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A comparative study of 129I content in environmental standard materials IAEA-375, NIST-4354 and NIST-4357 by Thermal Ionization Mass Spectrometry and Accelerator Mass Spectrometry

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Content

With the increasing number of AMS laboratories around the world analyzing 129I, the need for readily available standard materials has increased in order to verify analytical methods. Iodine environmental measurements have consistently been validated in the literature by using the standard material IAEA-375, Chernobyl Soil, which is the only material with a certified 129I activity. IAEA-375 has not been available for purchase since approximately 2010. Having no standard available with a certified value for 129I has necessitated looking for other materials to use. A standard reference material that does not have a certified value does have the advantage of having been prepared to allow sub-sampling that is representative of the bulk standard. Two other standard materials that are available (NIST-4354, freshwater lake sediment and NIST-4357, ocean sediment) have certified activities for a variety of radionuclides but not for 129I. Previous literature studies have shown that 129I is present in these materials; however the data available in the literature has been insufficient to establish a consensus value for 129I. These materials have been analyzed at INL through two chemical separation and mass spectrometric analysis techniques. They involve a combustion method of the starting material followed by thermal ionization mass spectrometry, TIMS, and a leaching preparation for analysis by accelerator mass spectrometry, AMS. Both methods were validated via analyses of IAEA-375 for 129I and show good agreement with the certified activity of 1.7 mBq/kg for 129I; (1.8 mBq/kg by TIMS and 1.6 mBq/kg by AMS) with both sets of results within the 95% confidence interval of the certified value. Results will be presented for the 129I activity and 129I/127I isotopic ratio for environmental radioactivity standards IAEA-375, NIST-4354 and NIST-4357. The authors would like to suggest that these standards should be analyzed by other laboratories and consensus values determined. Once values are available, these would be used to fulfill the increasing need for 129I standard materials that are readily available.

About the Presenter

Dr. Matthew Watrous received his bachelor's degree in chemistry from Montana State University in 1995 and a bachelor's degree in chemical engineering in 2001. He received his doctorate degree from the University of Idaho in 2010. Dr. Watrous focused on thermal ionization mass spectrometry and increased production of ions specifically. Dr. Watrous has been working at the Idaho National Laboratory since 2003 in the area of rare isotope measurements through mass spectrometry. Dr. Watrous works with a group involved in thermal ionization mass spectrometry as well as accelerator mass spectrometry at Idaho National Laboratory.

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