

## **DETERMINATION OF RADON CONCENTRATION IN THE STALACTITE WATER FROM MAHAR SADAN CAVE, KAW KA THAUNG CAVE AND EAIK SA TA YA CAVE IN KAYIN STATE, MYANMAR**

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### **Abstract**

The pure of drinking water is very important for health of our human beings. The water form stalactite can be used as drinking water. Radon gas involvement is a part of the fact that caused water pollution. Using RAD 7 nuclear radiation detector, we tried to test the stalactite water to know how much the level of radon gas involves in it. The following three caves from Kayin State have been experiment; Mahar Sadan cave, Kaw Ka Thaung cave and Eaik Sa Ta Ya cave. Review the results of the radon concentration are as follow; Mahar Sadan cave has  $10.7 \pm 11$  pCi/L, Kaw Ka Thaung cave has  $24.9 \pm 13$  pCi/L and Eaik Sa Ta Ya cave has  $29.3 \pm 18$  pCi/L. According to measurement, the extent of radon concentration in the cave cannot cause danger to human life that is why the stalactite water can be used.

**Keywords:** Radon concentration, stalactite water, RAD 7.

### **Introduction**

Two major chains of initial radioactive nuclear decay associated with the earth are Th-232 and U-238. Among the radioactive nuclear produced in the two mentioned chains, Radium-226 is a product of the U-238 radioactive decay series with half-life about 1600 years that emits alpha particle is very important. Radon 222, the most stable isotope in its family which is used in radio therapy and special properties as odourless, colourless, water-soluble and radioactive like in other 20 isotopes, is the daughter of alpha disintegration from Ra-226 with a half-life about 92 hours, can then enter the human body through the respiratory. The total amount of annual effective dose of natural radioactive sources is 2.4 mSv and 1.2 mSv nearly belongs to radon and its daughters. Radon-222 and its decay products are the most important source of human exposures. The second natural Radon isotope is Radon 219 which has a half-life 3.9 seconds and is produced from U 235 decay series. The third natural isotope located in the Th-232 decay chain is called Thorium with half-life 55.6 seconds. When the radon gas to be cooled below the freezing point it has a bright phosphoric color and in the lower temperature has yellow color. In normal temperature its color goes to be red orange. The average concentration of radon in the atmosphere is about one molecule of radon in molecule of air, and it is estimated that every square mile of soil to a depth of 6 inches contains approximately one gram of radium which decays to radon 222. At least 50 percent of natural exposures are due to radon gas and its corresponding decay products.

### **Radon in water and its hazards**

Once radon in water supply reaches people, it may produce human exposure via inhalation and direct digestion. Radon in water transfers into the air during showers, flushing

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toilets, washing dishes and washing clothes. The aerosols tend to deposit into the lungs where they release radiation that has been shown to increase the likelihood of lung cancer. Radon can also reach other body tissues through ingestion resulting in radiation exposure to the internal organs. Ingestion of radon is believed to increase the risk of stomach cancer. As stated one kind of water contamination is due to the existence of radon and this is very important in the quality of water.

**Table 1 A Save Level of Radon Gas for Public Area**

Radon concentration	Recommended Remedial Action Time
Less than 100 pCi/L	No action required
100 – 300 pCi/L	Save Level
greater than 300 pCi/L	Action required

### Measurement of radon in water samples

The concentration of radon in stalactite water is more than of spring waters and also deep wells, however if the water is moving more and more the concentration of radon is expected to be further reduced. The investigated water samples are collected from three caves in Kayin State. By keeping the samples in a cold place and at the least time the samples have been transported to laboratory.



**Figure 1** Location map of Kayin State

### Radon measurement system

In this research to determine the concentration of radon in stalactite water the RAD 7 Professional Electronic Radon Detector has been used. This system has suitable features to measure the concentration of radon gas in the water. The most important characteristics of this system is the high sensitivity and short time response. The detection system has RAD H<sub>2</sub>O accessory, RAD AQUA accessory and Water Probe accessory. RAD H<sub>2</sub>O accessory enables to measure collected water samples to detect radon with high accuracy over a wide range of

concentrations, obtain data within an hour of taking sample. RAD AQUA accessory handles the continuous monitoring of radon in water, offering accurate results in as little as half an hour. Water Probe accessory is used to collect radon samples from large bodies of water. The probe consists of a semi-permeable membrane tube mounted on an open wire frame. The tube is placed in a closed loop with the RAD7. When the probe is lower into water, radon passes through the membrane until the radon concentration of air in the loop is in equilibrium with that of water. As with the RAD AQUA, the RAD7 data and water temperature data are collected simultaneously and accessed by capture to determine the final result. RAD H<sub>2</sub>O accessory and RAD AQUA accessory are shown in figure 2 and figure 3.



**Figure 2** The RAD H<sub>2</sub>O Accessory



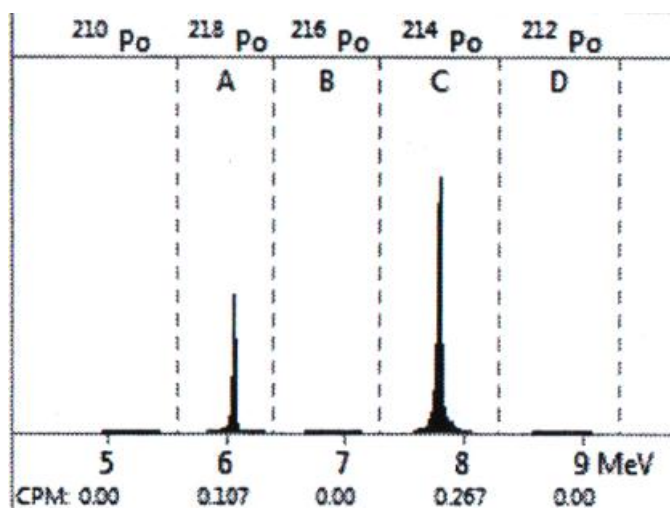
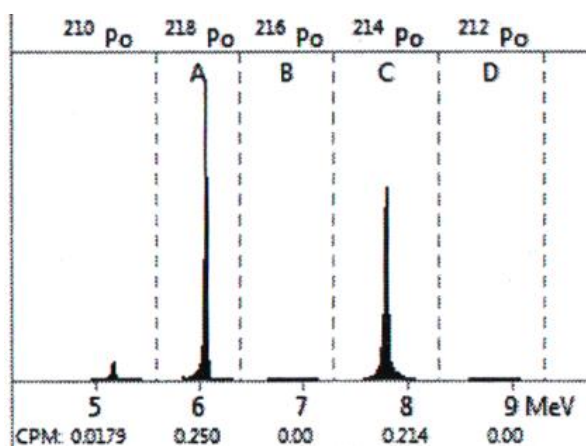
**Figure 3** The RAD AQUA Accessory

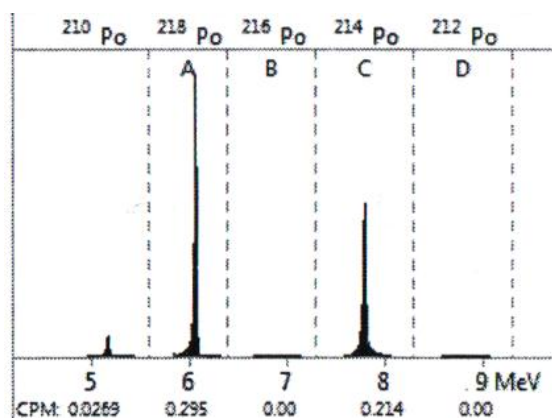
### Measurement results

In this research, radon concentrations in stalactite water samples from three cave of Kayin State is measured. The radon concentration in each sample has shown in table 2. In Figure4, 5 and 6 the spectrum of radon concentration of each sample are shown respectively.

**Table 2 Specific Activity of Samples**

Samples No	Caves Name	Specific Activity
1	Mahar Sadan Cave	$10.7 \pm 11$ pCi/L
2	Kaw Ka Thaung Cave	$24.9 \pm 13$ pCi/L
3	Eaik Sa Ta Ya Cave	$29.3 \pm 18$ pCi/L

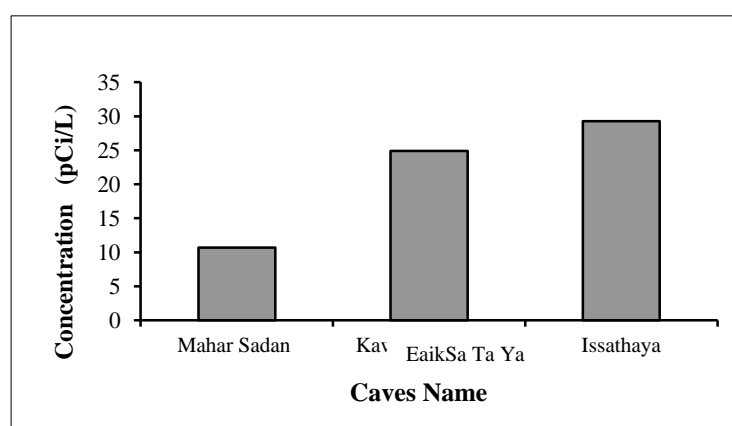
**Figure 4** The Spectrum of stalactite water sample in Mahar Sadan Cave**Figure 5** The Spectrum of stalactite water sample in Kaw Ka Thaung Cave



**Figure 6** The Spectrum of stalactite water sample in Eaik Sa Ta Ya Cave

### Discussion

When analyses the synthetic spectra for water samples of Mahar Sadan Cave, Kaw Ka Thaung Cave and Eaik Sa Ta Ya Cave, the following peaks are observed. At 5.3 MeV, a persistent peak will be developed as resultant of Polonium-210 build up. At 6.00 MeV, after less than one hour of exposure to radon (new radon) Po-218 peak A. At 6.78 MeV, the RAD 7 spectrum while continuous sampling thoron laden air (new thoron) Po-216 peak B. At 7.69 MeV, the RAD 7 spectrum after purging the instrument with radon-free air for more than 10 minutes (old radon) following exposure to radon, Po-214 peak C. At 8.78 MeV, the spectrum after discontinuing a length (old thoron) sampling of thoron laden air, Po 212. Peak D.



**Figure 7** The histogram of radon concentration (pCi/L) of each sample

### Conclusion

From the public health point of view, if we breathe radon gas, it tends to suffer from cancer, stomach (ingestion) cancer and skin allergy. As our study on three natural caves, we have observed as below: Mahar Sadan cave was low radon concentration in air. The reason was the size of the cave is larger enough and it also has good ventilation to reduce the concentration of radon gas. Although, Kaw Ka Thaung cave was large, it has poor ventilation, so the radon concentration was higher than the Mahar Sadon cave. For Eaik Sa Ta Ya cave, the size is smaller than Mahar Sadan cave and Kaw Ka Thaung. Its' ventilation is worse than the previous two.

Therefore, this one is the obviously highest radon concentration in water sample. According to measurement, the extent of radon concentration in the cave cannot caused danger to human life that is why the stalactite water can be used.

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