# thermo scientific

# Accurate analysis of arsenic by atomic absorption spectrometry

# Authors

Dr. Jianfeng Cui, Application Specialist, Thermo Fisher Scientific, Bremen, Germany

# **Keywords**

Arsenic, Atomic absorption, HGAAS, Hydride generation, Potable water

# Goal

This note demostrates the use of the Thermo Scientific<sup>™</sup> iCE<sup>™</sup> 3000 Series AAS with the Thermo Scientific<sup>™</sup> VP100 continuous flow vapour generation system for the arsenic in drinking waters. The sample is pre-reduced using a mixture of potassium iodide and L-ascorbic acid. Arsenic is then determined by Hydride Generation Atomic Absorption Spectrometry (HGAAS).

# Reagents

- Hydrochloric acid (AnalaR grade, 50%v/v)
- Sodium borohydride solution (AnalaR grade, 0.5% m/v in 0.5% m/v sodium hydroxide)
- Pre-reducing solution (AnalaR grade, 10% m/v potassium iodide + 10% m/v L-ascorbic acid)
- Arsenic master standard (1000 mg·kg<sup>-1</sup>)
- Arsenic sub-stock standard solution (200 µg·L<sup>-1</sup>) Transfer 0.2 mL of arsenic master standard solution to a 1 L volumetric flask and add 10 mL of pre-reducing solution, then dilute to volume with deionised water.

#### Working standards

Transfer 0, 1.0, 2.5 and 5.0 mL of the arsenic sub-stock standard solution into a series of 100 mL volumetric flasks. Add 10 mL of deionised water and 10 mL of hydrochloric acid to each flask and dilute to volume with deionised water. The working standards will contain 0, 2, 5 and 10  $\mu$ g·L<sup>-1</sup> of arsenic.



**APPLICATION NOTE 40729** 

#### Sample preparation

Into a test tube, add 16.0 mL of drinking water sample, 2.0 mL of concentrated hydrochloric acid and 2.0 mL of the pre-reducing solution and mix thoroughly. Allow the mixture to stand for 1-2 hours at room temperature. The sample will then be ready for analysis. Tap water samples were spiked with 0.25, 0.5, 1.0 and 2.0  $\mu$ g·L<sup>1</sup> of As and the spike recovery was calculated.

#### **Instrument parameters**

The iCE 3000 Series AAS was fitted with the VP100 continuous flow vapor generation system was set up using the instrument parameters shown in Figures 1 and 2.

5.		As
/apour	VP90/FI90/VP100	
Vapour Mode: Flame Heating	Standby Delay: (s)	
Acetylene Fuel Flow: (L/min) 1.0 +	Stabilise Delay: (s)	
Furnace Temperature: (*C) 900	Baseline Delay: (s)	
,	Carrier Gas Flow: (mL/min) 200	
	Pump Speed: (rpm) 40	
Vapour Kit: VP100		
Vapour Sample Compartment: Left Hand	The parameters specified above must be s	et up
Burner Height (mm) 13.7	manually on the VP90 or FI90.	
Measurement Delay: (s) 60		

Figure 1. Vapor generation parameters used for the analysis of arsenic in drinking waters.



Figure 2. Spectrometer parameters used for the analysis of arsenic in drinking waters.

# Results

The calibration is perfectly linear (Figure 3) and the characteristic concentration is 0.217  $\mu$ g·L<sup>-1</sup>. The unspiked tap water sample = 0.61 ± 0.02  $\mu$ g·L<sup>-1</sup> and the average spike recovery (see Table 1) for As was 103.2 ± 2.6%.



Figure 3. The calibration curve achieved from the analysis of arsenic standard solutions.

Table 1. Result of the analysis of spike recoveries.

Sample	Spike recovery
Tap Water + 0.25 µg·L <sup>-1</sup> As	0.27 μg·L¹
Tap Water + 0.50 µg·L <sup>.1</sup> As	0.48 µg·L¹
Tap Water + 1.00 µg·L <sup>-1</sup> As	1.03 µg·L¹
Tap Water + 2.00 µg·L¹ As	2.13 μg·L¹

#### Conclusion

The analysis of arsenic in drinking waters using the iCE 3000 Series AAS coupled with the VP100 continuous flow vapor generation system is carried out in a simple way. The continuous flow system ensure minimal carry out between samples and ensures rapid analysis of samples.



For Research Use Only. Not for use in diagnostic procedures. ©2019 Thermo Fisher Scientific Inc. All rights reserved. All trademarks are the property of Thermo Fisher Scientific. This information is presented as an example of the capabilities of Thermo Fisher Scientific products. It is not intended to encourage use of these products in any manner that might infringe the intellectual property rights of others. Specifications, terms and pricing are subject to change. Not all products are available in all countries. Please consult your local sales representative for details. **AN40729-EN 0319** 

