PHYSICOCHEMICAL ANALYSIS OF WATER FROM INLE LAKE

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Abstract

Present study involves the analysis of water from Inle Lake using some physicochemical parameters such as pH, electrical conductivity, total dissolved solids, salinity, and elemental concentrations. Water samples were collected from three sites located in Inle Lake for the period of one year i.e. August 2013 to August 2014. As a result, some physiochemical parameters such as temperature, pH, Total dissolved solids, salinity and elemental concentrations at three sites are in normal range and within the permissible limits.

Keywords: Inle Lake, physicochemical parameters, electrical conductivity

Introduction

Water pollution is defined as any contamination of water that lessens its value to humans and nature. Pollution represents imbalance of one or more elemental cycles. Water pollutants for the lakes are sediments nutrients, oxygen demanding organic wastes, thermal pollution, disease organism, and toxic organic wastes by United Nation Environmental Programme International Environmental Technology Centre/International Lake Environment Committee Foundation (UNEP-IETC/ILEC, 2001). Water quality and water resources play a vital role for both natural ecosystem and human development (Zaw Lwin and Sharma, 2012; Akaishi *et al*., 2006).

The Inle Lake, the second largest lake in Myanmar, is located in Shan state in the Northeastern side of the country. It is an important water resource for more than 170000 people inhabiting the lake surrounding. The main business in Inle Lake is agriculture on the floating gardens and tourism. Nowadays the lake is impacted by many factors including pesticides from agriculture, chemical dyes from textile processing, excess siltation from watershed erosion, and the dumping of wastes and garbage.

It was reported that the water quality had declined at an increasing rate and the government initiated the Inle Lake preservation project (Butkus and Myint, 2001; Su, M. and Jassby, 2000).

According to the assessment of its water quality in 2012, the tropic state index of the Inle Lake is found to be in the range of eutrophication**.**

The aim of this paper is to assess the some physicochemical properties of water from Inle Lake in order to monitor the surface water quality of Inle Lake.

Materials and Methods

Sampling Area

Inlay Lake is located at latitude 20° 46'N and longitude: 97° 01'E. The temperature is between12℃-28℃. The populations of the Intars are about 80,000. Inle Lake is a huge lake (22 km long and 10 km across) located in Shan State, over 900 meters above sea-level, and it is outrageously beautiful.

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Inlay Lake is a freshwater lake located in the Nyaungshwe Township of Taunggyi District of Shan State, part of Shan Hills in Myanmar. It is the second largest lake in Myanmar with an estimated surface area of 44.9 square miles (116 km^2), and one of the highest at an elevation of 2900 feet (880 m). During the dry season, the average water depth is 7 feet (2.1 m), with the deepest point being 12 feet (3.7 m), but during the rainy season this can increase by 5 feet (1.5 m). Water samples were collected from three different places of Inle lake such as Thalay village (sample name P), Heya Ywama Village (Silver smith) (sample name S), Inn paw khon (Weaveing) (sample name W) starting August 13, 2013 finishing August 14, 2014 for measuring metals residues. Map of Inle Lake is shown in Figure 1.

Thalay Village

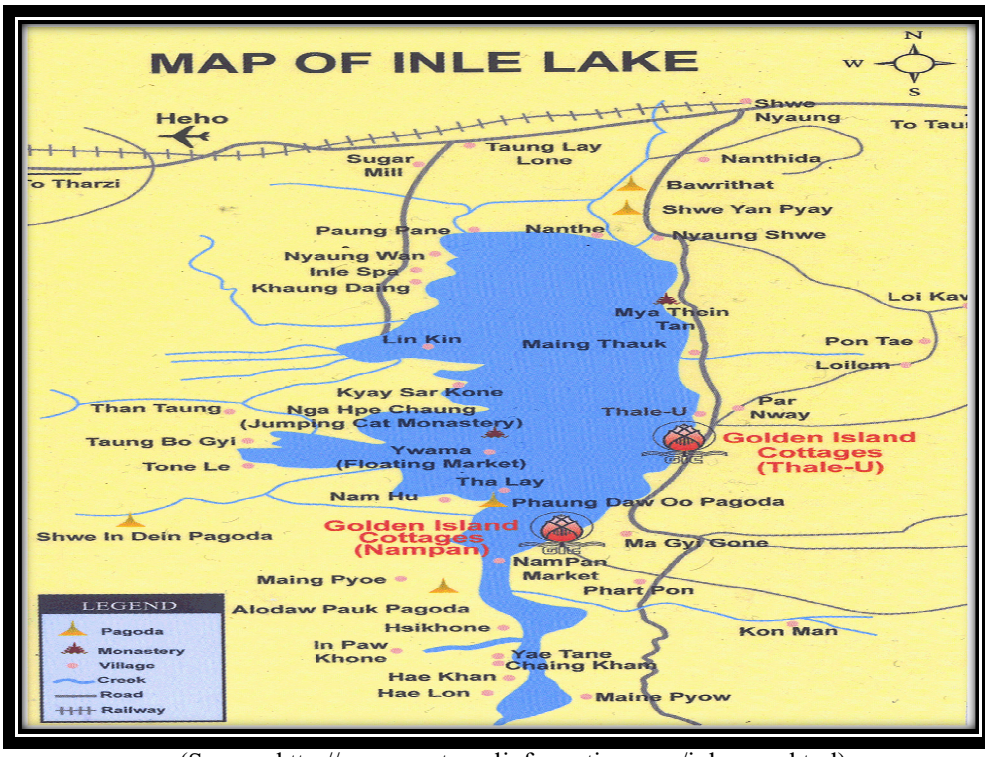
It is situated on the precinct of the Phaung Daw Oo Pagoda and opened daily. Local pilgrims and foreign visitors can buy different products of Inlay region as souvenirs. This region is crowded and very famous for tourist attraction.

Heya Ywama Village

This area is so filled with floating vegetation that it appears more land than lake. There are also many "floating gardens" where farmers plant crops like tomatoes on floating mats of vegetation anchored in place with bamboo poles. Ywama village which Gold Smith & Silver Smith Workshop is located is well known for its gold and silver ware.

Inn paw khon Village

Inn paw khon is also a popular tourist attraction, famous for its weaving workshops.



(Source: http://myanmartravelinformation.com/inle-map.html)

Figure 1 Figure 1 Map of Inle Lake

Collection of Water Samples

Water samples were collected from selected study sites to one liter plastic bottles with caps. Collected water samples were sent immediately to the laboratories of URC.

Methods

All water quality parameters were measured by Multiparameter Benchtop Meters (Cyber Scan 6000 Series Meters). Photograph of the Multiparameter Benchtop Meters (Cyber Scan 6000 Series Meters) is shown in Figure 2.

The samples were analyzed by the energy dispersive x-ray fluorescence spectrometry EDXRF (EDX-700), which has an Rh anode tube. This machine can provide the information of elements from silicon to uranium (Si-U). Photograph of the Shimadzu EDX-700 spectrometer is shown in Figure 3.

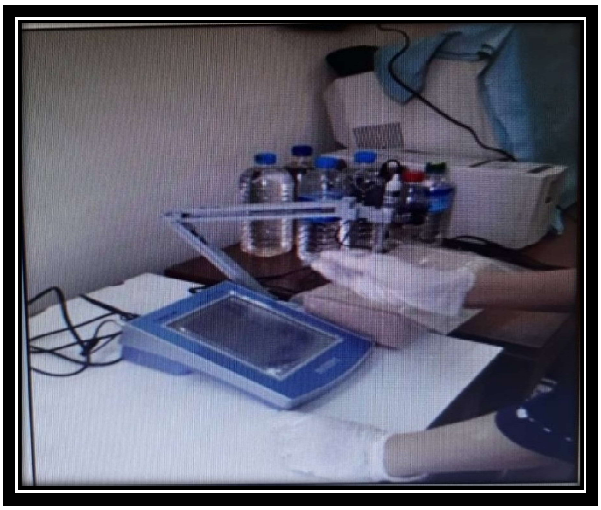


Figure 2 Photograph of the Multiparameter Benchtop Meters (Cyber Scan 6000 Series Meters)

Figure 3 Photograph of the Shimadzu EDX-700 spectrometer Universities' Research Centre (URC), Yangon University

Physicochemical Analysis

The temperatures of the samples were noted at the sampling point itself. Analysis was carried out for various water quality parameters such as pH, electrical conductivity, TDS, salinity, and elemental analysis.

X-ray Fluorescence Analysis (XRF)

The term "X-ray fluorescence analysis" (XRF) refers to the measurement of characteristic fluorescence emission resulting from the de-excitation of inner shell vacancies produced in the sample by means of suitable source of radiation. Numerous variants of the basic process have been studied. They differ both in the type and sources of ionization radiation and in the method employed to measure the fluorescent emission. For routine XRF analysis, two major approaches are distinguishable based on the detector used to measure the characteristic x-ray emission spectra.

The x-ray fluorescent analysis (XRF) is widely accepted as a standard method for elemental analysis since it offers a unique combination of flexibility and accuracy. The XRF

analysis is given qualitative and quantitative results. (Tertian R & Claisse F, 1982, Principles of Quantitative X-ray Fluorescence Analysis (London: Heyden))

Results and Discussion

The variation in physicochemical characteristics of the water samples of three locations have been summarized in Figure 4 (a-e).

Water Temperature

The temperature of water samples among the study sites (Thalay village, Heya Ywama village and Inn paw khon village) ranged from a minimum of 23.0 °C to a maximum of 31.2 °C. In case of water samples, temperature of all the three locations was found to be high in April and low in September. (Figure 4 a)

pH

The pH of water at all the study sites showed a range of variation (7.26 - 9.75). Throughout the study period, pH values of all the three locations were found to be high in July and low in first half of August. In all the three locations, pH is always alkaline. (Figure 4 b)

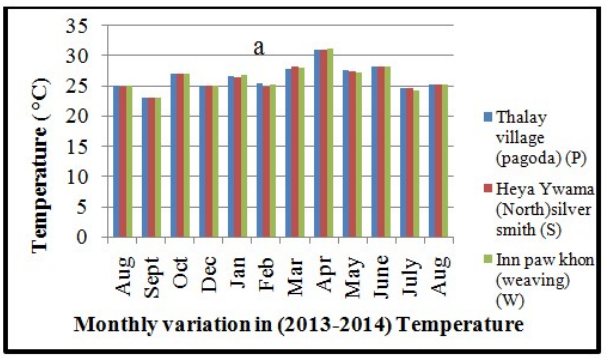
Electrical Conductivity (EC)

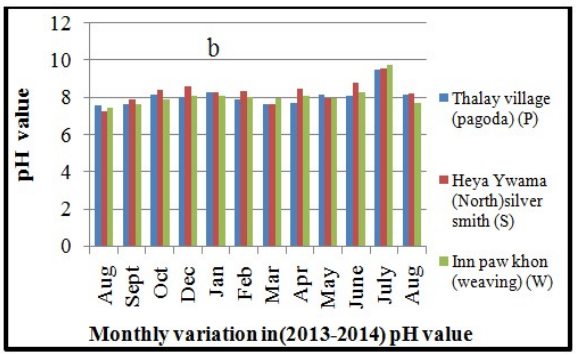
Electrical conductivity of water samples at different study sites ranged from a minimum of 185.7 ± 25.368 μS cm^{-1} to a maximum of 463.2 ± 58.313 μS cm^{-1}. EC of all the three locations were found to be high in January and low in second half of August.

There is a sharp increase in conductivity was observed from December to April in all the sites during the study periods. (Figure 4 c)

Total Dissolved Solids (TDS)

The total dissolved solids of water samples ranged from a minimum of 119.3± 16.251 ppm to a maximum of 228.0 ± 27.199 ppm of Thalay village, Heya Ywama village and Inn paw khon village respectively. In case of water samples, TDS of all the three locations were found to be high in January and low in second half of August. In water, total dissolved solids are composed mainly of carbonates, bicarbonates, chlorides, phosphates and nitrates of calcium, magnesium, sodium, potassium and manganese, organic matter, salt and other particles. The minimum values were recorded at three locations in August. (Figure 4 d)





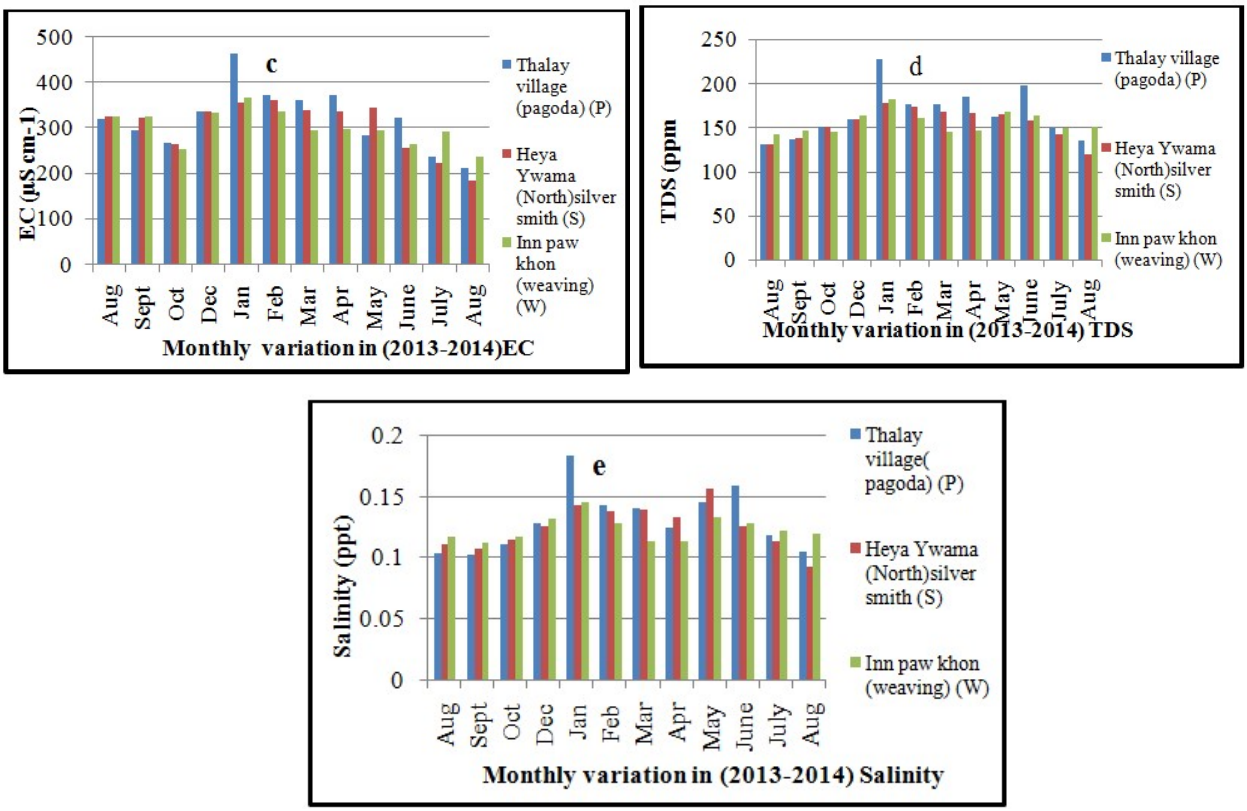


Figure 4 (a-e) Monthly variation of Physicochemical parameter (a = Temperature, b = pH, c = Conductivity, d = Total Dissolved Solid, e = Salinity) of water at three different sites of Inle Lake

Salinity

Salinity of water samples ranged from a minimum of 0.092 ± 0.014 ppt to a maximum of 0.184 ± 0.023 ppt of Thalay village, Heya Ywama village and Inn paw khon village respectively. In case of water samples, Salinity of all the three locations were found to be high in January and low in second half of August. (Figure 4 e)

The values obtained were then compared to available WHO standard. Water-quality standards or recommended limits for selected parameter were listed in Table 1.

Table 1 Water-quality standards or recommended limits for selected parameter

Parameter		Present Study	WHO standard*
pH	Range	7.26 – 9.75	6.5 - 8.5
	Mean	8.16 ± 0.224	
EC (µδ cm^{-1})	Range	185.7 – 463.2	500
	Mean	309.59 ± 25.83	
TDS (mg l^{-1} or ppm)	Range	119.3 – 228.0	500
	Mean	159.78 ± 12.72	
Salinity (ppt)	Range	0.092 – 0.184	Fresh water < 0.5 ppt Brackish 0.5 - 30 ppt Saltwater 30 - 40 ppt Optimum 15 - 25 ppt
	Mean	0.126 ± 0.0159	

The comparison of relative concentrations of elements vs month contained in water samples from Thalay village (Pagoda) P, Heya Ywama (North) (Silver) S, Inn paw khon(Weaving) W by EDXRF in Figure 5 (a-c).

According to these results, all samples have different concentrations of various elements. It was found that calcium (Ca) was contained in all water samples.

In Figure 5 a, the water samples from Thalay village had the same elements (S, K, Ca, Mn, Fe, Cu, Zn) in first half of August, December, February, June. Potassium (K) was not observed in September, March, April and May. Sulfur (S) was not observed in October and January. Zinc (Zn) was not observed in October, March and July. From this figure, the relative concentration of Ca was high in all samples. But the relative concentration of Zn was very few in first half of August, September, January, February, April, May, June and second half of August. And also the relative concentration of Mn was few in October, December and July. Then the relative concentration of Cu was few in March.

In Figure 5 b, the water samples from Heya Ywama had the same elements (S, K, Ca, Mn, Fe, Cu, Zn) in September, October, December, January, July and second half of August. Potassium (K) was not observed in April. Sulfur (S) was not observed in first half of August, February, April, May and June. Zinc (Zn) was not observed in February, April, May and June. Manganese (Mn) was not observed in March and April. From this figure, the relative concentration of Ca was high in all samples. But the relative concentration of Zn was very few in first half of August, September, October, December, January, March, July and second half of August. And also the relative concentration of Mn was few in February and June. Then the relative concentration of Cu was few in April and May.

In Figure 5 c, the water samples from Inn paw khon had the same elements (S, K, Ca, Mn, Fe, Cu, Zn) in first half of August, October, December, January, March, June and July. Potassium (K) was not observed in September, May and second half of August. Zinc (Zn) was not observed in September. Manganese (Mn) was not observed in September, February and April. From this figure, the relative concentration of Ca was high in all samples. But the relative concentration of Zn was very few in first half of August, October, December, January, February, March, April, May, June, July and second half of August. And also the relative concentration of Cu was few in September.

Calcium (Ca) is essential constituent of bone, shell and teeth of the body. The content of Ca in food can provide for nutrition. Aqueous calcium compounds are generally non toxic and represent no known health hazard. Not only is calcium for human life, but it is also an essential nutrient for plant growth.

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. It is an essential element and is present in all animal and plant tissues.

Manganese (Mn) is an essential element for medicine use, but excess concentrations in the body can cause toxicity. It is essential to iron and steel production. It can cause both toxicity and deficiency symptoms in plants.

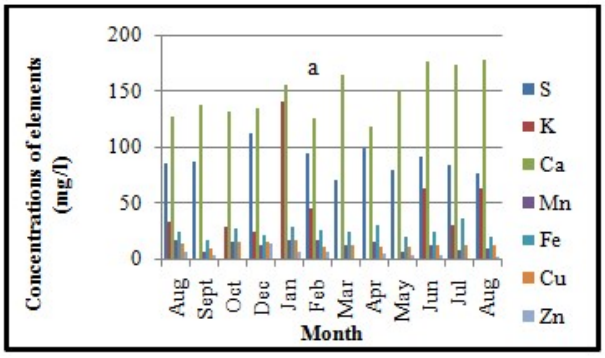


Figure 5 (a) Concentrations of elements vs Month contained in the water samples from Thalay Village (Pagoda) P by EDXRF

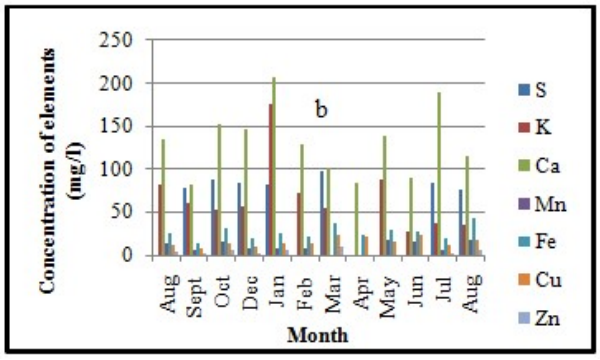


Figure 5 (b) Concentrations of elements vs Month contained in the water samples from Heya Ywama (Silver Smith) S by EDXRF

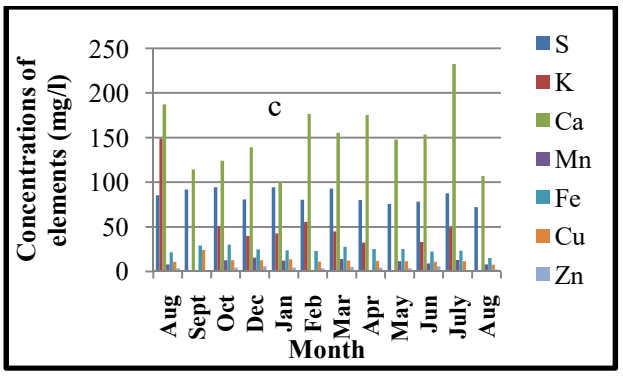


Figure 5 (c) Concentrations of elements vs Month contained in the water samples from Inn paw khon (weaving) W by EDXRF

The amount of copper (Cu) is necessary for normal body metabolism its absence is known to cause nutritional anemia in children. Large oral dosages of copper can cause emesis and may eventually results in liver damage.

Zinc (Zn) is an essential trace element and its necessary roles involve enzymes and enzymatic functions, protein synthesis and carbohydrate metabolism. It is necessary for normal growth and development in mammals. It is an essential trace element for animals and plants.

Sulfur (S) is very useful in medicine use. It is used in pharmaceuticals and it has no critical toxicity from food. It is an essential nutrient for plant.

Iron (Fe) is an essential element in body tissue as the form of hemoglobin in blood. It also has medicinal use. It is toxic when large amounts are taken into the body. When too many iron pills are taken, people (especially children) get sick. It is an essential element for almost all living species.

Conclusion

As a result, some physiochemical parameters such as temperature, pH, electrical conductivity, total dissolved solids, and salinity and elemental concentrations at three sites are in normal range and within the permissible limits.

These experiments are being carried out by using the EDXRF method, we can make conclusion that there are no toxic element which can given trouble for human health.

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