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In the present work a second-order calibration method has been applied to the simultaneous determination of Cu(II), Co(II) and Ni(II). The method is based on the applying multivariate curve resolution alternating least squares (MCR-ALS) for the analysis of augmented (Figure 1) standard addition data matrices of kinetic-spectrophotometric two-way data of Cu(II), Co(II) and Ni(II) complexation reactions with 1-(2-pyridylazo)2-naphthol (PAN). MCR is, by definition, a model-free or a soft-modeling method that focuses on describing the evolution of the experimental multicomponent measurements through their pure component contributions [1]. When the sensitivity of the calibration is affected by the presence of the chemical matrix of the sample, predictions using pure standards are expected to be biased. In classical univariate calibration, this drawback is solved by using a standard addition method [2]. The combination of standard addition with multivariate curve resolution has been shown to improve significantly the accuracy of predictions in the presence of matrix effects for excitation-emissions florescence [1] and GC-MS data [3]. In present study, this combination was used to overcome the influence of the matrix effect in kinetic-spectrophotometric determination of Cu(II), Co(II) and Ni(II). The absorption spectra of samples and standards were recorded in the time range 0–10 min (with 10 second intervals) after initiation of the reaction of these cations with PAN at pH 5. The results showed that the determination could be performed in the range 0.1–2 µg mL⁻¹ for each cations. The proposed method was successfully applied to the simultaneous determination of Cu(II), Ni(II) and Co(II) ions in several real samples.

Figure 1. Column wise augmented MCR bilinear models; D is unknown real sample two-way kinetic-spectrophotometric data and D+S₁, D+S₂ and D+S₃ are those of standard added ones.

References