

Cadmium and Lead Extraction from Environmental Samples with Complexes Matrix by Nanomagnetite Solid-Phase and Determine Their Trace Amounts

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Abstract : In this study, a new type of alumina-coated magnetite nanoparticles (Fe₃O₄/Al₂O₃ NPs) with sodium dodecyl sulfate- 1-(2-pyridylazo)-2-naphthol (SDS-PAN) as a new sorbent solid phase extraction (SPE) has been successfully synthesized and applied for preconcentration and separation of Cd and Pb in environmental samples. Compared with conventional SPE methods, the advantages of this new magnetic Mixed Hemimicelles Solid-Phase Extraction Procedure (MMHSPE) still include easy preparation and regeneration of sorbents, short times of sample pretreatment, high extraction yields, and high breakthrough volumes. It shows great analytical potential in preconcentration of Cd and Pb compounds from large volume water samples. Due to the high surface area of these new sorbents and the excellent adsorption capacity after surface modification by SDS-PAN, satisfactory concentration factor and extraction recoveries can be produced with only 0.05 g Fe₃O₄/Al₂O₃ NPs. The metals were eluted with 3mL HNO₃ 2 mol L⁻¹ directly and detected with the detection system Flame Atomic Absorption Spectrometry (FAAS). Various influencing parameters on the separation and preconcentration of trace metals, such as the amount of PAN, pH value, sample volume, standing time, desorption solvent and maximal extraction volume, amount of sorbent and concentration of eluent, were studied. The detection limits of this method for Cd and Pb were 0.3 and 0.7 ng mL⁻¹ and the R.S.D.s were 3.4 and 2.8% (C = 28.00 ng mL⁻¹, n = 6), respectively. The preconcentration factor of the modified nanoparticles was 166.6. The proposed method has been applied to the determination of these metal ions at trace levels in soil, river, tap, mineral, spring and wastewater samples with satisfactory results.

Keywords : Alumina-coated magnetite nanoparticles, Magnetic Mixed Hemimicell Solid-Phase Extraction, Cd and Pb, soil sample

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