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Application News

Atomic Absorption Spectrophotometer AA-7800F

Flame Photometric Analysis of Sodium in Lithium Carbonate Using Wavelength Shift Function of AA-7800

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User Benefits

- Content of sodium in lithium carbonate can be easily analyzed.
- By using the wavelength shift function to specify two analysis wavelengths, the background can be corrected even for flame emission spectrophotometry.

■ Introduction

Lithium carbonate acts on the central nervous system to suppress heightened emotions and has been shown to have beneficial effects, such as mood stabilization and depression reduction.

The Japanese Pharmacopoeia specifies evaluation methods for lithium carbonate, including identification, purity evaluation, and quantification methods. In this article, sodium in lithium carbonate was analyzed using an AA-7800 atomic absorption spectrophotometer, in accordance with the 18th edition of the Japanese Pharmacopoeia[1]. The following is a measurement example of using background correction with the AA-7800 wavelength shift function.

■ Flame Photometric Analysis and Wavelength Shift Function

The AA-7800 can be used as a flame emission spectrophotometer. In this case, atomic emission is measured, so the hollow cathode lamp of the light source, which is required for atomic absorption spectrometry, is unnecessary. High sensitivity can be obtained for alkaline and alkaline earth elements, such as Na and K, whose analysis wavelengths are in the longer wavelength range, where the light emission of the flame is less affected. However, when these components are measured in a sample with many coexisting materials, background emission from the coexisting materials may occur, and these must be corrected.

Because AA-7800 can be used to specify two analysis wavelengths using the wavelength shift function, background correction can also be corrected for flame photometric analysis by measuring the sum of atomic emission and background emission at a normal analysis wavelength, and then measuring the background emission at a wavelength shifted by a few nanometers.

■ Pretreatment of Samples

Commercially available lithium carbonate was used as the measurement sample. Samples were prepared in accordance with the 18th edition of the Japanese Pharmacopoeia, as follows:

1) 0.8 g of lithium carbonate was accurately measured and thoroughly dissolved in water to make exactly 100 mL. This was used as the sample stock solution.
2) 25 mL of the sample stock solution was accurately measured and added to water to make exactly 100 mL. This was used as the sample solution.
3) A commercial sodium standard solution was diluted with water to a concentration of exactly 10 ppm. This was used as the standard solution.
4) To exactly 25 mL of the sample stock solution was added exactly 20 mL of the standard solution and then water to make exactly 100 mL. This was used as the standard spiked solution.

■ Analytical Conditions

A Shimadzu AA-7800F atomic absorption spectrophotometer was used. The main conditions for flame photometric analysis are indicated in Table 1. Analysis was performed by flame photometric analysis method.

Table 1 Analytical Conditions for Flame Photometric Analysis

Element	Na
Analytical Instrument	AA-7800F
Analysis Wavelength	589 nm
Shift Wavelength	580 nm
Slit Width	0.2 nm
Lighting Mode	Emission
Height of Burner	7 mm
Type of Flame	Air-C_2H_2
C_2H_2 Flowrate	2.0 L/min
Integration Time	5 s
Repetitions	3 times

■ Sample Analysis

For the sample analysis, the emission intensity of sodium was measured using the AA-7800 spectrophotometer with the following conditions.

The wavelength was adjusted to 589 nm and the line search was performed with the standard spiked solution sprayed into the flame. The emission intensity measured from the standard spiked solution was designated as L_S.

Then the emission intensity L_T of the sample solution was measured. Next, the other conditions were made identical and, in order to correct the background emission originating from lithium carbonate, the wavelength was changed to 580 nm using the wavelength shift function and the sample solution emission intensity L_B was measured as the blank.

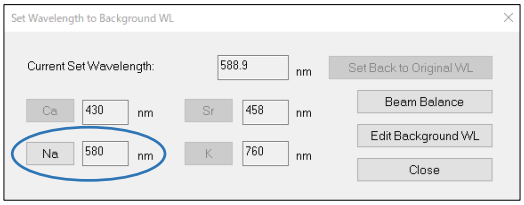

Fig. 1 [Wavelength Shift] Window

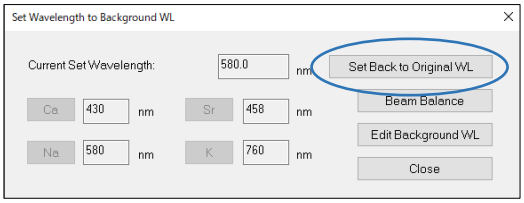

Fig. 2 After Wavelength Shift Setting

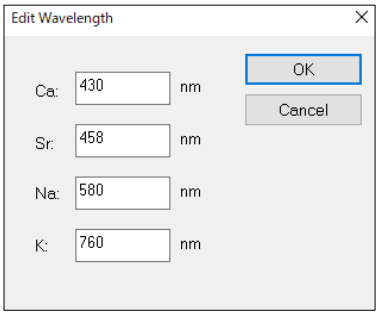

Fig. 3 [Edit Wavelength] Window

Fig. 1 shows the window for setting wavelength shift settings. When a measurement element is specified, the shifted wavelength is set as the analysis wavelength. That situation is shown in Fig. 2. If the [Set Back to Original WL] is clicked, the shifted wavelength is set as the original analysis wavelength and the window in Fig. 1 is shown again. To change the shifted wavelength, click [Edit Background WL] and edit the setting in 1 nm units in Fig. 3.

■ Analysis Result

Table 2 shows the measurement results and the lower limit of quantification (LOQ) of sodium by flame photometric analysis. The concentration of sodium was calculated using the following formula:

Amount (%) of Sodium (Na)

$= (L_T - L_B)/(L_S - L_T) \times M'/M \times 100$

M (mg): Lithium carbonate in 25 mL of the sample stock solution.

M′ (mg): Sodium in 20 mL of the standard solution.

The analysis result showed that the sodium content in lithium carbonate was lower than the upper limit (0.05%). The LOQ is expressed as the value of 10σ calculated from the standard deviation (SD), obtained by measuring the sample solution 10 times, converted to solid sample.

Table 2 Analysis Result and LOQ of Sample

Wavelength	Sample	Emission Intensity / Analysis Result
589 nm	L_S	0.5568
	L_T	0.0016
580 nm	L_B	0.0004
LOQ (%)		0.0002
Analysis Result of Sample (%)		0.0002

■ Conclusion

Evaluation of sodium in lithium carbonate using an AA-7800 spectrophotometer is simple and does not require complicated pretreatment. In addition, the wavelength shift function makes background correction easy and enables efficient operation. Furthermore, the AA-7800 enables analysis of sodium in lithium carbonate with high reproducibility according to the 18th edition of the Japanese Pharmacopoeia.

Flame Model AA-7800F

<Reference>

1) The 18th Edition of the Japanese Pharmacopoeia (the Ministry of Health, Labour and Welfare Notification No.220 of June 7, 2021)

2) Application News A407 “Flame Photometric Analysis with Wavelength Shift Using AA-7000”

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