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Silica-gel Particles Loaded with an Ionic Liquid for Separation of Zr(IV) Prior to Its Determination by ICP-OES

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Volume: 16 **Issue:** 7
Article Number: 1001
DOI: 10.3390/s16071001
Published: JUL 2016
[View Journal Impact](#)

Abstract

A new ionic liquid loaded silica gel amine (SG-APTMS-N, N-EPANTf2) was developed, as an adsorptive material, for selective adsorption and determination of zirconium, Zr(IV), without the need for a chelating intermediate. Based on a selectivity study, the SG-APTMS-N, N-EPANTf2 phase showed a perfect selectivity towards Zr(IV) at pH 4 as compared to other metallic ions, including gold [Au(III)], copper [Cu(II)], cobalt [Co(II)], chromium [Cr(III)], lead [Pb(II)], selenium [Se(IV)] and mercury [Hg(II)] ions. The influence of pH, Zr(IV) concentration, contact time and interfering ions on SG-APTMS-N, N-EPANTf2 uptake for Zr(IV) was evaluated. The presence of incorporated donor atoms in newly synthesized SG-APTMS-N, N-EPANTf2 phase played a significant role in enhancing its uptake capacity of Zr(IV) by 78.64% in contrast to silica gel (activated). The equilibrium and kinetic information of Zr(IV) adsorption onto SG-APTMS-N, N-EPANTf2 were best expressed by Langmuir and pseudo second-order kinetic models, respectively. General co-existing cations did not interfere with the extraction and detection of Zr(IV). Finally, the analytical efficiency of the newly developed method was also confirmed by implementing it for the determination of Zr(IV) in several water samples.

Keywords

Author Keywords: solid-phase extraction; ionic-liquid; Zr(IV) detection; adsorption isotherm; inductively coupled plasma-optical emission spectrometry (ICP-OES)

KeyWords Plus: SOLID-PHASE EXTRACTION; AQUEOUS-SOLUTION; METAL-IONS; SELECTIVE EXTRACTION; 2-PHASE SYSTEMS; CHROMATOGRAPHY; ANION; ACID; EQUILIBRIUM; ZIRCONIUM

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Funding Agency	Grant Number
Center of Excellence for Advanced Materials Research (CEAMR), King Abdulaziz University, Jeddah	CEAMR-SG-13-437

[View funding text](#)**Publisher**

MDPI AG, ST ALBAN-ANLAGE 66, CH-4052 BASEL, SWITZERLAND

Categories / Classification**Research Areas:** Chemistry; Electrochemistry; Instruments & Instrumentation**Web of Science Categories:** Chemistry, Analytical; Electrochemistry; Instruments & Instrumentation**Document Information****Document Type:** Article**Language:** English**Accession Number:** WOS:000380967000059**ISSN:** 1424-8220**Journal Information****Impact Factor:** [Journal Citation Reports](#)**Other Information****IDS Number:** DS7MG**Cited References in Web of Science Core Collection:** 51**Times Cited in Web of Science Core Collection:** 0