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Limit of detection for Se, Zn, Cu, Cd, Pb, Hg and As determination by white small-sized electrothermal vaporization capacitively coupled microplasma optical emission spectrometry and sample combustion compared to inductively coupled plasma optical emission spectrometry

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The limit of detection (LODs) is considered the most important figure of merit for a method, that determines the suitability and applicability for various samples using different analytical systems. The aim of the current study was the LODs evaluation of a green and white analytical method based on sample combustion (50 mg sample combustion in O_2 atmosphere followed by uptake in 0.1 mol L^{-1} HCl) and determination by small-sized electrothermal vaporization capacitively coupled microplasma optical emission spectrometry (SSETV-μCCP-OES). A number of 100 episodic emission spectra of elements for an integration time of 100 ms were recorded using the High-Speed Acquisition mode of the Maya2000 Pro microspectrometer Spectra Suite software. The analytical signal was obtained by 2D signal integration (time-wavelength) for different pixel numbers around the Central Pixel (CP) of the analytical line (CP, CP±1, CP±2 and CP±3). It was found that the best LODs (mg kg^{-1}) were obtained with CP±1 and CP±2, compared to CP strategy, namely 0.052 (Hg); 0.051 (Cu); 0.148 (Zn); 0.242 (Pb); 0.0042 (Cd); 0.322 (Se) and 0.173 (As). In terms of calibration curves linearity, it was found that the pixel numbers do not affect linearity, but affects the relative standard deviation of the blank (RSDB, %), becoming poorer as pixel numbers increases.

The LODs were also evaluated for inductively coupled plasma optical emission spectrometry (ICP-OES) with sample preparation based on classical microwave-assisted digestion in concentrated HNO_3 – H_2O_2 mixture. Arsenic, Hg and Se were determined by ICP-OES after hydride generation with $NaBH_4$ solution. In the case of both methods, the LODs were also discussed in the light of current European Legislations for maximum admitted concentrations of toxic metals in foodstuffs and food supplements. It was found that, generally the SSETV-μCCP-OES method is not suitable for toxic elements determination in vegetables and fruits, and it would necessitate its coupling with a preconcentration method, for example solid phase extraction (SPE) cartridges.

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