

# Application News

## No. AD-0123

*Clinical Research / AA-7000F*

### Determination of High Concentration Sodium by Flame Atomic Absorption Spectrophotometry (FAAS) at Different Wavelengths

#### □ Introduction

Clinical samples such as intravenous infusion or dialysis solutions contain large amounts of sodium (Na). Hence, dilution is indispensable when analyzing sodium. However, a higher dilution factor is accompanied by a greater risk of dilution error and contamination. Instead of dilution, measurement can be carried out at a lower instrument sensitivity. In FAAS analysis, a method to reduce sensitivity is by changing the burner head angle [1]. Another method is to use different measurement wavelengths. Table 1 shows the various measurement wavelengths and the sensitivity ratios [2].

Table 1: Measurement Wavelengths and Sensitivity Ratio for Na

Wavelength	Sensitivity Ratio
589.0 nm	100.0%
589.5 nm	35.0%
330.3 nm	0.5%

This application news demonstrates the analysis of Na in clinical and multi-element standards using Shimadzu AA-7000 FAAS at different wavelengths.

#### □ Experimental

The 10,000ppm Na standard solution and potassium chloride were purchased from Sigma-Aldrich, USA and J. T. Baker, USA respectively. Type E-1 ultra pure water with resistivity of 18MΩ was used. The Na hollow cathode lamp was obtained from Heraeus Noblelight, Germany.

The samples used in this analysis were:

- Clinical Standards catalogue no "FCNK3" from Reagecon, Ireland. It contains 100 mM sodium (Na) and 100 mM potassium (K).
- Multi-Element Calibration Standards catalogue no "REICPCAL5A" from Reagecon, Ireland which contains 2000ppm each of calcium (Ca), iron (Fe), potassium (K), magnesium (Mg) and sodium (Na)

- Multi-element Standard Solution 3 for ICP catalogue no "49596" from Sigma-Aldrich, USA. It is a Certified Reference Material (CRM) and contains 2000ppm Ca, 200ppm K, 400ppm Mg and 1000ppm Na.

The AAS analysis conditions are shown in Table 2.

Table 2: Instrument and Analytical Conditions

Instruments	: AA-7000 Flame
Flame	: Air-Acetylene Air = 15 L/min; Acetylene = 1.5 L/min
Burner Height	: 5 mm
Wavelength	: 589.0 nm / 589.5 nm / 330.3 nm
Lamp Current	: 8 mA
Slit Width	: 0.2 nm
Background Correction	: None
Matrix Modifier	: 0.1% Potassium

As different measurement wavelengths have different sensitivity ratios, the suitable concentration range in calibration graphs are also different. The highest concentration used to prepare the calibration curves at 589.0 nm, 589.5 nm and 330.3 nm were 1, 2 and 100 ppm, respectively. Due to this, the samples were prepared with different dilution factor as shown in Table 3.

Table 3: Sample Dilution Factors at Different Wavelengths

Wavelength	Sample Dilution Factor		
	FCNK3	REICPCAL5A	49596
589.0 nm	5000	5000	5000
589.5 nm	5000	5000	5000
330.3 nm	50	50	25

## □ Results and Discussion

All the calibration graphs measured at different wavelengths have a correlation coefficient (R) of more than 0.999 (Figure 1). The slope of the calibration graph for 589.0nm and 330.3nm were 0.84369 and 0.0042317 respectively. This shows that the sensitivity at 330.3nm was 0.5% compare to 589.0nm. These results are comparable to the data in Table 1.

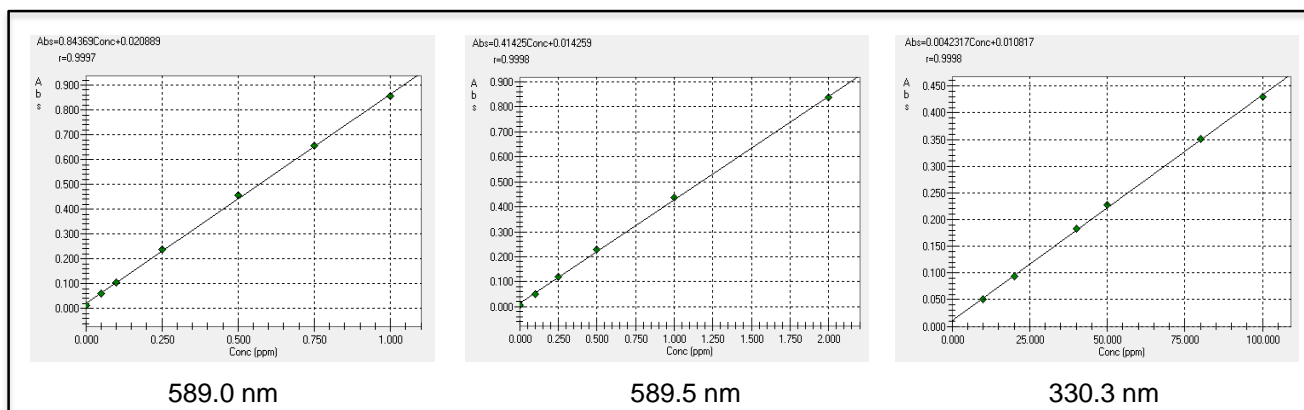


Figure 1: Na Calibration Graphs at Different Wavelengths

Table 4: Summary of Results

Wavelength	FCNK3 contains 100 mM Na			REICPCAL5A contains 2000 ppm Na			49596 contains 1000 ppm Na		
	Measured Conc*	% CV	% Accuracy	Measured Conc*	% CV	% Accuracy	Measured Conc*	% CV	% Accuracy
589.0 nm	100.0 mM	0.1	100.0%	2033.4 ppm	0.8	101.7 %	1023.5 ppm	0.1	102.4 %
589.5 nm	99.9 mM	0.4	99.9 %	2039.1 ppm	0.2	102.0 %	1034.9 ppm	0.4	103.5 %
330.3 nm	103.3 mM	0.5	103.3 %	2072.3 ppm	0.1	103.6 %	1036.1 ppm	0.7	103.6 %

Measured Conc\* = Measured Concentration

The results for the samples were satisfactory since the percentage accuracy was from 95 to 105% (Table 4). The results also showed good reproducibility as the percentage coefficient of variation (% CV) was less than 2%.

## □ Conclusions

The results show that dilution error can be reduced if Na is measured at 330.3 nm as it is less sensitive than 589.0 or 589.5 nm. There was no matrix interferences because accurate results were obtained for the samples analysed. To analyse Na in actual samples with different matrix compositions at 330.3 nm, it is necessary to check the accuracy and reproducibility by analysing a CRM.

## □ References

1. Shimadzu Application News A364 - Na Analysis by AA (2005).
2. Shimadzu Atomic Absorption Cook Book No for AA-7000 (2009).