Application Brief

Environmental

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Drinking Water Analysis using the Agilent 7800 ICP-MS (N8421A)

Accurate measurement of major and trace elements in natural waters

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Rapid delivery, easy to set up, and simple to use

The Agilent 7800 ICP-MS combines proven, robust hardware, auto-optimization tools, and pre-set methods to simplify routine analysis, making your laboratory more productive, and your results more reliable.

The Agilent 7800 ICP-MS (N8421A) is extraordinarily easy to set up and use and can be rapidly delivered to your lab. You'll be able to quickly produce reliable results for the widest range of sample types.

Using a preset method for drinking water analysis

In this study, the 7800 ICP-MS (product number N8421A) was fitted with a MicroMist glass concentric nebulizer, quartz Scott-type spray chamber, quartz torch with a 2.5 mm id injector, and nickel cones. The ORS^4 cell was used in no gas and helium collision mode. The plasma and tuning settings were optimized automatically by selecting the General Purpose plasma mode, and using autotune.

Table 1. 7800 ICP-MS (N8421A) operating parameters. RF power (1550 W), sampling depth (10 mm), and nebulizer gas flow rate (1.05 L/min) are set within the preset plasma mode.

	No Gas Mode	Helium Mode
Plasma Mode	General Purpose	
Extract 1 and Extract 2 (V)	0 and -185	
Deflect (V)	12.2	0.8
Energy Discrimination (V)	5.0	
He Flow (mL/min)	0	5.0

Standards and standard reference material

Calibration standards were prepared using a multi-elemental environmental calibration standard (Agilent p/n 5183-4688) and 1,000 mg/L single elemental standards for B and Hg (Kanto Chemical Co., Inc, Japan). An internal standard (ISTD) solution containing 1 ppm ^{6}Li, Sc, Ge, Rh, In, Tb, Lu, and Bi was prepared from Agilent Internal Standard mix (p/n 5188-6525) plus Ir (Kanto Chemical Co.). All elements were prepared at 1 ppm in 1% HNO_3 and 0.5% HCl. SRM NIST 1640a trace elements in natural water (Gaithersburg, MD, USA) was used to evaluate the method.

Method detection limits (MDLs)

The MDLs for elements typically analyzed in water quality studies were calculated according to US EPA method 200.8 (Table 2). The shaded elements are listed in Chinese GB 5749 Standards for Drinking Water Quality. The excellent MDLs show the suitability of the 7800 ICP-MS (N8421A) for the analysis of drinking water. If lower DLs are required for Fe and Se, High Energy Helium (HE-He) mode can also be used. The MDLs for Fe and Se in HE-He mode were 0.017 and 0.019 µg/L (ppb), respectively.

Table 2. Typical 7800 ICP-MS (N8421A) method detection limits.

Element	ISTD	MDL µg/L	Element	ISTD	MDL µg/L
^{9}Be	6Li	0.004	^{66}Zn	Rh	0.020
^{11}B	Sc	0.013	^{75}As	Ge	0.007
^{23}Na	Sc	0.123	^{78}Se	Ge	0.112
^{24}Mg	Sc	0.023	^{97}Mo	Rh	0.005
^{27}Al	Sc	0.012	^{107}Ag	Rh	0.003
^{39}K	Sc	0.839	^{111}Cd	Rh	0.005
^{51}V	Sc	0.006	^{123}Sb	Tb	0.005
^{52}Cr	Sc	0.008	^{135}Ba	Tb	0.023
^{55}Mn	Sc	0.015	^{202}Hg	Ir	0.001
^{56}Fe	Sc	0.056	^{205}Tl	Ir	0.004
^{59}Co	Sc	0.001	^{208}Pb	Bi	0.003
^{60}Ni	Sc	0.013	^{232}Th	Bi	0.001
^{63}Cu	Rh	0.008	^{238}U	Bi	0.002

Be to Al were measured in no gas mode; all other elements were measured in helium mode.

SRM recoveries

The NIST 1640a natural water SRM was measured using the 7800 ICP-MS (N8421A) and operating conditions given in Table 1. Table 3 shows the measured concentrations in the SRM and the recoveries compared to the certified values. The recovery results for all certified elements were ±10%. The data demonstrates the effectiveness of the 7800 ICP-MS (N8421A) for the determination of major and trace elements in natural waters.

Table 3. Recovery data for NIST 1640a SRM using the 7800 (N8421A).

Element	Measured Conc. µg/L	Certified Conc. µg/L	Recovery %
^{9}Be	2.940	3.026	97
^{11}B	289.7	303.1	96
^{23}Na	3124	3137	100
^{24}Mg	1053.2	1058.6	99
^{27}Al	53.5	53.0	101
^{39}K	554.9	579.9	96
^{51}V	14.9	15.05	99
^{52}Cr	39.96	40.54	99
^{55}Mn	41.30	40.39	102
^{56}Fe	37.3	36.8	101
^{59}Co	20.02	20.24	99
^{60}Ni	25.15	25.32	99
^{63}Cu	85.26	85.75	99
^{66}Zn	54.42	55.64	98
^{75}As	7.947	8.075	98
^{78}Se	19.66	20.13	98
^{97}Mo	44.48	45.60	98
^{107}Ag	7.894	8.081	98
^{111}Cd	3.965	3.992	99
^{123}Sb	5.042	5.105	99
^{135}Ba	151.24	151.80	100
^{202}Hg	< 0.001	-	-
^{205}Tl	1.575	1.619	97
^{208}Pb	11.836	12.101	98
^{232}Th	< 0.001	-	-
^{238}U	24.65	25.35	97

Spike recovery test for Th and U

Th and U are listed in HJ-700 China Environmental Protection Standard, so are sometimes analyzed in environmental water samples. The 7800 ICP-MS (N8421A) uses a fixed mass resolution setting for Th and U.
A 10 ppb spike recovery test was carried out to check instrument performance for Th and U. The recoveries were within ±5%, as shown in Table 4.

Table 4. Recovery of 10 ppb spikes of Th and U in NIST 1640a SRM.

Element	Unspiked Conc. µg/L	Spiked Conc. µg/L	Spike Recovery %
Th	< 0.001	9.66	97
U	24.65	34.85	102

The Agilent 7800 ICP-MS (N8421A) can accurately measure major and trace elements. With its fixed mass resolution, the sensitivity of Th and U is higher than typical ICP-MS. With the 7800 (N8421A) and 7900 (N8403A), you have the option of rapid delivery of an Agilent ICP-MS.

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