APPLICATION OF A LOW-BACKGROUND COUNTING CHAMBER TO STUDY THE RADIOACTIVITY OF ENVIRONMENTAL SAMPLES

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The gamma-spectrometric analysis of environmental samples generates methodological challenges mainly due to the low activities. The aim of this study was to solve these jobs to determine the 226Ra, 232Th and 40K content of Hungarian (coal slag, n=9) and Angolan (adobe, n=60) building materials and to qualify them by using international indices. A Canberra GR1319 detector, with 13% relative efficiency in a low-background counting chamber at the neutron guide hall of MTA EK, was used to fulfil these requirements. The chamber is made of the bombed Elizabeth-bridge and contains iron (150 mm), lead (5 mm) and copper (1.5 mm) as shielding layers. The measurement system enabled us to test the radon-tightness of HDPE (high density polyethylene) sample containers and to determine the full-energy peak efficiency in close sample-detector geometry with the efficiency transfer method. Our results supported that the sample containers can be considered as radon-tight and the efficiency transfer method is successful. The examination of the secular equilibrium between 226Ra and 238U and the uranium isotopic ratios of the coal slag samples enabled the accurate determination of 226Ra. The measurements carried out on the Angolan adobe samples showed varying radio isotopic compositions as a result of the different geological backgrounds. The activity concentration index and radium equivalent values of the coal slag samples revealed higher values than limit rates. Based on this study, the measurement system can be applied to the accurate and detailed determination of environmental samples' radioactivity with low activity.