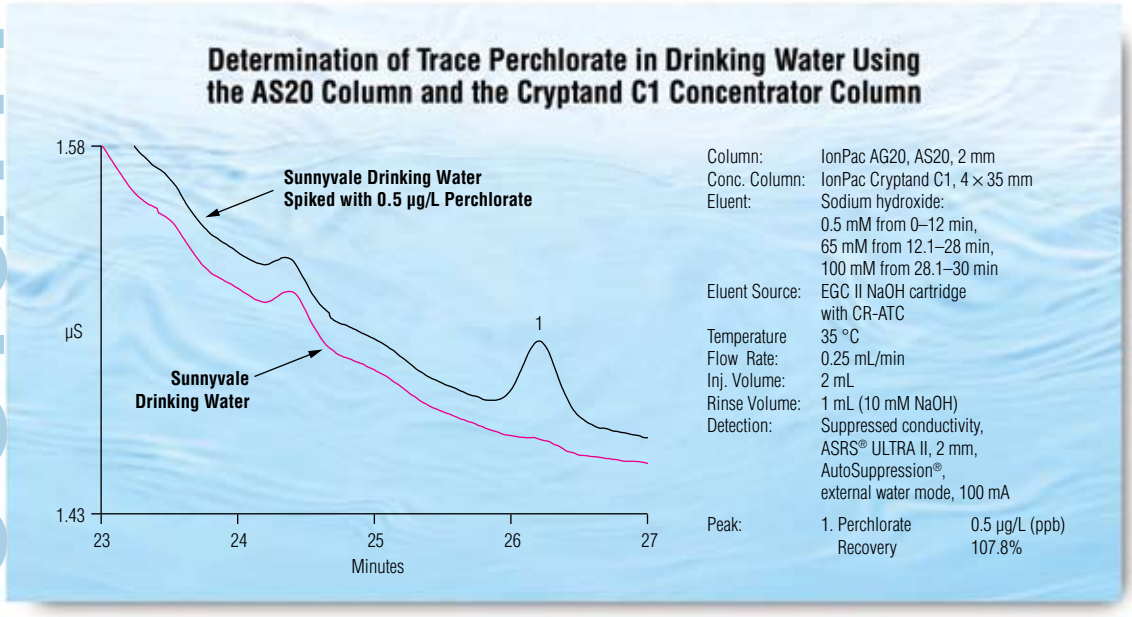
columns

IonPac® Cryptand C1 Concentrator Column



The IonPac Cryptand C1 Concentrator Column is designed primarily for the analysis of trace perchlorate in drinking water. A method using the Cryptand C1 Concentrator Column can quantify 140 ng/L (ppt) of perchlorate in a background of total dissolved solids (chloride, carbonate, and sulfate) at combined concentrations as high as 3000 mg/L. The Cryptand C1 Concentrator Column is the specified concentrator column for sample preconcentration in U.S. EPA Method 314.1.

The Cryptand C1 is an adjustable-capacity concentrator column containing a macroporous, 17.5-µm resin that has been grafted with the macrocyclic 2,2,2 cryptand compound. This column has approximately 30 µeq/col of cryptand capacity available for use. The functional capacity depends on the eluent concentration and type of cation bound within the cage of the cryptand molecule. The unique ability to adjust the capacity of the column from a fixed amount to nearly zero capacity can be achieved by changing either the eluent concentration or type of cation. This unique feature makes the Cryptand C1 Concentrator Column a powerful tool for the determination of trace perchlorate in drinking water and high-ionic-strength water.

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High-Efficiency Particle Structure

The IonPac Cryptand C1 Concentrator Column uses a resin technology based on a cryptand molecule covalently attached to a macroporous, styrene divinylbenzene resin, as illustrated in Figure 1. The cryptand molecule is a bicyclic compound capable of complexing metal cations such as potassium, sodium, and lithium. The cryptand molecule itself has minimal ion-exchange properties. However, in the presence of metal cations, a positively charged site is generated that functions as an anion-exchange site, thus allowing anion exchange to take place similar to conventional ion chromatography.

If the metal cation has a low binding constant (such as lithium with a binding constant of ~1), very few ion-exchange sites are generated and therefore the concentrator column has a very low capacity. However, if a cation with a higher binding constant is used (such as sodium with a binding constant of ~3.9), the concentrator has an intermediate anion-exchange capacity. Although numerous metal cations can be used for complexation, sodium hydroxide and lithium hydroxide eluents can be used successfully for most applications. On rare occasions where a very high-capacity mode is required, potassium hydroxide (binding constant ~5.4) can be used.

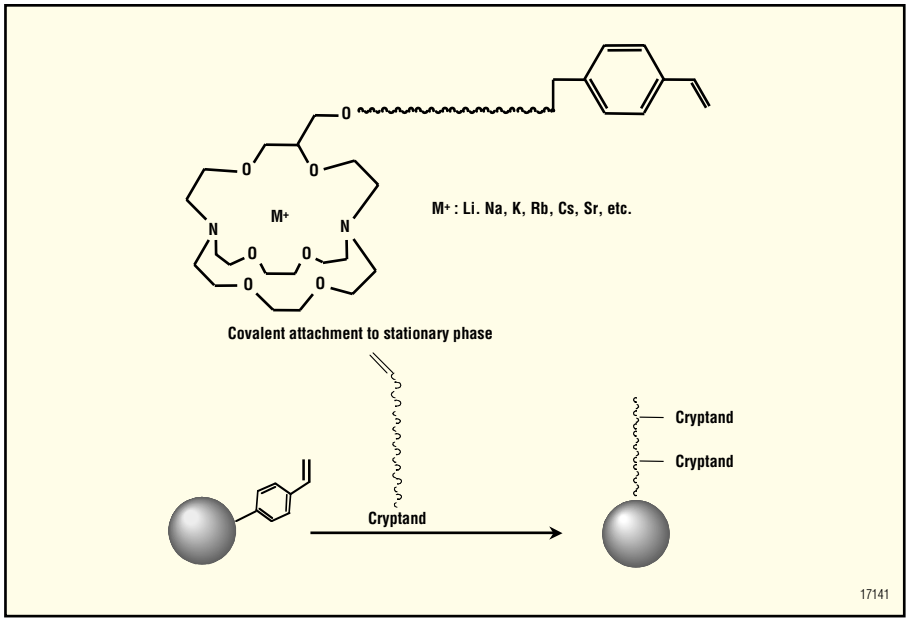


Figure 1. IonPac Cryptand C1 resin.

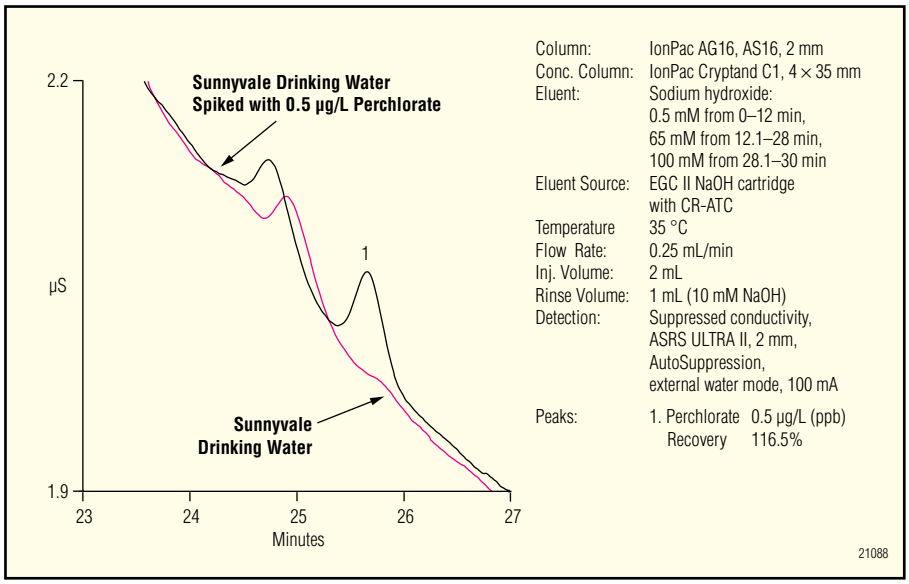


Figure 2. Determination of trace perchlorate in drinking water using the AS16 column following concentration on a Cryptand C1 Concentrator Column.

Determination of Trace Perchlorate in Drinking Water Matrices

Perchlorate (initially as ammonium perchlorate), which is widely used in the manufacture of rocket propellants, munitions, fireworks, and road flares, has been found in drinking water in areas where aerospace materials and munitions have been manufactured and tested. Perchlorate is a potential health concern because it interferes with the production of thyroid hormones and can cause neurological disorders in newborn children. The IonPac AS16 and AS20 columns were designed to determine trace perchlorate in drinking water matrices. Figures 2 and 3 show determinations of trace perchlorate in a drinking water sample using sample preconcentration on the Cryptand C1 Concentrator Column and a sodium hydroxide eluent coupled with suppressed conductivity detection. The Cryptand C1 Concentrator Column is used with a sodium hydroxide eluent to allow optimum concentrator capacity control for trapping and concentrating perchlorate. At high concentrations of sodium, the Cryptand C1 has high capacity, but at very low concentrations the capacity decreases to nearly zero and analytes such as perchlorate are released and eluted to the analytical column.

Figure 4 illustrates the system flow path for the determination of trace perchlorate according to U.S. EPA Method 314.1. The sample is first loaded onto the Cryptand C1 Concentrator Column manually or with an autosampler. Most environmental water samples contain dissolved solids in the form of chloride, carbonate, and sulfate at concentrations from 10 mg/L (ppm) up to as high as 1000 mg/L (ppm) each. The majority of the dissolved solids are rinsed off the Cryptand C1 Concentrator Column with a rinse step of 10 mM sodium hydroxide. Because perchlorate is highly retained relative to the dissolved solids, most if not all the perchlorate remains on the Cryptand C1 Column. The Cryptand C1 Concentrator Column is then switched in-line with the guard/analytical column set and the eluent concentration is stepped down to 0.5 mM sodium hydroxide. At 0.5 mM sodium hydroxide, the Cryptand C1 Concentrator Column has nearly zero capacity, and the perchlorate will elute off and onto the head of the guard/analytical column set, along with any residual dissolved solids.

The analytical column set (AS16 or AS20) has a fixed capacity, and the perchlorate concentrates at the head of the guard/analytical column set and is not eluted due to the low hydroxide eluent concentration (0.5 mM). A step change to 65 mM sodium hydroxide is used to elute the perchlorate in ~20 min. The perchlorate peak is well resolved from the residual dissolved solids. A final step change to 100 mM sodium hydroxide is used to elute off any residual ions that might be present in certain water samples. This step also ensures that the Cryptand C1 Concentrator Column is converted completely to the sodium form prior to the next analysis. The Cryptand C1 Concentrator Column is then switched out of line from the guard/analytical column set and is ready for loading a new sample.

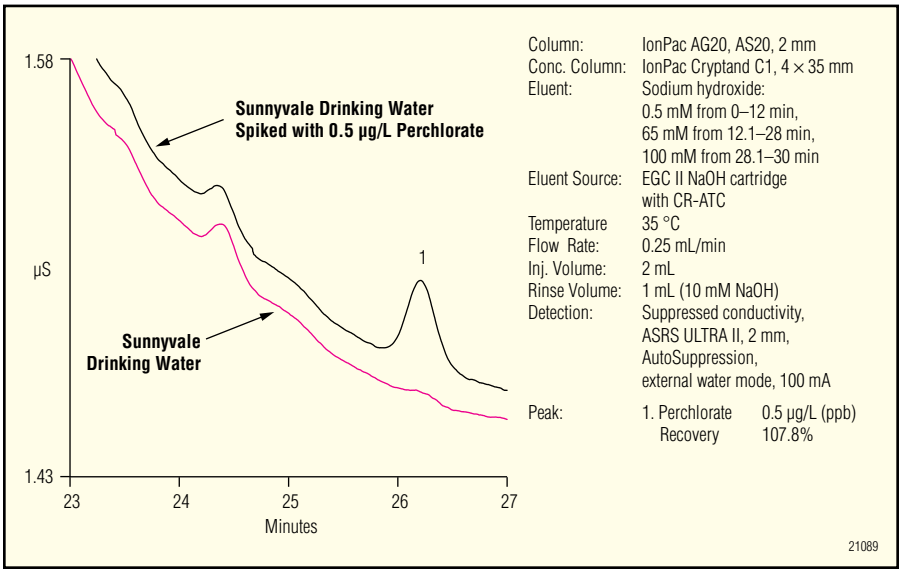
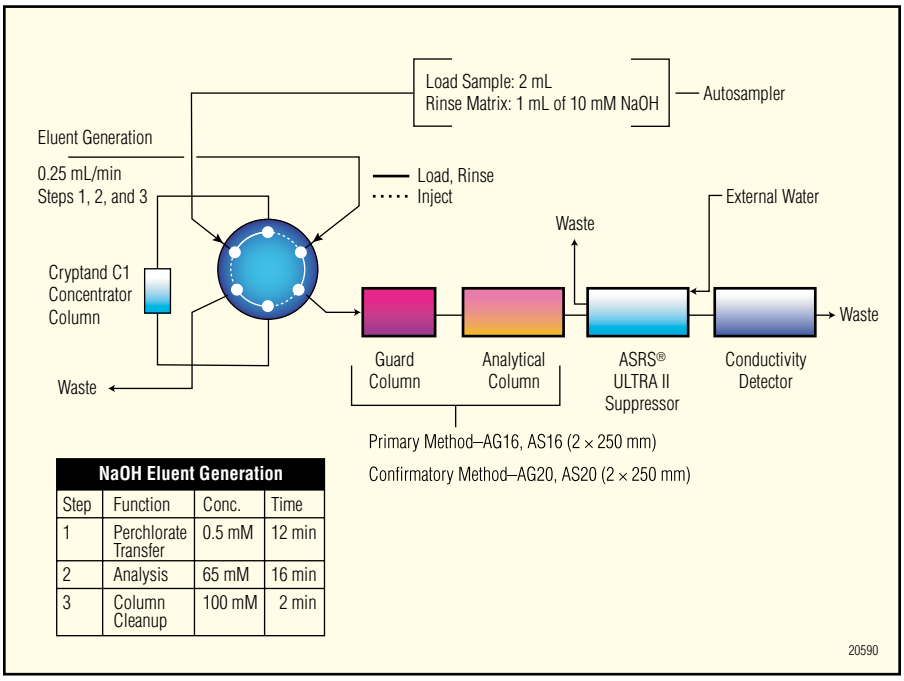


Figure 3. Determination of trace perchlorate in drinking water using the AS20 column following concentration on a Cryptand C1 Concentrator Column.



NaOH Eluent Generation

Step	Function	Conc.	Time
1	Perchlorate Transfer	0.5 mM	12 min
2	Analysis	65 mM	16 min
3	Column Cleanup	100 mM	2 min

Figure 4. System flow path for trace perchlorate in drinking water.

Low- to sub-µg/L (ppb) levels of perchlorate can easily be quantified using the AS16 and AS20 columns and a 2-mL sample injection, as shown in Figures 2 and 3.

SPECIFICATIONS

Dimensions: IonPac Cryptand C1 Concentrator Column:
4 × 35 mm

Maximum Operating Pressure:
4000 psi

Mobile Phase Compatibility:
pH 0–14; 0–100% HPLC solvents

Substrate Characteristics:
Bead Diameter (µm): 17.5
Pore Size: 100 Å
Cross-Linking (%DVB): 55%

Ion-Exchange Group:
Grafted Cryptand (with bound metal cation)

Functional Group Characteristics:
Variable hydrophobicity (eluent dependent)

Capacity:
4 × 35 mm concentrator column: 30 µeq (sodium form)

Column Construction:
Polyetheretherketone (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 number.

IonPac Cryptand C1 Concentrator Column

4 × 35 mm ..... P/N 062893

System Requirements for EGC-NaOH Eluent Generation

For NaOH eluents generated using the EGC-NaOH cartridge, use with ICS-2000, ICS-2500, or ICS-3000 RFIC systems equipped with eluent generation. The eluent generator is used to automatically produce sodium hydroxide gradients from deionized water. The EGC-NaOH cartridge can only be controlled using Chromeleon 6.7 and subsequent Chromeleon releases.

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