A Systematic Study for Copper and Zinc Determination in Bovine Liver by Solid Sampling Electrothermal Atomic Absorption Spectrometry

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This work describes a systematic study for the bovine liver candidate reference material preparation for Cu and Zn determination by solid sampling electrothermal atomic absorption spectrometry. The main parameters investigated were sample pretreatment, grinding process, micro homogeneity, particle size, sample size, and their relationship with the precision and accuracy of the results. Bovine liver sample was dried in a microwave oven, freeze-dried, and ground in ball and cryogenic mills. Small amounts of sample are directly weighed onto a boat-type platform using a microbalance and inserted into the graphite furnace with a mechanical solid sampling device. Alternative wavelengths were used for Cu (216.5 nm) and Zn (307.6 nm) to diminish the sensitivity, and for Cu the Zeeman-based three-field background corrector was also used. The pyrolysis and atomization temperatures adopted were 1000 °C and 2300 °C for Cu, and 700 °C and 1700 °C for Zn, respectively. For both elements it was possible to calibrate with aqueous solutions. However, for Zn the use of 250 μg W + 200 μg Rh as permanent chemical modifier was imperative. Under these conditions, the characteristic masses and detection limits were 1.4 ng and 1.6 ng for Cu, and 2.8 ng and 1.3 ng for Zn, respectively. The results showed good agreement and fair evidence for homogeneity of the entire mass when the sample was dried in microwave/stove and ground in cryogenic mill. The micro-homogeneity study showed that Zn is more susceptible to sample pretreatment than Cu. The bovine liver sample prepared in a microwave/stove and ground in cryogenic mill presents the best results for Cu and Zn. Good accuracy and precision was observed for bovine liver masses higher than 40 μg for Cu and 30 μg for Zn. For this bovine liver material, the concentrations found for Cu and Zn were 223±12 μg g^{-1} and 137±2 μg g^{-1}, respectively. The relative standard deviations were lower than 10% (n = 5). The reliability of the entire procedure was checked with bovine live from NIST (1577b) and determination of Cu and Zn using flame atomic absorption spectrometry, in which the value found were 222±4 μg g^{-1} and 128±4 μg g^{-1}, respectively.

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