

Application Bulletin

Of interest to: General analytical laboratories

I L 1, 2, 3, 4, 5, 7, 8, 9, 11, 16

Phenomenex Star Ion A300 IC anion column (6.1005.100)

for the determination of anions with chemical suppression

Summary

This bulletin describes the determination by ion chromatography of anions, particularly fluoride, chloride, nitrite, bromide, nitrate, orthophosphate and sulfate using the Phenomenex Star Ion A300 IC anion column with chemical suppression.

Instruments and accessories

- 2.732.0010 IC Detector
- 2.733.0130 IC Separation Center with 1 loop injector and Metrohm Suppressor Module MSM
- 2.709.0010 IC Pump
- 2.752.0010 Pump Unit
- 2.714.0310 IC Metrodata for 1 chromatography system with a maximum of 2 detectors
- 6.1005.100 Phenomenex Star Ion A300 IC anion column
- 6.2620.150 Pulsation dampener

Reagents

- Anion standards:
For the preparation of the standard solutions, commercial stock solutions containing $\beta(\text{anion}) = 1000 \text{ mg/L}$ are used.
- Sodium carbonate, anhydrous, puriss. p.a.
- Sodium hydrogen carbonate (sodium bicarbonate), puriss. p.a.
- Sulfuric acid, puriss. p.a.

Column specifications

- Column material: Polystyrene/divinylbenzene copolymer with quaternary ammonium groups
- Dimensions: 100 mm x 4.6 mm

- pH range: 1 ... 12
- Maximum flow: 2.0 mL/min (recommended flow 1.5 mL/min)
- Maximum pressure: 7 MPa (= 70 bar)
- Preparation: The column is delivered ex works filled with sodium carbonate/hydrogen carbonate eluent and can be used directly.
- Storage: The column is stored at room temperature in the eluent used.
- Regeneration: Rinse for 30 min with a solution containing 18 mmol/L sodium carbonate and 17 mmol/L sodium hydrogen carbonate (flow 1 mL/min).

General hints

- The column can only be used in IC systems with chemical suppression.
- The column is not to be recommended for the determination of chloride as carbonate interferes with this determination.
- Sample solutions must be microfiltered (0.45 µm).
- Eluents **must not contain any** organic solvents.
- To increase the useful lifespan of the separation column, it is advisable to use the 6.2620.150 pulsation dampener to attenuate the pressure shocks caused by the injector.

Standard system

Carbonate/hydrogen carbonate eluent

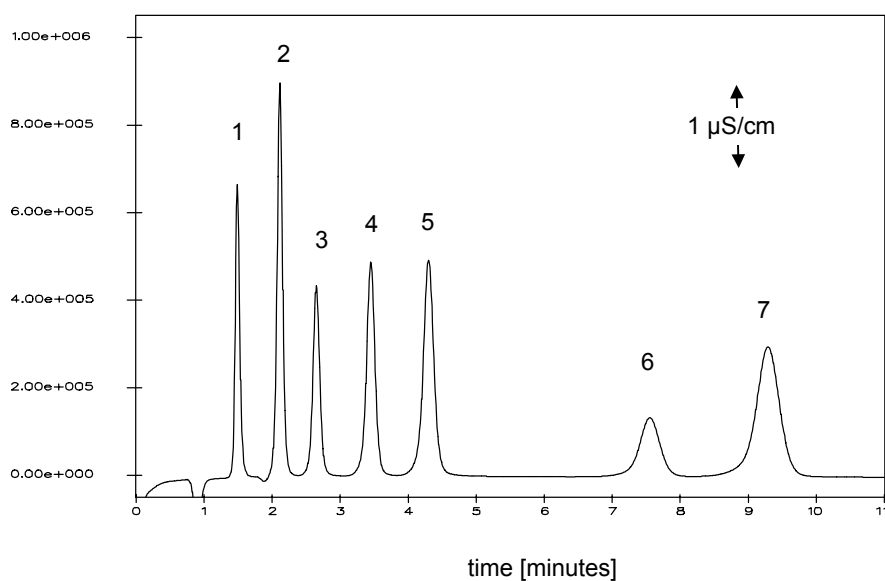
- Composition: 1.8 mmol/L sodium carbonate, 1.7 mmol/L sodium hydrogen carbonate (conductivity after chemical suppression approx. 14 µS/cm)
- Preparation: Dissolve 381 mg sodium carbonate (anhydrous) and 285 mg sodium hydrogen carbonate in ultrapure water and then make up to 2 L with ultrapure water. Before use, degas the eluent applying vacuum.
- Standard: For the preparation of the standard solutions, commercial stock solutions containing $\beta(\text{anion}) = 1000 \text{ mg/L}$ are used.

As an alternative, the stock solutions containing $\beta(\text{anion}) = 1000 \text{ mg/L}$ can also be prepared by dissolving the appropriate amount of a suitable salt (purity standard puriss. p.a.) in ultrapure water. The sample weight required per liter ultrapure water is shown in the table below.

To prepare the anion standard, these stock solutions are then diluted to the desired concentrations with ultrapure water.

Anion	Salt	Dry at	Sample weight [g]
Fluoride	NaF	105 °C	2.2100
Chloride	NaCl	105 °C	1.6484
Nitrite	NaNO ₂	105 °C	1.4998
Bromide	NaBr	105 °C	1.2877
Nitrate	NaNO ₃	105 °C	1.3707
Orthophosphate	KH ₂ PO ₄	105 °C	1.4330
Sulfate	Na ₂ SO ₄	105 °C	1.4790

- Flow: 1.5 mL/min
- Injection volume: 20 µL
- Detection: Conductivity after chemical suppression
- Full Scale: 5 µS/cm
- Polarity: +



Peak no.	Retention time [min]	Ion	Concentration [mg/L]
1	1.5	Fluoride	2
	1.9	System peak	
2	2.1	Chloride	5
3	2.6	Nitrite	5
4	3.4	Bromide	10
5	4.3	Nitrate	10
6	7.5	Orthophosphate	10
7	9.3	Sulfate	10

Appendix 1

Separation columns for ion chromatography

IC anion columns

Designation	Order no.	Chem. no	suppr. yes	Support material	pH range	Comments
Hamilton PRP-X100 IC anion column	6.1005.000	●		polystyrene/divinylbenzene	1 ... 13	rugged separation column for routine analysis; less well suited for fluoride determination
Super-Sep IC anion column	6.1009.000	●		polymethacrylate	1 ... 13	very good separation efficiency
Metrosep Anion Dual 1 IC glass cartridge	6.1006.020	●	●	hydroxymethacrylate	2 ... 12	favorable price/performance ratio; for routine analysis; separation of fluoride, acetate, formate; not suitable for low fluoride concentrations with acidic eluents or for low nitrite concentrations with chemical suppression
Metrosep Anion Dual 2 IC column	6.1006.100	●	●	polymethacrylate	1 ... 12	better separation efficiency than 6.1006.020 IC column; suitable for low nitrite concentrations
Phenomenex Star Ion A300 IC anion column	6.1005.100		●	polystyrene/divinylbenzene	1 ... 12	short analysis times; carbonate interferes with chloride

IC cation columns

Designation	Order no.	Support material	pH range	Comments
Vydac 400 IC cation column	6.1008.000	silica gel	2 ... 7	for the separation of monovalent cations
Nucleosil 5SA IC cation column	6.1007.000	spherical silica gel	2 ... 7	for the separation of divalent cations
Metrosep Cation 1-2 IC column	6.1010.000	spherical silica gel	2 ... 7	suitable for the separation of monovalent and divalent cations as well as for amines

IC exclusion columns

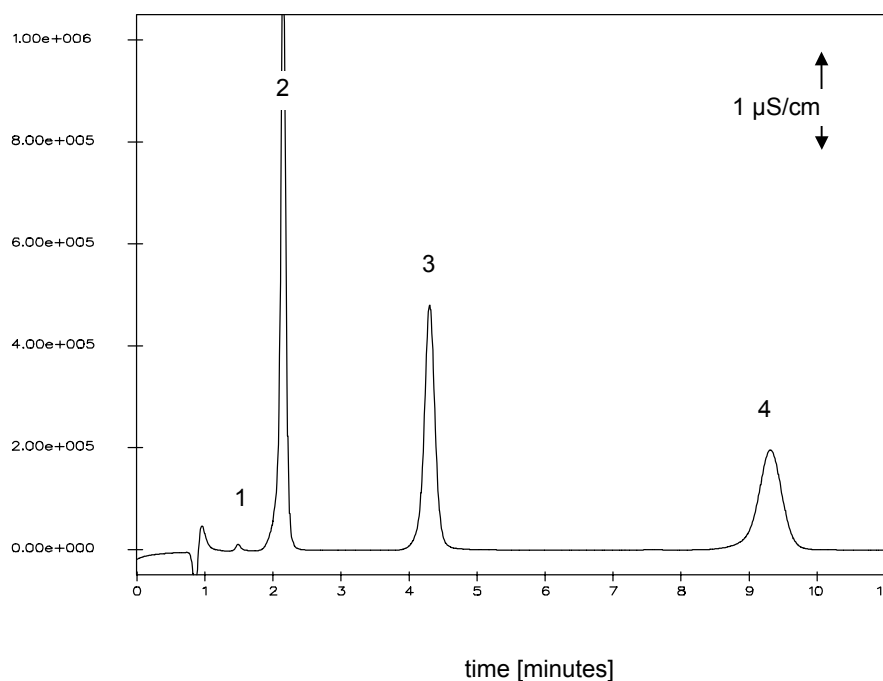
Designation	Order no.	Support material	pH range	Comments
Hamilton PRP-X300 IC exclusion column	6.1005.030	polystyrene/divinylbenzene	1 ... 13	determination of organic acids; sensitive formate determination

Appendix 2

1. Practical example

Drinking water

- Eluent: 1.8 mmol/L sodium carbonate, 1.7 mmol/L sodium hydrogen carbonate (conductivity after chemical suppression approx. 14 $\mu\text{S}/\text{cm}$)
- Flow: 1.5 mL/min
- Injection volume: 20 μL
- Detection: Conductivity after chemical suppression
- Full Scale: 5 $\mu\text{S}/\text{cm}$
- Polarity: +



Peak no.	Retention time [min]	Ion	Concentration [mg/L]
1	1.5	Fluoride	0.04
2	2.1	Chloride	6.7 *
3	4.3	Nitrate	9.8
4	6.6	Sulfate	6.6

*) Carbonate interferes with the determination of chloride: The determined Cl^- concentration is too high.