

Accurate analysis of arsenic by atomic absorption spectrometry

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Keywords

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

Goal

This note demonstrates the use of the Thermo Scientific™ iCE™ 3000 Series AAS with the Thermo Scientific™ 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⁻¹)
- Arsenic sub-stock standard solution (200 µg·L⁻¹) 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 µg·L⁻¹ of arsenic.

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 $\mu\text{g}\cdot\text{L}^{-1}$ 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.

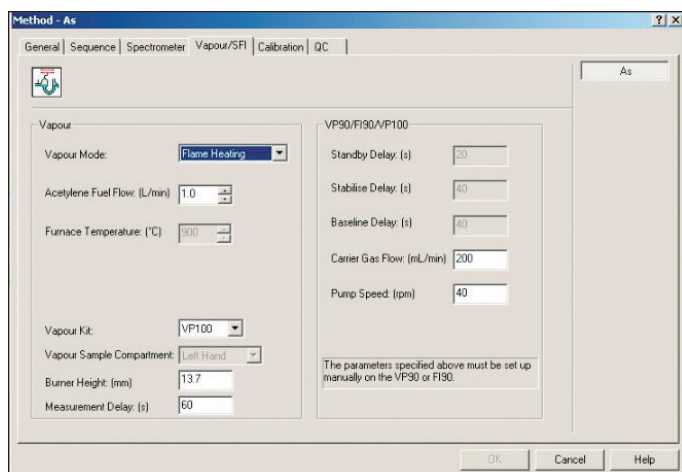


Figure 1. Vapor generation parameters used for the analysis of arsenic in drinking waters.

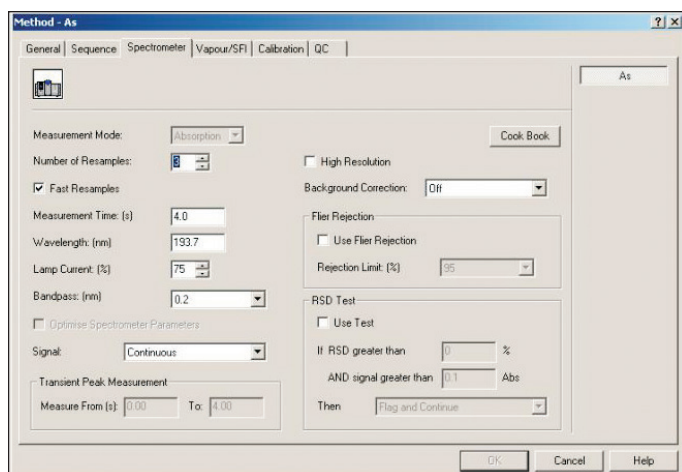


Figure 2. Spectrometer parameters used for the analysis of arsenic in drinking waters.

Results

The calibration is perfectly linear (Figure 3) and the characteristic concentration is $0.217 \mu\text{g}\cdot\text{L}^{-1}$. The unspiked tap water sample = $0.61 \pm 0.02 \mu\text{g}\cdot\text{L}^{-1}$ and the average spike recovery (see Table 1) for As was $103.2 \pm 2.6\%$.

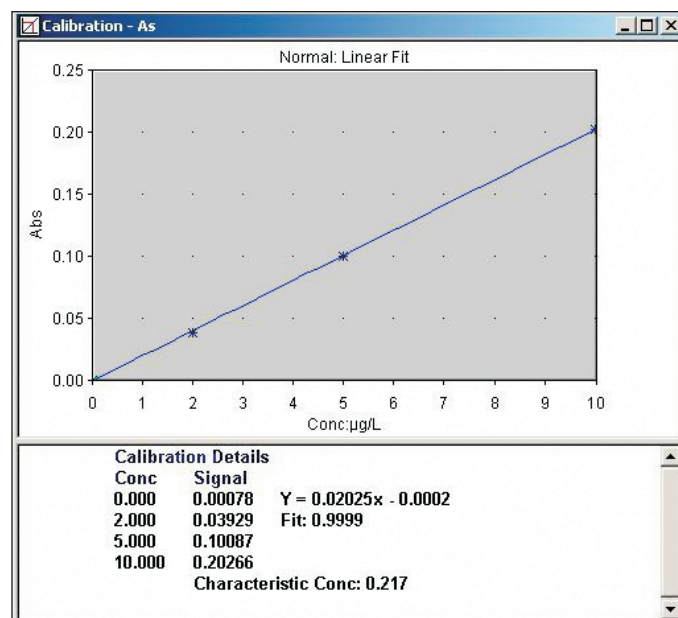


Figure 3. The calibration curve achieved from the analysis of arsenic standard solutions.

Table 1. Result of the analysis of spike recoveries.

Sample	Spike recovery
Tap Water + $0.25 \mu\text{g}\cdot\text{L}^{-1}$ As	$0.27 \mu\text{g}\cdot\text{L}^{-1}$
Tap Water + $0.50 \mu\text{g}\cdot\text{L}^{-1}$ As	$0.48 \mu\text{g}\cdot\text{L}^{-1}$
Tap Water + $1.00 \mu\text{g}\cdot\text{L}^{-1}$ As	$1.03 \mu\text{g}\cdot\text{L}^{-1}$
Tap Water + $2.00 \mu\text{g}\cdot\text{L}^{-1}$ As	$2.13 \mu\text{g}\cdot\text{L}^{-1}$

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.

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