An Investigation of Elemental Concentrations of Natural Myanmar Honey Samples by EDXRF Technique

Win Win Maw[1], Nwe Nwe Htoon[2], Thuzar Yin[3]

Abstract

Elemental concentrations of six natural honey samples from different places in Myanmar were analyzed by Energy Dispersive X-Ray Fluorescence (EDXRF). Iron (Fe) and copper (Cu) were found in all samples.Sulfur (S) was found in the sample S-1. Although, calcium(Ca) element was not found in the sample S-3 and S-6. Moreover, toxic elements such as arsenic (As), mercury (Hg),lead (Pb)…. etc, were not found in all natural honey samples.

Key words :Elemental concentrations, natural honey, different places in Myanmar, EDXRF.

Introduction

Honey, a popular sweetener throughout the world, is made by bees generally from nectars extracted from the nectarines of flowers. From ancient times, honey was used both as a natural sweetener and healing agent. Honey is an organic, natural sugar alternative with no additives that is easy on the stomach, adapts to all cooking processes, and has an indefinite shelf-life.Liquid honey is does not spoil. Because of its high sugar concentration, it kills most bacteria by plasmolysis. Natural airborne yeasts cannot become active in it because the moisture content is too low. The predominant sugars in honey are fructose and glucose. The glucose in honey is absorbed by the body quickly and gives an immediate energy boost, while the fructose is absorbed more slowly providing sustained energy.It is known that honey has also been found to keeps levels of blood sugar fairly constant compared to other types of sugar.The characterizations of honeys aids our understanding of its properties and applications – medicinal properties, anti-bacterial and antioxidant behaviours, and hence its use as a food ingredient in human diet. Whereas there are large volumes of data on the characterization of honeys from North America, Europe, Australia, India and South Africa, there is a paucity of data on Myanmar Honeys. Honey can prevent some diseases in our human body and also in animals. Honey should be used regularly and can be very helpful to lose weight. It contains enzymes that stimulate the digestive process and boost metabolism, which contributes to weight reduction. The proteins that contain honey take parting the formation of hormones.Regular use of honey strengthens the immune system of the body.

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Table 1 The six honey samples of different locations in Myanmar

Sample Number	Sample Name	States & Regions
S-1	Natural Honey	Nay Pyi Taw
S-2	Natural Honey	Rakhing (Sittwe)
S-3	Natural Honey	Kayah
S-4	Natural Honey	Shan (Aung Ban)
S-5	Natural Honey	Shan (Haeho)
S-6	Natural Honey	Mon

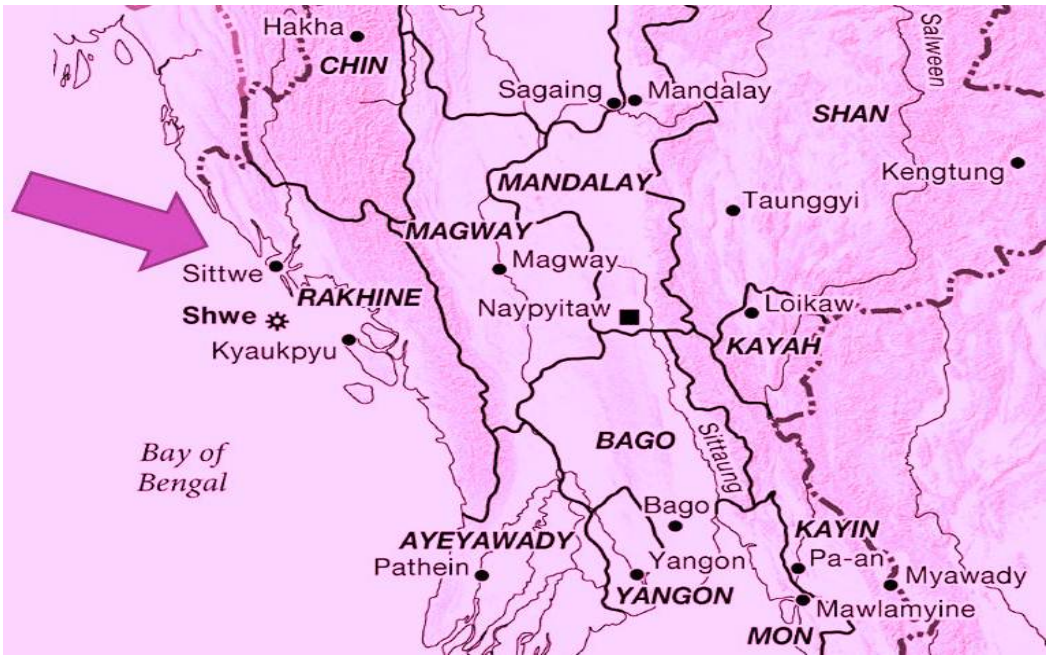

Figure 1 Sampling area of Naypyitaw,Kayah,Mon,Rakhine and Shan state in Myanmar.

Materials and Methods

Samples : In the present work, six -honey samples were collected (products of different locations) in our country. These samples were analyzed by the use of Energy Dispersive X-Ray Fluorescence (EDXRF) technique at normal conditions, i.e., products of original producers and no repaired. Sampling area of Naypyitaw, Kayah, Mon, Rakhine and Shan state in Myanmar are exhibited in Fig 1. Photographs of those samples are shown in Fig 2(a) – Fig 2(f).The various honey samples of different locations in Myanmar are presented in Table 1.

Sample Preparation : In this research, an EDXRF technique is well established as a technique for elemental analysis. Liquid samples of various honeys were dropped on to the filter paper and then were placed at the sample holder with the amount of 12.5 mg weight for each of the sample.

EDXRF Study : Energy Dispersive X-ray Fluorescence (EDXRF) is one of two general types of X-ray Fluorescence techniques used for elemental analysis applications. Energy dispersive x-ray fluorescence spectroscopy (EDXRF) is a proven technique for trace element analysis. The analytical technique is fast non-destructive and enables simultaneous determination of many elements with high sensitivity.

EDX-700 Spectrometer System : In this work, the Shimadzu EDX-700 spectrometer manufactured by Shimadzu Corporation in Japan is used for investigation in various kinds of Myanmar natural honey from different regions for qualitative and quantitative results. Measurements for this research work were performed at the Universities' Research Centre (URC), Yangon University. The fundamental parameter (FP) method was used to determine the concentration of elements contained in these samples.
The EDX-700 system is composed of two-parts: the X-ray spectrometer and personal computer controlled-system as shown in Fig 3 (a). The spectrometer contains the X-ray generating elements (X-ray tube, Rh (rhodium) target, sample chamber, Si(Li) detector, detector electronic system, LN_2 (liquid Nitrogen) cooling system and associated power supply unit. The personal computer (PC) includes the data memory broad and other standard PC elements. The collected spectra were analyzed using the Model of EDX-700 Machine and Quantitative Analysis Software .The Fundamental Parameter (FP) method was used for data analysis to study the elemental concentrations of unknown samples. The Shimadzu EDX-700(Energy Dispersive X-Ray Spectrometer system is shown in Fig 3 (b).

Figure 2 (a) Naypyitaw

Figure 2 (b) Rakhine

Figure 2 (c) Kayah

Figure 2 (d) Shan (Aung Ban)

Figure 2 (e) Shan (Haeho)

Figure 2 (f) Mon

Figure 2 (a) – Figure 2 (f) Six natural honey samples different locations in Myanmar.

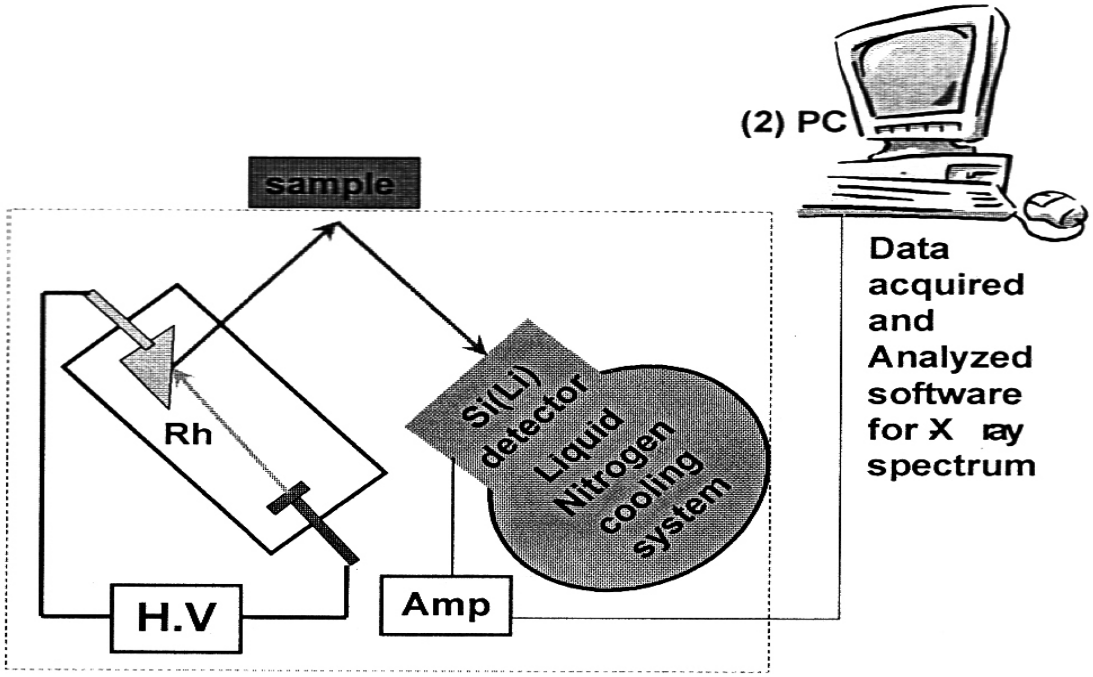

Figure 3(a) Two main parts of the EDX-700 Spectrometer system

Figure 3 (b) SHIMADZU EDX-700 (Energy Dispersive X-ray) spectrometer

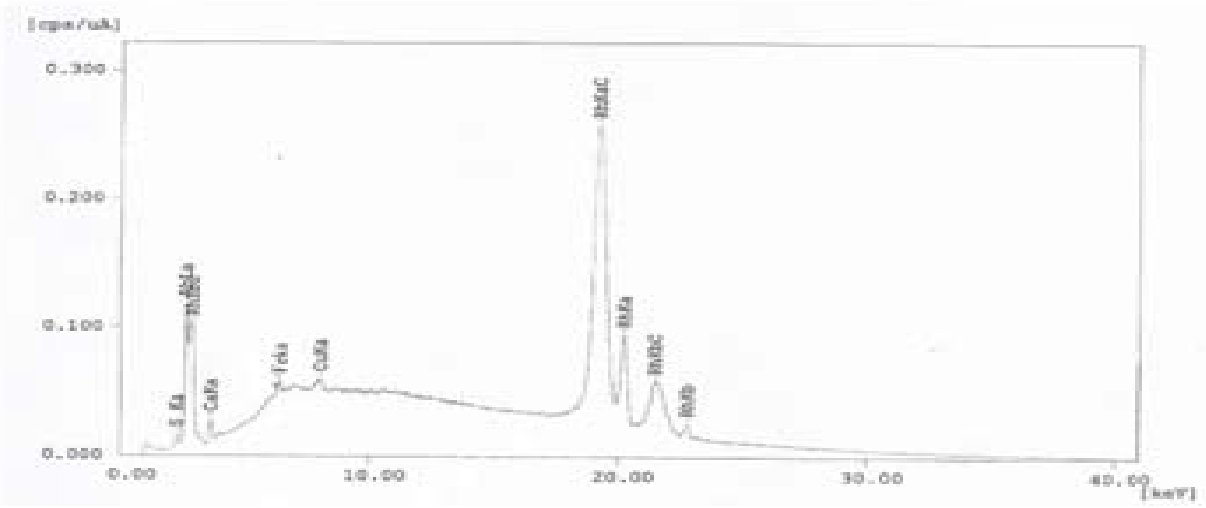

Figure 4 (a) EDXRF Spectrum For Sample 1

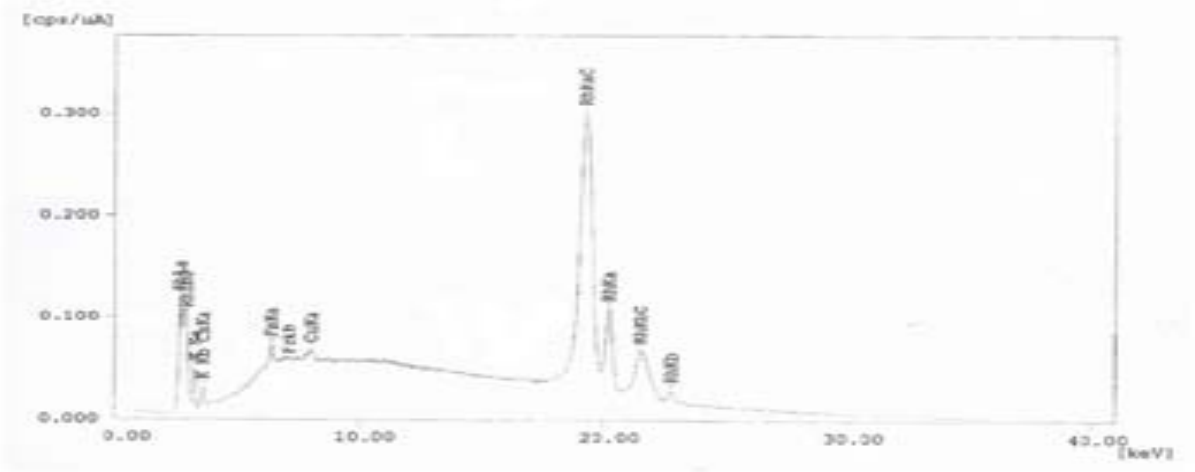

Figure 4 (b) EDXRF Spectrum For Sample 2

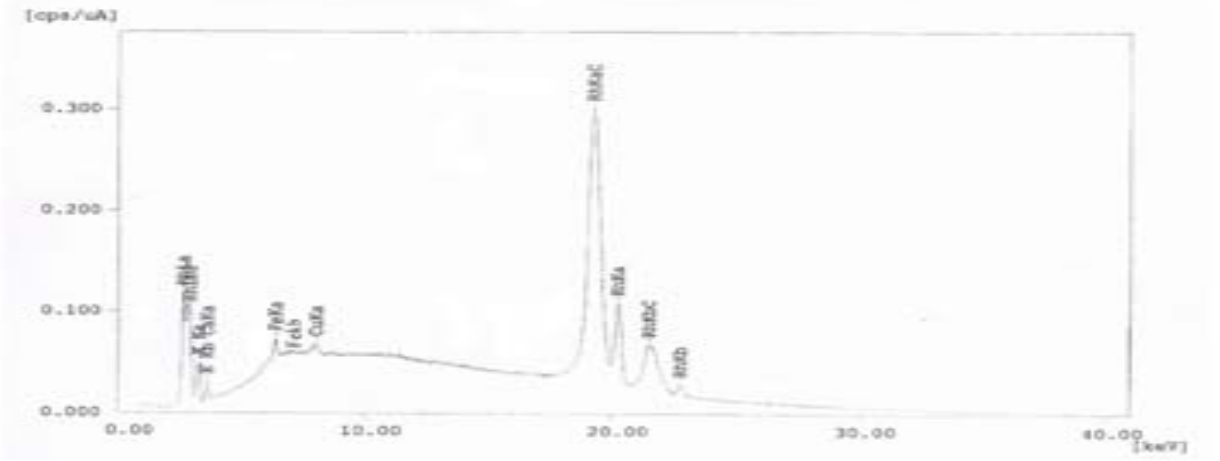

Figure 4 (c) EDXRF Spectrum For Sample 3

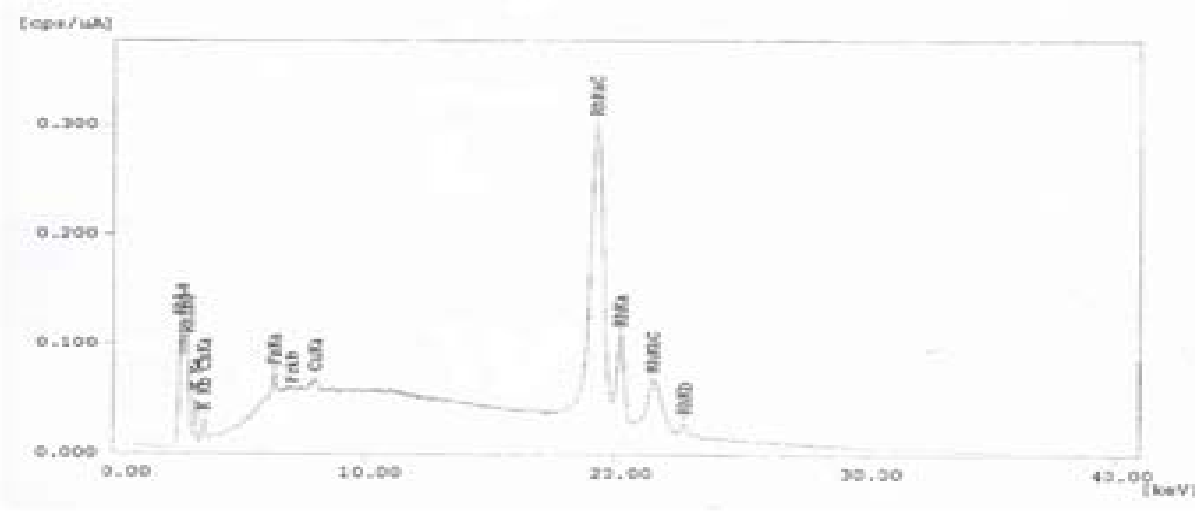

Figure 4 (d) EDXRF Spectrum For Sample 4

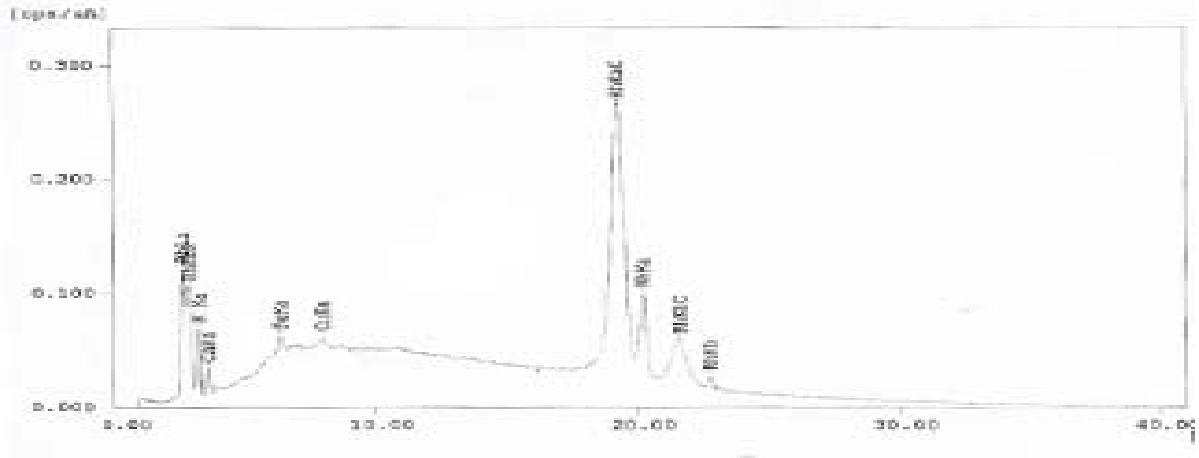

Figure 4 (e) EDXRF Spectrum For Sample 5

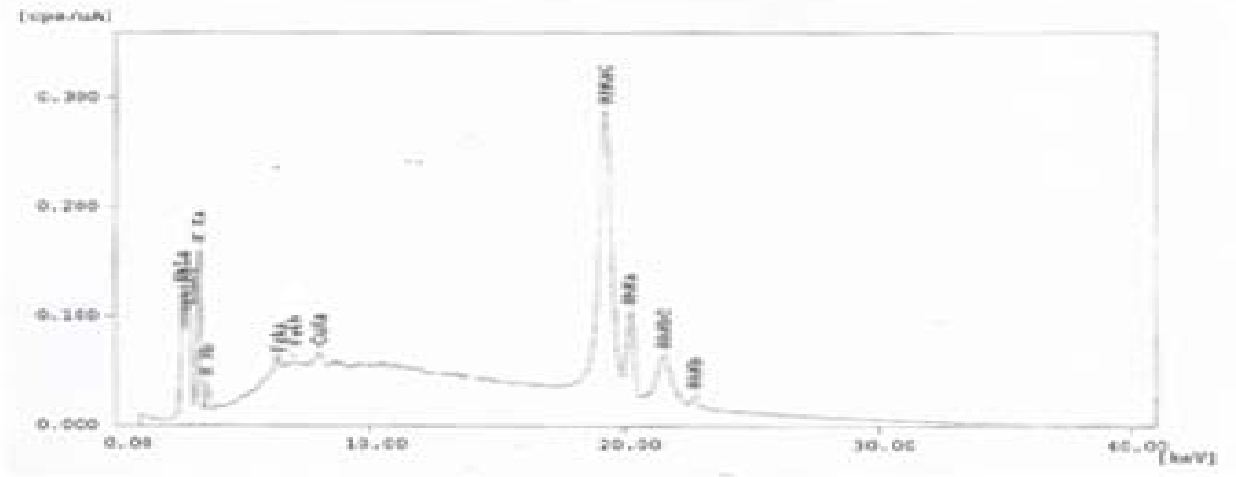

Figure 4 (f) EDXRF Spectrum For Sample 6

Table 2 Elemental concentration in six natural honey samples

Sample No	K(mg/l)	Fe (mg/l)	Ca(mg/l)	Cu (mg/l)	S (mg/l)	$C_6H_{10}O_5$ (mg/cm^2)
S-1	-	22.86	54.48	15.48	145.08	12.50
S-2	325.68	30.27	76.74	15.75	-	12.50
S-3	837.53	29.72	-	19.13	-	12.50
S-4	217.95	40.46	48.76	19.10	-	12.50
S-5	152.95	24.24	55.25	16.40	-	12.50
S-6	1075.83	38.80	-	16.07	-	12.50

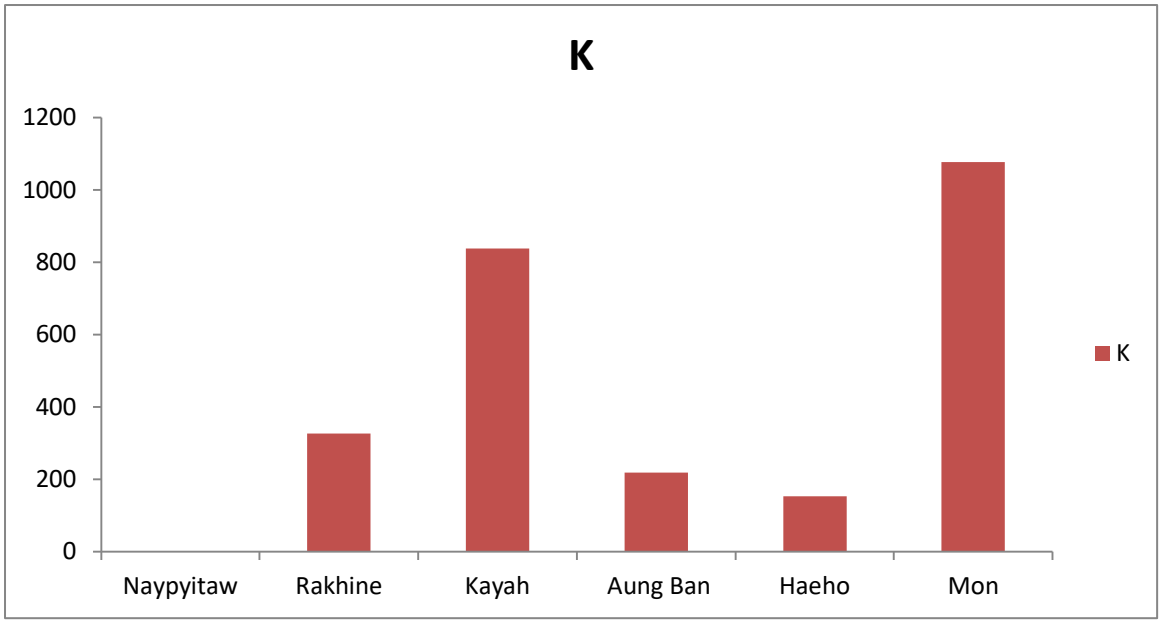

Figure 5 (a) The comparison graph of content of potassium (K) in six natural honey samples

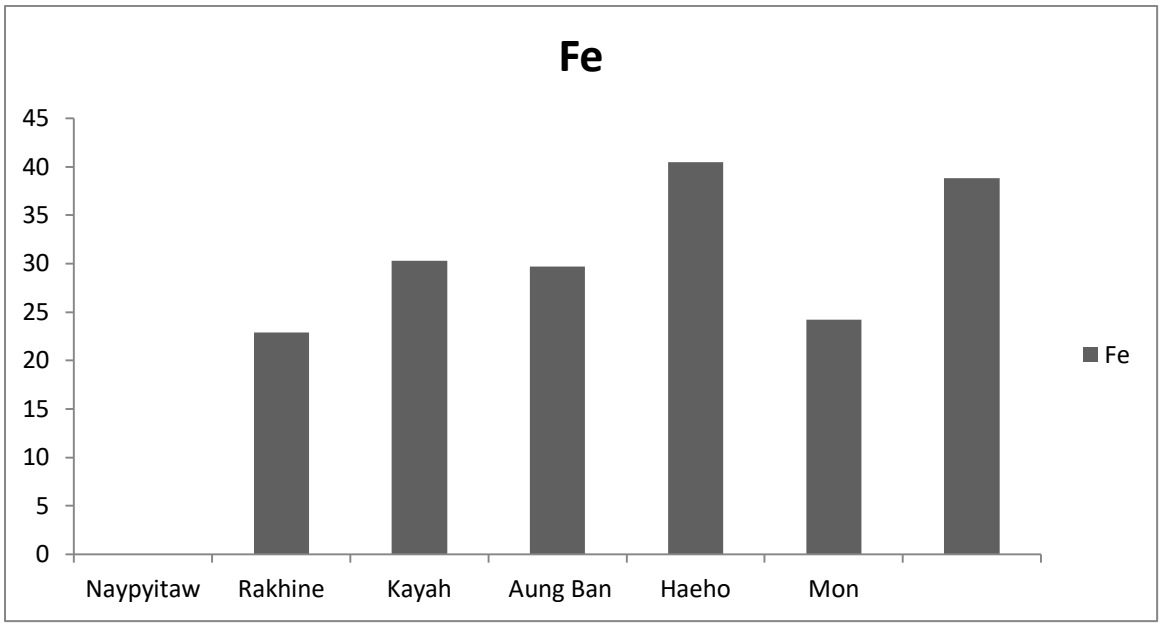

Figure 5 (b) The comparison graph of content of iron (Fe) in six natural honey samples

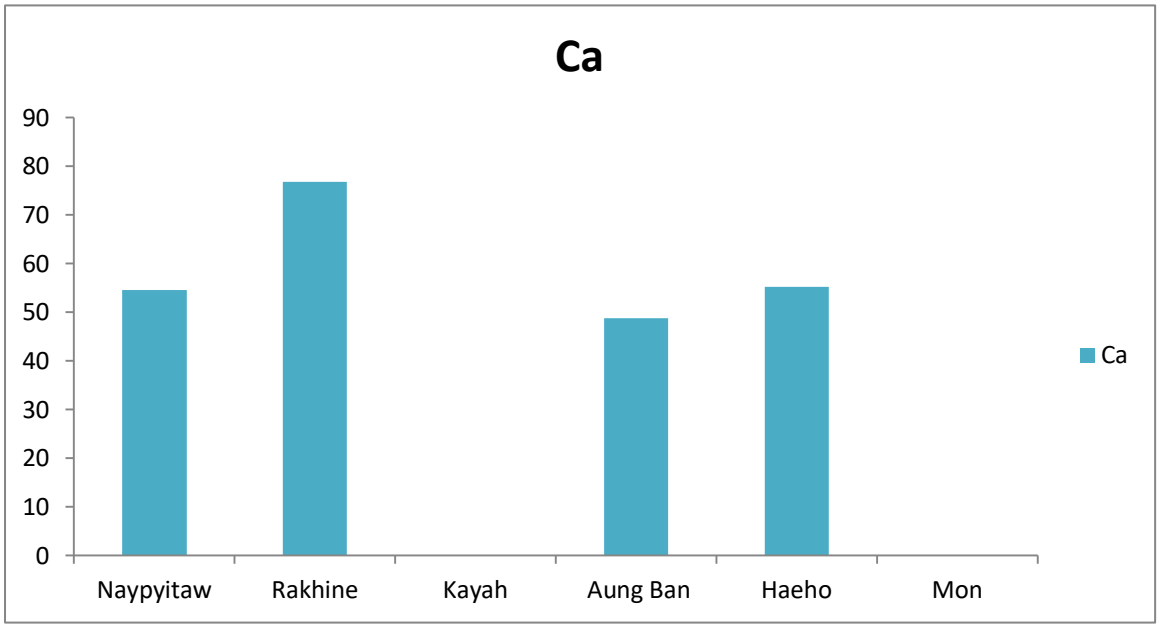

Figure 5 (c) The comparison graph of content of calcium (Ca) in six natural honey samples

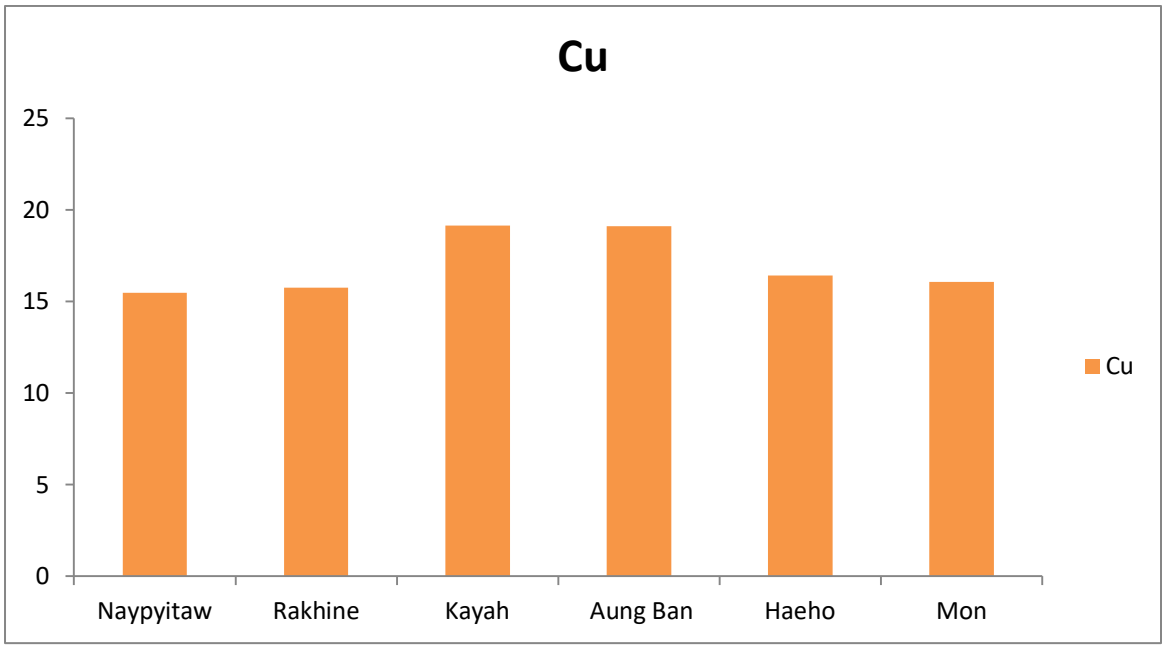

Figure 5 (d) The comparison graph of content of copper (Cu) in six natural honey samples

Figure 5 (e) The comparison graph of content of sulphur (S) in six natural honey samples

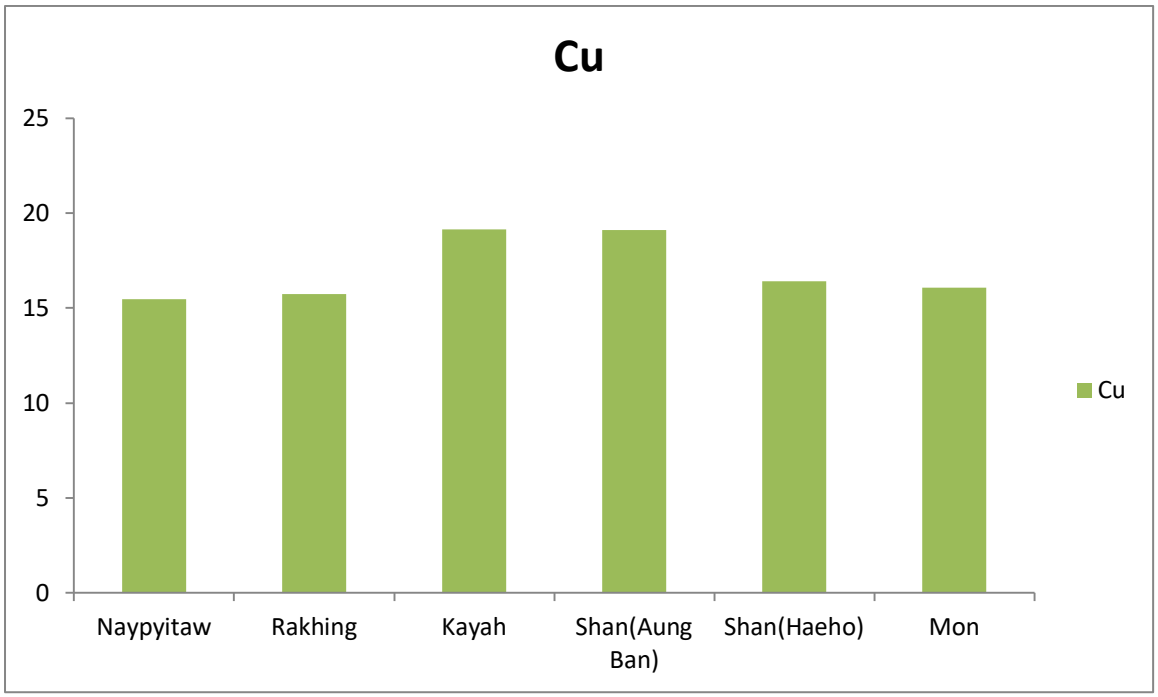

Figure 5 (f) The comparison graph of content of carbohydrate ($C_6H_{10}O_5$) in six natural honey samples

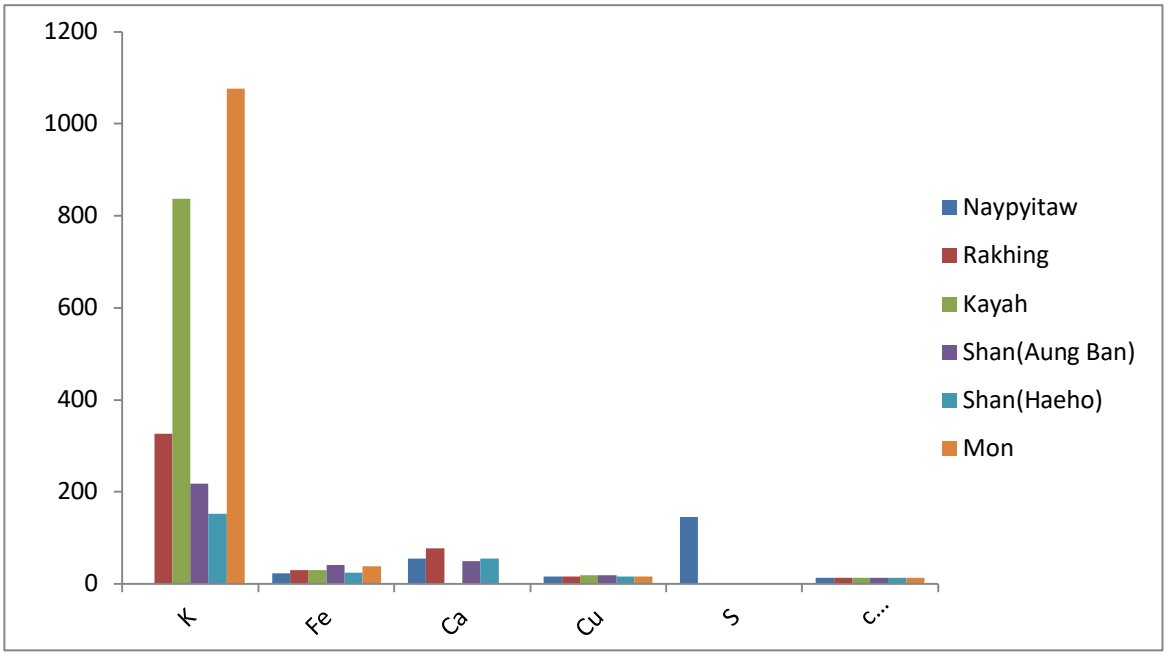

Figure 5 (g) The comparison graph of elemental concentrations in six natural honey samples from different places in Myanmar.

Results and Discussion

EDXRF spectra of six natural honey samples were observed in figure 4 (a) to Figure 4 (f). The results of the elemental concentrations in these samples were tabulated in Table 2. The comparison of elemental concentrations in six natural honey samples were shown in figure 5 (a) to 5 (g). According to the experimental results, iron (Fe) and copper (Cu) were found in all samples. The potassium(K) element was not found S-1. The calcium(Ca) element was not found S-3 and S-6. The calcium(Ca) element was the most and least contained in sample S- 2 and S-4. The concentrations of sulfur (S) was found in sample S-1.But, the sulfur element was not contained in five natural honey samples. The concentrations of carbohydrate ($C_6H_{10}O_5$) in all samples were the same.

Potassium (K) is one of the most active metals and it can support the metabolism of the body. It can also support the tonic effect for the body. It did not give toxic effects. Moreover it can supply the pharmaceutical necessity. Several studies have suggested diets low in potassium are associated with poor lung function and even asthma in children compared to those who eat normal amounts of potassium. Enhancing dietary intake of potassium through foods such as fish, fruits and vegetables may, therefore, prove to be of value for preventing or treating asthma. However, the evidence does not suggest that people with high blood pressure should take potassium supplements. Instead, potassium rich foods should be eaten everyday.Potassium is essential to life.

Iron (Fe) is an essential element in body tissue as the form of hemoglobin in blood. It also has medicinal use. Iron is required for the synthesis of hemoglobin, the pigment in red blood cells. Normally the iron liberated from old cells is retained and can be re-utilized. When, however, there is chronic bleeding from wounds or during severe and prolonged menstruation, the normal amount of dietary iron may be insufficient to replenish the body's supply. Losses of iron in the menses, the needs of a fetus, and the inevitable loss at labour and in the milk of a lactating woman increase the iron requirements of women during their reproductive life. Most dietary iron is in a form which cannot be absorbed from the gut. If menstrual losses are large, iron-deficiency anemia inevitably follows unless the diet is supplemented with absorbable iron compounds.

Calcium (Ca) is essential constituent of bone and teeth of the body. The content of Ca in food can provide for nutrition, is the most abundant in the human body. Roughly 99% of the body's calcium is found in the teeth and bones. It helps stave off osteoporosis, especially useful for post-menopausal women. This leads osteoporosis which then leads to pain, fractures, impaired physical ability and many other symptoms. In general, children benefit from lots of weight bearing exercise (running, jumping, having fun) and from getting enough calcium in their diets. Calcium is the most abundand metal in the human body: is the main constituent of bones and theets and it has keys metabolic functions.Calcium is sometimes referred to as lime. It is most commonly found in milk and milk products, but also in vegetables, nuts and beans. It is an essential component for the preservation of the human skeleton and teeth. It also assists the functions of nerves and muscles. The use of more than 2,5 grams of calcium per day without a medical necessity can lead to the development of kidney stones and sclerosis of kidneys and blood vessels.

Copper (Cu) is one of a relatively small group of metallic elements which are essential to human health. These elements, along with amino and fatty acids as well as vitamins, are required for normal metabolic processes. However, as the body cannot synthesize copper, the human diet must supply regular amounts for absorption.Copper has been used as a medicine for thousands of years including the treatment of chest wounds and the purifying of drinking water. Copper is a very common substance that occurs naturally in the environment and spreads through the environment through natural phenomena. Humans widely use copper. For instance it is applied in the industries and in agriculture. The production of copper has lifted over the last decades. Due to this, copper quantities in the environment have increased.Copper can be released into the environment by both natural sources and human activities. Because copper is released both naturally and through human activity it is very widespread in the environment. Copper is often found near mines, industrial settings, landfills and waste disposals. Most of its uses are based on this property or the fact that it is also a good thermal conductor. They have an attractive golden colour which varies with the copper content. They have a good resistance to tarnishing making them last a long a time.

Sulfur (S) is essential to good health but is easily destroyed by modern food processing methods resulting in widespread deficiencies. Sulfur is also an essential component in human nutrition. It is found in every cell in the body. Sulfur itself is held mainly in the muscles, skin, bones, nails and hair. Sulfur is very useful in medicine use. Sulfur was used in pharmaceuticals and it had no critical toxicity from food.All living things need sulfur. It is especially important for humans because it is part of the amino acid methionine, which is an absolute dietary requirement for us. The amino acid cysteine also contains sulfur. The average person takes in around 900 mg of sulfur per day, mainly in the form of protein.

Carbohydrates($C_6H_{10}O_5$) are the body's main source of energy. Human beings cannot function without carbohydrates. Glucose, a simple sugar discussed below, is essential for cells to function. A diet without carbohydrates can force the body to break down proteins and fats for energy, which may cause harm. They are an important source of chemical energy in our diet.Carbohydrates like glucose and fructose are used as sweeteners in food as well as sweets themselves.So,Carbohydrates are one of the main types of nutrients. They are the most important source of energy for our body. Our digestive system changes carbohydrates into glucose (blood sugar).

Conclusion

Elemental concentrations of six natural honey samples were analyzed by EDXRF method. According to the experimental results obtained, iron (Fe) and copper (Cu) were found in all samples. Other minor elements contained in these samples were potassium (K),calcium(Ca), sulfur (S)and carbohydrate ($C_6H_{10}O_5$) compound. The potassium element is the most contained in sample S-6 . Potassium ions are found in all cells. It is important for maintaining fluid and electrolyte balance. The Iron element is also the most and least concentrated in sample S-4 and S-1. Iron is required for the synthesis of hemoglobin, the pigment in red blood cells. In sample S-2, calcium is the most contained. Calcium is an essential component for the preservation of the human skeleton and teeth. It also assists the functions of nerves and muscles. Sulfur is contained in sample S-1. Sulfur is also an essential component in human nutrition. The $C_6H_{10}O_5$ compound is contained the same concentration. Carbohydrates provide the body with glucose, which is converted to energy used to support bodily functions and physical activity. Therefore, these elements content in Myanmar natural honey samples are required for human health.

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