

RAPID OFF-LINE DETECTION METHOD FOR ALPHA-PARTICLE EMITTING RADIONUCLIDES IN WATER SAMPLES

Pia Vesterbacka and Roy Pöllänen
STUK- Radiation and Nuclear Safety Authority,
Laippatie 4, 00880 Helsinki, Finland

In a nuclear or radiation emergency there is a growing need for rapid off-line and on-line analytical methods to detect radionuclide threat agents in water. Efficient analysis tools are needed especially for rapid screening of samples with low and medium activity concentrations. Although different types of rapid detection methods are available, there is room to develop sensitivity of the methods.

In the rapid off-line method presented here, water samples were evaporated and the residues were measured by alpha spectrometry. A novel analysis tool known as ADAM was used to unfold the alpha spectra. Because of the omission of radiochemical sample processing there may be a number of peaks of different radionuclides present in the spectra. In the fitting, the peaks of each radionuclide are treated as a group which enables efficient spectrum unfolding even in the case of complex alpha spectra.

Sixty drilled well water samples were selected for the study. From the samples, an aliquote of 15 ml was evaporated into stainless disc under IR lamp. After evaporation the alpha particles were counted (AlphaAnalyst Canberra) for one week. From the same water samples, gross alpha activity concentrations were determined by liquid scintillation method. In addition, radiochemical uranium analyses were performed for 18 water samples to verify ADAM software in calculating U activity concentrations and isotopic ratios.

The results demonstrated that the correlation between activity concentrations calculated by ADAM to that determined by liquid scintillation method was good. Radiochemical analyses indicated that U isotope ratios were equal. Based on the results obtained in this study ADAM software can be used to rapidly detect low and medium level concentrations in water. Moreover, ADAM gives more nuclide specific information compared to the conventional methods based on either liquid scintillation counting or proportional counting. With this method sample preparation is simple and availability of the results is fast.