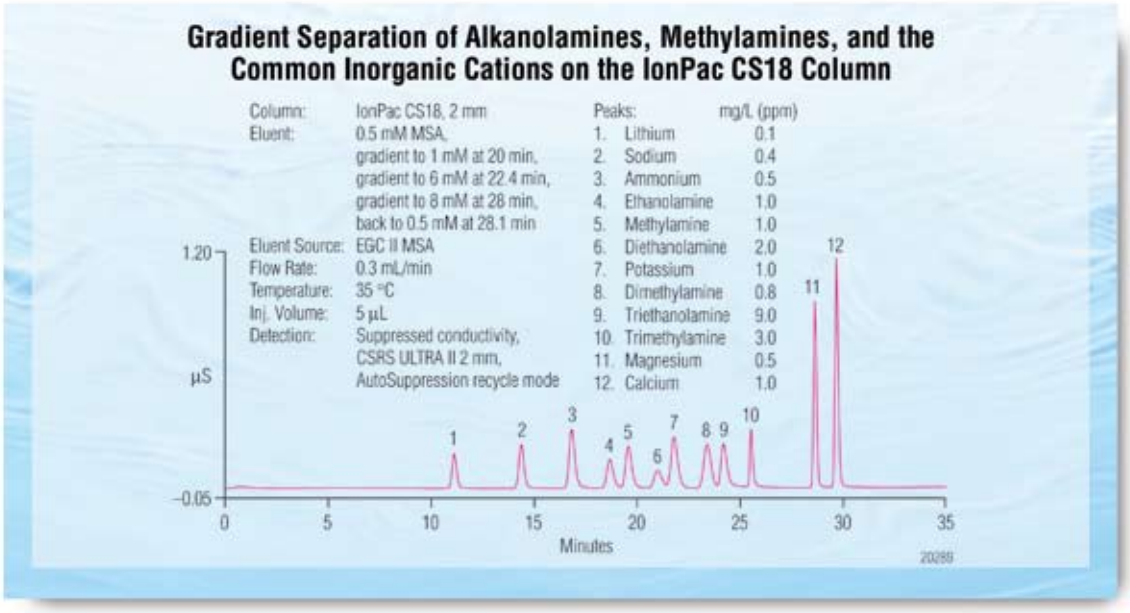
columns

IonPac® CS18 Cation-Exchange Column



The IonPac CS18 is a cation-exchange column of moderate capacity and hydrophobicity, recommended for isocratic and gradient separations of polar amines such as alkanolamines, methylamines, and moderately hydrophobic amines including biogenic amines, alkyl diamines and polyamines. The CS18 is ideally used with Reagent-Free™ Ion Chromatography (RFIC™) systems for automatic methanesulfonic acid (MSA) eluent generation and electrolytic eluent suppression with conductivity detection.

Now sold under the Thermo Scientific brand

Thermo SCIENTIFIC

Superior Chromatographic Performance

- Universal column for polar amines, including alkanolamines and methylamines in diverse sample matrices.
- Universal column for moderately hydrophobic amines including biogenic amines, alkyl diamines, and polyamines.
- Optimized for simple isocratic or gradient separations with minimal baseline shift during gradients.
- Simplified RFIC system requires only a deionized water source to produce MSA eluent.
- RFIC eluent suppressors (CSRS® ULTRA II or CAES®) provide electrolytic suppression with minimal baseline shift during gradients and enhanced analyte sensitivity.
- CS18 can be used with suppressed and nonsuppressed conductivity detection.
- Compatible with moderate amounts of organic solvents, excluding alcohols, to enhance analyte solubility, modify column selectivity, and allow effective column cleanup.
- Moderate capacity: 290 µeq/col (2 × 250 mm column). Only a modest acid concentration is required to elute amines.
- Sample matrices include power plant waters treated with ammonium, morpholine or ethanolamine, chemical additives, chemical process solutions, refinery scrubber solutions, personal care products, and food samples.

DIONEX

Passion. Power. Productivity.

Unique Carboxylate Cation Exchanger for Small Amines

The CS18 is a unique moderately hydrophobic, moderate capacity, weak cation exchanger designed for polar amines, and moderately hydrophobic amines, plus the common inorganic cations using either suppressed or nonsuppressed conductivity detection. The resin bead structure of the CS18 is composed of a polymeric 6-µm substrate consisting of ethylvinyl benzene cross-linked with 55% divinylbenzene, which is first surface-modified before grafting on it a functional layer consisting of weak carboxylic acid groups (See Figure 1). The CS18 resin bead is produced using a novel technology, different from previous grafting technologies. This technology involves the combination of monomer properties in the functional layer, the nature of the polymeric substrate bead, and the monomer attachment method—the composite of which results in a column with unique performance.

The IonPac CS18 column offers selectivity comparable to those obtained with silica-based cation exchangers, such as excellent resolution of sodium, ammonium, and ethanolamine. The common inorganic cations can be isocratically separated from methylamine, dimethylamine, and trimethylamine. The CS18 is polymer-based and can be used with eluents of pH 0–7. This column is compatible with 20% of the typical organic solvents (acetonitrile and acetone). The CS18, when used with suppressed conductivity detection, facilitates gradient elution to resolve difficult analyte pairs and reduce total run time, all with minimal baseline shift during gradients.

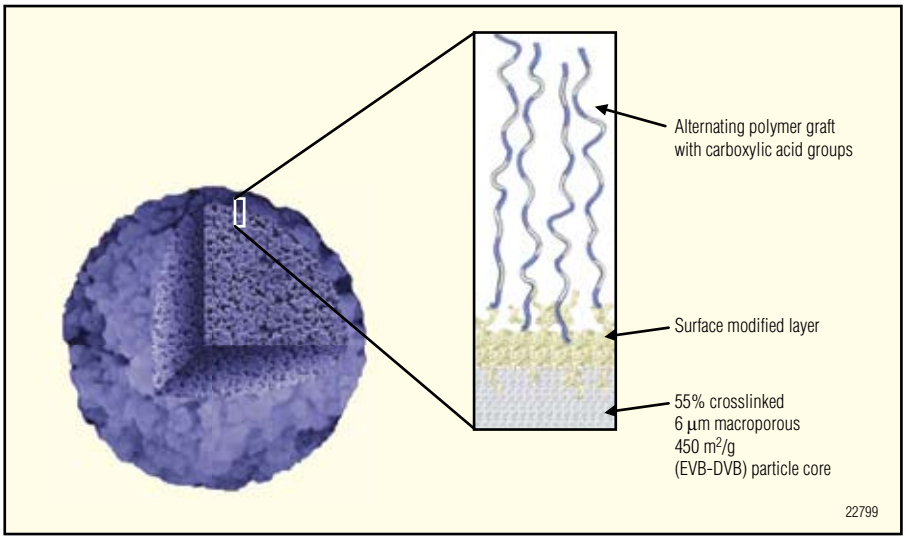


Figure 1. Structure of an IonPac CS18 packing particle.

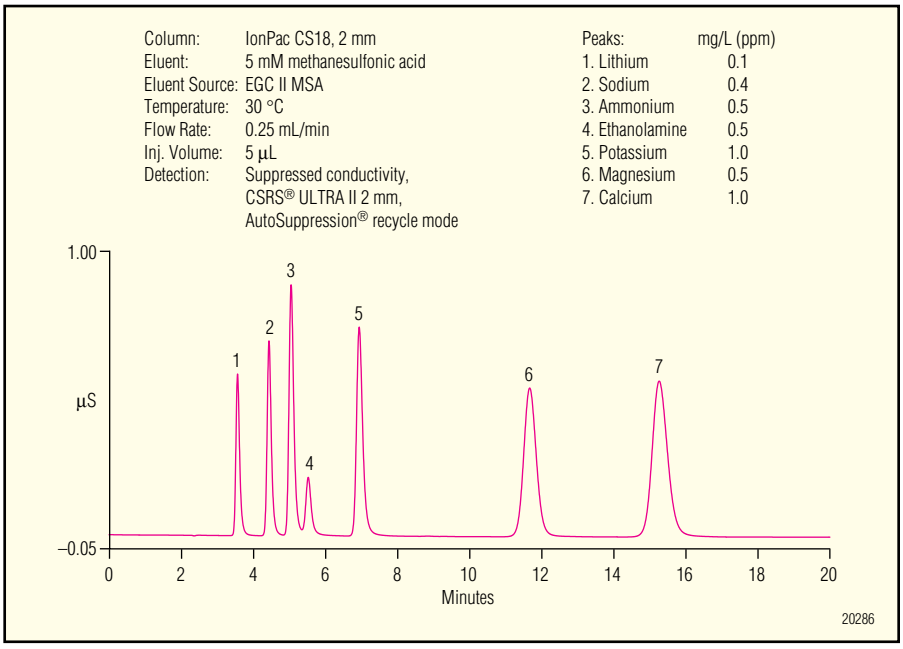


Figure 2. Determination of the common inorganic anions, plus ammonium and ethanolamine, using the IonPac CS18.

Common Inorganic Cations

Figure 2 illustrates the separation of the common inorganic cations, plus ammonium and ethanolamine, using the standard operating conditions. Using 5 mM MSA at elevated temperature (30 °C) coupled with suppressed conductivity detection, these analytes can be separated in approximately 16 min (analytical column).

Determination of Alkanolamines and the Common Inorganic Cations

Alkanolamines, including monoethanolamine, diethanolamine, and triethanolamine, are most commonly used individually, but are also used in combination to optimize scrubber treatment efficiency for specific chemical processes. In large plants, different alkanolamines may be used in adjacent units to accommodate different scrubbing requirements. The CS18 has unique selectivity for alkanolamines and therefore can resolve mixtures of these priority scrubber amines using a 5 mM MSA eluent at elevated temperature with suppressed conductivity detection, as illustrated in Figure 3.

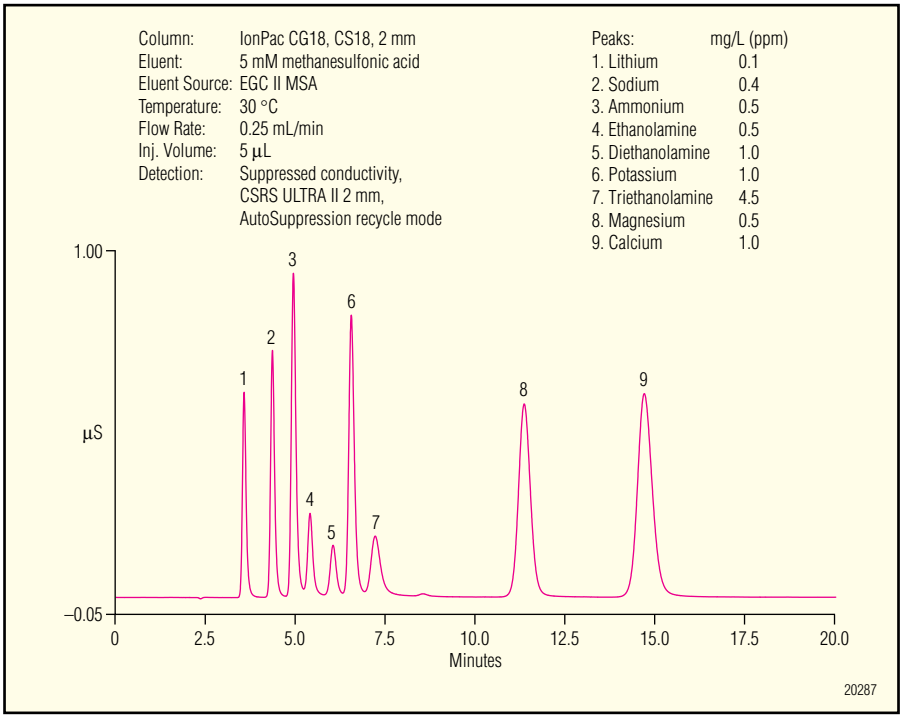


Figure 3. Separation of alkanolamines and the common inorganic cations on the IonPac CS18 column.

Determination of Methylamines and the Group I and II Cations

The CS18 column is the recommended column for the determination of methylamines and the common inorganic cations in diverse sample matrices, including scrubber solutions, process streams, and wastewater. The methylamines elute with good peak efficiencies and symmetries when the column is run with a simple isocratic eluent at elevated temperature (40 °C), as illustrated in Figure 4.

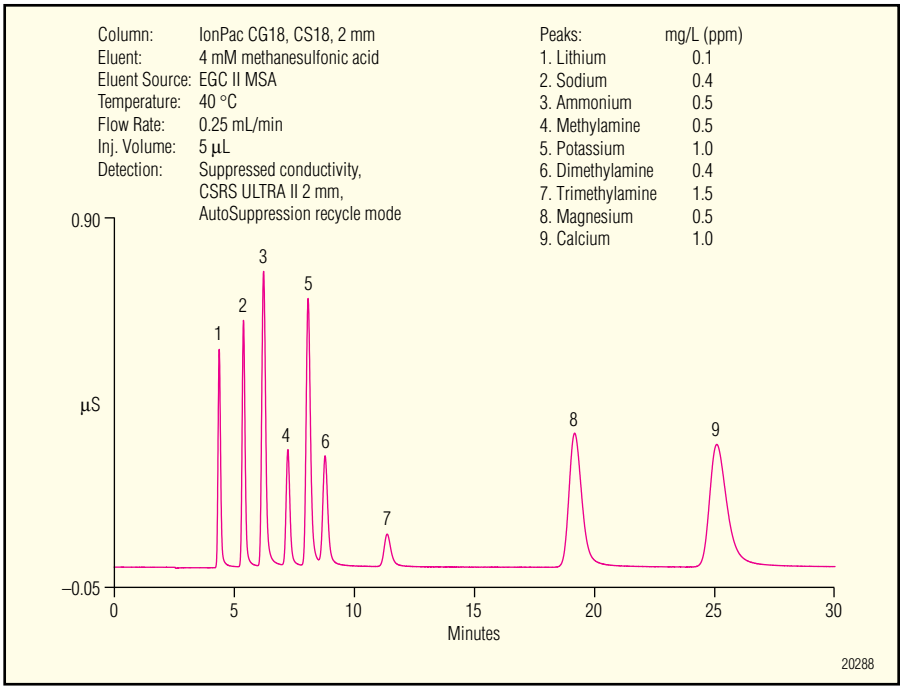


Figure 4. Separation of methylamines and the common inorganic cations on the IonPac CS18 column.

Gradient Separation of Alkanolamines and Methylamines

The CS18 column is ideally suited to separate small, hydrophilic amines, including alkanolamines and methylamines in a single run using a modest acidic gradient. Figure 5 shows an optimized MSA gradient separation of these amines, plus the common inorganic cations. Note that the baseline essentially remains unchanged during the MSA gradient.

Determination of Biogenic Amines, Methylamines, and the Group I and II Cations

Biogenic amines including putrescine, cadaverine, spermine, spermidine, and histamine as well as methylamines are important to monitor in foods because they are indicators of food spoilage. As shown in Figure 6, the IonPac CS18 column can easily separate the biogenic amines, methylamines, and the Group I and II cations using an aqueous eluent without organic solvent added. The biogenic amines and methylamines elute with good peak efficiencies and symmetries when the column is operated with a simple acidic gradient and elevated temperature.

Using the IonPac CS18 column and suppressed conductivity detection, these biogenic amines and methylamines can easily be determined in complex food matrices. Amperometric detection can also be used to detect biogenic amines. This detection mode provides the advantage of specificity for oxidizable amines including the biogenic amines. Inorganic cations present in the sample are not detected using amperometric detection. Higher concentrations of these ions do not interfere with the quantification of the biogenic amines.

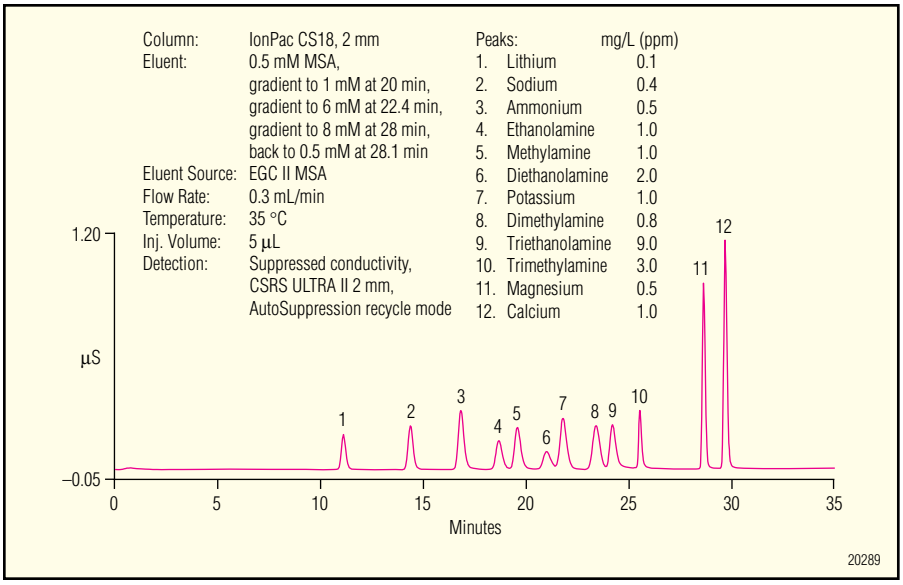


Figure 5. Gradient separation of alkanolamines, methylamines, and the common inorganic cations on the IonPac CS18 column.

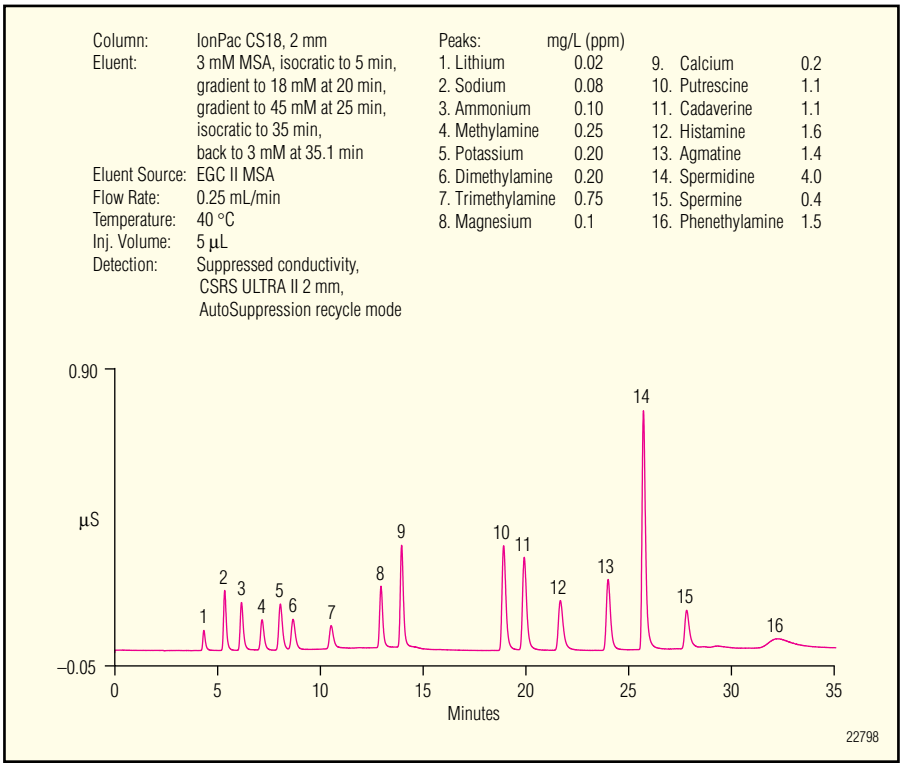


Figure 6. Biogenic amines, methylamines, and the common six cations on the IonPac CS18 column.

Frequently Monitored Amines in the Petrochemical Industry

Ethanolamine (MEA), diethanolamine (DEA), *N*-methyldiethanolamine (MDEA) and other amines are used in recirculating systems for scrubbing acid gases like hydrogen sulfide. It is important to monitor their concentration in the recirculating water solution.

Inorganic cations such as sodium and potassium can contaminate an amine scrubbing solution and bind anions that are not stripped out. At elevated concentrations, precipitation of solids and hindered treating performance can occur. There can also be corrosion issues with the increased ionic content of the solution.

Morpholine, n-methylmorpholine, methylamine, and ethylamine are used often for pH control. A variety of other amines are used for corrosion and foam control. Figure 7 shows the separation of a variety of amines and the extended Group I and II inorganic cations that are monitored in the petrochemical industry. The CS18 column provides excellent separation of these analytes using a simple MSA gradient and elevated temperature.

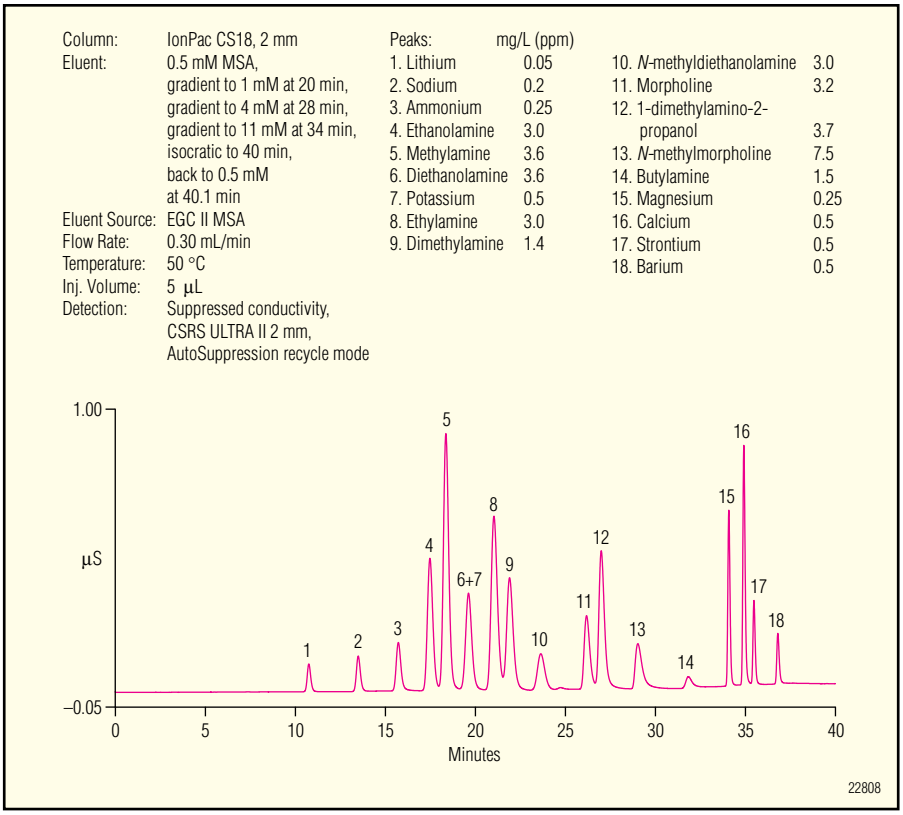


Figure 7. Amines of interest in the petrochemical industry. Diethanolamine and potassium are resolved using a lower column temperature (see Figures 3 and 5).

Determination of Amine Additives in Power Plant and Boiler Waters

Most U.S. Power Plants use one or more "advanced amines" as additives for secondary system pH control. The proportions and amounts of these amines need to be carefully monitored to be effective in corrosion prevention. The amine separation shown in Figure 8 represents the most widely used amines in the Power Industry.

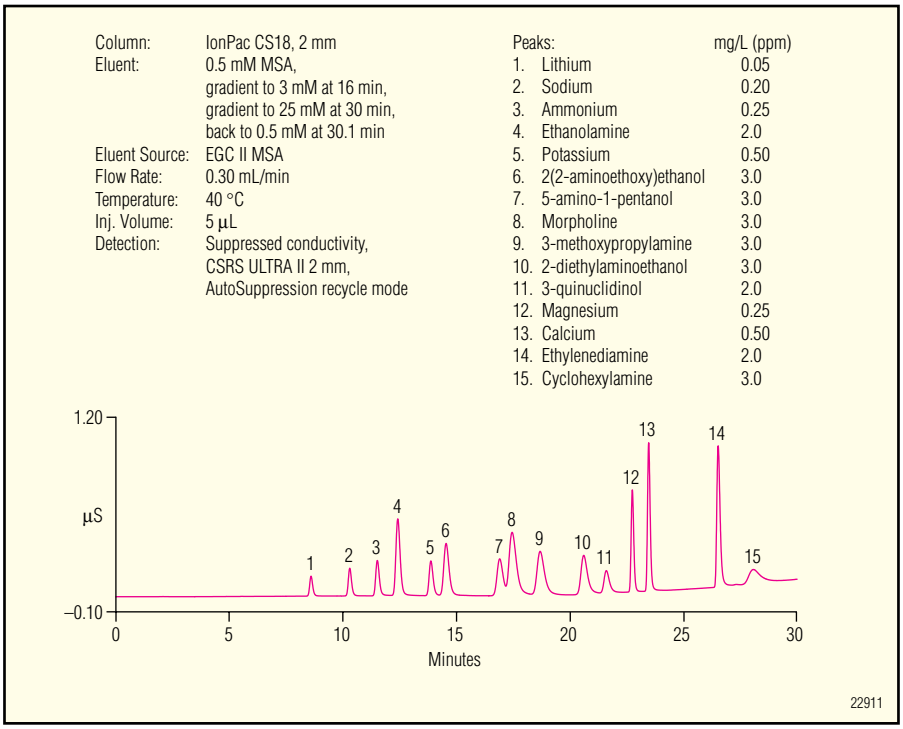


Figure 8: Separation of a variety of amines used in the power industry using the IonPac CS18 column.

Determination of Diamines in Complex Sample Matrices

The unique cation-exchange surface of the IonPac CS18 column allows the elution of lithium, sodium, ammonium, potassium, magnesium and calcium, and alkyl diamines with an organic solvent-free eluent. The alkyl diamines elute after the six common cations with good peak efficiencies and symmetries when the column is operated with a simple acidic gradient at elevated temperature. The excellent selectivity for the diamines is shown in Figure 9. Despite the gradient change from 3 mM to 45 mM methanesulfonic acid, the baseline shift is undetected. Alkyl diamines larger than 1,10-decanediamine are not soluble in aqueous solutions and therefore require the addition of organic solvent to the eluent when they are present in the sample.

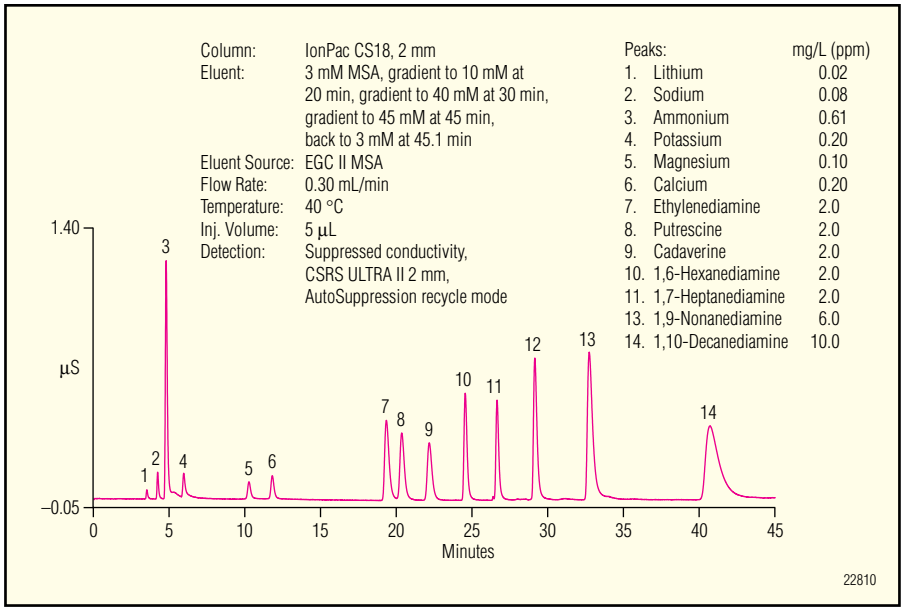


Figure 9: Determination of diamines and the Group I and II cations using the IonPac CS18 column.

Nonsuppressed Conductivity Detection with the CS18

When extended calibration linearity for ammonium or other weak bases is required and analyte concentrations are high, the CS18 column with nonsuppressed conductivity detection is recommended. The CS18 can be used for many of the nonsuppressed applications supported by the IonPac SCS 1 Silica Cation Separator but with much greater column stability. Figure 10 shows a comparison of the separation of the common inorganic cations plus ammonium and ethanolamine with nonsuppressed and suppressed conductivity detection.

It should be noted that use of gradients and/or eluent step changes are not practical when the column is operated in the nonsuppressed mode. Also, the use of the eluent generator in the nonsuppressed mode is not recommended as the noise will be high. To minimize the noise in the nonsuppressed mode, the column must be operated at constant temperature.

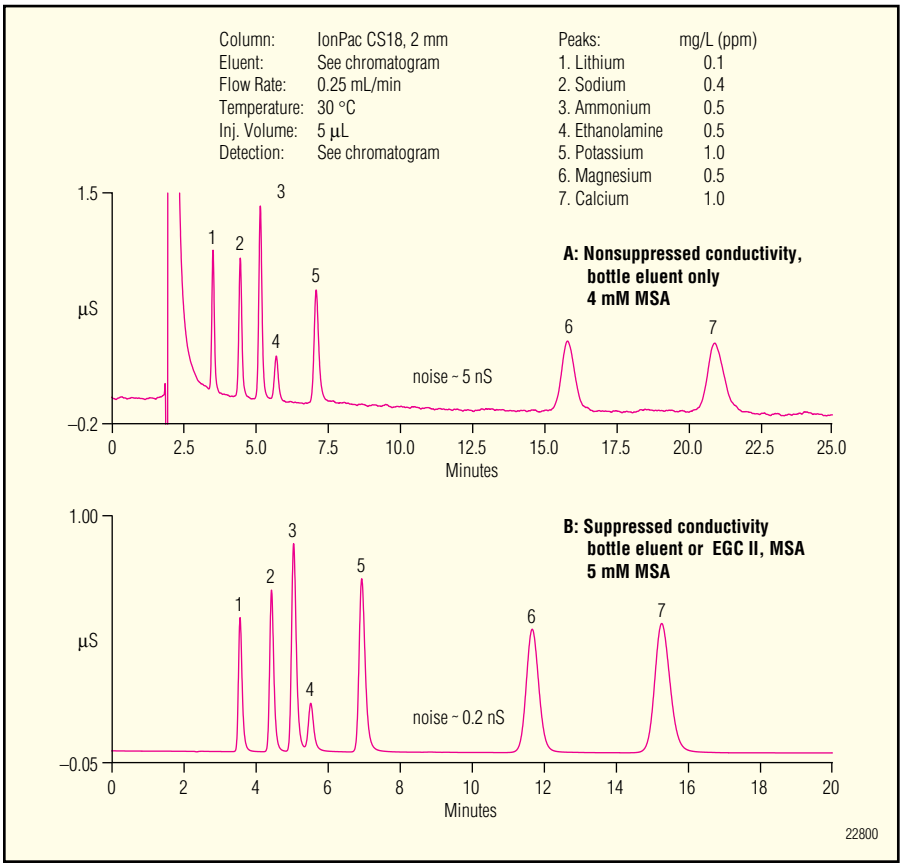


Figure 10. Separation of the common inorganic cations and ethanolamine on the IonPac CS18 column with nonsuppressed and suppressed conductivity detection.

System Requirements

The CS18 operated in the suppressed conductivity mode is recommended for use with the ICS-2000 or ICS-3000 IC Systems equipped with an eluent generator. The CS18 can be used with older Dionex IC Systems equipped with an EG40 or EG50 Eluent Generator or an RFC-30 Reagent-Free Controller. The eluent generator automatically produces methanesulfonic acid gradients from deionized water.

Suppressor Recommendations

For optimum ease of use and economy, the CS18 should be used with the CSRS ULTRA II Cation Self-Regenerating Suppressor or the Cation Atlas Electrolytic Suppressor (CAES). We recommend operating the IonPac CS18 column at an elevated temperature (30 °C) to ensure reproducible retention times in all environmental conditions.

Cation Trap Columns

When using the eluent generator for eluent delivery, we recommend using a CR-CTC Continuously Regenerated Cation Trap Column to remove cationic contaminants from the eluent. The CR-CTC should be installed between the EluGen® cartridge and the eluent generator degas module.

Alternatively, a CTC Cation Trap Column can be used and is installed between the gradient pump and the injection valve.

Concentrator Columns

For trace analysis work, we recommend using the IonPac CG18 guard column when a single-piston pump such as the DQP or DXP is used for sample delivery. Use the TCC-LP1, TCC-ULP1, or TCC-XLP1 Cation Concentrator Column when the sample is delivered with a syringe or with an autosampler.

SPECIFICATIONS

Dimensions: IonPac CS18 Analytical Column:
2 × 250 mm

Dimensions: IonPac CG18 Guard Column:
2 × 50 mm

Maximum Operating Pressure:
4000 psi

Mobile Phase Compatibility:
Acidic eluents (pH 0–7), 20% HPLC solvents, alcohols should be avoided.

Substrate Characteristics:
Bead Diameter (µm): 6.0 µm
Cross-Linking: 55%

Ion-Exchange Group:
Grafted carboxylic acid

Functional Group Characteristics:
Medium hydrophobic

Capacity (µeq/column):
2 × 250 mm analytical column:
290 µeq/col
2 × 50 mm guard column:
58 µeq/col

Column Construction:
PEEK with 10-32 threaded ferrule-style end fittings. All components are nonmetallic.

ORDERING INFORMATION

To order in the U.S., call 1-800-346-6390, 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.

Analytical and Guard Columns

IonPac CS18 Analytical Column (2 × 250 mm) ..... P/N 062878
IonPac CG18 Guard Column (2 × 50 mm) ..... P/N 062880

Trap Columns

CR-CTC Continuously Regenerated Cation Trap Column
(For use with the EG50 with built-in CR-TC control, the EG40 with EG40 CR-TC Add-On Kit or the RFC-30 Reagent-Free Controller)..... P/N 060478
CTC Cation Trap Column (4 × 35 mm)
(for use with 2-mm columns) ..... P/N 043132

Trace Cation Concentrator Columns

TCC-LP1 Trace Cation Concentrator Low Pressure
(4 × 35 mm)..... P/N 046027
TCC-ULP1 Trace Cation Concentrator Ultralow Pressure
(5 × 23 mm)..... P/N 063783
TCC-XLP1 Trace Cation Concentrator Extremely Low Pressure
(6 × 16 mm)..... P/N 063889

Mixer

IonPac Mixer (required for use with nonsuppressed conductivity detection) ..... P/N 063443

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