LEAD FILM SCREEN PRINTED ELECTRODE FOR
ADSORPTIVE STRIPPING VOLTAMMETRIC DETERMINATION
OF Co(II) AND Ni(II)

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The preparation of an in-situ plated lead film screen-printed electrode (PbF-SPE) and its application for adsorptive stripping voltammetric determination of nickel and cobalt in the form of the complexes with dimethylglyoxime is reported. The lead film was electrochemically deposited in situ on a commercially available three-electrode screen-printed electrochemical strip from a 0.2 M ammonia buffer solution (pH 8.2) containing 4×10^{-5} M Pb(NO\textsubscript{3})\textsubscript{2} and 1×10^{-5} M dimethylglyoxime. The square wave adsorptive stripping voltammetric signals of Ni(II) and Co(II), obtained using the designed lead film screen-printed electrode deposited in-situ in the supporting electrolyte containing 0.2 M ammonia buffer, 1×10^{-5} M DMG and 4×10^{-5} M Pb(II), are well-defined and very well separated (ΔEp ≈ 200 mV). The linear dependence of the SW-AdSV peak currents vs. concentration of Ni(II) and Co(II) in the investigated solutions was restricted by accumulation time and the concentration ratio of Ni(II):Co(II). When Ni(II) and Co(II) were simultaneously present in the solutions the sensitivity of their signals was higher but the linear ranges were shorter. The interaction of Ni(II) and Co(II) clearly changed the slopes of calibration graphs. The repeatability of the Ni(II) and Co(II) adsorptive stripping voltammetric signals obtained at the lead film screen-printed electrode were equal to 4% and 3%, respectively (n = 10). The limits of detection established for simultaneous determination of Ni and Co for 90 s of accumulation time were 0.2 and 0.3 µg·L\textsuperscript{-1}, respectively.

Voltammetric studies were complemented with optical and scanning microscopic observations. SEM investigations revealed that lead may form three different types of crystals (micrometer-sized isometric grainy crystals, flower-like crystals, sub-micrometer crystallites) depending on the concentration of lead. The presence of DMG and Co(II) or Ni(II) had a negligible effect on lead film microstructure. The results of the voltammetric studies indicate that the cobalt signal is less sensitive than nickel to changes in the lead film morphology.

The described procedure may help simplify the protocol for the determination of Ni(II) and Co(II) using film electrodes (three-in-one setup, in-situ plating). One of the features that makes this possible is its insensitivity to dissolved oxygen (work in non-deaerated solution) and tolerance to the presence of a large excess of zinc and iron.

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KEYWORDS: Adsorptive stripping voltammetry; Lead film screen-printed electrode; Nickel; Cobalt

REFERENCES: