Dionex IonPac Columns for U.S. EPA Methods 300.0 (B) and 300.1 (B) for Compliance Monitoring of Oxyhalides in Drinking Water

Columns

U.S. EPA Method 300.0 (B) and 300.1 (B) are used for compliance monitoring of inorganic anions and oxyhalides in drinking water samples. The Thermo Scientific™ Dionex™ IonPac™ AS9 column is specified in U.S. EPA Method 300.0 (B) and the Dionex IonPac AS9-HC column is specified in U.S. EPA Method 300.1 (B). However, any anion-exchange column can be used as long as it meets the method performance criteria. The Dionex IonPac AS9 and AS9-HC columns are over 15 years old and there are now better Dionex IonPac columns that use the latest technology, including high capacity 4 µm particle size resins.

Eluents

Depending on the column, either carbonate or hydroxide eluents can be used to separate the common inorganic anions, including fluoride, chloride, nitrite, sulfate, bromide, nitrate, and phosphate as well as the oxyhalides, bromate, chlorate, and chlorite. Hydroxide eluents are typically used for gradient separations and determining analytes present at very low concentrations due the lower background conductivity. Carbonate eluents are used for simpler isocratic separations of well-characterized samples.

Column Length

In general, 250 mm columns are used for higher resolution of more complex matrices while shorter 150 mm columns are used for fast analysis of relatively clean matrices. The longer columns have more ion-exchange capacity than their shorter versions allowing the analysis of higher ionic strength samples without dilution. Guard columns (30–50 mm long) are installed in front of the analytical columns to protect them from situations that may damage the analytical columns. Below are the recommended Dionex IonPac columns for performing U.S. EPA Methods 300.0 (B) and 300.1 (B).

Determination of Oxyhalides and Common Anions in:	Hydroxide Eluent Column and Guard PN	Carbonate Eluent Column and Guard PN	Formats (mm)
Drinking water, wastewater, and other **complex matrices**. The 250 mm format provides **higher capacity** and **more resolving power**.	**Dionex IonPac AS19**	**Dionex IonPac AS23**	
	072064	079782	0.4 × 250
	062886	064145	2 × 250
	062885	064149	4 × 250
	Dionex IonPac AG19	Dionex IonPac AG23	
	072065	083160	0.4 × 50
	062888	064143	2 × 50
	062887	064147	4 × 50
Drinking water, wastewater, and other **complex matrices**. The smaller particles provide both **excellent resolution** and high capacity. An HPIC system is required.	**Dionex IonPac AS19-4µm**	A 4 µm equivalent is not available at this time; use the Dionex IonPac AS23 column above.	
	083230		0.4 × 250
	083223		2 × 250
	083217		4 × 250
	Dionex IonPac AG19-4µm		
	083233		0.4 × 50
	083225		2 × 50
	083221		4 × 50
Drinking water preserved with **ethylenediamine (EDA)** and other **complex matrices**. The 250 mm format provides **higher capacity** and **more resolving power**.	**Dionex IonPac AS27**	An EDA-optimized version is not available at this time; use the Dionex IonPac AS23 column above.	
	088441		0.4 × 250
	088439		2 × 250
	088437		4 × 250
	Dionex IonPac AG27		
	088442		0.4 × 50
	088440		2 × 50
	088438		4 × 50

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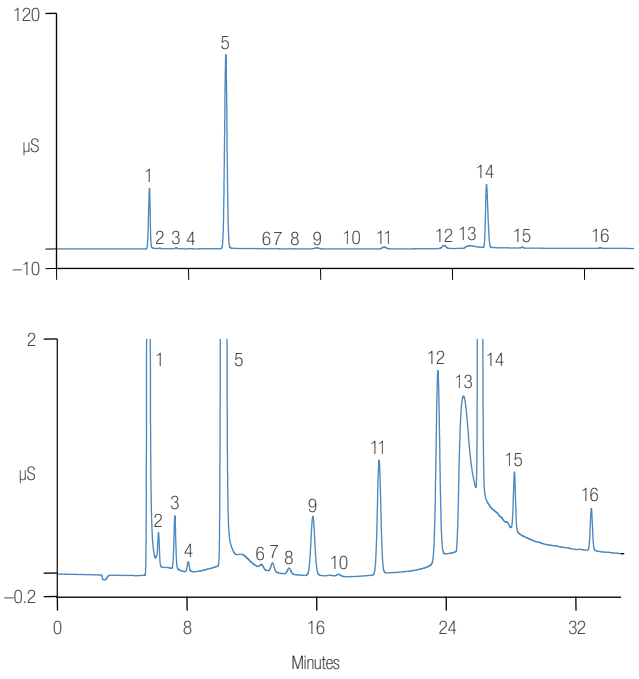
The figures below show an example of a typical analysis for each of the four columns recommended for U.S. EPA Methods 300.0 (B) and 300.1 (B). Note that the 4 µm resin columns have more efficient peaks than the larger particle columns.

Figure 1. Analysis of municipal drinking water spiked with a surrogate anion, trichloroacetate using a Dionex IonPac AS19-4µm capillary column.

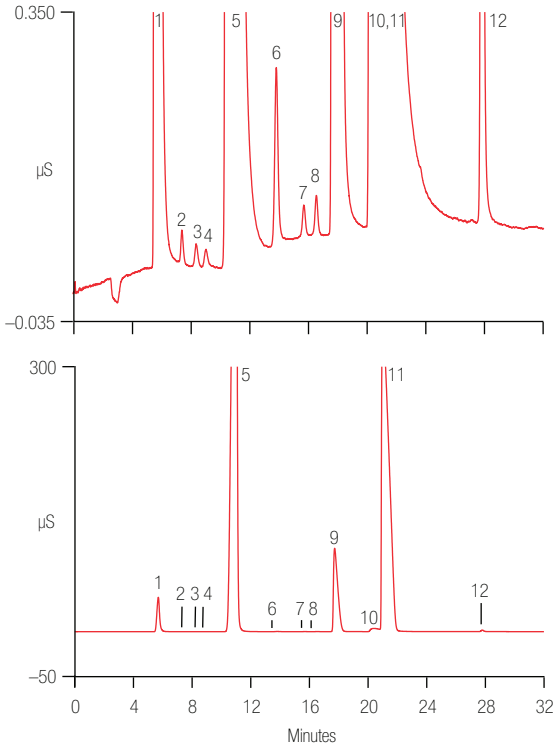


Column:	Dionex IonPac AG19-4µm (0.4 × 50 mm)/ AS19-4µm (0.4 × 250 mm)
Eluent:	10 mM KOH from 0 to 13 min, 10–45 mM KOH from 10 to 28 min
Eluent Source:	Thermo Scientific Dionex EGC-KOH (Capillary) cartridge
Flow Rate:	10 µL/min
Inj. Volume:	2 µL
Temperature:	30 °C
Detection:	Suppressed conductivity, Thermo Scientific™ Dionex™ ACES™ 300 Anion Capillary Electrolytic Suppressor, AutoSuppression, recycle mode
Sample:	Municipal Drinking Water spiked with 1 ppm Trichloroacetate

Peaks:				
1.	Fluoride	0.718 mg/L	9. Chlorate	0.117 mg/L
2.	Acetate	0.017	10. Bromide	0.002
3.	Formate	0.029	11. Nitrate	0.151
4.	Chlorite	0.009	12. Trichloroacetate	1.03
5.	Chloride	6.02	13. Carbonate	NQ
6.	Unknown	—	14. Sulfate	2.84
7.	Nitrite	0.008	15. Oxalate	0.041
8.	Unknown	—	16. Phosphate	0.065

The smaller particles produce higher backpressures and therefore systems that can operate up to 5000 psi are recommended when using 4 µm particle columns.

Figure 2. Analysis of drinking water using a Dionex IonPac AS19 column.



Column:	Dionex IonPac AG19 (4 × 50 mm)/AS19 (4 × 250 mm)
Eluent:	10 mM KOH from 0 to 10 min, 10–45 mM KOH from 10 to 25 min
Eluent Source:	Dionex EGC II KOH cartridge with CR-ATC
Flow Rate:	1.0 mL/min
Inj. Volume:	500 µL
Temperature:	30 °C
Suppressor:	Thermo Scientific™ Dionex™ ASRS™ 300 Anion Self-Regenerating Suppressor, 4 mm, AutoSuppression, external water mode

Peaks:			
1.	Fluoride	1	mg/L
2.	Formate	—	
3.	Chlorite	0.005	
4.	Bromate	0.005	
5.	Chloride	50	
6.	Nitrite	0.005	
7.	Chlorate	0.005	
8.	Bromide	0.005	
9.	Nitrate	10	
10.	Carbonate	25	
11.	Sulfate	50	
12.	Phosphate	0.2	

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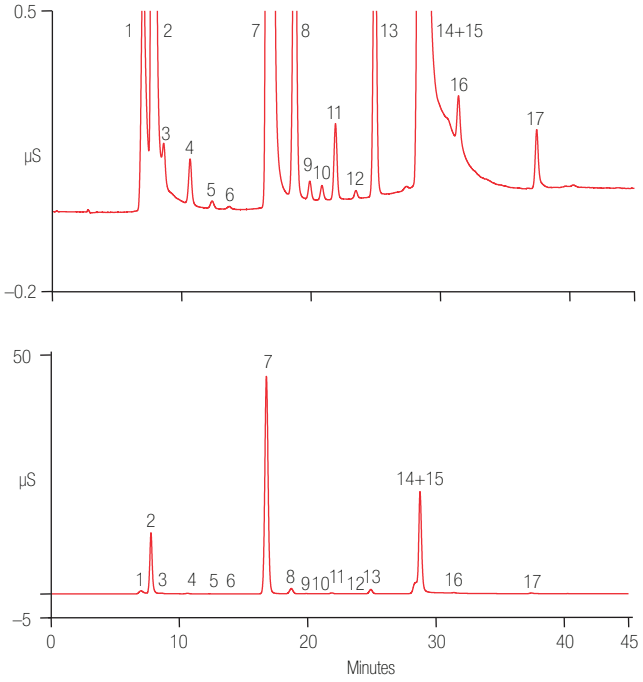
Figure 3. Analysis of municipal drinking water preserved with ethylenediamine and spiked with a surrogate anion, dichloroacetate using a Dionex IonPac AS27 column.

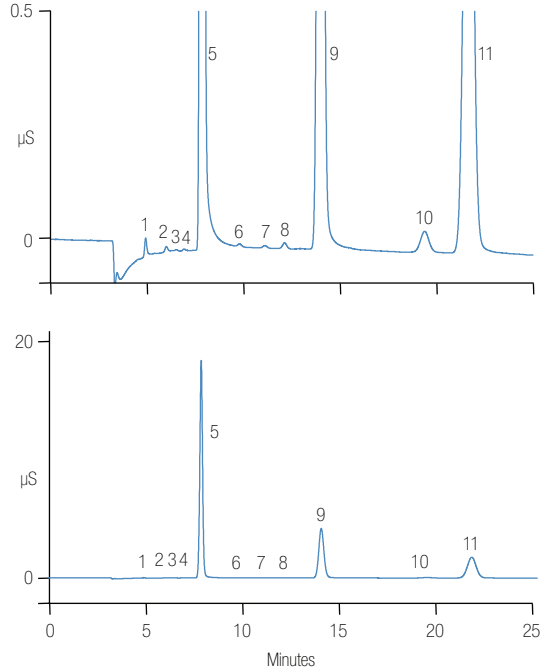


Column: Dionex IonPac AG27 (4 × 50 mm)/AS27 (4 × 250 mm)
Eluent: 8 mM KOH from 0 to 10 min, 8–60 mM KOH from 10 to 35 min
Eluent Source: Dionex EGC 500 KOH cartridge
Flow Rate: 1.0 mL/min
Inj. Volume: 200 µL
Temperature: 30 °C
Detection: Suppressed conductivity, Thermo Scientific™ Dionex™ AERS™ 500 Anion Electrolytic Regenerating Suppressor, 4 mm, AutoSuppression, recycle mode
Sample: Municipal Drinking Water spiked with 50 ppm Ethylenediamine, 0.5 ppm Dichloroacetate and 5 ppb Bromate

Peaks:

1. Unknown	—	mg/L	10. Unknown	—	mg/L
2. Fluoride	0.73		11. Chlorate	0.053	
3. Acetate	NQ		12. Bromide	0.005	
4. Formate	NQ		13. Nitrate	0.22	
5. Chlorite	0.006		14. Carbonate	NQ	
6. Bromate	0.005		15. Sulfate	4.01	
7. Chloride	6.21		16. Oxalate	0.02	
8. Dichloroacetate	0.50		17. Phosphate	0.10	
9. Nitrite	0.008				

Figure 4. Analysis of wastewater using a Dionex IonPac AS23 Capillary column.



Column: Dionex IonPac AG23 (0.4 × 50 mm)/AS23 (0.4 × 250 mm)
Eluent: 4.5 mM Sodium carbonate
0.8 mM Sodium bicarbonate
Temperature: 30 °C
Flow Rate: 10 µL/min
Inj. Volume: 0.4 µL
Detection: Suppressed conductivity, Dionex ACES 300 Suppressor, AutoSuppression, recycle mode

Peaks:

1. Fluoride	0.01	mg/L
2. Formate	NQ	
3. Chlorite	<0.01	
4. Bromate	0.010	
5. Chloride	7.0	
6. Nitrite	<0.01	
7. Chlorate	0.01	
8. Bromide	0.02	
9. Nitrate	5.9	
10. Phosphate	0.3	
11. Sulfate	3.9	

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