

## Evaluation of Different Liquid Scintillation Counting Methods for $^{222}\text{Rn}$ Determination in Waters

**Authors :** Jovana Nikolov, Natasa Todorovic, Ivana Stojkovic

**Abstract :** Monitoring of  $^{222}\text{Rn}$  in drinking or surface waters, as well as in groundwater has been performed in connection with geological, hydrogeological and hydrological surveys and health hazard studies. Liquid scintillation counting (LSC) is often preferred analytical method for  $^{222}\text{Rn}$  measurements in waters because it allows multiple-sample automatic analysis. LSC method implies mixing of water samples with organic scintillation cocktail, which triggers radon diffusion from the aqueous into organic phase for which it has a much greater affinity, eliminating possibility of radon emanation in that manner. Two direct LSC methods that assume different sample composition have been presented, optimized and evaluated in this study. One-phase method assumed direct mixing of 10 ml sample with 10 ml of emulsifying cocktail (Ultima Gold AB scintillation cocktail is used). Two-phase method involved usage of water-immiscible cocktails (in this study High Efficiency Mineral Oil Scintillator, Opti-Fluor O and Ultima Gold F are used). Calibration samples were prepared with aqueous  $^{226}\text{Ra}$  standard in glass 20 ml vials and counted on ultra-low background spectrometer Quantulus 1220TM equipped with PSA (Pulse Shape Analysis) circuit which discriminates alpha/beta spectra. Since calibration procedure is carried out with  $^{226}\text{Ra}$  standard, which has both alpha and beta progenies, it is clear that PSA discriminator has vital importance in order to provide reliable and precise spectra separation. Consequentially, calibration procedure was done through investigation of PSA discriminator level influence on  $^{222}\text{Rn}$  efficiency detection, using  $^{226}\text{Ra}$  calibration standard in wide range of activity concentrations. Evaluation of presented methods was based on obtained efficiency detections and achieved Minimal Detectable Activity (MDA). Comparison of presented methods, accuracy and precision as well as different scintillation cocktail's performance was considered from results of measurements of  $^{226}\text{Ra}$  spiked water samples with known activity and environmental samples.

**Keywords :**  $^{222}\text{Rn}$  in water, Quantulus1220TM, scintillation cocktail, PSA parameter

**Conference Title :** ICRER 2018 : International Conference on Radioecology and Environmental Radioactivity

**Conference Location :** Tokyo, Japan

**Conference Dates :** March 27-28, 2018