Application Note AN-S-353

Routine drinking water analysis

Robust analysis of major anions by ion chromatography

Water is the basis of all life. It is essential for any metabolism and it is our primary foodstuff. However, availability of water, especially in the needed drinking water quality, is limited. Therefore, quality control and risk assessment is of tremendous importance to manage the global drinking water supply. To accomplish this, reliable, fast, and robust techniques must be available for water laboratories or drinking water providers to perform valid analysis.

Ion chromatography (IC) is the method of choice to determine the concentration of common ions in water. This information is crucial as drinking water must meet certain standards to guarantee health (e.g. nitrite and nitrate), as well as technical suitability (e.g. corrosiveness of chloride and sulfate).

The Eco IC is an ion chromatograph suitable for economical routine water analysis. It is fully automated and equipped with a conductivity detector, and optional chemical suppression. With this option, the background can be reduced significantly, increasing the signal to noise ratio, widening the detection range to ever lower limits. Using an A Supp 17 anion column, the analysis of major anions in drinking waters is robust and can be performed at ambient temperatures without additional temperature conditioning.

SAMPLE AND SAMPLE PREPERATION

Drinking water, which is usually particle-free and not turbid, is analyzed directly. However, for turbid samples and samples containing particles, filtration is recommended to prevent clogging of the system and to improve the column lifetime. Inline Ultrafiltration is an optional add-on to automate sample filtration as an inline sample preparation step.

EXPERIMENTAL

The analysis is performed on a compact IC system, fully automated with a compact autosampler and Inline Ultrafiltration (Figure 1). The anions are separated on the analytical column Metrosep A Supp 17 - 150/4.0 using a sodium carbonate / sodium hydrogen carbonate eluent. The column is operated at ambient temperature, providing sufficient separation with lower technical complexity for thermostability. After separation, chemical suppression with the Metrohm Suppressor Module (MSM) reduces the background conductivity to approximately 10 µS/cm and improves the S/N ratio. All anions are determined with a conductivity detector and quantified with the software MagIC Net.

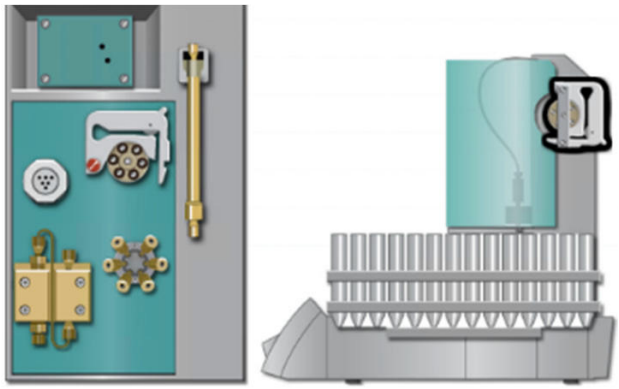

Figure 1. Compact and economic instrumentation to quantify anions in water: Eco IC with an 863 Compact Autosampler.

RESULTS

The calibration ranged from 0.05–2.50 mg/L for fluoride, nitrite, bromide, and phosphate, from 1–50 mg/L for chloride and nitrate, and 5–100 mg/L for sulfate.

Various drinking waters from Switzerland were analyzed in this study. Figure 2 shows a typical chromatogram. The major inorganic anions measured were chloride (7–23 mg/L), nitrate (7–9 mg/L), and sulfate (5–35 mg/L).

Fluoride concentrations were in the range of 0.05–0.090 mg/L. Nitrite, bromide, and phosphate were not detected in substantial amounts. All samples fulfilled the quality requirements of local (TBDV 817.022.11) and EPA regulations (Safe Drinking Water Act) with respect to the tested ions.

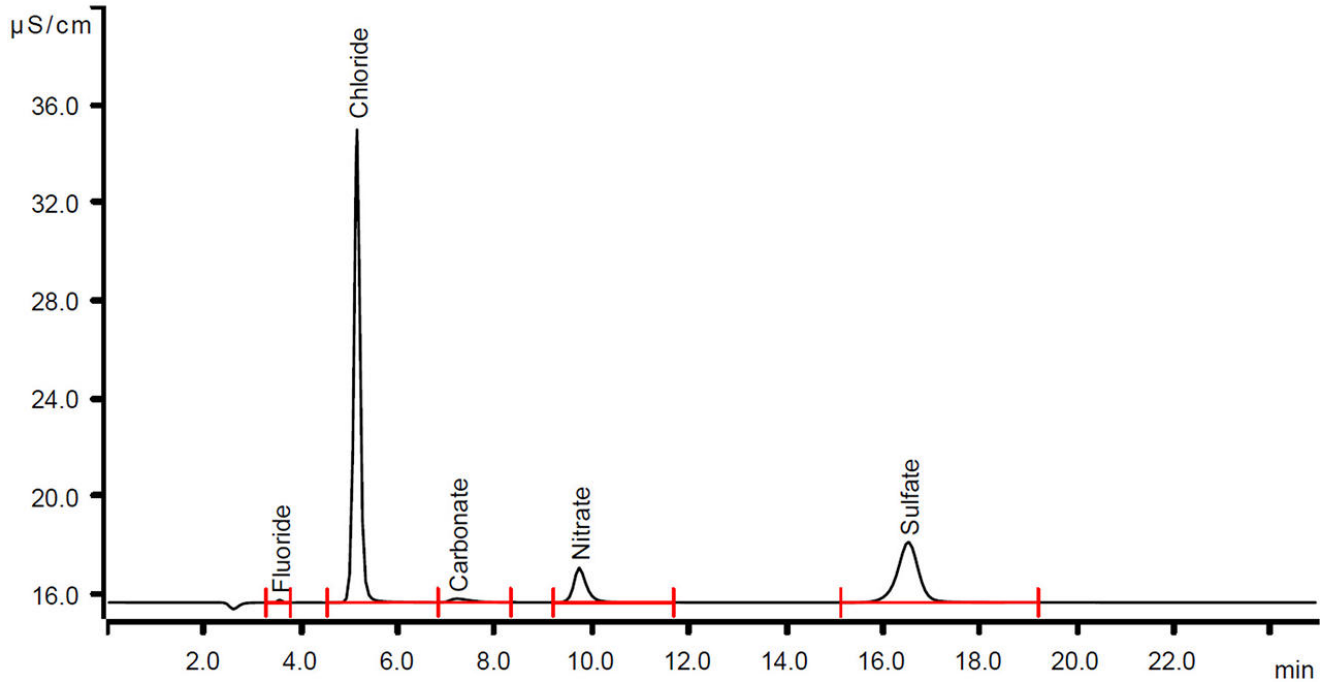

Figure 2. Chromatogram of common anions in drinking water analyzed with an Eco IC. The sample was injected with a 10 µL fixed volume loop. The conductivity was determined after chemical suppression and separation under ambient temperature with a Metrosep A Supp 17.

Table 1. Concentrations of typical anions in a drinking water sample. (n.q. = not quantified)

Analyte	Tap water 1 (mg/L)
Fluoride	0.07
Chloride	22.78
System peak / carbonate	n.q.
Nitrate	7.28
Sulfate	15.34

Table 1 summarizes the concentrations of the major anions in drinking water from a village in Eastern Switzerland. The repeatability of results was acceptable with the described setup. Limits of detection were calculated according to EPA standards (EPA 608.3, 624.1, and 625.1) and were in the µg/L range for all tested anions.

CONCLUSION

Quality control for anions in drinking water is highly important to ensure that the waters meet the overall technical and health-related guidelines. Ion chromatography is a well-established multi-component technique for water analysis. It delivers fast and reliable results. Both the purchase price and running costs of the robust Eco IC are low, thus making it a perfect tool for routine water analysis. Additional automation and Inline Ultrafiltration save time and reduce labor costs as optional equipment.

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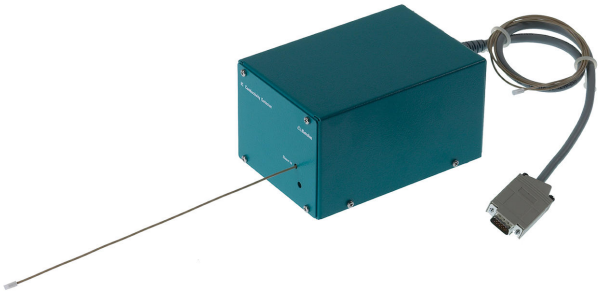
CONFIGURATION

Eco IC

Ion chromatography for everyone! The Eco IC is the entry into ion chromatography at a very affordable price. The instrument is particularly suitable for water analysis in routine operations and for training purposes at schools and universities. Included in the scope of delivery are the conductivity detector, the Metrohm Suppressor Module ("MSM") and the software. Later automation for up to 36 samples and the use of Inline Ultrafiltration are possible at any time.



IC Conductivity Detector

Compact and intelligent high performance conductivity detector for intelligent IC instruments. Outstanding temperature stability, the complete signal processing within the protected detector block and the latest generation of DSP – Digital Signal Processing – guarantee the highest precision of the measurement. No change of measuring ranges (not even automatic ones) is required, due to the dynamic working range.

Metrosep A Supp 17 - 150/4.0

The Metrosep A Supp 17 - 150/4.0 separation column is the column of choice for anion determinations that require good separating efficiency and short separation times at room temperature. The maximum flow rate of 1.4 mL/min then also makes it possible to optimize the determination. The Metrosep A-Supp-17 columns convince with their good price-performance ratio.

863 Compact IC Autosampler

The 863 Compact IC Autosampler is the ideal help for routine analysis. It enables automation of the full range of Metrohm IC instruments.

MSM Rotor A

Suppressor rotor for all IC instruments with MSM (Metrohm Suppressor Module)