Evaluation of Internal Standardization for the Determination of Arsenic and Selenium by Simultaneous Multielement Atomic Absorption Spectrometry

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The aim of the present work was to study the use of an internal standardization technique in multielement electrothermal atomic absorption spectrometry. Specifically, bismuth and tellurium have been evaluated as internal standards (IS) to minimize matrix effects on the direct determination of selenium and arsenic in real samples, such as sediments and plant tissues, by graphite furnace atomic absorption spectrometry (GFAAS) using tubes with integrated platform, pre-treated with Zr and Ir (200 μg + 20 μg) as permanent modifier or Pd + Mg (5 μg + 3 μg) as chemical modifier in solution. A Perkin-Elmer SIMAA 6000 simultaneous multielement spectrometer was used to study the correlation between two integrated absorbance signals.

From the comparison of the two IS candidates, Te was selected as the optimal one for both analytes, since it presents similar pyrolysis and atomization temperatures with As and Se and compensates adequately for matrix effects on both analytes. Zr and Ir (200 μg + 20 μg) coating was selected for the validation of both methods. Analytical curves in the range of 10–50 μg L⁻¹ As and 20–100 μg L⁻¹ Se concentration interval were established using the ratio analyte absorbance to IS absorbance versus analyte concentration, and typical linear correlations of r ≥ 0.99 were obtained. Limits of detection were 1.48 and 1.96 μg L⁻¹ for As and Se, respectively. Relative standard deviations (RSD) for a plant sample with matrix effect (CRM 281, rye grass) spiked with 100 μg L⁻¹ As and 200 μg L⁻¹ Se were 1.3 % and 2.3 % (n=20), respectively, using 100 μg L⁻¹ Te as IS, whereas for a standard solution containing 100 μg L⁻¹ As and 200 μg L⁻¹ Se were 3.0% and 1.2% (n=20), respectively, with 100 μg L⁻¹ Te as IS. The accuracy of the proposed method was evaluated by an addition-recovery experiment and all recovery values were in the 95–105% range for As determination and 95–100% range for Se determination.