

systems

Reagent-Free Ion Chromatography Systems with Eluent Regeneration



Since the introduction of Reagent-Free™ ion chromatography (RFIC™) systems in 2003, Dionex has continued to simplify IC while increasing the capabilities and power of ion analysis. Eluent regeneration brings the consistency and ease of operation of RFIC systems to users with systems dedicated to the analysis of anions or cations in samples with low- to moderate-concentration matrices. Reagent-Free IC systems with Eluent Regeneration (RFIC-ER™ systems) use the suppressor to regenerate returning eluent, allowing a single preparation of eluent to be used for up to four weeks. RFIC-ER systems perform isocratic separations with carbonate or MSA eluents. For applications that require hydroxide eluents or eluent gradients, RFIC systems with Eluent Generation (RFIC-EG™ systems) are recommended.

Eluent Regeneration for Ion Chromatography

Eluent and regenerant preparation, equilibration, calibration, and waste disposal all take instrument and analyst time away from analysis. Variations in eluent and standard preparation can also be sources of error. RFIC-ER systems help reduce the work and variability in ion chromatography.

Eluent regeneration takes advantage of the electrolytic suppressor to regenerate effluent

returning from the conductivity cell. A single eluent preparation can be regenerated for up to four weeks, reducing labor and increasing consistency and reproducibility. RFIC-ER systems can regenerate eluent for isocratic IC separations using carbonate, carbonate/bicarbonate, or methanesulfonic acid. These always on, always ready systems are ideal for the analysis of drinking, ground-, and surface waters, and are intended for use as systems dedicated to these analyses.



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Benefits of Eluent Regeneration

- A single preparation of eluent can be used for up to four weeks, reducing labor and waste.
- Trap, purification, and catalytic columns purify returning eluent, assuring consistent, high quality eluent for separations.
- Consistent eluent concentration generates reproducible results.
- Because it is a closed loop, the always on, always ready RFIC-ER system remains equilibrated and calibrated between eluent changes, up to four weeks.
- Less-frequent eluent preparation reduces unintentional variations in concentration, increasing reliability and reproducibility.
- RFIC-ER systems are designed for high throughput analyses of anions or cations in low- to moderate-concentration matrices.

Principles of Eluent Regeneration

The same electrolytic process that suppresses eluent for detection is used to regenerate eluent for reuse. After detection, suppressed eluent is passed through an analyte trap column to remove analyte ions (Figure 1). The suppressed eluent is then returned to the suppressor to provide the water for electrolytic suppression. Eluent counterions migrate across the suppressor's ion-exchange membrane and enter the suppressor effluent stream. This effluent contains the eluent ions and H_2 and O_2 gases (Figure 2). A catalytic column recombines the oxygen and hydrogen to form water. Because the electrolysis gases are recombined stoichiometrically, no water is lost in the system and eluent concentration remains constant. The suppressor effluent is then returned to the eluent reservoir for reuse. A purification column is plumbed after the pump to further assure eluent purity.

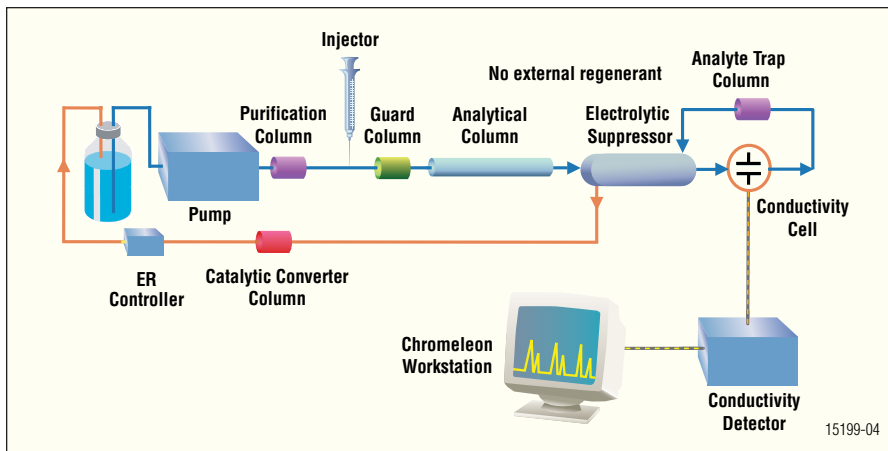


Figure 1. Diagram of an RFIC-ER system.

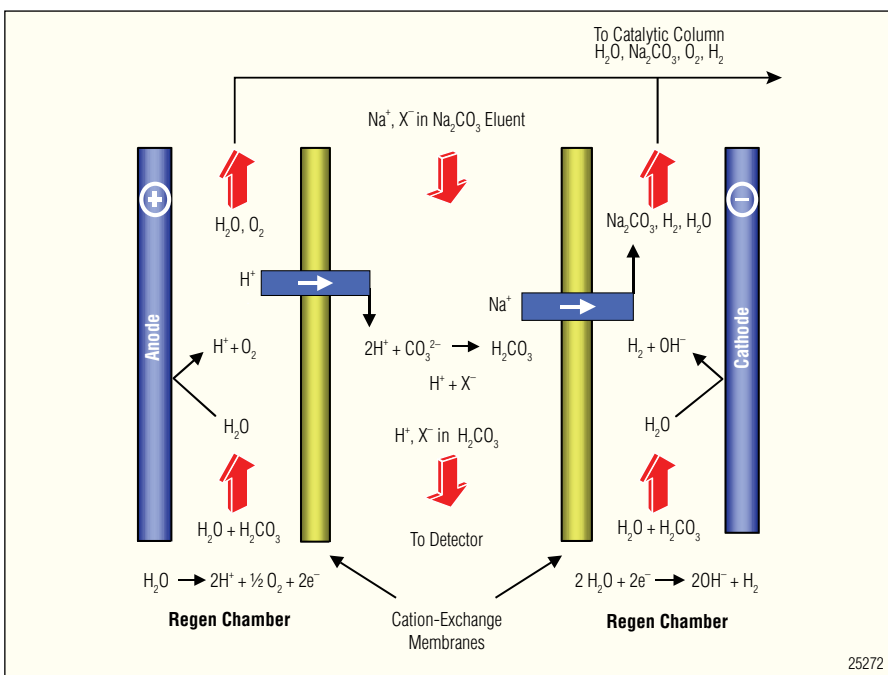


Figure 2. Suppression and regeneration of a carbonate eluent using an ASRS[®] 300 suppressor.

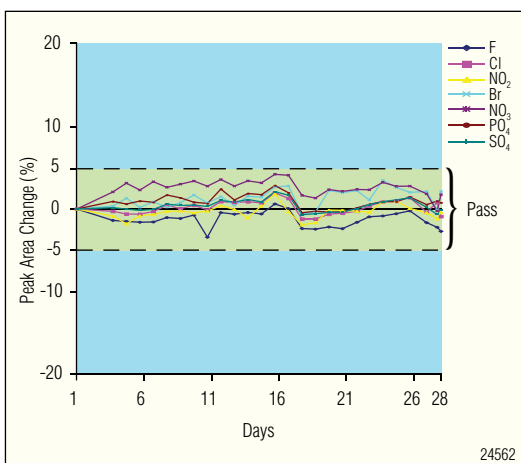


Figure 3. Graph of peak area changes over 28 days for a calibration check standard injected once daily. Peak areas remained within the $\pm 5\%$ specification for the entire time; no recalibration was required.

Effortless Consistency

Consistent eluent concentration helps produce consistent results. An RFIC-ER system is a closed loop, and can remain running without requiring more eluent or generating additional waste. When left running, the system remains equilibrated and calibrated between eluent changes. A routine check standard is enough to ensure calibration (Figure 3), reducing calibration frequency to once monthly.

Figure 4 shows an overlay of 100 injections of a tap water sample, determined using regenerated MSA eluent. The peak retention times and areas are highly consistent. This represents 25 h of system operation without recalibration, reequilibration, eluent replacement, or waste disposal.

Figure 5 shows this same consistency for calibration check standards run over the course of 32 days. Day-to-day and run-to-run, the RFIC-ER system produces reliable results without effort. All the operator has to do is load samples. The system takes care of the rest for up to a month.

Anion Concentrator for ER

The AC-ER (4 × 16 mm) Anion Concentrator Column is a general purpose, low-dead-volume, extremely low-pressure anion concentrator column for use with eluent regeneration systems. The AC-ER is available in a 4 × 16 mm format for very low dead volume to maximize the number of injections that can be made on an RFIC-ER™ system between eluent exchanges. The AC-ER has a capacity of 12.0 µeq/column and a void volume of approximately 70 µL.

With an AC-ER column installed in an RFIC-ER system, each injection only adds 75 µL of sample matrix into the eluent regardless of the sample volume (70 µL + 5 µL for connecting tubing). Therefore, approximately 266 injections can be performed before the eluent needs to be replaced, regardless of the actual amount of sample loaded onto the concentrator.

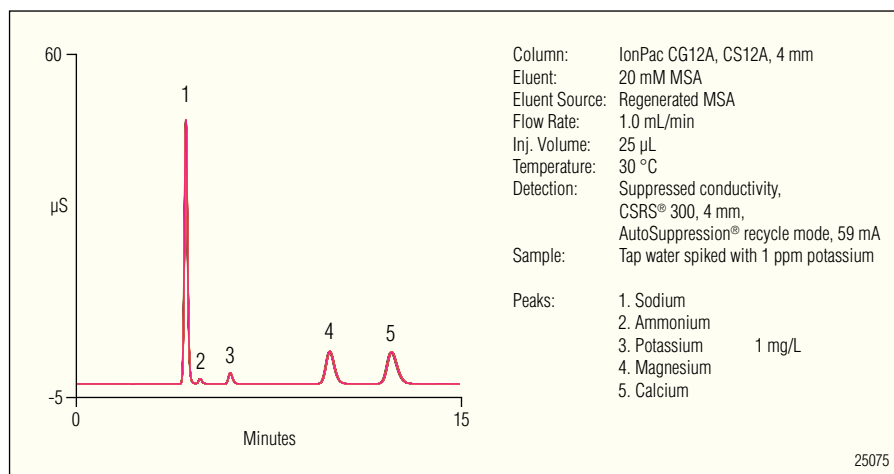


Figure 4. Overlay of chromatograms for 100 injections of tap water spiked with 1 mg/L potassium and determined using an ICS-1500 RFIC-ER system.

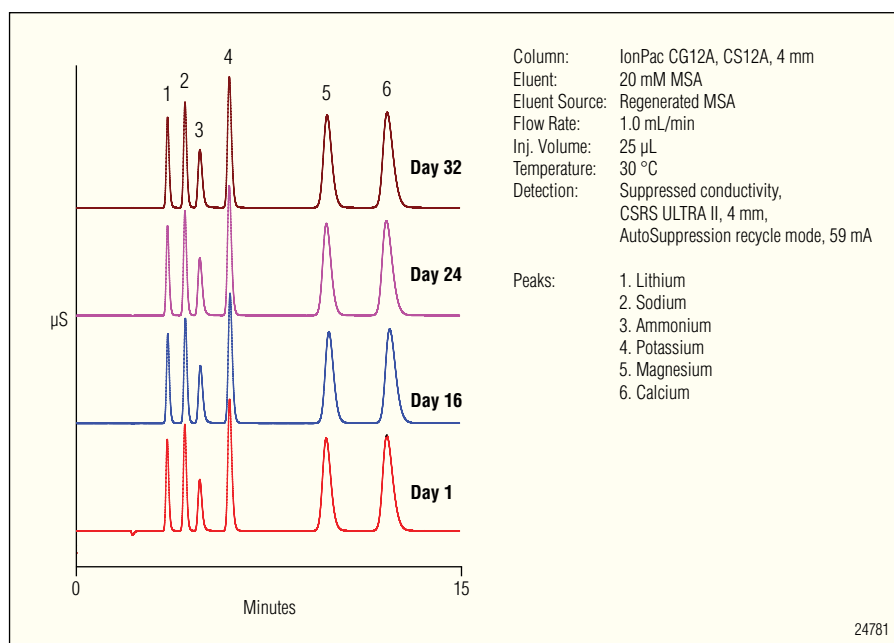


Figure 5. Overlay of representative chromatograms for a calibration check standard run over the course of 32 days on an ICS-1500 RFIC-ER system.

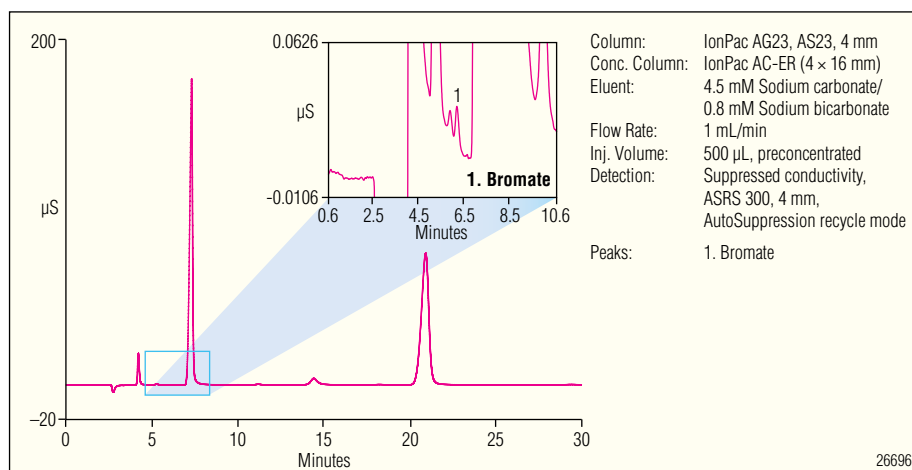


Figure 6. Determination of bromate in a municipal water sample using a Reagent-Free™ IC system with eluent regeneration and an AC-ER Concentrator Column.

By using a matrix elimination step with the AC-ER in place, solvents can be directly injected onto the AC-ER then flushed off before injection into the RFIC-ER system, protecting the eluent from solvent contamination. The AC-ER concentrator brings a host of trace-level applications within range of RFIC-ER systems, including analysis of bromate to 5 ppb in drinking water (Figure 6), and analysis of common anions in ethanol.

System Control

RFIC-ER system control is built into Chromeleon® Chromatography Data System Software. Wellness features monitor eluent, trap column, and purification column usage, warning the operator when replacement or regeneration is necessary.

ELUENT REGENERATION SYSTEM SPECIFICATIONS

Eluent Controller

Dimensions (h × w × d):

13.6 in × 4.1 in × 4 in
34.5 cm × 10.5 cm × 10 cm

Weight:

1.76 lb
0.8 kg

Maximum Operating Pressure:

3000 psi post pump
200 psi post suppressor

Back Pressure:

Less than 335 psi at 1.0 mL/min

Maximum Flow Rate:

2.0 mL/min

Eluent Compatibility:

Carbonate eluents up to 20 mM
MSA eluents up to 34 mM

Solvent Compatibility:

Not compatible with organic solvents in mobile phase

Temperature Range:

5 °C to 40 °C

Eluent Purification Column

Lifetime:

91 days using AS23 chemistry

Analyte Trap Columns

Capacity:

130,000 µL (e.g., 5200 × 25 µL injections)

ORDERING INFORMATION

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

Eluent Regeneration Kits and Accessories

RFIC-ER Anion Startup Kit.....	067797
Includes anion consumables kit and installation kit	
RFIC-ER Cation Startup Kit.....	067798
Includes cation consumables kit and installation kit	
RFIC-ER Anion Consumables Kit.....	067791
RFIC-ER Cation Consumables Kit.....	067792
AC-ER Anion Concentrator Column.....	072778
RFIC-ER 4 L Eluent Bottle.....	066019

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