Low level Selenium analysis for water monitoring purposes: A simple approach

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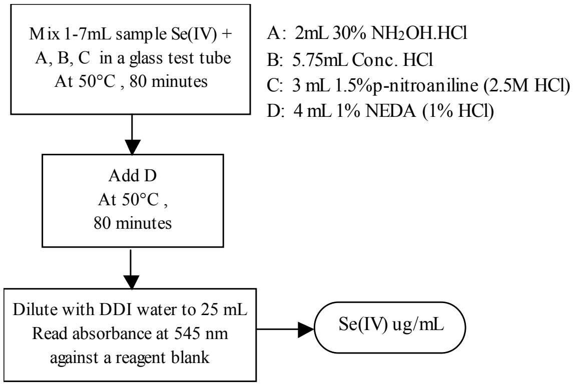
Selenium (Se) has been recognized as a significant pollutant of fresh water systems, and it is hazardous to aquatic life and human health [1]. Se contaminated groundwaters affect millions of people in China, Colombia and the US [2], yet analytical methods for monitoring low-level Se in natural waters are usually complex, technologically demanding and expensive, specifically for monitoring purposes in 3rd world countries. In this work, a simple and inexpensive spectrophotometric Se determination procedure in aqueous media is presented. The developed mechanism and protocol (schematic below) follows a 2-step reaction that is based on the azo coupling of amines to form a red azo compound.



The maximum absorbance of the azo dye is at 545nm, it has a maximum absorptivity of 2.85×10^{4} L mol^{-1} cm^{-1} and follows the Beer's law between 0.01 to 2.50mg/L. Quality parameter checks showed that total Se is determined with a sensitivity of 0.0124mg/l, an accuracy of +/- 1% and a precision with standard deviations of 2.5% at the low end of the concentration range. Various tests showed that sample preparation must convert all Se species to Se(IV) and interfering ions (e.g., Fe, Cu) must be removed or masked. This method can be easily adapted for aqueous Se analyses in natural waters following standard sample handling protocols [3]. Thus, accurate, rapid, simple and cheap low-level Se determination can be achieved and this will aid establish if Se levels in drinking waters are within the WHO drinking water quality guidelines [1].

[1] *WHO Water guidelines* (2003) [2] Holland & Turekian (2004) Elsevier/Pergamon. Amsterdam [3] Eaton *et al*. (1998) American Public Health Association, Washington.

Study of the C-rich phases of two cometary particles with electron microscopy and nanoSIMS

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We investigated the presence and nature of carbon in two Wild 2 particles called Ada (~12 µm) and Febo (~8 µm). Ada is composed of nodules of fayalite each surrounded by rims of crystalline SiO_2 (tridymite). Febo is composed of a large pyrrhotite grain, two silicates (enstatite and fayalite) and fine-grained material. Microtomed sections of each particle were first analyzed by TEM coupled with EELS to locate and characterize C-rich phases and to determine the particles mineralogy. Then the sections were analyzed with a NanoSIMS 50L for their C, N, O and H isotopic compositions. TEM analyses revealed the presence of amorphous carbon in small (<200 nm) regions in both particles. NanoSIMS isotopic images show that the C-rich spots observed with EELS are ^{15}N-enriched. In Febo we found five spots showing an enrichment in ^{15}N (δ^{15}N from 420 to 639 ±20 to 70 ‰, 1σ) that were clearly associated with the C-rich regions. The carbonaceous material has approximately solar C and D/H isotopic compositions, and the bulk O isotopic composition was found to be $\delta^{17}O=-18 \pm 13$ ‰ and $\delta^{18}O=-37 \pm 12$ ‰ (1σ). In Ada we found a C-rich phase with enrichments in the isotope ^{15}N ($\delta^{15}N = 550 \pm 70$ ‰, 1σ) and the isotope D ($\delta D=610 \pm 254$ ‰ 1σ). The C isotopic composition at this phase is normal (-4±19 ‰). ^{15}N enrichments overlaid to the organic material prove that the latter is indigenous to Wild 2, not contamination, and implies formation in cold (~10 K) environments. The O isotopes show homogeneous distributions (fayalite: $\delta^{17}O=3.1\pm13.9$ ‰; $\delta^{18}O=-3.1\pm6.7$ ‰ and crystalline SiO_2: $\delta^{17}O=9.0\pm12.1$ ‰; $\delta^{18}O=-10.4\pm5.6$ ‰).