Application Bulletin

| Of interest to: | General analytical laboratories | I L 1, 2, 3, 4, 5, 7, 8, 9, 11, 16 |

Hamilton PRP-X100 IC anion column (6.1005.000)

for the determination of anions without chemical suppression

Summary

This bulletin describes the determination by ion chromatography of anions, particularly fluoride, chloride, nitrite, bromide, nitrate and sulfate using the Hamilton PRP-X100 IC anion column without chemical suppression.

Instruments and accessories

- 2.732.0010   IC Detector
- 2.733.0010   IC Separation Center with 1 loop injector
- 2.709.0010   IC Pump
- 2.714.0310   IC Metrodata for 1 chromatography system with a maximum of 2 detectors
- 6.1005.000   Hamilton PRP-X100 IC anion column
- 6.2620.150   Pulsation dampener

Reagents

- Anion standards:
  For the preparation of the standard solutions, commercial stock solutions containing β(anion) = 1000 mg/L are used.
- Phthalic acid, puriss. p.a.
- Acetone, HPLC quality
- Sodium hydroxide c(NaOH) = 2 mol/L

Column specifications

- Column material: Polystyrene/divinylbenzene copolymer with quaternary ammonium groups
- Dimensions: 125 mm x 4.0 mm
- Precolumn: 6.1005.020 PRP-X100 IC precolumn cartridge (used together with the 6.2821.040 cartridge head or the 6.2821.050 double cartridge holder)

- pH range: 1 ... 13 (at temperatures above 30 °C no more than pH = 8)

- Maximum flow: 8.0 mL/min

- Maximum pressure: 34 MPa (= 340 bar)

- Preparation: The column is delivered ex works filled with phthalic acid eluent pH = 5.0.

- Storage: For short periods of time (weeks) the column is stored in eluent, for longer periods of time (months) in methanol/water (1 : 4).

- Regeneration: Rinse the column with 0.5 mol/L tartaric acid or with nitric acid (10 mL $c(HNO_3)$ = 6 mol/L in 1L methanol) at 0.5 mL/min for approx. 2 h.

General hints

- The column can only be used in IC systems without chemical suppression.

- Sample solutions must be microfiltered (0.45 µm).

- Under certain conditions it is advisable to dilute the samples with eluent or to use H^+ ion exchanger cartridges (6.1012.110).

- To increase the useful lifespan of the separation column, it is advisable to use the 6.1005.020 precolumn cartridge and the 6.2620.150 pulsation dampener to attenuate the pressure shocks caused by the injector.

Standard system

Phthalic acid eluent

- Composition: 2 mmol/L phthalic acid, 10% acetone; pH = 5.0 (NaOH) (conductivity approx. 160 µS/cm)

- Preparation: Dissolve 664 mg phthalic acid in 200 mL acetone with stirring, then make up to 2 L with ultrapure water and adjust the pH value to 5.0 with c(NaOH) = 2 mol/L.

- Standard: For the preparation of the standard solutions, commercial stock solutions containing β(anion) = 1000 mg/L are used.

  As an alternative, the stock solutions containing β(anion) = 1000 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
Sulfate	Na_2SO_4	105 °C	1.4790

- Flow: 2.0 mL/min
- Injection volume: 100 µL
- Detection: Conductivity
- Full Scale: 4 µS/cm
- Polarity: +

time [minutes]
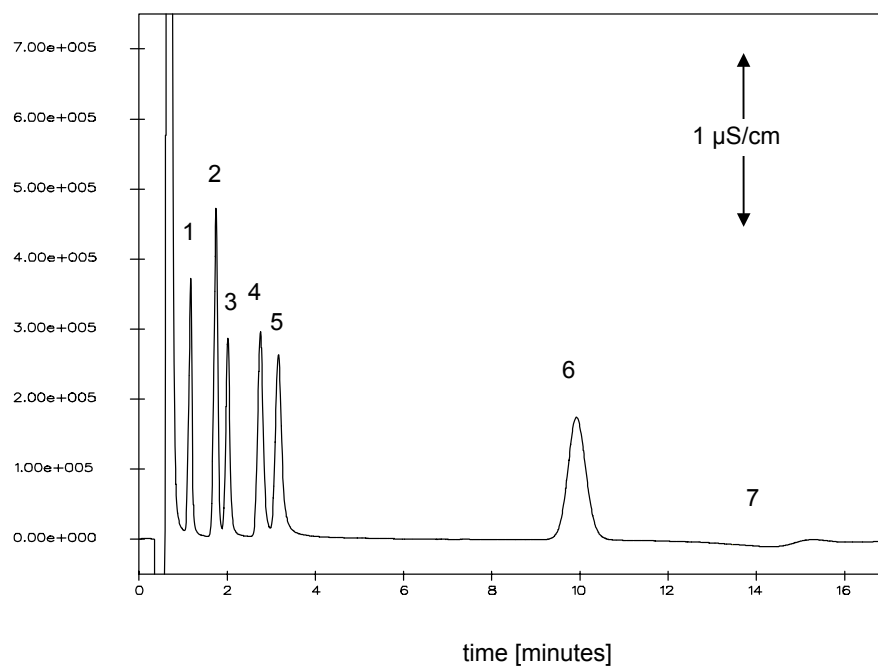
Peak no.	Retention time [min]	Ion	Concentration [mg/L]
1	1.2	Fluoride	5
2	1.8	Chloride	5
3	2.0	Nitrite	5
4	2.7	Bromide	10
5	3.2	Nitrate	10
6	9.9	Sulfate	10
7		System peak	

Appendix 1

Separation columns for ion chromatography

IC anion columns

Designation	Order no.	Chem. suppr. no	Chem. 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	●	●	hydroxylmethacrylate	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

Practical example

Drinking water

- Eluent: 2 mmol/L phthalic acid, 10% acetone; pH = 5.0 (NaOH) (conductivity approx. 160 µS/cm)

- Flow: 2.0 mL/min

- Injection volume: 100 µL

- Detection: Conductivity

- Full Scale: 4 µS/cm

- Polarity: +

- Sample preparation: The sample is injected through a H^+ ion exchanger cartridge (6.1012.110).

time [minutes]
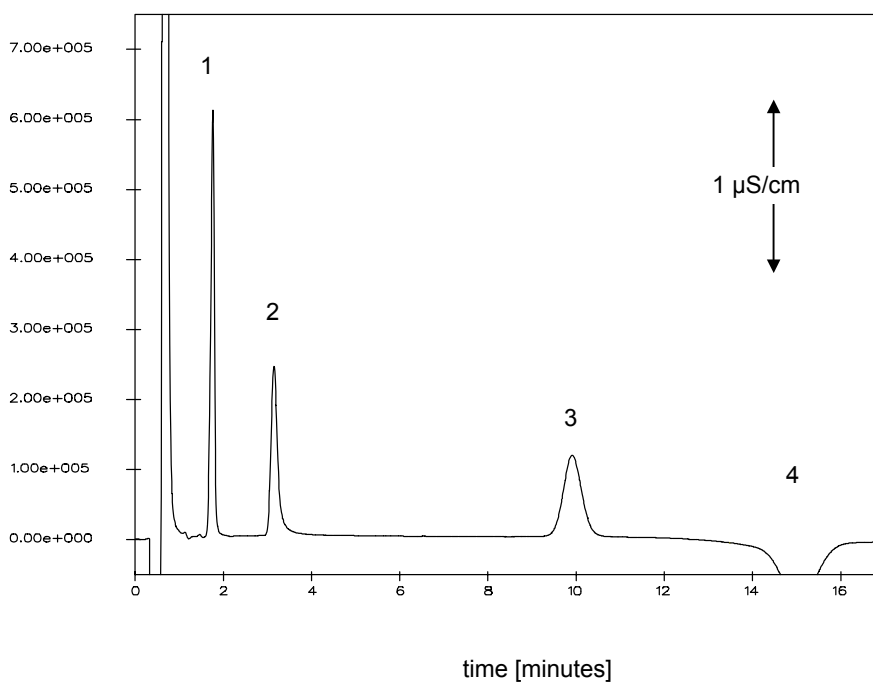
Peak no.	Retention time [min]	Ion	Concentration [mg/L]
1	1.8	Chloride	6.0
2	3.2	Nitrate	9.0
3	9.9	Sulfate	6.6
4		System peak	