PO 1.21

Use of different simple methods for the estimation of radium concentration in a variety of environmental samples

Z.Tosheva[1], S. Chalupnik[2], N.Dimova[3], A.Kies[1]

[1]University of Luxembourg, av. de la Faiencerie 162a,
1511 Luxembourg, Luxembourg
[2]Central Mining Institute, Katowice, Poland
[3]Institute for Nuclear research and Nuclear Energy, Bulgarian Academie of Science,
Tzarigradsko Shossee 72,1784 Sofia, Bulgaria

Radium is one of the most important radionuclides in the natural environment. Therefore precise and accurate methods of determination of radium in the different environmental objects are highly desirable (Williams, 1990). Simple and non-destructive methods can be used for high radium concentrations, while more complicated methods are needed for measurements of low concentrations, especially if the concentration of the different radium isotopes has to be measured. Usually the modern techniques like ICPMS are not applicable.

Before measurement of an environmental sample an important decision concerns the method that can be applied. For instance a low concentration of ^{226}Ra in samples can be measured by the emanation method, which is not applicable for the other radium isotopes – ^{228}Ra and ^{224}Ra. On the other hand, by means of gamma spectroscopy ^{226}Ra and ^{228}Ra isotopes can be measured in water and in soil or sediments (Lucas & Markun, 1992). Unfortunately this method is time consuming and not applicable for low concentrations of radium isotopes. A combination of solvent extraction or extraction on manganese dioxide followed by different measuring techniques like LSC or alpha spectrometry is applied for such determinations (Eikenberg, 2003, Möbius at al.1993).

Measuring procedures depend strongly on the presence of barium ions in water samples, for instance barium interferes strongly in the alpha spectrometry method (Smithson, 1990). High salinity is also a source of problems, such that it is not possible to elute radium isotopes from soils or sediments, to evaporate water samples or to mix them directly with scintillation liquid. Another source of difficulties is the quantity of available sample material.

We compare the results from different methods for samples with extremely high radium concentration in rock material (13kBq/kg); from rock and sediments with low concentrations from Antarctica (6-12 Bq/kg) and for high salinity water samples from the mineral Spas of Bad Kreuznach, Germany (15-60 Bq/L). Some of the comparisons have been done in different laboratories under cross-laboratory comparisons.

To conclude we propose some simple criteria for the choice of the adequate measurement techniques and the related chemical procedures for simple, adequate not time consuming estimation of the concentrations of radium isotopes for different applications.