AN ACCURATE, PRECISE, AND RAPID METHOD FOR ANALYSIS OF LOW-LEVEL SR-90 IN NIST BONE ASH STANDARD REFERENCE MATERIAL

Z. C. Lin and K. G. W. Inn

Radioactivity Group, Ionizing Radiation Division, National Institute of Standards and Technology, Building 245, Room C114, Gaithersburg, MD 20899 USA.

Discrepancies in the analysis of low-level Sr-90 have been observed repeatedly in intercomparisons of the NIST radioactivity natural matrix standard reference material (SRM). Results of intercomparisons reveal discrepancies among radiochemical methods thereby reducing the reliability of the certified value. To understand the analytical challenges of handling complex sample matrixes, we have developed a rapid radiochemical method capable of processing up to 15 g of bone sample with consistent chemical yields of 90-95%. Significant improvement in measurement accuracy and precision was achieved through the following three approaches. First, after removal of Pu, U, Am, and Th from the sample matrix by TRU resin for alpha analysis, a dedicated (single sample) extraction chromatography column packed with 4 g of Sr resin, to prevent carrier breakthrough, was used repeatedly to separate Sr from the sample matrix and interfering radionuclides, such as Pb-210 and Y-90, as well as gravimetrical interfering elements of Ca and Ba. The entire separation can be fully automated and completed within 2 hours. Second, use of data fitting and extrapolation technique to eliminate the bias and the variations caused by H_2O absorption in the gravimetric yield determination. Third, Sr-90 carbonate sources are repeatedly counted by gas-flow proportional counters. Because the Sr-90 single sample dedicated source provides an unlimited counting time, the counting uncertainty is significantly reduced. The analytical results show that the developed method is capable of measuring mBq levels of Sr-90 with a precision better than 3%, at a confidence level of 95%. The accuracy and versatility of the method was also checked and verified by the NIST natural matrix SRMs and other independent methods.