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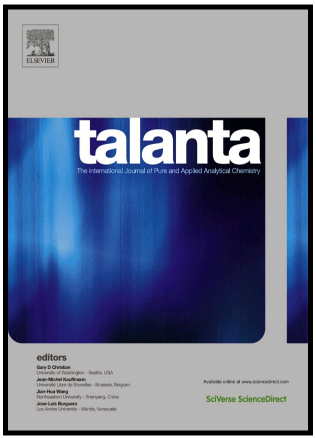

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PII: S0039-9140(18)30257-1
DOI: https://doi.org/10.1016/j.talanta.2018.03.019
Reference: TAL18453

To appear in: *Talanta*

Received date: 18 December 2017
Revised date: 5 March 2018
Accepted date: 7 March 2018

Cite this article as: P. Montoro Leal, E. Vereda Alonso, M.M. López Guerrero, M.T. Siles Cordero, J.M. Cano Pavón and A. García de Torres, Speciation analysis of inorganic arsenic by magnetic solid phase extraction on-line with inductively coupled mass spectrometry determination, *Talanta,* https://doi.org/10.1016/j.talanta.2018.03.019

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Speciation analysis of inorganic arsenic by magnetic solid phase extraction on-line with inductively coupled mass spectrometry determination

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Abstract

Arsenic, one of the main environmental pollutants and potent natural poison, is a chemical element that is spread throughout the Earth's crust. It is well known that the toxicity of arsenic is highly dependent on its chemical forms. Generally, the inorganic species are more toxic than its organics forms, and As(III) is 60 times more toxic than As(V). In environmental waters, arsenic exists predominantly in two chemical forms: As(III) and As(V). In view of these facts, fast, sensitive, accurate and simple analytical methods for the speciation of inorganic arsenic in environmental waters are required. In this work, a new magnetic solid phase extraction with a hydride generation system was coupled on line with inductively coupled plasma mass spectrometry (MSPE-HG-ICP-MS). The new system was based on the retention of As(III) and As(V) in two knotted reactors filled with (Fe_3O_4) magnetic nanoparticles functionalized with [1,5-bis (2-pyridyl) 3-sulfophenylmethylene] thiocarbonohydrazide (PSTH-MNPs). As(III) and total inorganic As were sequentially eluted in different reduction conditions. The concentration of As(V) was obtained by subtracting As(III) from total As. The system runs in a fully automated way and the method has proved to have a wide linear range and to be precise, sensitive and fast. The detection limits found were 2.7 and 3.2 ng/L for As(III) and total As, respectively; with relative standard deviations (RSDs) of 2.5 and 2.7 % and a sample throughput of 14.4 h^{-1}. In order to validate the developed method, several certified reference samples of environmental waters including sea water, were analyzed and the determined values were in good agreement with the certified values. The proposed method was successfully applied to the speciation analysis of inorganic arsenic in well-water and sea water.

Graphical abstract

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