Analysis of aluminum using a high-temperature burner (flame method)

Measurements were made using a high-temperature burner that utilized nitrous oxide as the auxiliary gas, because Al must be atomized at high temperature. When making high-temperature burner measurements, carbon may become deposited on the flame outlet and bring about a reduction in measured values. For these data, the measurement method of Blank → Sample A → Sample B → Al 30 mg/L was repeated 10 times, and the stability of the data with the high-temperature burner was confirmed. Although 40 samples were measured here, carbon deposits on the burner flame outlet had no effect on the data. Stable quantitative values were obtained with no fluctuation in the baseline due to the double beam effect using the polarized Zeeman correction method.

Model ZA3000 Atomic Absorption Spectrophotometer

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- ✓ Measurements were performed using a high-temperature burner (P/N: 7J0-8857).
- ✓ Sample A and Sample B consisted of river water samples to which Al was added.

■ Measurement conditions

Table 1 - Al measurement conditions

Element	Al	Atomizer	STD Burner
Instrument	ZA3000	Flame	N_2O-C_2H_2
Atomization	Flame	Fuel (C_2H_2)	7.0 L/min
Wavelength	309.3 nm	Oxidant (N_2O)	160 kPa
Lamp Current	10.0 mA		6.0 L/min
Slit Width	1.3 nm	Burner Height	10.0 mm

Table 2 – Al measurement parameters

Meas. Mode	Working Curve
Signal Mode	BKG Correction
Curve Order	Linear
Calculation	Integration
Time Constant	1.0 s
Calculation Time	5.0 s
Delay Time	5.0 s

■ Measurement results

Table 3 - Sample names

No.	Sample name	No.	Sample name
S1	Al 0 mg/L	U1, U5, U9, U13, U17, U21, U25, U29, U33, U37	Blank
S2	Al 10 mg/L		
S3	Al 20 mg/L	U2, U6, U10, U14, U18, U22, U26, U30, U34, U38	Sample A
S4	Al 30 mg/L	U3, U7, U11, U15, U19, U23, U27, U31, U35, U39	Sample B
S5	Al 40 mg/L	U4, U8, U12, U16, U20, U24, U28, U32, U36, U40	Al 30 mg/L
S6	Al 50 mg/L		

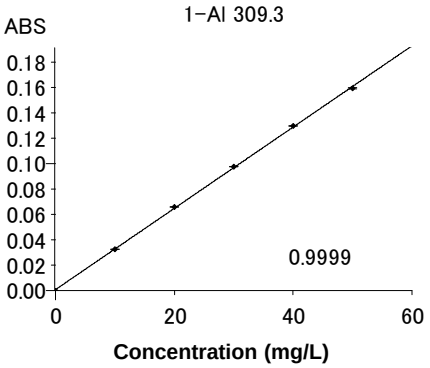

Figure 1 – Al calibration curve

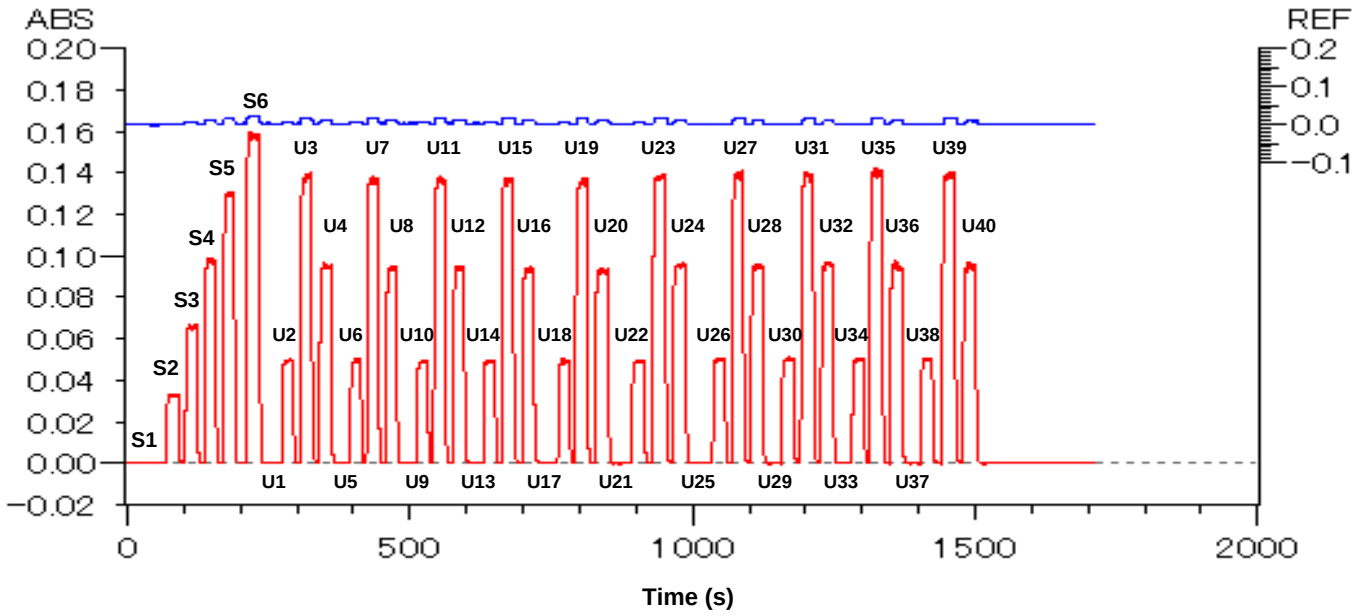

Figure 2 – Al atomic absorption signal profile

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- ✓ The RSD of the quantitative value of each sample measured 10 times is 0.9% to 1.1%, and a stable quantitative value can be obtained.
- ✓ As shown in Figure 4, there was little carbon deposited on the flame outlet after the completion of measurements.

Table 4 - Concentration and absorbance for each sample

ID	Sample name	Concentration (mg/L)	RSD (%)	Absorbance
STD 1		0.00	***	-0.0001
STD 2		10.00	0.00	0.0325
STD 3		20.00	0.30	0.0658
STD 4		30.00	0.00	0.0975
STD 5		40.00	0.15	0.1296
STD 6		50.00	0.31	0.1593
UNK 1	Blank	-0.21	0.00	0.0001
UNK 2	Sample A	15.18	0.72	0.0494
UNK 3	Sample B	42.75	0.35	0.1376
UNK 4	Al 30 mg/L	29.37	0.24	0.0948
UNK 5	Blank	-0.23	***	0.0001
UNK 6	Sample A	15.22	0.13	0.0495
UNK 7	Sample B	42.42	0.00	0.1365
UNK 8	Al 30 mg/L	29.06	0.07	0.0938
UNK 9	Blank	-0.23	***	0.0001
UNK 10	Sample A	15.14	0.33	0.0492
UNK 11	Sample B	42.34	0.38	0.1363
UNK 12	Al 30 mg/L	29.09	0.55	0.0939
UNK 13	Blank	-0.26	***	-0.0001
UNK 14	Sample A	15.12	0.46	0.0492
UNK 15	Sample B	42.23	0.09	0.1359
UNK 16	Al 30 mg/L	28.90	0.38	0.0933
UNK 17	Blank	-0.24	0.00	0.0000
UNK 18	Sample A	15.17	1.71	0.0493
UNK 19	Sample B	42.00	0.50	0.1352
UNK 20	Al 30 mg/L	28.72	0.38	0.0927
UNK 21	Blank	-0.26	***	-0.0001
UNK 22	Sample A	15.07	0.27	0.0490
UNK 23	Sample B	42.81	0.26	0.1378
UNK 24	Al 30 mg/L	29.53	0.07	0.0953
UNK 25	Blank	-0.24	0.00	0.0000
UNK 26	Sample A	15.37	0.72	0.0500
UNK 27	Sample B	43.20	0.09	0.1390
UNK 28	Al 30 mg/L	29.44	0.07	0.0950
UNK 29	Blank	-0.24	0.00	0.0000
UNK 30	Sample A	15.47	0.13	0.0503
UNK 31	Sample B	43.06	0.86	0.1386
UNK 32	Al 30 mg/L	29.69	0.07	0.0958
UNK 33	Blank	-0.26	***	-0.0001
UNK 34	Sample A	15.32	0.00	0.0498
UNK 35	Sample B	43.47	0.58	0.1399
UNK 36	Al 30 mg/L	29.56	0.81	0.0954
UNK 37	Blank	-0.24	0.00	0.0000
UNK 38	Sample A	15.39	0.58	0.0500
UNK 39	Sample B	43.12	0.07	0.1388
UNK 40	Al 30 mg/L	29.65	1.85	0.0957

Table 5 - Measurement results for Al within samples

	Mean concentration (mg/L)	SD	RSD
Blank	ND	-	-
Sample A	15.25	0.13	0.9%
Sample B	42.74	0.48	1.1%
Al 30 mg/L	29.30	0.34	1.1%

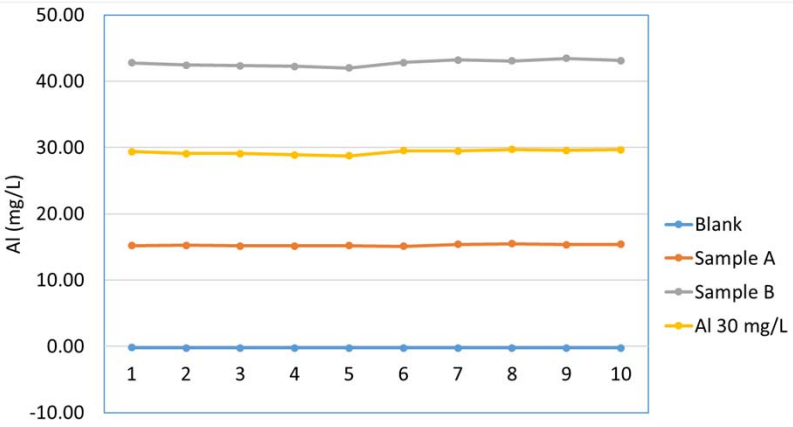

Figure 3 - Changes in measured values for Al due to high-temperature burner

Figure 4 - High-temperature burner (left) and close-up of flame outlet after completion of measurements (right)

[KEY WORDS]

environmental analysis, environmental water, river water, aluminum, Al, flame, high-temperature burner, AA, ZA3000, ZA3300, environment

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