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Direct determination of copper and zinc in alcoholic and non-alcoholic drinks using high-resolution continuum source flame atomic absorption spectrometry and internal standardization

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**DIRECT DETERMINATION OF COPPER AND ZINC IN ALCOHOLIC AND NON-ALCOHOLIC DRINKS USING HIGH-RESOLUTION CONTINUUM SOURCE FLAME ATOMIC ABSORPTION SPECTROMETRY AND INTERNAL STANDARDIZATION**

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**Abstract**

A simple, rapid, direct and multi-element method based on high-resolution continuum source flame atomic absorption spectrometry (HR-CS FAAS) was developed to analyse a large variety of beverages with successful results. The use of the internal standard (IS) calibration method was explored to carry out the direct analysis of drinks with different sugar and/or alcohol content using only one calibration curve. The main absorption lines for the analytes (Cu, Zn and Pb) and the possible ISs (Ag, Co, Ni and Bi) were chosen to perform the analysis. In addition, the possibility of introducing the sample in the spectrometer in a continuous or discontinuous mode was investigated. The limits of quantification (LOQs) obtained using Ag as IS and the continuous sample introduction mode were 0.040 mg L<sup>-1</sup> for Zn, 0.016 mg L<sup>-1</sup> for Cu, and 0.099 mg L<sup>-1</sup> for Pb. In addition, the precision, expressed as the relative standard deviation (RSD), was lower than 4% for the three elements. The developed IS method was applied to analyse different commercial beverages: an apple juice, a ready-to-drink beverage containing fruit juices, an isotonic drink, a lemon and lime flavoured soft drink, a beer, a wine, a gin, a whisky, a rum, and an apple liqueur. For comparison, these beverages were also analysed using a conventional external calibration procedure. The Cu concentration was lower than 1.28 mg L<sup>-1</sup> and 0.15 mg L<sup>-1</sup> in alcoholic and non-alcoholic drinks, respectively, and Zn concentration was lower than 0.37 mg L<sup>-1</sup> in alcoholic and 12.3 mg L<sup>-1</sup> in non-alcoholic drinks. The Pb concentration in all the analysed samples was below the limit of detection (LOD). The recoveries in the validation studies were within 92-109% for Cu, 93-111% for Zn and 94-110% for Pb.

**Keywords:** High-resolution continuum source flame AAS (HR-CS FAAS); Direct analysis; Internal standardization; Beverage; Trace metal determination.

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