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Measurement of Rn-222 in Groundwater by the use of Gamma-ray Spectroscopy with a Background Control System

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ABSTRACT

Simple and accurate procedures for the determination of radon-222 in groundwater have been studied using HPGe detector with nitrogen flushing system. Radon-222 activity was calculated from the gamma-ray measurement of its progenies (Pb-214, Bi-214) on the assumption that radon and progenies were in secular equilibrium. The counting container for sampling and reaching at equilibrium was 450mL aluminum Marinelli beaker. Background radiation induced from radon and its progenies in atmosphere of counting chamber was eliminated and stabilized using a nitrogen flushing system. Equilibrium and nitrogen flushing conditions have been optimized for the determination of radon in groundwater without any radiochemical treatments. The nitrogen flushing setup and background variations are presented in Fig. 1 and 2, respectively. The optimum conditions are described in table 1.

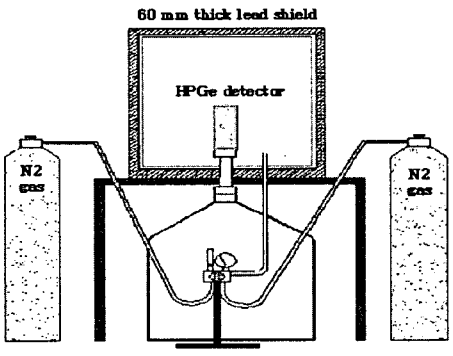

Fig. 1. The nitrogen flushing system.

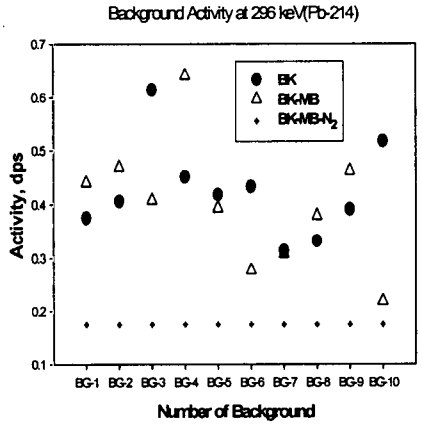

Fig. 2. Background variation with and without nitrogen flushing.

Table 1. The procedures for the determination of Rn-222 in groundwater by Gamma-ray spectrometry

Procedures	Description
Sampling and Sealing	450mL Aluminum Marinelli Beaker by sampling rule and screw aluminum cover
Mounting groundwater	on HPGe detector in counting chamber
Nitrogen flushing	5L/min first 3h for decay out Pb-214, Bi-214
Activity measurement	2L/min during activity measurement

Key words: Radon, Groundwater, Nitrogen flushing, Background control, Gamma-spectroscopy