

Environmental

Municipal drinking water analysis by fast IC

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Introduction

Ion chromatography (IC) is a well-accepted technique for monitoring inorganic anions in water, including surface, ground, drinking, and wastewaters. In the U.S., water quality is regulated through the Safe Drinking Water Act (SDWA) and the Clean Water Act (CWA) and enforced through the United States Environmental Protection Agency (U.S. EPA)¹. Ion chromatography methods have been approved by the U.S. EPA for compliance monitoring of inorganic anions in drinking water since the 1980s through U.S. EPA Method 300.0 that was updated in 1997 to U.S. EPA Method 300.1². Various IC methods for water analysis have been demonstrated in Thermo Scientific Application Notes using standard or microbore flow rate columns with both carbonate/bicarbonate and hydroxide eluents.³

This work demonstrates the determination of inorganic anions in drinking water by IC using a Thermo Scientific™ Dionex™ IonPac™ AS22-Fast-4 μ m column⁴ set on a Thermo Scientific™ Dionex™ Inuvion™ Ion Chromatography system. The Dionex Inuvion IC system is a new integrated, single-channel compact IC system. The five-minute analysis method used here was previously reported in Application Brief 120⁵.

Method

Reagent, sample, and standard

- Degassed deionized (DI) water, 18 M Ω ·cm resistance or better
- Municipal drinking water
- Thermo Scientific™ Dionex™ Combined Seven Anion Standard II (P/N 057590)

Instrument method parameters

Instrument	Dionex Inuvion system (P/N 22185-60108)
Autosampler	Thermo Scientific™ Dionex™ AS-DV autosampler (P/N 068907) with 5 mL Thermo Scientific™ Dionex™ PolyVials™ and filter caps (P/N 038141)
Columns	Dionex IonPac AS22-Fast-4 μ m column set (P/N 088487, 088486)
Eluent	4.5 mM Na ₂ CO ₃ / 1.4 mM NaHCO ₃ (Prepared from Thermo Scientific™ Dionex™ AS22 Eluent Concentrate, P/N 063965)
Eluent flow rate	2.0 mL/min
Inj. volume	10 μ L (full loop)
Column temp.	30 °C
Detection	Suppressed conductivity, Thermo Scientific™ Dionex™ AERS 500 Carbonate Suppressor, 4 mm (P/N 085029)
Background conductance	~22 μ S/cm
System backpressure	~1,800 psi (100 psi = 0.6894 MPa)
Run time	5 min
Software	Thermo Scientific™ Chromeleon™ Chromatography Data System (CDS) software version 7.3.2

Results and discussion

Figure 1 shows a separation of inorganic anions within 5 min using the Dionex IonPac AS22-Fast-4 μ m column. As this figure shows, the seven inorganic anions are well resolved. The Dionex IonPac AS22-Fast-4 μ m column can be used for compliance monitoring of inorganic anions in drinking and other environmental waters. This 5-min method allows more samples to be run every hour compared to most IC methods used to determine anions in drinking water.

Figure 2 shows the determination of inorganic anions in a drinking water sample. Among the common anions, fluoride, nitrate, and nitrite are regulated with the Maximum Contaminant Level (MCL) for fluoride at 4 mg/L, nitrite at 1 mg/L, and nitrate at 10 mg/L. The results show that the drinking water sample contains chloride (9.6 mg/L), nitrate (1.2 mg/L), and sulfate (16.5 mg/L) with less than 1 mg/L of fluoride (0.6 mg/L), and nitrite (0.1 mg/L), which meet the regulatory criteria.

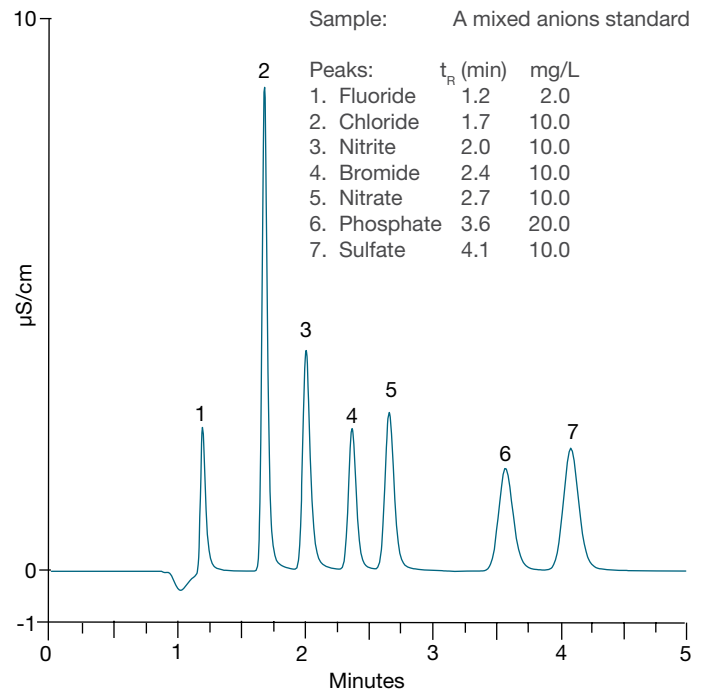


Figure 1. Separation of inorganic anions using a Dionex IonPac AS22-Fast-4 μ m column

Sample: Municipal drinking water

Peaks:	t_r (min)	mg/L
1. Fluoride	1.2	0.6
2. Chloride	1.6	9.1
3. Nitrite	2.0	0.1
4. Unknown	–	–
5. Nitrate	2.6	1.2
6. Phosphate	3.5	0.2
7. Sulfate	4.0	16.5

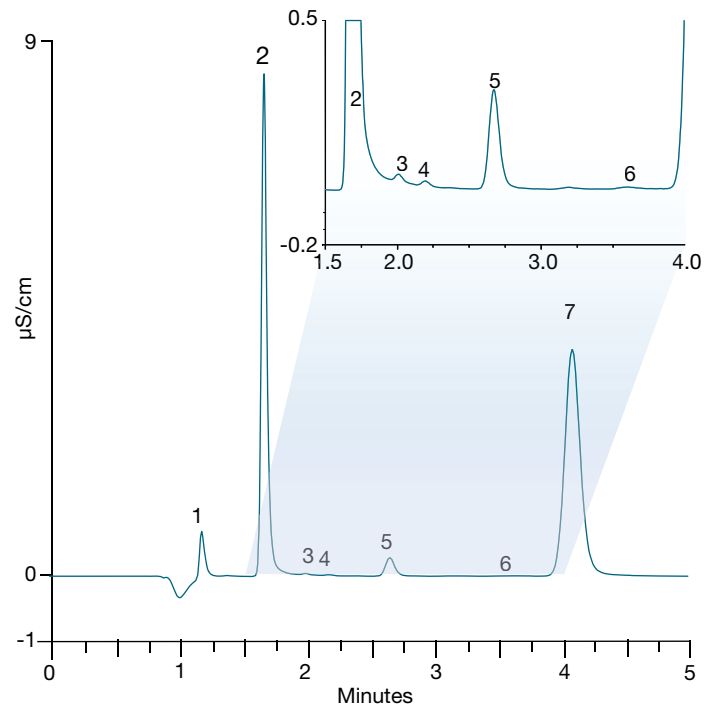


Figure 2. Determination of inorganic anions in a drinking water sample

Conclusion

This work shows the determination of inorganic anions in a drinking water sample using a Dionex Inuvion IC system in 5 min. The integrated Dionex Inuvion IC system coupled with the Dionex AS-DV autosampler, the Dionex IonPac AS22-Fast-4 μ m columns, and an electrolytically regenerated suppressor provides a simple and fast instrument setup for routine determination of inorganic anions in drinking water.

References

1. National Primary Drinking Water Regulations. (Accessed May 31, 2023.)
2. U.S. EPA Method 300.1. The Determination of Inorganic Anions in Water by Ion Chromatography; rev 1.0; U.S. EPA, Office of Water: Cincinnati, OH, 1997. (Accessed May 31, 2023.)
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5. Thermo Scientific Application Brief 120: Municipal Drinking Water Analysis by Fast IC, Sunnyvale, CA, USA, 2011.

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