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Novel solid-phase extractor based on functionalization of multi-walled carbon nano tubes with 5-aminosalicylic acid for preconcentration of Pb(II) in water samples prior to determination by ICP-OES

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Abstract

New solid-phase extractor (MWCNTs-5-ASA) was synthesized via covalent immobilization of 5-aminosalicylic acid onto multi-walled carbon nanotubes (MWCNTs). The success of the functionalization process was confirmed using Fourier transform infrared spectroscopy, scanning electron microscope, and surface coverage determination. Batch experiments were conducted as a function of pH to explore MWCNTs-5-ASA efficiency to extract several metal ions viz., Cr(III), Fe(III), Co(II), Ni(II), Cu(II), Zn(II), Cd(II) and Pb(II). It was found that Pb(II) exhibits the highest extraction percentage with maximum adsorption capacity 32.75 mg g⁻¹. Its binding performance was well fitted with Langmuir sorption isotherm. On the other hand, the selective separation and preconcentration of trace Pb(II) under dynamic conditions prior to determination by inductively coupled plasma-optical emission spectrometry was investigated under different parameters. These included the rate of flow and volume of sample solution, in addition to the type of the eluate, its volume and concentration. The effect of a variety of foreign ions on the recovery percentage was also evaluated. Trace Pb(II) ions present in 500 mL aqueous solution adjusted to pH 4.0 were retained on 50 mg of MWCNTs-5-ASA and completely eluted using 4.0 mL of 2 M HNO₃. The limit of detection and the precision of the method were 0.25 ng mL⁻¹ and 2.8 %, respectively (N = 5). This methodology has been applied for the determination of Pb(II) in water samples with good results.

Keywords

Author Keywords: Solid phase extraction; Lead; 5-Aminosalicylic acid; Preconcentration; ICP-OES; Selectivity

KeyWords Plus: HEAVY-METAL IONS; ATOMIC-ABSORPTION-SPECTROMETRY; ACTIVATED CARBON; SELECTIVE SEPARATION; AQUEOUS-SOLUTION; NATURAL-WATER; SILICA-GEL; ENVIRONMENTAL-SAMPLES; IMPRINTED POLYMERS; SCHIFFS BASES

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