

O 38A - Development of a new method for preconcentration, chemical vapour generation and determination of metal ions by ICP OES in environmental samples using magnetic nanoparticles

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Abstract

Silica-coated magnetic nanoparticles (MNP SCMNPs) modified with [1,5-bis (2-pyridyl)-3-sulphophenyl methylene] thiocarbonylhydrazide were synthesized by a sol-gel method. These magnetic nanoparticles (PSTH-nmp) were employed as a SPE adsorbent for separating and concentrating trace amounts 14 elements (Pd, Cr, Mn, Zn, Cd, Hg, As, Sb, Bi, Cu, Pt, Sn, Se, Co) from environmental samples. The main aim of this work was to develop a precise and accurate method for the simultaneous determination of the aforementioned metals from natural water samples (sea water, estuarine, lake and river water) by the on line pre-concentration SPE CVG ICP OES using PSTH-nmp, with the least demanding and simple sample preparation procedure. The developed method was validated by analysing natural water certified reference materials (SLRS-4, TMDA 54.4, SW2 Batch 125, SRM 1643e). Sea water and water well samples collected from Málaga (Spain) were analysed too.

The procedure has demonstrated to be fast, easy, automatic, selective, low cost and with good sensitivity. The main advantage of PSTH-nmp is its very good stability and resistance because chemisorption of chelating molecules on the surface of solid supports provides immobility, mechanical stability and insolubility. It costs is low compared with other chelating sorbents. The detection limits obtained are adequate for the analyzed samples. Furthermore, the method proposed has permitted the simultaneous determination of the 14 elements, saving time of analysis and achieving a sample throughput of about 12.8 h⁻¹.

Table 1. Analytical performance.

Element	Detection limit/ $\mu\text{g L}^{-1}$	Determination limit / $\mu\text{g L}^{-1}$	Enrichment factor	Element	Detection limit/ $\mu\text{g L}^{-1}$	Determination limit / $\mu\text{g L}^{-1}$	Enrichment factor
Pd	3.67	17.23	6.5	Sb	0.04	0.96	32.3
Cr	7.16	25.26	1	Bi	0.23	31.3	2.95
Mn	3.16	22.92	1.5	Cu	28.42	1.0	1.52
Zn	11.30	51.70	2.1	Pt	8.81	2.7	4.46
Cd	0.59	4.02	46.85	Sn	17.10	3.3	4.53
Hg	0.02	0.75	1.82	Se	2.85	83.6	4.79
As	0.01	2.32	113.4	Co	0.49	385.5	2.69

Keywords: MNPs, ICP-OES, trace elements determination, environmental waters

Acknowledgements The authors thank the Spanish Ministerio de Ciencia y Tecnología (MCyT project no. CTQ2013-44791-P) for supporting this study and also FEDER funds. And Universidad de Málaga, Plan Propio and Universidad de Málaga, Campus de Excelencia Internacional del Mar, CEI MAR.