

ANALYSIS OF ELEMENTAL CONCENTRATION OF THE HOT SPRING SAMPLES FROM PEDAT, KLONEHTAR AND MAUNG MAGAN IN TANINTHARYI REGION BY USING EDXRF AND AAS METHODS

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Abstract

Hot spring samples were collected from Pedat, Klonehtar and Maungmagan in Tanintharyi Region. These samples were quantitative analysed of the concentration of elements by using Energy Dispersive X-Ray Fluorescence (EDXRF) and the Atomic Absorption Spectroscopy (AAS) Methods. It was found that the content of the concentration of elements in these samples are S, Ca, Na, K, Mg, Si, Al and Fe. These elements are not toxic for human. It was observed that extend of elements categorized in above three locations are different by using EDXRF and AAS methods.

Keywords: Pedat, Klonehtar and Maungmagan hot springs in Tanintharyi Region, EDXRF and AAS, effects of bathing in hot springs

Introduction

Natural hot springs were found in many countries and make a significant contribution to health, wellness and recreational tourism. As an alternative health source natural hot springs have the profound benefit of being reasonably independent and attracts visitors all year round. A high awareness about therapeutics value of natural hot springs due to their mineral content is common throughout the related literature. In many European countries, as medical treatment based on natural hot springs is integrated into the respective health system and supported by the medical profession based on clinical studies and success rates. Government policies and regulations in countries such as Japan, Germany or Taiwan indicate strongly that natural hot springs are an important part of the national health system and provide evidence for their role in health wellness and recreational uses. The use of hot springs for medical treatment is probably as old as mankind and is a common practice in several countries for treatments such as hydrotherapy and balneotherapy. Hydrotherapy involves the use of common water, whereas balneotherapy employs natural mineral water either in a spa or not. (Samet J M *et al* 2000)



Figure 1 Maungmagan Hot Springs (Maungmagan Village, Launglone Township, Tanintharyi Region)

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Figure 2 Klonethtar Hot Springs (Klonethtar Village, Yayphyu Township, Tanintharyi Region)



Figure 3 Pedat Hot Springs (Pedat Village, Thayetchaung Township, Tanintharyi Region)

Sample collection and sample preparation

Sample Collection

Hot springs are numerous in Myanmar and for centuries the Myanmar people have enjoyed in hot spring bathing. So, the hot spring waters were chosen from three different locations in Tanintharyi Region, such as Maungmagan hot springs, Klonethtar hot springs and Pedat hot springs. Hot spring waters from three locations were collected in different temperatures. The temperature of Maungmagan hot spring is about 52°C, as far as 10 miles from Dawei city, Klonethtar hot spring is about 48°C as far as 22 miles from Dawei city and Pedat hot spring is about 90°C, as far as 67 miles from Dawei city.

Sample Preparation

Hot Spring samples (waters and sands) were collected from Maungmagan, Klonethtar and Pedat. One litre of water from each hot spring were measured to find the content of the concentration of elements by using Atomic Absorption Spectroscopy (AAS) method, shown in Figure 4. Then 5 g of sand from each hot spring were measured to find the content of the relative concentration of elements by using Energy Dispersive X-Ray Fluorescence (EDXRF) method, shown in Figure 5.



Figure 4 Hot Spring waters in Maungmagan, Klonehtar and Pedat



Figure 5 Sands in Maungmagan, Klonehtar and Pedat Hot Springs

Results and Discussion

The Concentration of S, Ca, Na, K and Mg contained in hot spring waters by using AAS method

Table 1. Results of elemental concentration in Maungmagan Hot Spring (water)

Elements	Concentration (mg/L)
S	31.3
Ca	96.15
Na	36.99
K	223.3
Mg	0.64

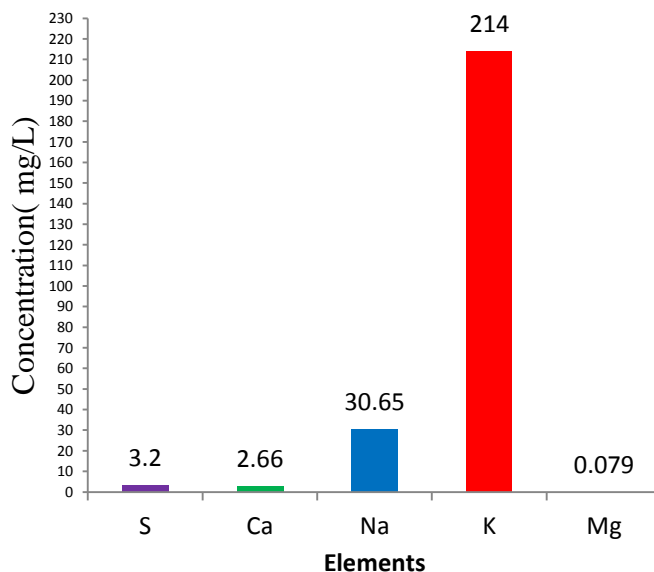


Figure 6 The concentration of elements in Maungmagan Hot Spring

Table 2 Results of elemental concentration in Klonehtar Hot Spring (water)

Elements	Concentration (mg/L)
S	3.2
Ca	2.66
Na	30.65
K	214.0
Mg	0.079

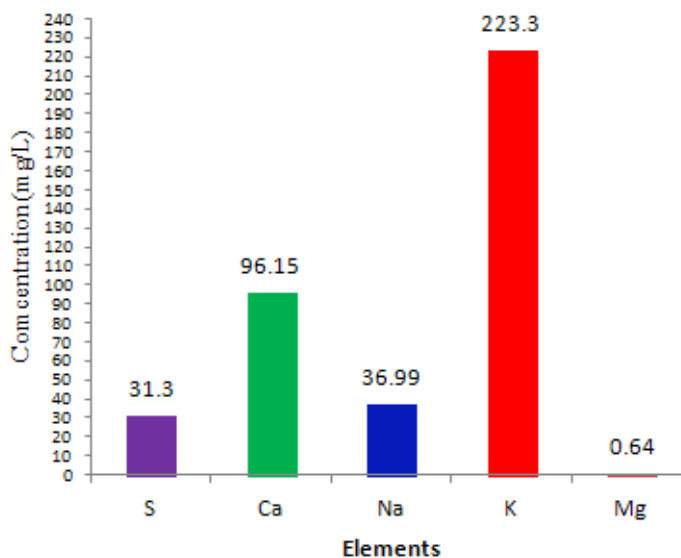


Figure 7 The concentration of elements in Klonehtar Hot Spring

Table 3 Results of elemental concentration in Pedat Hot Spring (water)

Elements	Concentration (mg/L)
S	4.2
Ca	-
Na	32.69
K	213.3
Mg	0.041

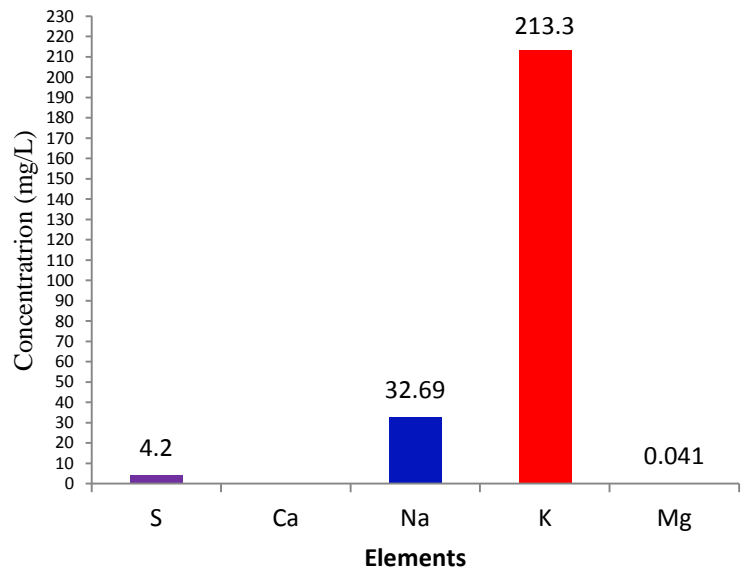


Figure 8 The concentration of elements in Pedat Hot Spring

Table 4 The comparison of the concentration of S, Ca, Na, The K and Mg in Maungmagan, Klonehtar and Pedat Hot Springs (waters)

Locations	S(mg/L)	Ca(mg/L)	Na(mg/L)	K(mg/L)	Mg(mg/L)
Maungmagan	31.3	96.15	36.99	223.3	0.64
Klonehtar	3.2	2.66	30.65	214.0	0.079
Pedat	4.2	-	32.69	213.3	0.041

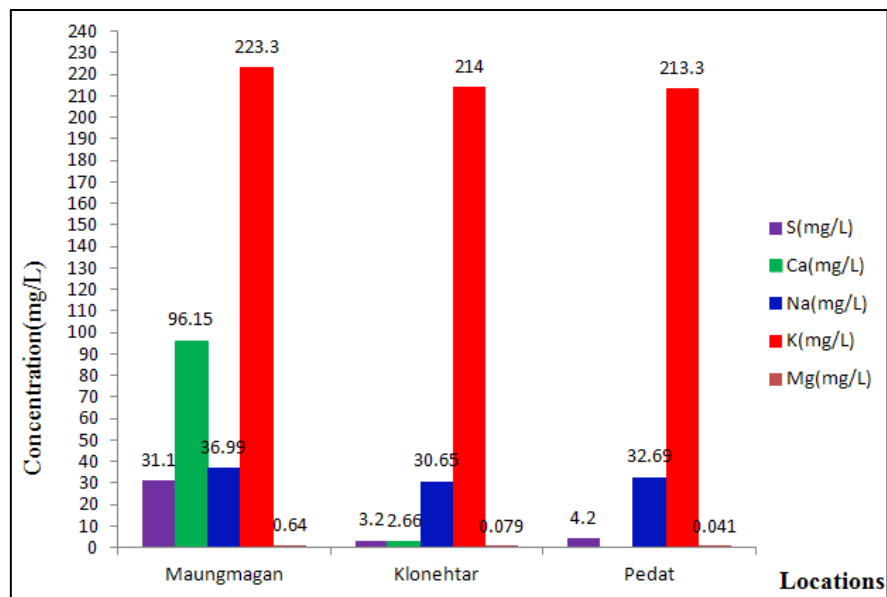


Figure 9 The comparison of the concentration of S, Ca, Na, The K and Mg in three locations

The relative concentration of Si, Al, Fe, K, Ca and S contained in Maungmagan, Klonehtar and Pedat Hot Springs

Table 5 Results of elemental concentration in Maungmagan Hot Spring (sand)

Elements	Relative Concentration (%)
Si	10.636
Al	-
Fe	0.135
K	0.255
Ca	0.368
S	0.284

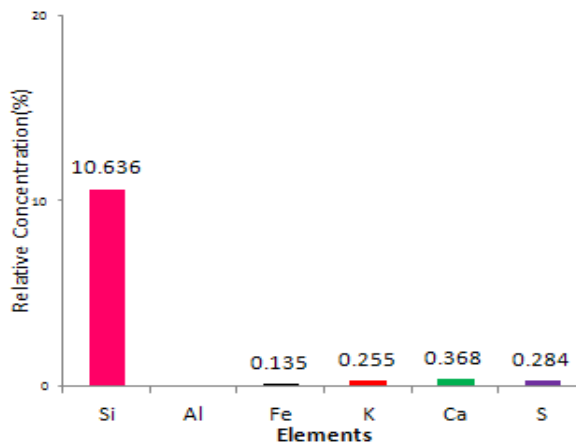


Figure 10 The concentration of elements in Maungmagan Hot Spring

Table 6 Results of elemental concentration in Klonehtar Hot Spring (sand)

Elements	Relative Concentration (%)
Si	18.970
Al	6.848
Fe	1.377
K	0.982
Ca	0.924
S	-

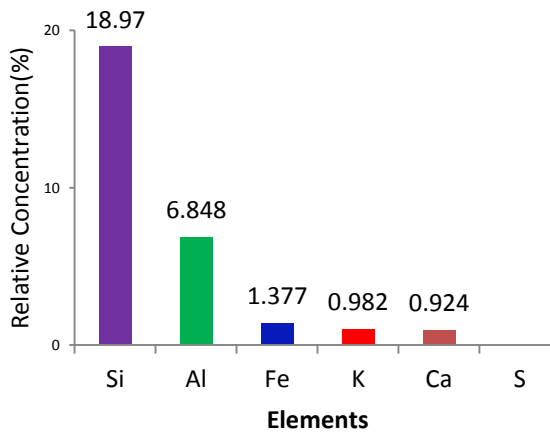


Figure 11 The concentration of elements in Klonehtar Hot Spring

Table 7 Results of elemental concentration in Pedat Hot Spring (sand)

Elements	Relative Concentration (%)
Si	13.458
Al	4.874
Fe	1.768
Ca	1.653
K	1.616
S	-

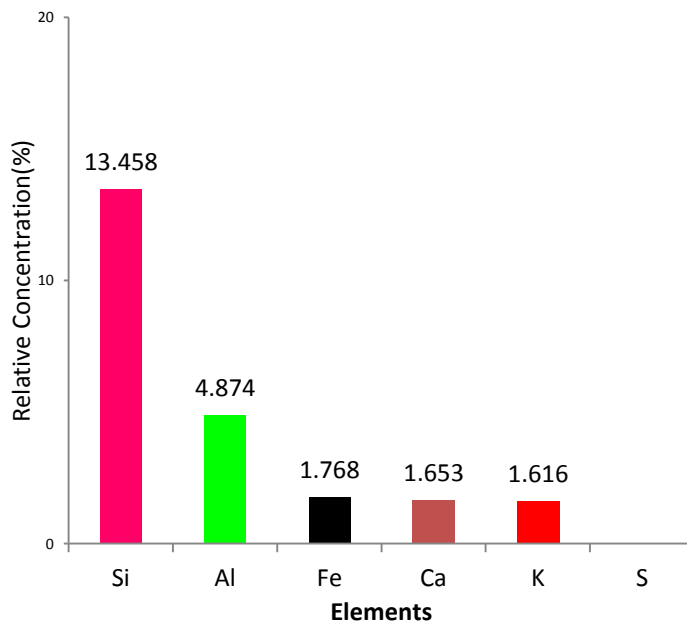


Figure 12 The concentration of elements in Pedat Hot Spring

Health effects of Sulfur (S)

This element helps to product body against toxins in the environment. Alleviates from taking soothe and pain while bathing in hot sulphur springs. Also it gives to lower cholesterol and blood pressure. Soaking in sulphur water get an effective way to relieve the burning, pain, itching and hemorrhoids. Sulfur works with vitamins B1 and B5 to promote metabolism and communication between nerve cells. Every body needs sulfur because it is the most concentrated in keratin which gives strong hairs, nails and skins. So bathing in sulfur springs benefits bronchus to expand, making airways open and improving lung ventilation. Also help boost metabolism, relieve metabolism, reduce depression and anxiety and cure insomnia. (J Peters & K Aberams 2003)

Health effects of Calcium (Ca)

Helps good circulation in the body, numerous positive impact and lower blood pressure. Body weight reduces when bathing in the hot springs contain with calcium. Also released in stress-induced, relaxation and control the heart beats. An excess (too much) of deficiency (not enough) of calcium, can change the biorhythm of the heart and cause serious problems.(Booth A & Camacho P 2013)

Health effects of Sodium (Na)

Taking a bath in hot springs contain with sodium, relieve stress and muscles feel. Bathing in hot springs contain with sodium to keep the skin hydrated, cure irritation and balanced the level of oil skin. Also to remove dead skin cells, become calmer and energized. (He J & Chen J, et al 2009)

Health effects of Potassium (K)

Bathing in Potassium hot springs treats many skin infections, including eczema, canker sores, dermatitis, acne and vaginal. Insufficient potassium intakes can increase blood pressure, kidney stone risk and often urine excretion. Potassium is one of the seven essential macrominerals. The human body requires at least 100 milligrams of potassium daily to support key processes. (Black RB & Weiss Jo 1988)

Health effects of Magnesium (Mg)

Magnesium is one of the six essential macrominerals that comprise 99% of the body's mineral content. Magnesium helps build bones, enables nerves to function, and is essential to the production of energy from food. Magnesium has been shown to have therapeutic value in treating conditions such as headaches, chronic pain, asthma and sleep disorders. Without the presence of magnesium in the body, energy could not be produced or used in the cells, muscle could not contract and relax. Magnesium helps maintain normal muscle and nerve function keeps heart rhythm steady, supports a healthy immune system and keeps bones strong. Also regulate blood sugar levels and promotes normal blood pressure. (Demmelmaier, I. et al 2017)

Health effects of Silicon (Si)

Silicon concentrates in no particular organ of the body but is found mainly in connective tissues and skin. Silicon is non-toxic element. Silicon irritates the skin and eyes on contact more than long time. Inhalation will cause irritation to the lungs and redness. Reddening, scaling and itching are characteristics of skin inflammation. The human body contains approximately 7 grams of silicon, which is present in various tissues and body fluids. (Jugdaohsingh R & Anderson SH.2002)

Health effects of Aluminium (Al)

Aluminum is a very common component of the Earth's mineral composition. It is not essential element for life and a constituent of rather inert minerals. It has often been regarded as not presenting significant health hazard. Aluminum may contribute to the inception and advancement of Alzheimer's disease (AD) by causing excessive inflammatory activity within the brain and speeding the rate of brain aging. (Wafon, J.E 2009)

Health effects of Iron (Fe)

Bathing in iron (Fe) hot spring burns 140 calories per hour about the same as a craft beer, For maximum therapeutic benefit, doctors recommend soaking for 20 minutes at a time, combined with gentle stretches in the water. As bathing occurs, circulation and oxygen flow increases much like when exercises. (Fairbanks VF 1999)

Effects of bathing in hot springs

Bathing the including S, Na, Ca, Mg, K, Si, Al and Fe in hot springs water can get many benefits such as improve circulation, treat skin infection, reduce stress, detoxify boost immune system and provide low-impact cardio. Help blood circulation, hypertension, nervous imbalances and other osclerosis.

Sulfur is a mineral present in every cell of bodies and is used to make collagen, which keeps skins smooth and healthy. Hot springs are a rich source of S and its healing benefits include treating skin irritations and infections such as rashes and eczema. The high temperature

of hot springs can increase heart rate and lower both diastolic and mean blood pressure. It does not safe to soak in hot water when pregnant. Hot water can raise body temperature to 38.9°C for 10 minutes triggering hyperthermia. Some studies reported that hyperthermia during the first four-six weeks of pregnancy increases the risk of neural tube defects brain and spinal cord damage in babies.

Reduce stress

Hot springs help body relax, which benefits many aspects of health, including sleeping patterns and nutrient assimilations. The relaxation promoted by the heat and buoyancy of hot springs also helps increase the range of motion of muscles and joints, making the soaking beneficial for individuals recovering from suffering from rheumatoid arthritis. Bathing repeatedly in hot springs can help autonomic nervous system and normalize endocrine system as well as 'release toxins' in body through sweating. Cardio is an important part of any fitness routine. As heart rate rises during cardiovascular exercise, body is prompted to burn more calories, energy and fat.

Conclusion

The Study Hot Spring areas lies in the Tanintharyi Region Maungmagan, Klonehtar and Pedat hot springs. It was found that the content of the concentration of elements S, Ca, Na, K and Mg in Maungmagan hot spring are more than in other two hot springs by using AAS method, shown in Table 4 and Figure 9. Also included the content of the concentration of Si, Al, Fe, Ca, K and S were found by using EDXRF method, shown in Table 5, 6, 7 and Figure 10, 11, 12. These elements are benefits for human body. Among three hot springs, Maungmagan hot spring is the most famous and popular in this region, also it is nearest from Maungmagan beach and Dawei city. It is not only for adolescent, young people, enjoyable but also the aged and apoplexy peoples befitting bastion hot spring. Maungmagan hot spring is the salty hot spring, it is very rare hot spring. So for above many reasons, Maungmagan hot spring is the best hot spring for healthy in Tanintharyi Region.

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