

Chemometric-Based Voltammetric Method for Analysis of Vitamins and Heavy Metals in Honey Samples

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Abstract : The analysis of heavy metals in honey samples is crucial. When found in honey, they denote environmental pollution. Some of these heavy metals as lead either present at low or high concentrations are considered to be toxic. Other heavy metals, for example, copper and zinc, if present at low concentrations, they considered safe even vital minerals. On the contrary, if they present at high concentrations, they are toxic. Their voltammetric determination in honey represents a challenge due to the presence of other electro-active components as vitamins, which may overlap with the peaks of the metal, hindering their accurate and precise determination. The simultaneous analysis of some vitamins: nicotinic acid (B3) and riboflavin (B2), and heavy metals: lead, cadmium, and zinc, in honey samples, was addressed. The analysis was done in 0.1 M Potassium Chloride (KCl) using a hanging mercury drop electrode (HMDE), followed by chemometric manipulation of the voltammetric data using the derivative method. Then the derivative data were convoluted using discrete Fourier functions. The proposed method allowed the simultaneous analysis of vitamins and metals though their varied responses and sensitivities. Although their peaks were overlapped, the proposed chemometric method allowed their accurate and precise analysis. After the chemometric treatment of the data, metals were successfully quantified at low levels in the presence of vitamins (1: 2000). The heavy metals limit of detection (LOD) values after the chemometric treatment of data decreased by more than 60% than those obtained from the direct voltammetric method. The method applicability was tested by analyzing the selected metals and vitamins in real honey samples obtained from different botanical origins.

Keywords : chemometrics, overlapped voltammetric peaks, derivative and convoluted derivative methods, metals and vitamins

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