Determination of $^{226}$Ra in natural water samples by liquid scintillation counting

Osváth, Szabolcs; Rell, Péter; Kónyi, Júlia Kövendiné ; Szabó, Gyula

Publication date: 2017

Document Version
Publisher's PDF, also known as Version of record

Link back to DTU Orbit

Citation (APA):

General rights
Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

- Users may download and print one copy of any publication from the public portal for the purpose of private study or research.
- You may not further distribute the material or use it for any profit-making activity or commercial gain
- You may freely distribute the URL identifying the publication in the public portal

If you believe that this document breaches copyright please contact us providing details, and we will remove access to the work immediately and investigate your claim.
Introduction

Determination of Ra in drinking waters, natural waters and other environmental samples is an important task due to its high radioactivity. Ra can be determined directly or via its progenies (e.g., 214Pb, 214Bi). According to the newest comprehensive papers (IAEA, 2010; and Asl and Rell, 2013), spectrometry, scintillation counting and LSC are commonly used in the determination of Ra. However, in another recent comprehensive paper (Dapelo et al., 2010) only spectrometry, scintillation counting and its mass spectrometric methods are referred, while LSC is only mentioned as a technique for determination of Ra.

Method

Through the demonstration of the sample preparation procedure used. 0.5–1.5 L sample was taken, filtered through a 0.45 µm filter and pH was adjusted to 4–7 using 1 M HNO3 or 1 M NaOH. After that 4 Bq 133Ba tracer and 1.25 g MnO2 Resin® were added. (As no extra gamma-spectrometry was used for measurement of 133Ba, the overall time consumption of this method (about 20 hours) is comparable with that of methods based on spectrometry and more convenient than that of methods based on Ra in growth. In addition, the uncertainty of recovery too much.)

Results

The results of 13 analyzed water samples (bottled mineral waters, medicinal thermal waters and natural surface waters) can be seen in Table 1 and 3. Our experiments have shown that the average chemical recovery was 65±15%, and we could not find correlation between recovery and sample composition (allocate earth content).

Discussion:

Five point of the method is that the same LSC measurement was used for determination of activity of “Ra tracer” as well as that of 133Ba (see Figure 2), as proposed by Teller and Smith (1994).

To optimize the pulse decay discriminator setting of the LSC analyzer, 241Am standard was used as pure -emitter progeny of 226Ra (namely 222Rn, 218Po and 214Po) are present (as shown in Figure 3). Their in-growth particles are detected via their Compton electrons, counting efficiency can be higher than 100%).

Conclusions

A relatively fast, simple and reliable method has been developed for determination of Ra from natural water samples, using scintillation separation and LSC measurement. Activities of Ra (for determination of the chemical yield of the procedure and Ra were determined from the same LSC measurement. As no extra gamma-spectrometry was used for measurement of Ra, the overall time consumption of this method (about 20 hours) is comparable with that of methods based on spectrometry and more convenient than that of methods based on Ra in growth. In addition, the uncertainty of recovery too much.)

This method was successfully applied for analysis of bottled mineral waters, medicinal thermal waters and natural surface waters.

References


