SHIMADZU APPLICATION NEWS

SPECTROPHOTOMETRIC ANALYSIS



Measurement of Litium (Li) and Aluminium (AI) in Human Sera

Lithium compounds are used as therapeutic agents in psychiatric disorders, however, due to the occurrence of side-effects if too much is taken, it is necessary to control the dosage by monitoring its concentration in blood sera.

In January, 2000, the United States FDA (Food and Drug Administration) announced the content restriction of aluminium in non-oral drugs (drip solutions, etc.). Orally ingested aluminium is almost all excreted as it is from the body, without being

absorbed, and the majority of the portion that is absorbed in the body is thought to be excreted in the urine. However, it has been pointed out that individuals with renal dysfunction who take aluminium non-orally over a long period of time display symptoms of toxicity. Introduced here are examples of analysis of lithium and aluminium in human sera (NIST 909b Human Sera Level I and II) by the flame method and furnace method, respectively.

Analysis of Li

Analysis was conducted using the calibration curve method.

1mL of sample was transferred to a test tube, 1mL of 1% Cs solution and 1mL of hydrochoric acid (1+10) were added, and the total volume was brought to 10mL using pure water to complete preparation of the analysis sample.

One measurement was conducted for each sample.



Fig. 1 Li Measurement Data

Table 2 Li Analysis Results

Sample Name	Analysis Value(µg/mL)	Certified Value(µg/mL)
NIST 909b Level I	4.20	4.265 ±0.0034
NIST 909b Level II	17.6	18.04 ±0.016

Wavelength	: 670.8nm
Slit width	: 0.5nm
Lamp mode	: NON-BGC
Flame type	: Air – acetylene
Acetylene flow rate	e : 1.8L/min
Air flow rate	: 8.0L/min
Burner height	: 7mm
Burner angle	: 0°

Table 1 Li Analytical Conditions

Analysis of Al

Analysis was conducted using the standard addition method.

1mL of Level I sample was transferred to each of 5 test tubes, and 1mL of 1% Triton X-100 aqueous solution and 1mL of nitric acid (1+100) were added. In addition, 0, 1, 2, 3 and 4mL of 25ng/mL aluminium standard solution were added to the test tubes, and the volumes were brought to 10mL using pure water to complete preparation of the analysis samples.

The Level I sample was processed in the same way as the Level I sample, and a non-added and 5ng/mL (equivalent to 50ng/mL in serum) -added samples were prepared, and measurement was conducted by the simple standard addition method.

Two repetitions of the measurement were conducted.

Table 3 AI Analytical Conditions

Wavelength : 309.3nm Slit width : 0.5nm Lamp mode : BGC-D2

Temperature Program (Tube used : platform tube)

Stage	Temp. (°C)	Time	Heating Mode	Ar Gas Flow Rate (L/min)
1	120	10	RAMP	0.2
2	120	30	STEP	0.2
3	250	10	RAMP	0.2
4	250	10	STEP	0.2
5	1200	15	RAMP	1.0
6	1200	15	RAMP	1.0
7	2300	5	STEP	0.0
8	2600	2	STEP	1.0

Stage 7 is atomization stage.

Calibration Curve (Calibration Curve No. : Abs 0.200 0.100 0.000 5.000 10.0 Conc(ng/mL)	02) Cor (ng 0.0 5.0 7.5 00	nc A /mL) 000 0 000 0 000 0 000 0 000 0	bs .0546 .0946 .1286 .1754 .2115		
Abs=0.0158Conc+0.054 r=0.9991					
MSA 1 : MSA Average Concentration ABS BG Position 0.0000 0.0546 0.0010 2	Sample Amt. 20				<u>%RSD</u> 2.4584
MSA 2 : MSA Average <u>Concertration</u> <u>ABS</u> <u>BG</u> Pos <u>2.5000</u> 0.0946 0.0012 3	Sample tion <u>Amt.</u> 20				<u>%RSD</u> 1.5689
MSA 3 : MSA Average Concentration ABS BG Pois 5.0000 0.1286 0.0018 4	Sample tion Amt. 20				<u>%RSD</u> 1.7595
MSA 4 : MSA Average Concentration ABS BG Posi 7.5000 0.1754 0.0016 5	Sample Amt. 20				<u>%RSD</u> 1.9351
MSA 5 : MSA Average Concertration ABS BG Post 10.0000 0.2115 0.0010 6	Sample Amt. 20				%RSD 2.1397
NIST 909b Level I : MSA Result <u>Concentration</u> 3.4225		Dilution Factor 10.00	Meas Conc. 34.2250	Meas Conc. Unit ng/mL	
NIST 909b Level II : SMSA Average <u>Concentration</u> ABS BG Poi 4.9544 0.0782 0.0008 77	Sample Amt. 20	Dilution Factor 10.00	Meas Conc. 49.5440	Meas Conc. Unit ng/mL	<u>%RSD</u> 1.8977
NIST 909b Level II +5ng/mL : SMSA Average Concentration ABS BG Posi 9.9468 0.1570 0.0026 9	Sample Amt. 20	Dilution Factor 1.00	Meas Conc. 9.9468	Meas Conc. Unit ng/mL	<u>%RSD</u> 1.3065

Fig. 2 Al Measurement Data

Table 4 Al Analysis Results

Sample Name	Analysis Value(ng/mL)
NIST 909b Level I	34.2
NIST 909b Level II	49.5

The certified values were not available.



Fig. 3 Peak Profiles of Al

*The published data was not acquired using an instrument registered by Japanese pharmaceutical affairs law.



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