Inductively coupled plasma mass spectrometry is not an indispensable analytical tool for measuring very low concentrations of metals in waters and foods

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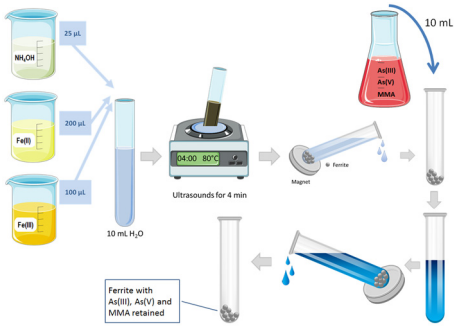
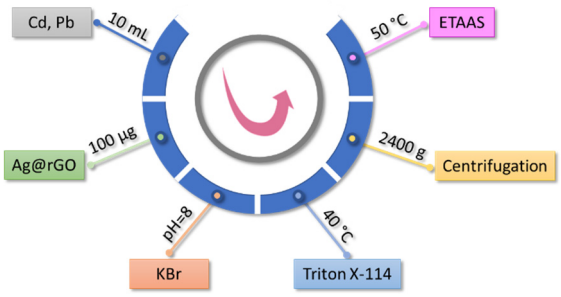
Plasma-based techniques have gained relevance in the analytical laboratory. Especially inductively coupled plasma mass-spectrometry (ICP-MS) is a powerful analytical tool that is nowadays widely used for the determination of very low concentrations of metals and metalloids in a variety of samples, including waters and foods. The attainable sensitivity and its multi-elemental character, as well the rapidity in the measurement, are important characteristics that have led in such widespread use, sometimes resulting even in abuse. The advantages are undeniable, but the high cost of acquisition and maintenance of the instrument put this technique beyond the reach of laboratories with a small budget.

Preconcentration can be done by liquid-liquid or solid-liquid microextraction, so that the analyte present in a relatively large volume of sample is finally transferred to a small volume of liquid, increasing its concentration and facilitating the subsequent analytical measurement. Of particular interest are recent procedures that use magnetic nanoparticles to carry out the liquid-solid preconcentration process, since the tedious centrifugation step is avoided as the separation is achieved by means of a simple magnet.

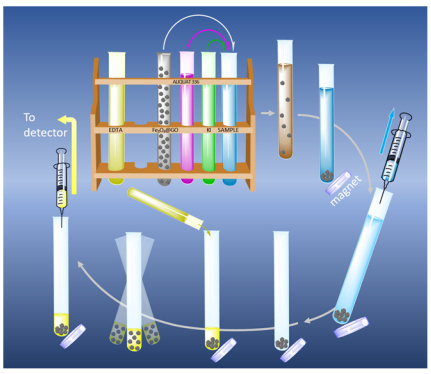
This communication summarises some of the advances recently developed in this sense in our laboratory which demonstrate that, as indicated in the title, the ICP-MS instrument is not absolutely mandatory in the analytical laboratory since at least part of its tasks could be carried out by means of the mentioned preconcentration stage coupled to an ETAAS final measurement.



Magnetic ferrite particles combined with electrothermal atomic absorption spectrometry for the speciation of low concentrations of arsenic, Talanta, 181 (2018), 6-12

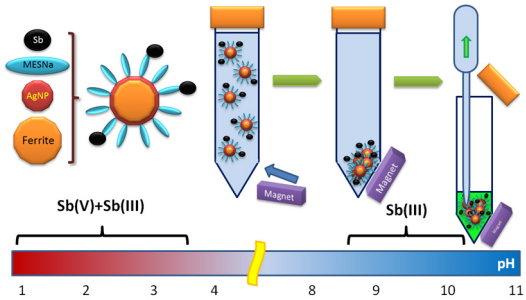


Solid-phase dispersive microextraction using reduced graphene oxide for the sensitive determination of cadmium and lead in waters, Analytical Methods, 11 (2019), 635-641.



Dispersive micro-solid phase extraction with a magnetic nanocomposite followed by electrothermal atomic absorption measurement for the speciation of thallium, Talanta, 228 (2021), 122206

In contrast, atomic absorption spectrometry (AAS) is a lower-cost technique that is present in virtually all laboratories and is now often underutilised as it is displaced by more expensive plasma-based instruments. When an appropriate sample preconcentration procedure is used in conjunction with an AAS instrument provided with an electrothermal atomizer (ETAAS), analytical procedures of very high sensitivity, comparable or even better than those achieved with plasma-based techniques but at a much lower cost per analysis, are obtained.



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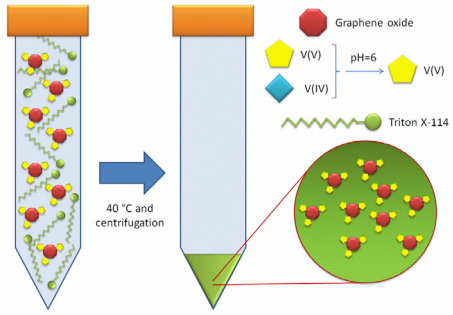
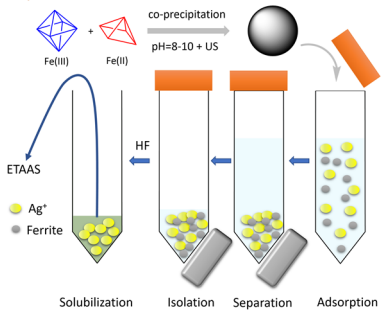
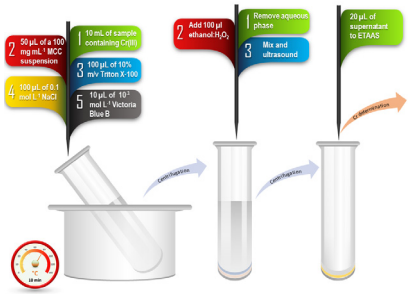


Graphite furnace atomic absorption spectrometric determination of vanadium after cloud point extraction in the presence of graphene oxide, Spectrochimica Acta Part B-Atomic Spectroscopy, 143 (2018), 42-47



Freshly prepared magnetic ferrite for the speciation of silver using dispersive micro-solid phase extraction and electrothermal atomic absorption spectrometry, J. Anal. At. Spectrom., 34 (2019), 2112-2118.



Microcrystalline cellulose for the dispersive solid-phase microextraction and sensitive determination of chromium in water using electrothermal atomic absorption spectrometry, J. Anal. At. Spectrom., 33 (2018), 1529-1535.

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