Use of silica sol as the sorbent for the visual detection of iron(II) ion

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Abstract: A simple detection of iron (II) ion was reported. Iron(II) was firstly derivatized by complexation with 1, 10-phenathroline (Phen) and preconcentrated by dispersive micro-solid phase extraction (d-μ-SPE) using silica sol as the sorbent. Silica sol was synthesized by the hydrolysis and condensation reaction between tetraethyl orthosilicate (TEOS) and L-Arginine. The stability of [Fe²⁺–Phen] complex was studied in the pH range 2.0–9.0, providing high sensitivity at pH 7.0. The adsorption of [Fe²⁺–Phen] complex was simultaneously occurred with aggregation of silica sol in the presence of tetrabutylammonium bromide (TBABr). The enriched [Fe²⁺–Phen] complex on silica sol was detected by naked-eye and normal camera in combination with Image J program. Several experimental parameters affecting the extraction of [Fe²⁺–Phen] including the amount of silica sol, type of surfactant, amount of TBABr, extraction and centrifugation time were studied and optimized. The selectivity was investigated in term of interference. The interfering species studied are Co²⁺, Cu²⁺, Fe³⁺, Mg²⁺, Mn²⁺, Al³⁺, Cd²⁺, Ni²⁺ and Zn²⁺. The proposed method showed high selectivity towards Fe²⁺. Under the optimal conditions, the enrichment factor was 7 and the linear range was from 0.07 mg/L to 1.43 mg/L. The limit of detection and the limit of quantitation were 18 µg/L and 62 µg/L, respectively. The applicability of the method was demonstrated for the detection of iron(II) in vegetable samples.

Keywords: Dispersive micro-solid phase extraction; Silica sol; Naked-eye detection; Iron(II)