

# Simultaneous analysis of radium and radon in hot spring water using radon emission and pair measurement technique

Kil Yong Lee<sup>1\*</sup> and Kyeong-Seok Ko<sup>1</sup>

<sup>1</sup>Geologic Environmental Research Division, Korea Institute of Geoscience and Mineral Resources, 124, Gwahak-ro Yuseong-gu, Daejeon 34132, Republic of Korea

\*E-mail: kylee@kigam.re.kr

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A new method has been devised for simultaneous analysis of radon ( $^{222}\text{Rn}$ ) and radium ( $^{226}\text{Ra}$ ) in hot spring water. It was based on radon exhalation and pair measurements using an air radon detector (RAD7, DurrIDGE Co., USA). A sample of hot spring water was collected in a measuring bottle with a set of air loop tubes and immediately sealed. Radon activity in bottled water samples was measured twice (pair measurements) using RAD7. For pair measurements, the first measurement was taken within 3 days after the water sample was taken, and the second measurement was taken about 5 days after the first measurement. The activity concentrations of radon and radium in hot spring water can be determined simultaneously using two radon activities obtained from pair measurements, radium-radon radio-equilibrium curves and air-water partitioning coefficient. The most commonly used method for measuring radium in water samples is gamma ray spectroscopy. In gamma ray spectroscopy, water sample should be sealed and then stored for at least 25 days to allow that radon and its progeny are in secular equilibrium with the parent radium. In addition, the radon concentration in the counting room and lead shield is affected by environmental factors such as temperature, humidity and ventilation, etc. Therefore, it is important to minimize and stabilize the radon concentration in the air inside the counting room and lead shield. The devised method was compared with the conventional gamma ray spectroscopy of radium, the latter after pre-concentration by adsorption with Mn fibers in a 10 L water sample. Radon in water was generally measured using LSC method. Some hot springs contain high concentrations of radium as well as radon. Sometimes radon concentration can be overestimated by radon generated from the radium in hot springs. In the present method, radium and radon could be measured simultaneously in hot spring water within 7 days after water was collected.

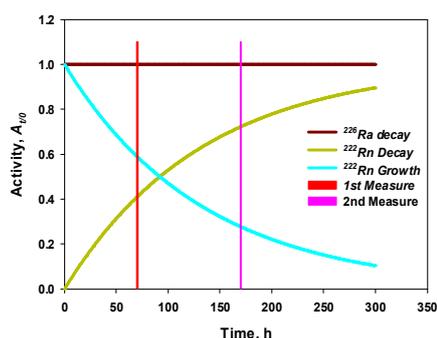


Fig. 1. Decay and growth curves of radon and radium with pair measurement.

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