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Measurement of very low amounts of arsenic in soils and waters: is ICP-MS the indispensable analytical tool?

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The toxicity of arsenic and its wide distribution in the nature needs nowadays not to be emphasized, and the convenience of reliable analytical tools for arsenic determination at very low levels is clear. Leaving aside atomic fluorescence spectrometers specifically designed for this purpose, the task is currently carried out by using inductively coupled plasma mass spectrometry (ICP-MS), a powerful but expensive technique that is not available in all laboratories. However, as the recent literature clearly shows, a similar or even better analytical performance for the determination of several elements can be achieved by replacing the ICP-MS instrument by an AAS spectrometer (which is commonly present in any laboratory and involves low acquisition and maintenance costs) provided that a simple microextraction step is used to preconcentrate the sample. This communication reports the optimization and results obtained with a new analytical procedure based on this idea and focused to the determination of very low concentrations of arsenic in waters and extracts from soils and sediments.

The procedure is based on a micro-solid phase extraction process for the separation and preconcentration of arsenic that uses magnetic particles covered with silver nanoparticles functionalized with the sodium salt of 2-mercaptoethane-sulphonate (MESNa). This composite is obtained in an easy way in the laboratory. After the sample is treated with a low amount (only a few milligrams) of the magnetic material, the solid phase is separated by means of a magnetic field, and then introduced into an electrothermal atomizer (ETAAS) for arsenic determination. The preconcentration factor is close to 200 with a detection limit below 0.1 μg L-1 arsenic. Speciation of As(III) and As(V) can be achieved by means of two extractions carried out at different acidity. The results for total arsenic are verified using certified reference materials.

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