Determination of Elements and Radon in Water from Gold Mines at Bago Region

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Abstract– **The purpose of this research is focused on the point of view of public health. The measurements of elements and radon concentration from Byut Myaung and Kalain gold mines in Shwe Kyin Township at Bago Region were recorded. Water samples were collected and analyzed by using RAD7 detector in laboratory to get the record of radon concentrations. It was found that the radon concentration in water samples from Byut Myaung and Kalain gold mines were 8.20±1.33 pCi/L and 4.84±0.68 pCi/L respectively. When the water samples were analyzed with Atomic Absorption Spectrometer (AAS), it can be seen the concentrations of particular hazardous elements (K and Pb). Potassium volume in water samples from Byut Myaung gold mine was 1.49 mg/L and that from Kalain gold mine was 0.99 mg/L although the lead has been obtained in water samples from both sites no trace of it was found. In this research, the results were accepted the safety limit as specified by World Health Organization (WHO) standard.**

Keywords– **Radon Concentrations; water samples; RAD 7 and AAS**

I. INTRODUCTION

Radon is a colorless, odorless, tasteless, mixed with air and also known as an inert gas. Radon can move easily through ground water, soil, rock and can exist in the river via groundwater. It is present everywhere on the earth surface and reaches by different processes and accumulates in the houses and underground mines [1]. The pore space in soil grains might contain water and if the radon atom terminates its recoil in the water, the radon may be prevalence to water around the mining sites (mine dump, mine tailings or ravine). Radon can only be detected or measured with special detectors. Two methods can be used for measuring of radon concentration as short term and long term methods [2]. In this research, RAD-7 solid state detector (short term) and Atomic Absorption Spectrometer (AAS) was used to determine the radon concentration and elements in water samples from Byut Myaung and Kalain gold mines, Shwe Kyin Township, Bago Region.

A. Natural Water System

Water is colorless and odorless substance found all over the world. Water is made up of billions of molecules and can be found flow as liquid in rivers, stream, and oceans. And then its solid state as ice can be seen easily whether the north or south pores. Water can easily transform to gaseous state as vapor in the atmosphere. It also occupied in most of underground, inside plants and animals.

Human bodies were also existing over 75 percentages of water and receiving many advantages for good health. Water carries and serves nutrients for all cells in human body and supplies sufficient oxygen volume for our brains. Water is indeed in main function for the body to absorb and assimilate minerals, vitamins, amino acids, glucose and other substance. Water has a property of good resist or flushes out toxins and waste and helps to adjust body temperature.

In generally water can be classified into two features on ground. There are surface water and ground water. Surface water includes drinking water, lakes, rivers, streams, oceans and other public uses. Ground water locates beneath the ground and contains gravels, limestone, subsurface layer of soil and bedrocks [3].

B. Health Effect of Radon

The radon high levels are mostly found in which the ground water flows through sand formations or granite. When the radon contaminated water is ingested, the health

problem or its effects can be resulted as stomach cancer. Then radon can be toxic as well as by other ways. Radon can be aerated by being passed through as fire extinguisher, fire horse wheel, pressure pump, laundry machines and shower heads, poisoning both of water and air. Radon in tap water can be released to air when it is used for cooking, bathing, washing, (etc.) [4, 5].

C. Natural Decay Series

Radioactive decay occurs when an unstable (radioactive) isotope transforms to a more stable isotope, generally by emitting a subatomic particle such as an alpha or beta particle. Radionuclide that give rise to alpha and beta particles are shown in this Figure 1 [6].

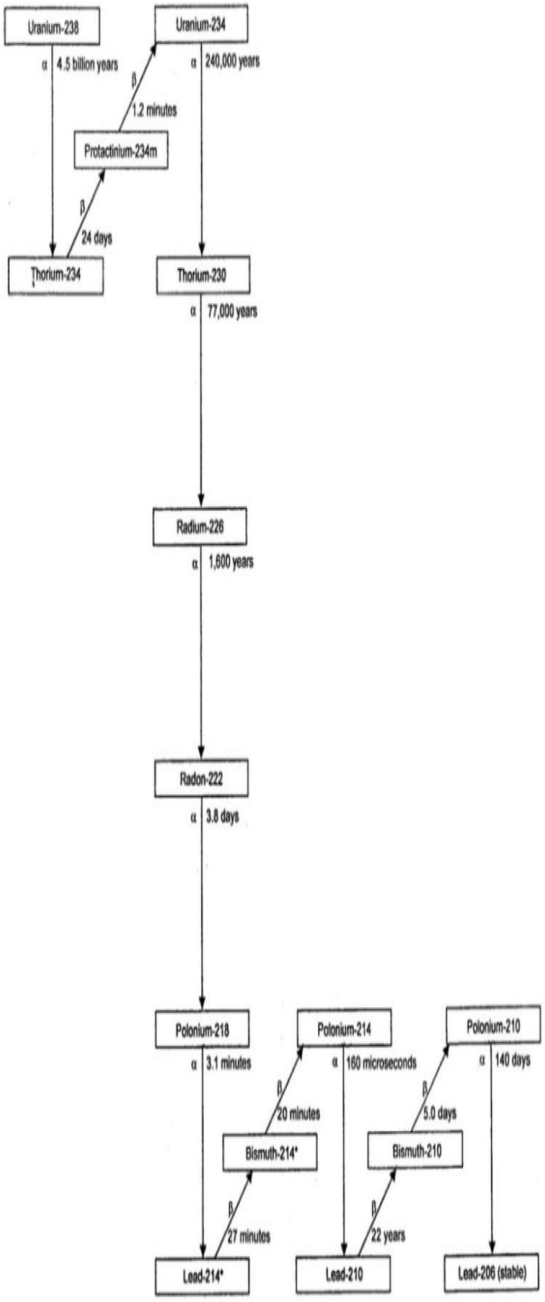


Figure 1: Natural Decay Series: Uranium – 238

D. A Safe Level of Radon Gas

Radon concentrations are generally found in two types. They are indoor and outdoor. Indoor radon levels are highest specific activity and outdoor radon levels are lowest specific activity. When outdoor radon level are low to easily dilute concentration, indoor radon concentrations are higher and found in place such as water treatment facilities, mines and caves. The safety level of radon concentrations in water samples must be that of WHO recommended permissible level between (100 pCi/L) and (300 pCi/L) [7].

II. MATERIAL AND METHODS

A. Sample collection

The RAD 7 detector was performed in water samples at Byut Myaung and Kalain gold mines at 284 ft above sea level. The samples are collected at 17° 50' 46.08' north latitude, 96° 57' 46.80' east longitude, Kalain and Byut Myaung gold mines with GPS MAP 62 S as shown in figure 6. Water samples were collected in clean liter polythene bottles from two different mines. Two of the samples were collected from Byut Myaung and Kalain gold mines are show in figure 2 and 3. The location sites of Byut Myaung and Kalain gold mines in Shwe Kyin Township at Bago Region are shown in Figure 4 and Figure 5.

Figure 2: Water Samples from Byut Myaung Gold Mine

Figure 3: Water Samples from Kalain gold mine

Figure 4: Location Site of Byut Myaung Gold Mine

Figure 5: Location Site of Kalain Gold Mine

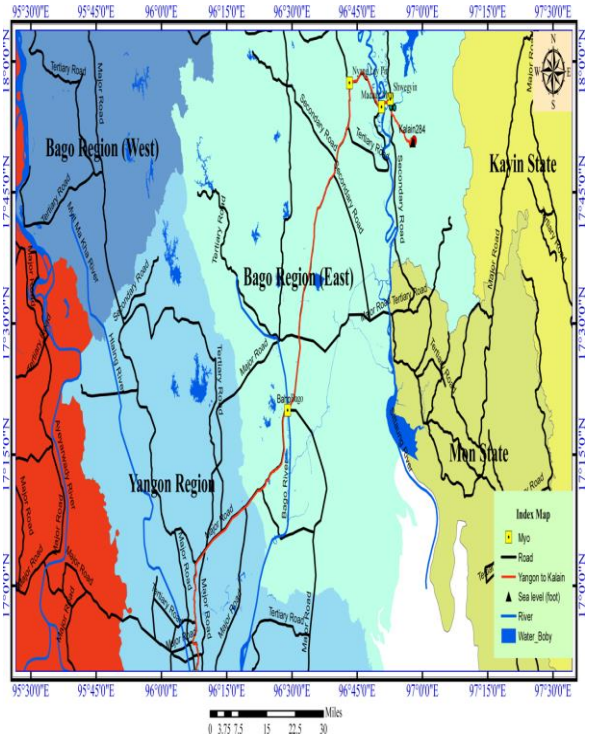


Figure 6: Location Map of Byut Myaung and Kalain Goldmines from Yangon Region

III. MEASUREMENT PROCEDURE

The Water Probe 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 RAD 7.When the probe is lowered into water, radon passes through the membrane until the radon concentration of the air in the loop is in equilibrium with that of the water. As with the RAD AQUR, the RAD7 data and water temperature data are collected simultaneously and accessed by CAPTURE Software of RAD 7 to determine the final result [8].

Atomic absorption spectrometry (AAS) is an analytical technique that measures the concentrations of elements. Atomic absorption is so sensitive that it can measure down to parts per billion of a gram (μgdm^{-3}) in a sample. The technique makes use of the wavelengths of light specifically absorbed by an element. They correspond to the energies needed to promote electrons from one energy level to another, higher, energy level [9].

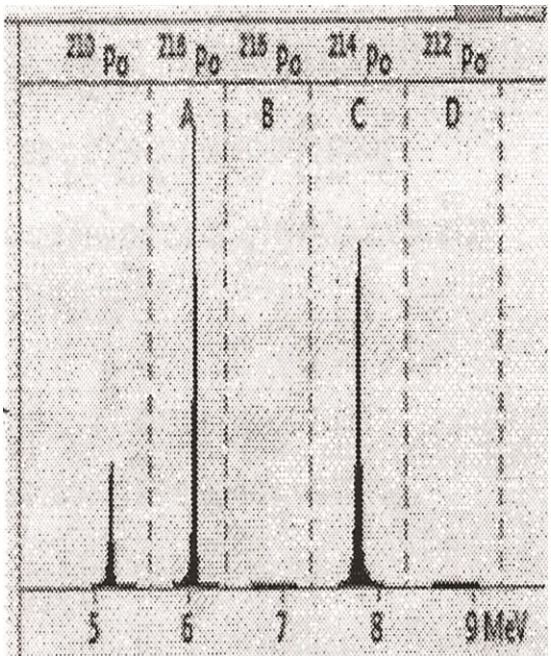
Advantage of atomic absorption spectroscopy (AAS) is an easy, high throughput technology used primarily to analyze compound solutions. Atomic absorption spectroscopy (AAS) is used in food, and beverage, water, clinical and pharmaceutical analysis. It shows greater sensitivity. It provides a reducing environment for easily oxidized elements [9].

Disadvantages of atomic absorption spectroscopy (AAS) method are as follows: need to separate lamp for each element to be determined is main limitation atomic absorption spectroscopy (AAS). In aqueous solution, the predominant anion effect interfere the signal to a significant level. Sample must be in solution or at least volatile and only solutions can be analyzed [9].

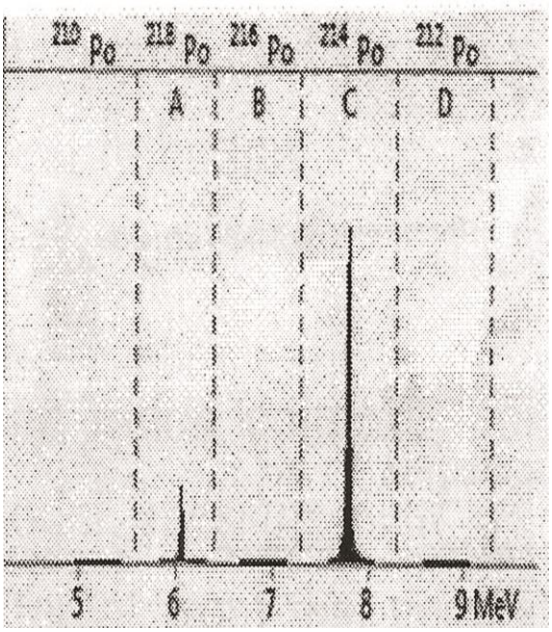
The concentrations to toxic elements such as Pb and K in two water samples from mining sites were analyzed by AA-6300 SHIMADZU at AMTT analytical laboratory.

IV. RESULTS AND DISCUSSION

When analyzing the synthetic spectra for water samples at Byut Myaung and Kalain gold mines, the following peaks result are observed. The operational radon spectra for water samples were also respectively mentioned as below figure 7(a) and figure 7(b). The heights of the peaks on the spectrum depend on the concentration of the radon and to which radon had exposed. At 5.3 MeV, a persistent peak will be developed as resultant of Polonium-210 buildup. At 6.00MeV, after less than one hour of exposure to radon are called new radon Po-218 peak A. At 6.78MeV, the RAD7 spectrum while continuous sampling thoron laden air (new thoron) Po-216 peak B. At 7.69MeV, the RAD7 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 8.78MeV, the spectrum after discontinuing a lengthy (old thoron) are sampling of thoron laden air, Po 212 Peak D.



(a) Byut Myaung spectrum



(b) Kalain spectrum

Figure 7: Operational Radon Spectra for water samples from (a) Byut Myaung and (b) Kalain gold mines

After the determination of water samples detected by using RAD7, two different results were obtained as shown in TABLE I. As shown in TABLE I, the specific activity of Byut Myaung gold mine was higher than that of Kalain gold mine. TABLE II shows the concentration of potassium and lead contained in two water samples from different location analyzed by atomic absorption spectroscopy (AAS). The concentrations of lead in two samples were not detected. The concentration of potassium in Byut Myaung (1.49 mg/L) was higher than that of Kalain (0.99 mg/L). According to world health organization (WHO) reports, average concentration of potassium in raw and treated drinking water in different areas vary between <1 and 8 mg/L.

TABLE I

Specific Activity of Water Samples from Different Locations

Samples No:	**Location**	**Specific Activity (pCi/L)**
1	Byut Myaung	8.20 ± 1.33
2	Kalain	4.84 ± 0.68

TABLE II

Atomic Absorption Spectroscopy Data for Water Samples from Different Locations

Samples No:	**Name**	**Lead (mg/L)**	**Potassium (mg/L)**
1	Byut Myaung	ND	1.49
2	Kalain	ND	0.99

ND = not detected (< LOD)
LOD = limit of detection
Pb < 0.006 mg/L

V. CONCLUSION

According to the results, Byut Myaung gold mine has the highest specific activity and Kalain gold mine has the lowest specific activity. In water samples from Byut Myaung and Kalain gold mines, the contents of lead are not detected because those are lower than the limit of detection (Pb < 0.006 mg/L). The potassium contents for these samples are 1.49 mg/L and 0.99 mg/L. The Analytical report described lead concentration for safety limit and monitor potassium for K^{40} activity. This result showed that in low risk of radon exposure due to K^{40} which contribute only 0.012 % to natural potassium. It is not seriously effect to the workers because the workers do not stay longer at these locations. However, continuous monitoring should be needed for trace of safety radon concentration of water from other hilly region and mining area as radon can cause at least some skin allergy and malignancies in human body. The second largest cause of lung cancer is believed because of the concentration of radon while the first is due to smoking.

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