COMPARISON OF VARIOUS XRF QUANTITATIVE METHODS FOR DETERMINATION OF TOXIC ELEMENTS IN SUPPLEMENTS

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There has been increasing media and public scrutiny of the ongoing problem of toxic elements in dietary supplements. The CA Department of Public Health compiled a report describing Chinese herbal medicines known to contain one or more toxic elements (1). A study by Saper et al on 70 different Ayurvedic medicines sold in Boston area stores found detectable levels of Pb in 19% of the products with levels as high as 4%, and Hg in 9% of the products with median value of 2% and a maximum level of 10% (2). For the most part, these studies have relied on the use of techniques such as Atomic Absorption Spectrophotometry (AAS) and Inductively Coupled Plasma Mass Spectrometry (ICP-MS) for quantitation. XRF is well suited for the analysis of products such as these which may contain toxicologically significant levels of elements in a more concentrated form.

The focus of this study is the XRF analysis of 28 different dietary supplement products via several different quantitative methods. A study by Dolan et al on these same products reported As, Hg, and Pb levels ranging as high as 4, 17, and 49 ppm via ICP-MS (3). These samples represent a considerable challenge for XRF given spectral overlaps of As and Pb, significant variability of sample matrices, and element concentrations close to the detection limits. Both portable and lab-based XRF instruments were employed in an attempt to mimic how such products might be screened in the field and/or analyzed using more rigorous lab-based quantitative methods. Samples were placed into sample cups and analyzed “as is” via a handheld XRF instrument using both factory and empirical calibrations, and the same subsamples were homogenized and analyzed via lab-based XRF using fundamental parameter-based quantitation and empirical calibrations. This presentation will compare the results from these different quantitative methods and will hopefully demonstrate the suitability of XRF for this application.