Analysis of Hazardous Elemental Concentrations of Water from Hot Spring near Ywathitgyi Village in Hopin Township, Kachin State by EDXRF Method

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Abstract

Elemental concentrations of water from a Hot Spring near Ywathitgyi village was investigated by using Energy Dispersive X-Ray Fluorescence (EDXRF) Analyzer(MESA-50). The water samples were collected in every first week of the month during the cold season and measured in Myitkyina University. Mainly, organic compounds were observed as CH_2 .Chromium (Cr) and Chlorine (Cl) included in second maximum amount. "As" elements was not found. Chlorine concentrations in hot spring was very high in comparing with two water samples of Myathidar quarter and Gardgone quarter in Hopin Township. The "pH" values of these water samples were less than "7 " but it was within the limit of drinking water level (6.5 to 8.5).The color of water in hot spring is normal but the taste is brackish. Due to the physical nature of the hot spring, it is a common salt hot spring.

Introduction

There are many hot springs in the World.A hot spring is a spring produced by the emergence of heated water. It rises from the Earth's crust. There are geothermal heat in many locations all over the crust of the earth.Some of hot springs contain water that is a safe temperature for bathing. Others are so hot that immersion can result in injury or death.

In general, the temperature of rocks within the earth increases with depth. The rate of temperature increase with depth is known as the geothermal gradient. If water percolates deeply enough into the crust, it will be heated as it comes into contact with hot rocks. So water become hot and split out to surface of earth.Depending on the chemical substances of the hot springs, there are sodium bicarbonate spring, sulfate spring, ferrous spring, sodium hydrogen carbonate spring, chloride spring, common spring, gesso spring and saline bitter spring.[1]

According to the physical nature of the hot spring, there are common hot spring (the temperature is under the boiling point), intermittent spring (the water is under the boiling point but springs up intermittently), bubbling spring (the water reaches the boiling point), fountain spring (the water is above the boiling point but it's also a kind of intermittent spring), air vent spring or sulfur air vent spring and hot muddy spring.[4]According to the temperature of the spring, thereare low temperature hot spring (25°C~49°C), medium temperature (50°C~74°C), high temperature (75°C~96°C) and hot boiling spring(above 97°C).Temperature of hot spring is above its surrounding. The water temperature of a hot spring is usually 6.5 °C(12 °F) or more above mean air temperature.A natural spring of water is greater than 21.1 °C (70 °F)A spring with water above the core human body temperature 36.7 °C(98 °F) is called a Thermal Spring.[1]Hot Spring is attracted how and why it can be used to be fit in physical condition for human being.

In Kachin, there is a Hot Spring used for bath and drinking to be healthy. So it is interested to do research and analysis for elemental concentrations in water of Hot Spring has done for one year. Other two water samples near Hot Spring in Hopin Township were collected and compared in the research. Moreover, the three soil samples were also collected from nearly six inches deep of these places. But,the toxic element concentrations and pH level were described in this research paper.

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Materials and Method

Atthe first week of a month, Water samples were collected from hot spring in Ywarthitgyi, Myathidar Quarter and Gardgone Quarter in Hopin Township. It is long from December to March. The map of Hopin Township and the Photograph of the Hot Spring were shown in Figure 1 and Figure 2.Before measuring, the water sample was put in University of Research Centre (URC) for one week.Each watersample which was 6.6ml (6.6g), put into a cup holderof the MESA-50 Analyzer to measure quantities and qualities of elements.

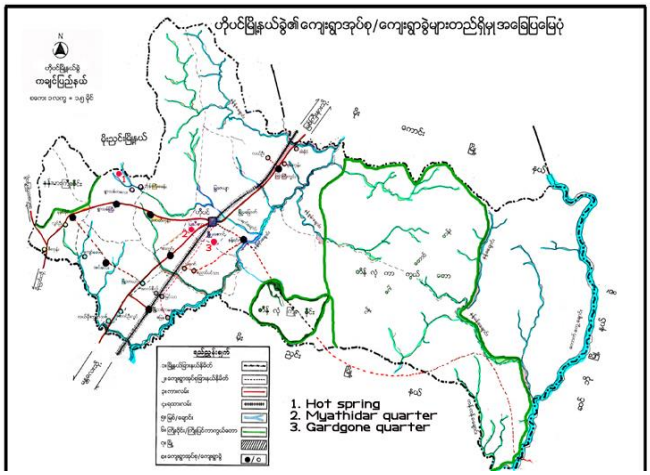

Figure 1. The Map of Hopin Township in Mohyein Division, Kachin State

Figure 2.Photograph ofthe Hot Spring

Experimental Detail

Measurements for this research work were performed at the Universities' Research Center, Myitkyina University. The photograph of measuring pH value was presented in Figure 3. To measure elemental concentrations,MESA-50 X-ray fluorescence analyzer was connected with a computer and HP jet color printer.Firstly, MESA-50 X-ray fluorescence analyzer shown in Figure 4, was charged and a key of this analyzer switches ON to open the chamber.The chamber was opened with manual and a sample cup was placed in the sample holder.Then, the sample was covered square shape lip of the chambers . At that time, operator selected the measurement conditions by using the MESA -50VS software from the computer. In this research, the target is RoHS for hazard element (Pb,Cd,Cr,As,Br,Cl) measurement. The photograph which showed the conduction of operation was given in Figure 5.The MESA-50VS software used fundamental parameter method with standard library files.Experimental measurement condition of X-ray Fluorescence Analyzer (MESA-50)for all water samples were presented in Table 1.

Figure 3.Photograph of Measuring in pH value

Figure 4.Photograph of Horiba MESA-50

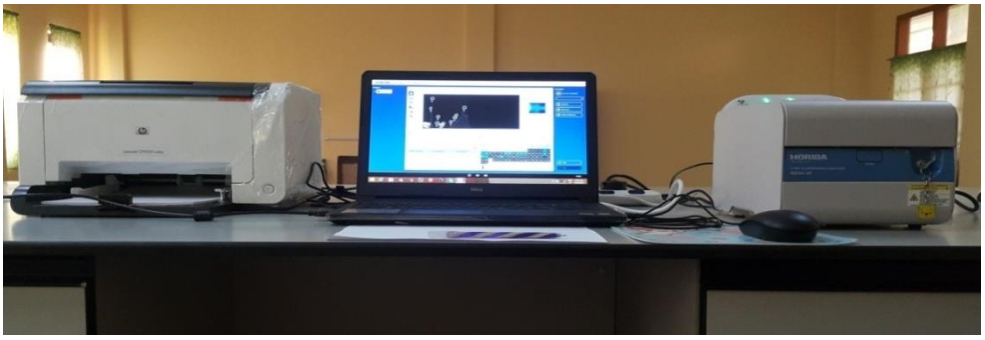

Figure 5.Photograph of Operation in EDXRF M All water sample were acidic since value of pH were less the

Table 1. Experimental Measurement Condition of X-ray Fluorescence Analyzer(MESA-50) for All Water Samples

Sample / Conditions	Hot spring Water	Myathidar Water	Gartgone Water
X-ray Tube voltage	15kV	15kV	15kV
Collimator	3mm	3mm	3mm
Preset time	100s	100s	100s
X-ray Tube Current	200 µA	200 µA	200 µA
Processing Time	Process 2	Process 2	Process 2
Fitter	None	None	None
Work Flow	Rohs Auto 1	Rohs Auto 1	Rohs Auto 1
Detector	SDD(Silicon Drift Detector)	SDD(Silicon Drift Detector)	SDD(Silicon Drift Detector)

Results and Discussion

pH values of the samples were given in Table 2.Except the water sample of Gardgone, all water sample were acidic since value of pH were less the 7.0. But, the pH values were acceptable to drink due to the standard drinking water limit of Environmental Protection Agency (EPA). The pH range for ground water system laid between 6.0 to 8.5. The color of water from Hot Spring and Gardgone quarter have normal water condition .The color of water from Myathidar quarter is faint yellow and it cannot drink since it has ferrous taste.

Measurement results of MESA-50 analyzer were tabulated in Table 3 to Table 5 for the water samples in four months.Mainly, the hazardous elements Pb,Cd,Hg,As,Cr,Br,Cl were investigated. Comparison of water from the Hot Spring near Ywarthitgyi village in Hopin Township for four months was presented in Figure 4.In the water of hot spring, chlorine concentrations is maximum. It has more concentrations in December due to the Figure 4.Comparison of water from Myathida Quarter in Hopin Township for four months was shown in Figure 5.In Myathidar Quarter, Chromium(Cr) and Chrorine (Cl) concentration in water were obvious.Comparison of water from Gaudgone Quarter in Hopin township for four months was shown in Figure 6.Due to Figure 6, Chromium (Cr) and Chlorine (Cl) concentrations were observed In December, January, February and March, The elemental concentrations were presented in Figure 7 to Figure 10.Due to the comparison, the Chlorine (Cl) concentrations of water in Hot Spring is the most element in comparing with other elements.The National Primary Drinking Water Standard (2009) was presented in Table 6. Due to this standard level, the chorine concentration of the Hot Spring was greater than the Maximum Residual Disinfectant level (MRDI) 4.0.

Table 2.pH Levels of Water in Hot Spring, Myathidar Quarter and Gardgone Quarter

Place	pH	Temperature(F)	Month	Place	pH	Temperature(F)	Month
Hot Spring	6.66	74.9	December	Hot Spring	6.43	75.2	February
Myathidar Quarter	6.97	74.7		Myathidar Quarter	6.52	73.5	
Gardgone	7.22	74.8		Gardgone	6.55	75.3	
Hot Spring	6.53	74.7	January	Hot Spring	6.43	75	March
Myathidar Quarter	6.85	75.1		Myathidar Quarter	6.63	75.3	
Gardgone	6.76	75.2		Gardgone	6.73	75.2	

Table 3. Elemental Concentrations of Water from Hot Spring in Ywathitgyi Village

Elements	December(ppm)	January(ppm)	February(ppm)	March(ppm)
Pb	0.0±0.1	0.0±0.1	0.0±0.1	0.0±0.1
Cd	0.0±0.8	0.8±1.2	0.0±0.9	0.0±0.0
Cr	3.7±0.7	2.5±0.7	0.2±0.4	5.3±0.1
Hg	0.2±0.1	0.0±0.1	0.0±0.1	0.0±0.1
Br	3.6±0.2	3.4±0.2	3.2±0.2	3.5±0.3
Cl	497.7±8.8	477.8±8.7	466.8±8.6	477.5±8.7
Other Elements	**Ni=(0.0001±0.0001)wt%, Co=(0.0000±0.0001)wt% ,CH_2=99.9993wt%**	**Ni=(0.0001±0.0001)wt %, CH_2=99.9991wt%**	**Ni=(0.0001±.0001)wt %, CH_2=99.9997wt%**	**Ni=(0.0001± 0.0001)wt%, Cu=(0.0001± 0.0001)wt%, CH_2=99.9997wt%**

Table 4.Elemental Concentrations of Water in Myathidar Quarter

Elements	December(ppm)	January(ppm)	February(ppm)	March(ppm)
Pb	0.0±0.1	0.0±0.2	0.0±0.1	0.0±0.1
Cd	0.0±1.1	0.0±0.0	0.0±0.0	0.0±0.0
Cr	0.2±0.5	0.6±0.6	2.2±0.7	2.7±0.7
Hg	0.0±0.1	0.0±0.1	0.0±0.0	0.0±0.0
Br	0.0±0.0	0.0±0.0	0.2±0.1	0.1±0.1
Cl	0.1±0.0	2.5±0.6	0.1±0.0	13.9±1.5
Other Elements	Fe=(0.0003±0.0002)wt%, CH_2=99.999wt%	Ni=(0.0001±0.0001)wt% , CH_2=100.000wt%	Ni=(0.0001±0.0001)wt %, CH_2=100.000wt%	Ni=(0.0001±0.0001)wt%, Fe=(0.0004± 0.0002)wt%, CH_2=100.000wt%

Table 5. Elemental Concentrations of Water in Gardgone Quarter

Elements	December(ppm)	January(ppm)	February(ppm)	March(ppm)
Pb	0.0±0.1	0.0±0.0	0.0±0.1	0.0±0.1
Cd	0.0±0.7	0.0±0.9	0.0±0.0	0.0±0.0
Cr	0.9±0.5	0.0±0.4	3.3±0.7	0.0±0.4
Hg	0.0±0.0	0.0±0.1	0.0±0.1	0.0±0.0
Br	0.0±0.0	0.0±0.0	0.3±0.1	0.2±0.1
Cl	22.7±1.9	23.8±1.9	0.1±0.0	0.1±0.0
Other Elements	Ni=(0.0001±0.0001)wt%, CH_2=100.000wt%	Sc=(0.0015±0.0035)wt%, CH_2=99.9987wt%	Ni=(0.0001±0.0001)wt%, Cu=(0.0001±0.0001)wt%, CH_2=100wt%	Ni=(0.0001±0.0001)wt %, CH_2=100.000wt%

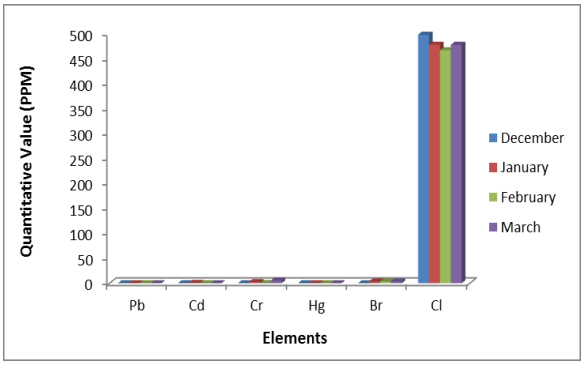

Figure 4.Comparsion of Elements in Hot Spring for Four Months by EDXRF Method

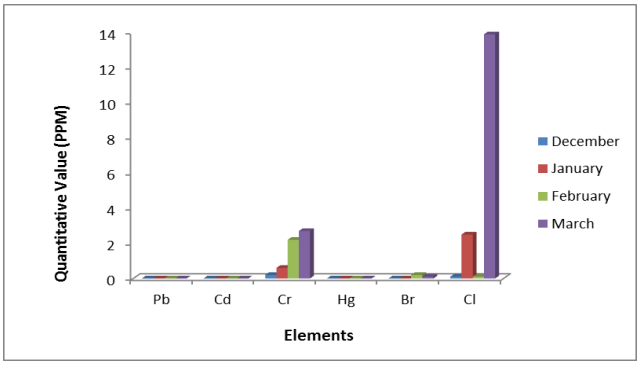

Figure 5.Comparison of Elements in Water of Myathida Quarter for Four Months

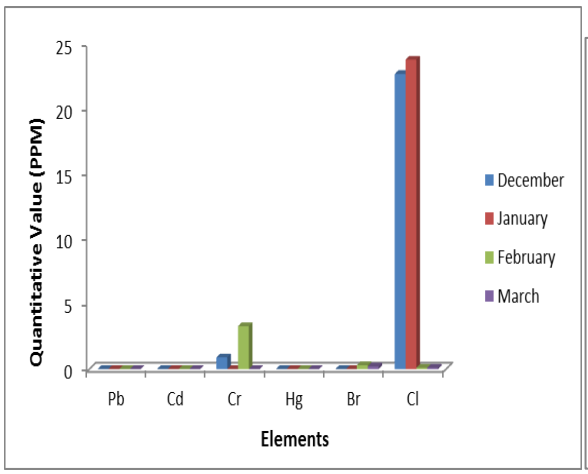

Figure 6. Comparison of Elements in Water of Myathida Quarter for Four Months

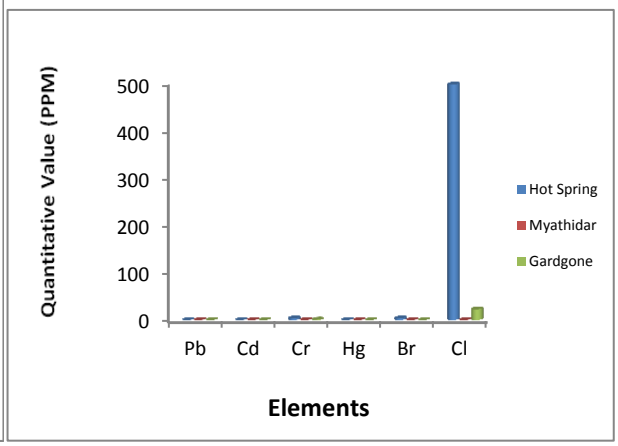

Figure 7.Comparison of Elements of Hot Spring, Myathidar, Gardgone in December

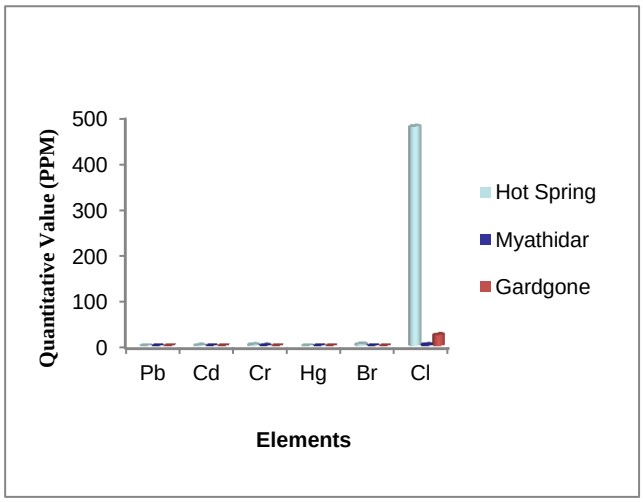

Figure 8.Comparison of Elements of Hot Spring Myathidar, Gardgone in January

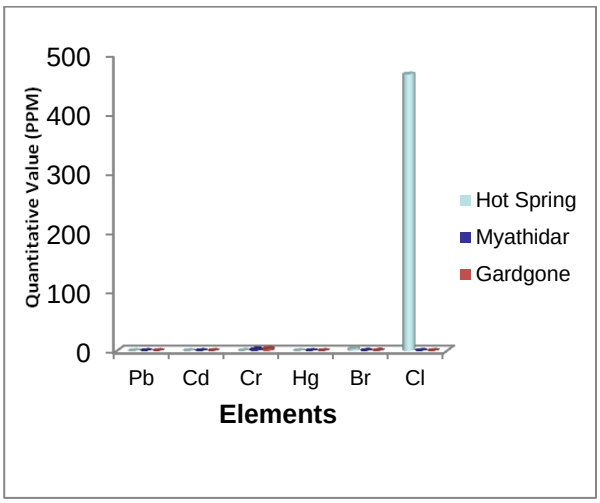

Figure 9.Comparison of Elements of Hot Spring, Myathidar, Gardgone in February

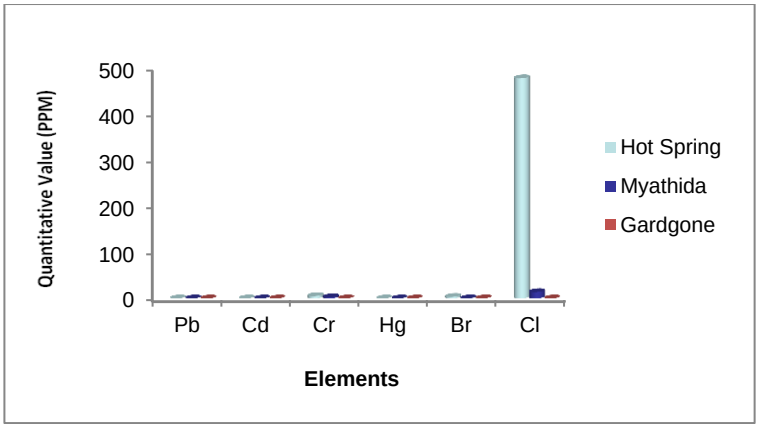

Figure 10.Comparison of Elements of Hot Spring, Myathidar, Gardgonein March

Table 6. National Primary Drinking Water Standard

Contaminants	Maximum Contaminant Level (ppm)
• Barium (Ba)	2
• Beryllium (Be)	0.004
• Cadmium (Cd)	0.005
• Chromium (Cr)	0.1
• Copper (Cu)	1.3
• Iron (Fe)	88.20
• Mercury (Hg)	10
• Nickel (Ni)	29.40
• Antimony(Sb)	0.006
• Selenium (Se)	0.05
• Lead(pb)	0.015
• Arsenic(As)	0.010
• Chlorine(Cl)	4

Conclusion

In this research, the concentrations of elements in Hot Spring were analyzed in four months. Mainly organic compound CH_2 was observed in maximum. The results showed the Lead (Pb), Cadmium (Cd), Chromium (Cr), Mercury (Hg), Bromine (Br), Chlorine (Ni), Iron (Fe), Coppe (Cu) and Scandium (Sc) were observed in a few amount. Except Chlorine (Cl), these concentrations were less than the limit of Maximum Contaminant level of drinking water. When the elemental concentrations were compared with the water concentrations of Myathidar Quarter and Gardgone Quarter, the Chlorine (Cl) concentration was higher than other two samples. Maximum chemical concentration of the water sample ofHot Spring is Chlorine. So there will be chlorine ions in the Hot Spring. There is no odor. But the taste of water of the Hot Spring is brackish. This water contains salts. There isbe saline in the Hot Spring. Therefore, it can be concluded that this Hot Spring will be chloride Hot Spring. The water of Hot Spring can be drunk and it can support to bath. It can relax the muscles of human being. This research can support only to know the hazardous elemental concentrations of this water sample of the Hot Spring. There are no complete chemical aspects. Moreover, microbiological aspects and radiological aspects have not investigated for these water samples of Hot Spring. This research is a fundament research to develop other aspects in doing researches for the Hot Spring.

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