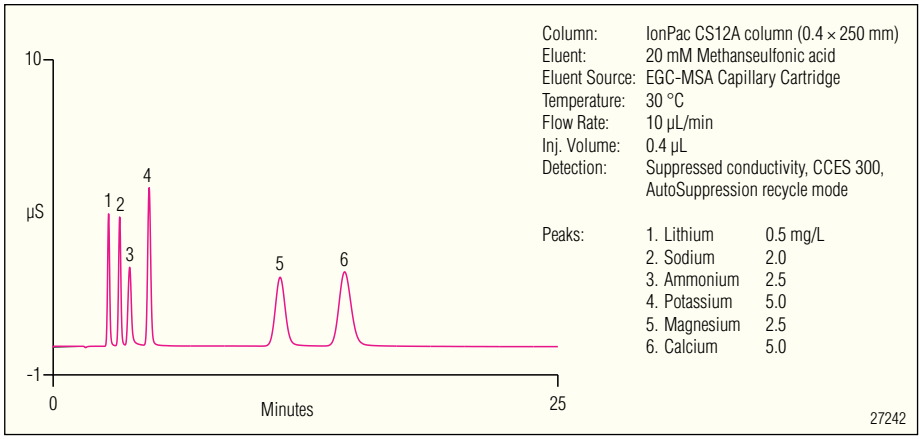


Figure 24. Separation of six common cations using an IonPac CS12A Capillary column.

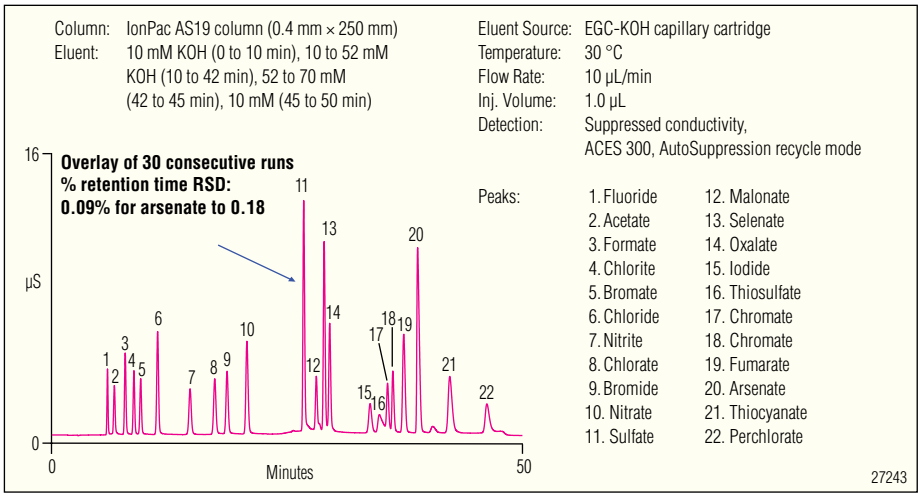


Figure 25. Separation of 22 anions on an IonPac AS19 Capillary column.

Atlas Electrolytic Suppressor (AES) for Routine IC Analysis

The Atlas suppressor is designed for optimal performance when using routine carbonate/bicarbonate, MSA, or sulfuric acid eluents. The patented design of the AES results in much faster daily start-up times to improve the throughput of routine sample analysis. The AES improves the analysis of standard anions and cations by lowering the noise. For routine analysis, the peak response and efficiencies are equivalent to the performance of an SRS 300.

AES Technology

The MonoDisc™ suppression bed of the AES is composed of ion-exchange monolith and flow distribution discs (patented technology). This configuration, illustrated in Figure 26, facilitates efficient exchange of the eluent counter ions for regenerant ions, resulting in eluent suppression and analyte response enhancement.

AES System Control

ICS-1000, ICS-1100, ICS-1500, ICS-1600, ICS-2000, ICS-2100, ICS-2500, ICS-3000, and ICS-5000 series systems include software and hardware to control the AES suppressor. DX-600 or DX-320 systems must be configured with Chromeleon 6.2/PeakNet 6.2 or higher, and an ED50A, CD25A, or IC25A detector. DX-600, DX-500, or DX-320 systems using earlier versions of PeakNet software require the RFC-10 or RFC-30 Suppressor Controller. The RFC-10 or RFC-30 is required for the DX-120, along with a DX-120 adapter cable.

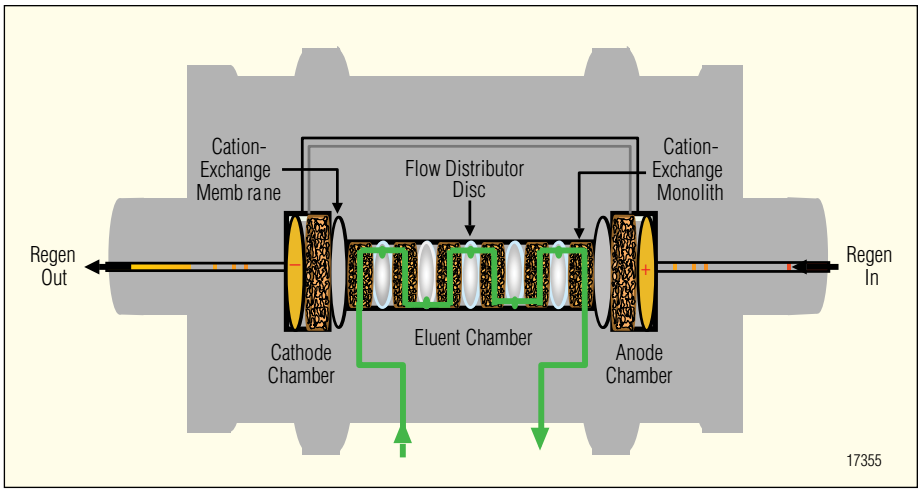


Figure 26. Anion Atlas Electrolytic Suppressor (AAES) using electrolytic regeneration of the MonoDisc eluent chamber.

APPLICATIONS USING THE AES	
Anion Analysis Using Carbonate/Bicarbonate Eluents • One AAES format is used for all column formats. • Eluent concentrations up to 25 mN at 1.0 mL/min can be suppressed. • Eluents containing solvents should not be used.	**IonPac® Anion Columns** • 4 mm: AS23, AS22, AS14A, AS14, AS9-SC, AS9-HC, AS12A, AS4A-SC, AS4A, AS4 • 3 mm: AS14A, 5µm • 2 mm: AS23, AS22, AS14, AS12A, AS9-HC, AS9-SC, AS4A-SC
Cation Analysis Using MSA or Sulfuric Acid Eluents • One CAES format is used for all column formats. • Eluent concentrations up to 25 mN at 1.0 mL/min can be suppressed. • Eluents containing solvents should not be used.	**IonPac Cation Columns** • 4 mm: CS12, CS12A, CS14, CS17, CS18 • 3 mm: CS12A-5µm • 2 mm: CS12, CS12A, CS14, CS17, CS18

SYSTEM CONTROL OF THE AES		
IC System	**AES Hardware Control Requirements**	**AES Software Control Requirements**
ICS-1000, 1100, 1500, 1600, 2000, 2100, 2500, 3000, and 5000	Integrated, no additional hardware required	Chromeleon 6.2 or higher
DX-600 with ED50A or CD25A detector	Integrated, no additional hardware required	Chromeleon 6.2 or higher
DX-320 with IC25A detector	Integrated, no additional hardware required	Chromeleon or higher
DX-600 or with ED50 or CD25 detector	RFC-10 or RFC 30 Reagent-Free Controller	No software required for RFC[1]
DX-500 with ED40/50 or CD20/25 detector	RFC-10 or RFC 30 Reagent-Free Controller	No software required for RFC[1]
DX-320 with IC25 detector	RFC-10 or RFC 30 Reagent-Free Controller	No software required for RFC[1]
DX-120	RFC-10 or RFC 30 Reagent-Free Controller	No software required for RFC[1]

[1] Chromeleon can be used to control the DX system.

Key Applications Using an AES Suppressor

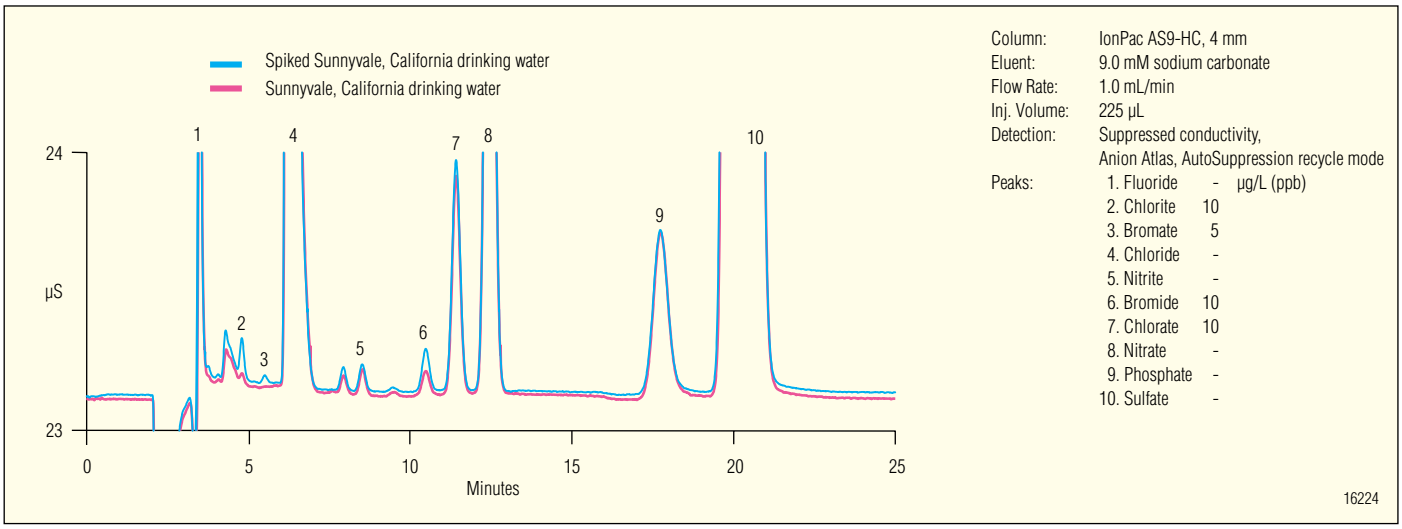


Figure 27. Separation of target analytes on the IonPac AS9-HC column offers an ideal method for determination of oxyhalides and bromide in drinking water samples. This figure illustrates the use of an Anion Atlas Electrolytic Suppressor (AAES) for the analysis of spiked (blue trace) and unspiked (red trace) drinking water samples. The drinking water sample was spiked with chlorite, chlorate, and bromide at 10 µg/L and bromate at 5 µg/L. Because of the low baseline noise that can be achieved when using the AAES, 5 µg/L bromate is detected easily.

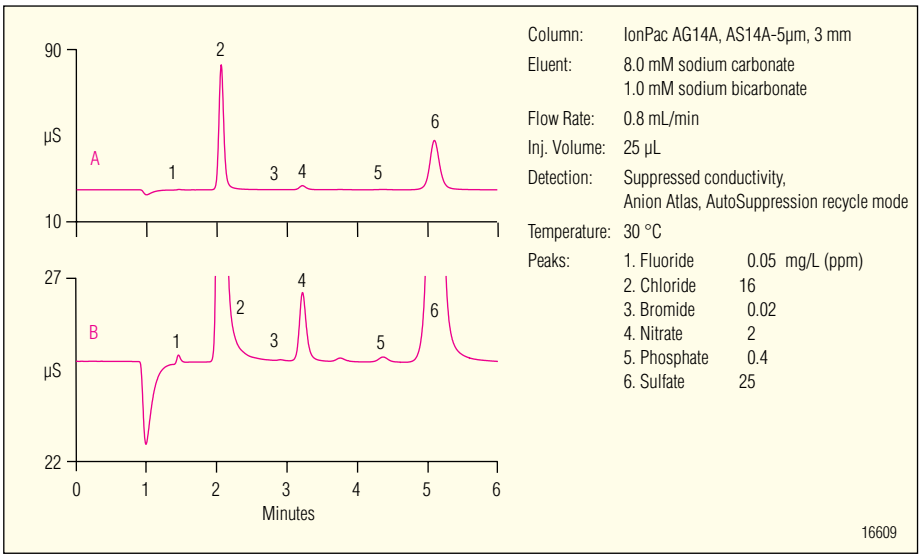


Figure 28. Routine analysis of anions in drinking water using the IonPac AS14A-5µm column and the Anion Atlas Electrolytic Suppressor. A) Full scale. B) Magnification of baseline to show resolution of low-concentration analytes.

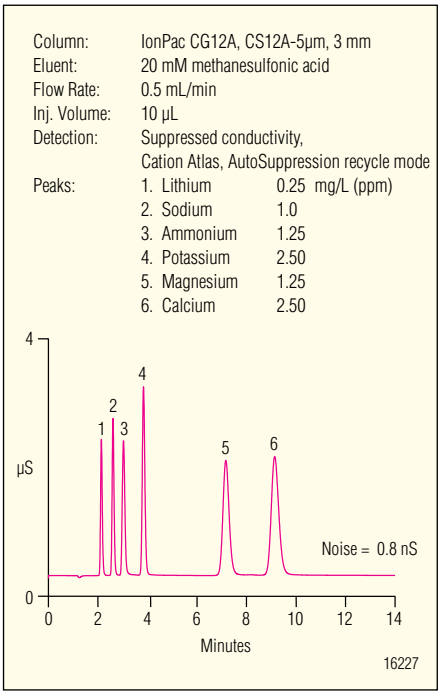


Figure 29. Analysis of common cations plus ammonium using the IonPac CS12A-5 µm column and the Cation Atlas Electrolytic Suppressor (CAES).

SRS ORDERING INFORMATION

In the U.S., call 1-800-346-6390, order on-line at http://dstore.dionex.com, or contact the Dionex regional office nearest you. Outside the U.S., order through your local Dionex office or distributor. Refer to the following part numbers.

SRS Self-Regenerating Suppressors	Part Number

ASRS 300 (2 mm) Anion Self-Regenerating Suppressor 064555

For use with 2 and 3 mm microbore anion-exchange columns. Replaces the ASRS ULTRA II (P/N 061562), ASRS ULTRA (P/N 053947), ASRS I (P/N 043187), and the ASRS II (P/N 046078).

ASRS 300 (4 mm) Anion Self-Regenerating Suppressor 064554

For use with 4 and 5 mm anion-exchange columns. Replaces the ASRS ULTRA II (P/N 061561), ASRS ULTRA (P/N 053946), ASRS I (P/N 043189), and the ASRS II (P/N 046081).

CSRS 300 (2 mm) Cation Self-Regenerating Suppressor 064557

For use with 2 and 3 mm microbore cation-exchange columns. Replaces the CSRS ULTRA II (P/N 061564), CSRS ULTRA (P/N 053949), CSRS I (P/N 043188), and the CSRS II (P/N 046080).

CSRS 300 (4 mm) Cation Self-Regenerating Suppressor 064556

For use with 4 mm cation-exchange columns. Replaces the CSRS ULTRA II (P/N 061563), CSRS ULTRA (P/N 053948), CSRS I (P/N 043190), and the CSRS II (P/N 046079).

SRS 300 Suppressors for Mobile Phase Ion Chromatography (MPIC)

For ASRS MPIC (NS1 ion-pairing suppressor): Order the ASRS 300.
Note: *The AMMS-ICE 300 Anion MicroMembrane Suppressor cannot be used for anion MPIC.*

For CSRS MPIC (NS1 ion-pairing suppressor): Order the CSRS 300.

SRS 300 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 016388
For flushing the SRS 300 at start-up.

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 038018

For SRS 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 SRS with pneumatic delivery of regenerant.

SRS Gas-Assisted Regeneration Kit 056886

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 SRS 300 for operation in these modes.

SRD-10 Suppressor Regenerant Detector 074395

The 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.

SCC-10 Suppressor Current Controller 074053

The SCC-10 is an external adapter designed for use with legacy instruments that only offer a few settings for suppressor current. The SCC-10 is powered from the existing suppressor current supply, and can output 12 discreet current settings from 10 mA to 250 mA.

MMS ORDERING INFORMATION

In the U.S., call 1-800-346-6390, order on-line at http://dstore.dionex.com, or contact the Dionex regional office nearest you. Outside the U.S., order through your local Dionex office or distributor. Refer to the following part numbers.

MMS 300 Suppressors	Part Number
AMMS 300 (2 mm) Anion MicroMembrane Suppressor	064559
For use with 2 and 3 mm anion-exchange columns. Replaces the 2 mm AMMS II (P/N 043106) and the AMMS III (P/N 056751).	
AMMS 300 (4 mm) Anion MicroMembrane Suppressor	064558
For use with 4 and 5 mm anion-exchange columns. Replaces the AMMS I (P/N 043189), AMMS II (P/N 043074), and the AMMS III (P/N 056750).	
CMMS 300 (2 mm) Cation MicroMembrane Suppressor	064561
For use with 2 and 3 mm cation-exchange columns. Replaces the 2 mm CMMS II (P/N 043107), and the CMMS III (P/N 056753).	
CMMS 300 (4 mm) Cation MicroMembrane Suppressor	064560
For use with 4 and 5 mm cation-exchange columns. Replaces the CMMS I (P/N 043190), CMMS II (P/N 043021) and the CMMS III (P/N 056752).	

Chemical Regeneration MMS 300 Kits for Displacement	Part Number
Installation Kit for Displacement Chemical Regeneration Operation	
2 L DCR Kit	056882
4 L DCR Kit	056884
Includes one regenerant reservoir, cap, and all tubing and fittings to install the MMS 300 in the DCR mode. Order the size that matches the system's eluent bottle size.	
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	038018
For MMS 300 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 MMS 300 for operation in this mode.	
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

MMS 300 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	016388
For flushing the MMS 300 at start-up.	
Syringe Adapter, female Luer lock, 1/4-28 threads	024305

CES ORDERING INFORMATION

In the U.S., call 1-800-346-6390, order on-line at http://dstore.dionex.com, or contact the Dionex regional office nearest you. Outside the U.S., order through your local Dionex office or distributor. Refer to the following part numbers.

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

Optional Kits	Part Number
External Regenerant Installation Kit For CES 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 CES with pneumatic delivery of external water	038018

ATLAS ORDERING INFORMATION

In the U.S., call 1-800-346-6390, order on-line at http://dstore.dionex.com, or contact the Dionex regional office nearest you. Outside the U.S., order through your local Dionex office or distributor. Refer to the following part numbers.

Atlas Suppressors	Part Number
Anion Atlas Electrolytic Suppressor (AAES)	056116

The Anion Atlas 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/PeakNet 6.2 or higher with an ED50A, CD25A, or IC25A for direct control. Older systems (DX-500 with ED50 or CD25; DX-320 with IC25; and DX-120) require an RFC-10 or RFC-30 Controller. The DX-120 also requires an DX-120 Adapter Cable listed below.

Cation Atlas Electrolytic Suppressor (CAES) 056118

The Cation Atlas 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/PeakNet 6.2 or higher with an ED50A, CD25A, or IC25A for direct control. Older systems (DX-500 with ED50 or CD25; DX-320 with IC25; and DX-120) require an RFC-10 or RFC-30 Controller. The DX-120 also requires an DX-120 Adapter Cable listed below.

RFC-10, RFC-30 Suppressor Controllers	Part Number
RFC-30 Reagent-Free Controller with EGC II KOH Cartridge and CR-ATC Continuously Regenerated Anion Trap Column	060667
RFC-30 Reagent-Free Controller with EGC II MSA Cartridge and CR-CTC II Continuously Regenerated Cation Trap Column	060668
RFC-10 Suppressor Controller	060335
DX-120 Adapter Cable for RFC-10 or RFC-30	057861

This adapter cable is required to interface the RFC-10 or RFC-30 to the DX-120.

Atlas Spare Parts	Part Number
Backpressure loop, l ea. for 5 and 4 mm system,	045877
3 and 2 mm systems	045878
Syringe, 1.0 mL, disposable	016388

For flushing the Atlas at start-up.

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	038018

For 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 AES with pneumatic delivery of regenerant.

Trap Column and Suppressor Regeneration Kit 059659

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.

ATLAS ORDERING INFORMATION

In the U.S., call 1-800-346-6390, order on-line at http://dstore.dionex.com, or contact the Dionex regional office nearest you. Outside the U.S., order through your local Dionex office or distributor. Refer to the following part numbers.

Atlas Suppressors	Part Number

Anion Atlas Electrolytic Suppressor (AAES) 056116

The Anion Atlas 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/PeakNet 6.2 or higher with an ED50A, CD25A, or IC25A for direct control. Older systems (DX-500 with ED50 or CD25; DX-320 with IC25; and DX-120) require an RFC-10 or RFC-30 Controller. The DX-120 also requires an DX-120 Adapter Cable listed below.

Cation Atlas Electrolytic Suppressor (CAES).....056118

The Cation Atlas 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/PeakNet 6.2 or higher with an ED50A, CD25A, or IC25A for direct control. Older systems (DX-500 with ED50 or CD25; DX-320 with IC25; and DX-120) require an RFC-10 or RFC-30 Controller. The DX-120 also requires an DX-120 Adapter Cable listed below.

RFC-10, RFC-30 Suppressor Controllers	Part Number

RFC-30 Reagent-Free Controller with
EGC II KOH Cartridge and CR-ATC
Continuously Regenerated Anion Trap Column 060667

RFC-30 Reagent-Free Controller with
EGC II MSA Cartridge and CR-CTC II
Continuously Regenerated Cation Trap Column 060668

RFC-10 Suppressor Controller 060335

DX-120 Adapter Cable for RFC-10 or RFC-30 057861

This adapter cable is required to interface the RFC-10 or RFC-30 to the DX-120.

Atlas Spare Parts	Part Number

Backpressure loop, l ea.
for 5 and 4 mm system, ... 045877
3 and 2 mm systems 045878

Syringe, 1.0 mL, disposable 016388

For flushing the Atlas at start-up.

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 038018

For 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 AES with pneumatic delivery of regenerant.

Trap Column and Suppressor Regeneration Kit..... 059659

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.

AMMS-ICE ORDERING INFORMATION

In the U.S., call 1-800-346-6390, order on-line at http://dstore.dionex.com, or contact the Dionex regional office nearest you. Outside the U.S., order through your local Dionex office or distributor. Refer to the following part numbers.

AMMS-ICE Suppressor	Part Number
AMMS-ICE 300 4 mm Suppressor	067527

Regenerant Kits and Reagent	Part Number
External Regenerant Installation Kit	038018

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 AMMS-ICE 300 suppressor.

AMMS-ICE Cation Regenerant Solution

500 mL of 0.1 M tetrabutylammonium hydroxide (TBAOH) 039602

AMMS-ICE Spare Parts	Part Number
Backpressure loop, 1 each for 4 mm system	045877
Syringe, 1.0 mL, disposable	016388

For flushing the AMMS-ICE Suppressor at start-up.

Syringe Adapter, female Luer lock, 1/4-28 threads	024305

SRS SUPPRESSOR CONTROLLER ORDERING INFORMATION

In the U.S., call 1-800-346-6390, order online at http://dstore.dionex.com, or contact the Dionex regional office nearest you. Outside the U.S., order through your local Dionex office or distributor. Refer to the following part numbers.

SRS Suppressor Controllers	Part Number
RFC-30 Reagent-Free Controller with EGC II KOH Cartridge and CR-ATC Continuously Regenerated Anion Trap	060667
RFC-30 Reagent-Free Controller with EGC II MSA Cartridge and CR-CTC II Continuously Regenerated Cation Trap	060668
RFC-10 Suppressor Controller	060335
DX-120 Adapter Cable	057861

Note: Earlier Dionex systems can accommodate SRS 300 or AES suppressor operation with SCR-1 and SC-20 stand-alone controller modules. These modules are now discontinued and replaced by the RFC-10 or RFC-30.

Patent Numbers
6,650,546; 6,508,985; 6,495,371; 6,436,719; 6,425,284; 6,077,434; 6,328,885; 6,325,976, 5,597,734; 5,773,615; 5,622,171; 5,569,365; 5,352,360; 5,248,426; 4,999,098

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