

## **PRECONCENTRATION, QUANTITATION, AND SPECIATION OF SUB-PPM LEVELS OF ARSENIC (III) AND (V) IN WATER VIA HAND-HELD XRF**

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ED-XRF instruments have greatly reduced the time and effort to screen environmental samples for various toxic metals down to ppm levels. However, XRF has not been widely used to detect toxic elements in water, due to the fact that the limits of detection (LOD) for most toxic elements are around 10 ppm or higher, and the regulatory limit for many toxic elements are in the low ppb range. The introduction of the x-ray tube-based field portable ED-XRF has greatly facilitated on-site semi-quantitative analysis, thus eliminating the need to collect and transport all samples back to the laboratory for quantitative analysis (including the ones that don't contain excessive levels). Using a field portable ED-XRF for on-site determination of toxic elements in water samples would be of great utility for many applications, from import screening of bottled water, environmental samples, and food security.

Certainly, colorimetric-based test kits represent an alternative technique for on-site arsenic determination. However, these kits are often prone to false positives. They also generate arsine gas in the detection process, which poses a health hazard to the analyst. Total reflection x-ray fluorescence (TXRF) is able to detect trace levels of toxic elements in water without pre-concentration. However, these instruments are not readily portable, cannot analyze a sample in bulk, and require evaporation of water samples prior to analysis.

This presentation will describe a procedure for on-site detection arsenic (As) in drinking water down to 10 ppb with the use of resins and a field-portable ED-XRF. The procedure involves the speciation and pre-concentration of As (III) and (V), the most toxic forms of arsenic found in drinking water, followed by analysis via a handheld XRF. Speciation takes advantage of the different charge states of As using an anion exchange resin to first isolate and concentrate As (III). The sample is then pre-concentrated and analyzed under a different set of conditions to determine As (V). Analysis of the resin is then performed, resulting in semi-quantitative analysis of both As (III) and (V). We will discuss the effect of resin mass, sample volume, and flow rate and how each affects the sensitivity and detection limit. The presentation will include a case study analysis and profiling of a California Superfund site known to be highly contaminated with As. It will also include a discussion of the practical applications of the method, as well as the simultaneous detection of several other toxic elements such as lead, mercury and selenium using a mixed-bed resin.