Fully automated inline eluent preparation on demand

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Ion Chromatography

Summary

By using the 800 Dosino and the 849 Level Control as the only additional devices, Metrohm`s intelligent ion chromatography (IC) systems – the 850 Professional IC and the Compact IC family – can be easily extended to perform any unattended inline eluent preparation. Fully controlled by MagIC Net™, the 849 Level Control monitors the eluent level while the Dosino performs all dosing and liquid handling tasks.

Consecutive injections of a 250-µg/L standard over approximately 20 days revealed an excellent retention-time stability. After more than 800 consecutive injections, relative standard deviations for anions (F^-, Cl^-, NO_2^-, Br^-, NO_3^-, PO_4^{3-}, SO_4^{2-}) and cations (Li^+, Na^+, NH_4^+, K^+, Ca^{2+}, Mg^{2+}) were smaller than 0.55 and 0.41%, respectively. In the case of a 24-hour sequence, retention-time precision for anions and cations was better than 0.09 and 0.08%, respectively.

The presented inline eluent preparation system increases the retention-time reproducibility and allows the determination of anions and cations over a one-month period without manual eluent preparation.

Introduction

Ion chromatographic (IC) determinations require the off-line preparation of eluents, a procedure that involves various weighing, mixing and degassing steps. Apart from being tedious and labor-intensive, these steps are prone to contamination and uncontrolled procedure variations. As a consequence, poor batch-to-batch reproducibilities are obtained. Furthermore, the manual preparation and replenishment of eluents precludes unattended operation. All these problems can be overcome by applying a new technique that combines the accuracy of the intelligent Dosino technology with the versatility of MagIC Net™.

The simple setup just needs a Dosino that takes over the eluent preparation. The Dosino automatically dilutes a concentrate with ultrapure water and subsequently transfers it to the eluent bottle. First, two liters of eluent are prepared. As the eluent is consumed, the eluent bottle is continuously replenished at defined time intervals. This means that the eluent bottle is always ready for a determination series. With a dilution factor of 20, a two-liter bottle of concentrated eluent achieves an unattended running time of one month (on the Metrosep A Supp 5).

This presentation demonstrates how inline eluent preparation eliminates error-prone and labor-intensive eluent preparation steps while at the same time improving the accuracy of the chromatographic analysis.

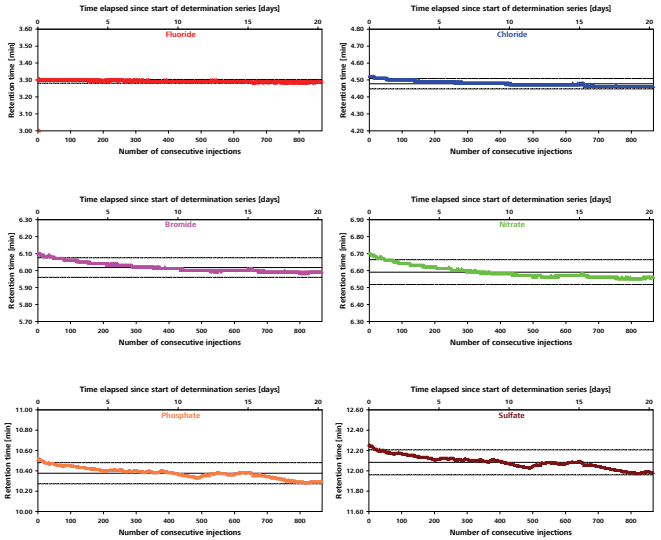
Instrumentation

- 850 Professional IC AnCat – MCS
- 858 Professional Sample Processor
- 849 Level Control
- 800 Dosino
- Dosing Unit 50 mL

Retention-time stability

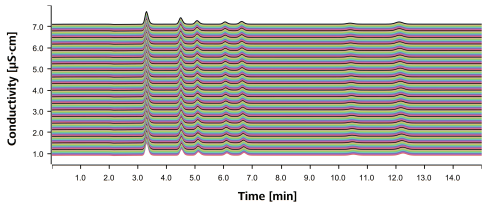
250-µg/L multi-anion and multi-cation standards were continually injected (867 and 830 determinations, respectively) over a 20-day period. For every ion determined, the average retention times (solid line) and the corresponding 95% confidence limits (dashed lines) are indicated in control charts.

Anions



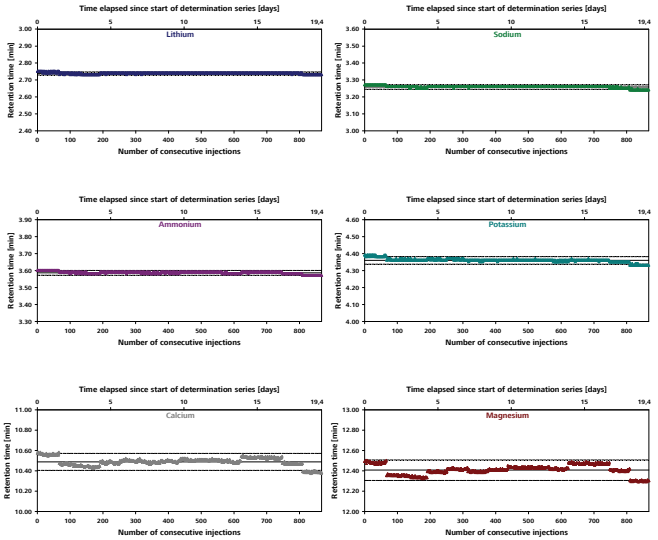
	Time [days]	Fluoride	Chloride	Nitrite[a]	Bromide	Nitrate	Phosphate	Sulfate
Mean value RT [min]	≈20 (n = 867)	3.29	4.48	5.05	6.02	6.59	10.38	12.08
RT_{max}-RT_{min} [s]		1.8	3.6	5.4	7.2	9.0	14.4	16.8
RSD [%]		0.17	0.35	0.42	0.48	0.55	0.50	0.51
Mean value RT [min]	≈1[b] (n = 43)	3.29	4.48	5.04	6.01	6.58	10.38	12.09
RT_{max}-RT_{min} [s]		0.6	0.6	0.6	0.6	0.0	1.2	1.8
RSD [%]		0.06	0.06	0.03	0.03	0	0.07	0.09

[a]control chart not shown, [b]data taken between 9th and 10th day



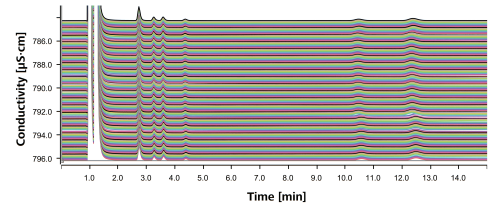
Column: Metrosep A Supp 5 – 100
Eluent: 3.2 mmol/L sodium carbonate
1.0 mmol/L sodium hydrogen carbonate
Flow: 0.7 mL/min
Column temp.: 45 °C
Sample loop: 20 µL

Cations



	Time [days]	Lithium	Sodium	Ammonium	Potassium	Calcium	Magnesium
Mean value RT [min]	≈20 (n = 830)	2.74	3.26	3.59	4.36	10.49	12.41
RT_{max}-RT_{min} [s]		1.2	1.8	1.8	3.6	12.6	12.6
RSD [%]		0.16	0.20	0.20	0.26	0.40	0.41
Mean value RT [min]	≈1[a] (n = 40)	2.74	3.26	3.59	4.36	10.49	12.41
RT_{max}-RT_{min} [s]		0	0	0.6	0.6	1.8	1.2
RSD [%]		0	0	0.08	0.04	0.07	0.05

[a]data taken between 10th and 11th day



Column: Metrosep C 4 – 100
Eluent: 1.7 mmol/L nitric acid
0.7 mmol/L dipicolinic acid
Flow: 0.9 mL/min
Column temp.: 45 °C
Sample loop: 10 µL

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