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Innovation in metrology: fast automated radiochemical separation for strontium 89 and 90

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Measuring radioactivity in food and for radiological monitoring of the environment around Nuclear Facilities or mining sites purposes requires a quantification of the radioactive isotopes (especially beta emitters) present in the different compartments (liquids or solids).

Strontium 89 and 90 [1], both pure beta emitters are radioactive isotopes of interest. Because of their toxicity and the similarity of their chemical and physical behavior with calcium, these elements may be found through the food chain. After the Fukushima accident, the necessity of a rapid quantification of radioactive isotopes such as strontium 89 and 90 appeared.

The new technique developed deals with the determination of the activity concentration of strontium 89 and 90 in water. It includes two steps: the chemical separation by ionic chromatography and the measurement of the activity concentration of strontium 89 and 90 by Cerenkov Effect. In this poster, this chemical separation by ionic chromatography is explained.

An automated separation has been developed and allows isolating strontium isotopes, including the radioactive ones: strontium 89 and 90. The separation can be done within one hour. It was achieved through the adaptation of existing analytical chemistry equipments with on-line couplings [2]. The protocol of separation is based on the use of ions exchange columns of Ionic chromatography, not as a separation and measurement technique of the cation but only as a separation technique. At the release time of the ion to be quantified, a fraction collector allows its recovery.
The test portion collected is then analyzed with appropriate measurement techniques (radioactive measurement with a liquid scintillation counter (LSC) or mass spectrometry) to determine the activity concentrations of strontium 89 and 90.

The results presented at the 17th Radiochemical Conference are linked to the development of the chemical separation of strontium by ionic chromatography. Studied parameters such as the collection time, the test sample volume, the resin capacity will be discussed.
This optimized protocol was then tested with standard solutions and proficiency test samples.

[1] Tovedal A, Nygren U, Ramebäck H. Methodology for determination of 89Sr and 90Sr in radiological emergency: i. scenario dependent evaluation of potentially interfering radionuclides. Journal of Radioanalytical and Nuclear Chemistry 2009; 282(2): 455–459.
[2] L.Lazare, C.Crestey, C.Bleistein: Measurement of 90Sr in primary coolant of pressurized water reactor. Journal of Radioanalytical and Nuclear Chemistry 2009, 279(2): 633-638.

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