THE INVESTIGATION OF ELEMENTAL CONTENT IN WATER SAMPLES COLLECTED FROM YANGON REGION USING EDXRF AND AAS METHODS

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Abstract

Energy Dispersive X-Ray Fluorescence Method for elemental concentration quantitatively and toxic and heavy elemental concentration were investigation by using Atomic Absorption Spectroscopy. The natural water samples were collected from artesian well in the eastern district of Yangon Region. The elemental concentrations were compared with the permissible standard levels and pH values were determined by using digital pH meter. The elemental contents were observed in the range as follows: Mn (0-0.394) ppm, Fe (0.028-0.236) ppm, Cu (0.031-0.076) ppm, Zn (0.025-0.505) ppm, As (0-0.002) ppm, Pb (0.047-0.080) ppm. Then, the comparison with World Health Organization guideline values were used. The concentration of the observed elements except Lead (Pb) were found to be within the acceptable levels. According to the pH value results, the artesian water from Thingangyun Township and Tamwe Township can be used as drinking water.

Keywords: EDXRF method, AAS method, pH method.

Introduction

Earth is known as the "Blue Planet" because 71 percent of the Earth's surface is covered with water. Water also exists below land surface and as water vapour in the air. Water is a finite source. Water on the Earth occurs in three forms: vapour; clouds, mist and steam, fluid; rain, in streams, lakes, dams, wetlands and the sea, solid; ice in glaciers, hail, snow and frost. Water is found in many different forms and in many different places. There are spring water, purified water, mineral water, artesian water, tap water, well water and sparkling water and so on. Artesian water is special and is not simply from an underground spring but this title of "artesian" contains specific parameters about how deeply set the water source is. It has the chance of being 'more pure' than basic spring water since it comes from a deeper source and has to travel through deeper levels of natural filtering through

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Earth. To be an artesian well the water in the aquifer must be under enough pressure to force it up the well to a level that is higher than the top of the aquifer. Artesian water comes from an artesian well that is deep in the earth. In the present study, artesian water samples were analyzed by EDXRF techniques and especially to find out the toxic and heavy elemental concentration by using AAS techniques. After the elemental concentrations were compared with the permissible standard levels and pH values.

Experimental Details

Sample Collection

The water samples were collected from specific places in eastern district of Yangon Region. Map of places of sample collection in Eastern District of Yangon Region is shown in Figure (1). The places were chosen because they were crowded area in respective site and mainly used artesian water in those places. Seven artesian water samples were collected in this work. The collected water samples from respective artesian well (at least 100 ft depth) were immediately stored in separate air tight narrow cleaned 1 Litre bottle.

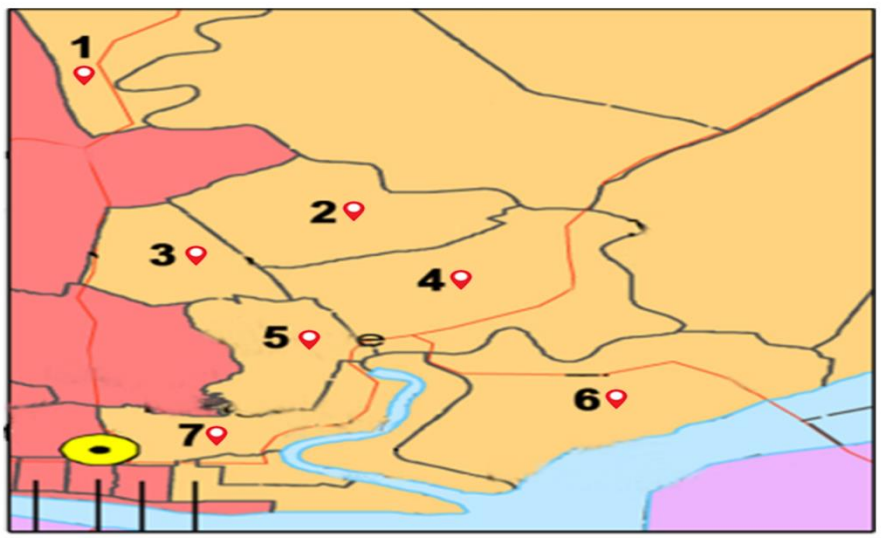

Figure 1: Map of Places of Sample Collection

1 = Thiri Kan Thar Street, North Okkalapa Township

2 = Kyaw Thu Street, South Okkalapa Township

3 = Yan Shin Street, Yankin Township

4 = Pyi Thar Yar Street, Thingangyun Township

5 = Ar Thaw Ka Street, Tamwe Township

6 = Aung Thu Kha Street, Thaketa Township

7 = Mya Yar Kone Street, Mingalartaungnyunt Township

Sample Preparation and Measurement

Artesian water samples were filtered with filter paper. The elemental concentration in liquid, filter paper was used for experimental purposes. The filter paper was cut into a circular with 30 mm (3cm) diameter and then the water sample of (0.1 ml) was dropped on that paper using pipette. And then it was completely left dried in room temperature and carefully and separately stored. After that these papers were analyzed by EDX-720 spectrometer.

Water samples are poured into 100ml beaker and 1ml of nitric acid is added. For the determination of trace and matrix elements in water samples, sample are not filtered, but acidified with acid to pH<2. Prepared samples for measuring with AA-900H Spectrometer.

Results and Discussion

Elemental contents, analyzed by EDX-720 spectrometer, in seven artesian water samples collected from specific places in Eastern district of Yangon Region were expressed in Table (1). The comparison of elemental concentration in each of artesian water samples were expressed in Figure (2). The results obtained by EDXRF technique can be seen that the contents of heavy toxic elements such as nickel (Ni), arsenic (As), cadmium (Cd), mercury (Hg) and lead (Pb) were not included. So, the rest of work should be performed with using of AAS technique. Table (2) shows the elemental concentration of Seven Artesian Water samples by AA-900H Spectrometer. Comparison of Iron, Copper, Zinc, Arsenic and Lead Concentration of artesian water samples by AAS are shown in Figure 3,4,5,6,7 and 8 respectively.

The pH values of samples from different regions were shown in Table 3. The results indicate that the data show the relative concentration of toxic elements contained in the sample of analysis. The concentrations of arsenic were detected in the range from 0.001 ppm to 0.002 ppm. This value is lower than the guideline value of 0.01 ppm. The concentrations of lead were detected in the range from 0.047 ppm to 0.080 ppm. This value is slightly greater than the guideline value of 0.015 ppm.

Table 1: Elemental Concentration of Seven Artesian Water Samples by EDX-720 Spectrometer

Sample No.	Elemental Concentration (ppm) of Artesian Water Samples									
	S	**K**	**Ca**	**Mn**	**Fe**	**Co**	**Cu**	**Gd**	**Tb**	Tm
S-1	ND	44.975	75.992	9.316	14.214	8.138	12.000	ND	ND	ND
S-2	44.139	ND	70.355	ND	13.526	ND	11.775	25.606	ND	ND
S-3	ND	ND	69.627	ND	16.062	ND	10.677	ND	ND	ND
S-4	46.925	ND	59.562	6.434	15.075	ND	9.320	ND	ND	ND
S-5	ND	33.358	68.538	ND	14.675	ND	9.362	22.395	25.449	ND
S-6	ND	ND	80.092	9.812	15.115	ND	8.081	29.449	ND	14.290
S-7	ND	ND	73.512	ND	7.326	ND	10.738	23.689	40.453	ND

ND = Not Detected

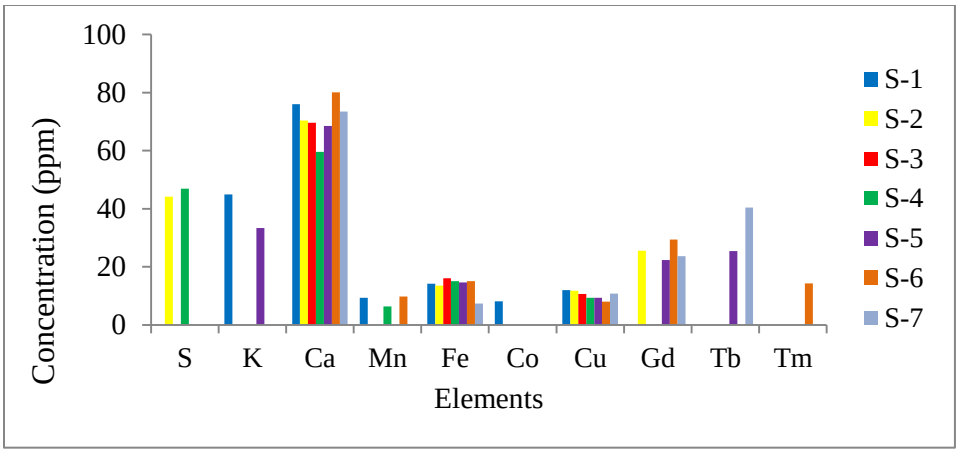

Figure 2: Comparison of elemental concentration in seven artesian water samples by EDX-720 spectrometer

Table 2: Elemental Concentration of Seven Artesian Water Samples by AA-900H Spectrometer

Sample No.	Elemental Concentration (ppm) of Artesian Water Samples						
	Mn	**Fe**	**Cu**	**Zn**	**As**	**Cd**	**Pb**
S-1	ND	0.124	0.039	0.033	ND	ND	0.052
S-2	0.085	0.236	0.031	0.047	0.002	ND	0.051
S-3	0.057	0.086	0.046	0.040	0.002	ND	0.069
S-4	0.198	0.028	0.076	0.505	0.002	ND	0.047
S-5	0.078	0.083	0.040	0.041	0.001	ND	0.080
S-6	0.394	0.110	0.036	0.029	0.002	ND	0.073
S-7	ND	0.130	0.038	0.025	ND	ND	0.075

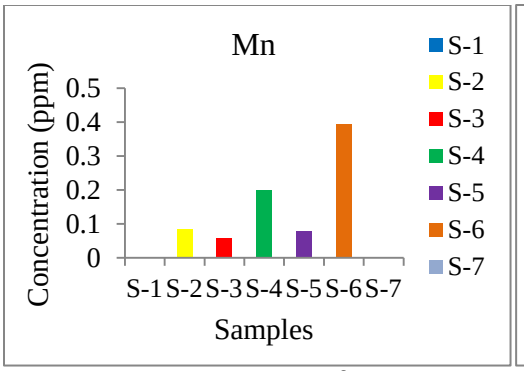

Figure 3: Comparison of Manganese (Mn) concentration of artesian water samples by AAS

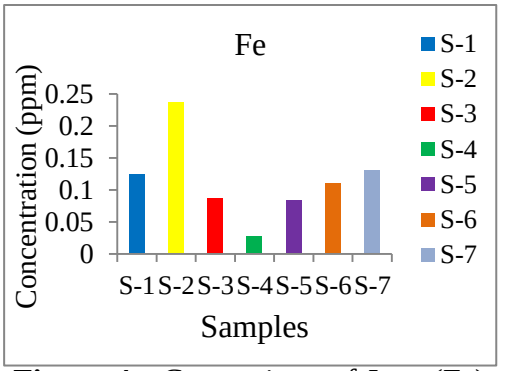

Figure 4: Comparison of Iron (Fe) concentration of artesian water samples by AAS

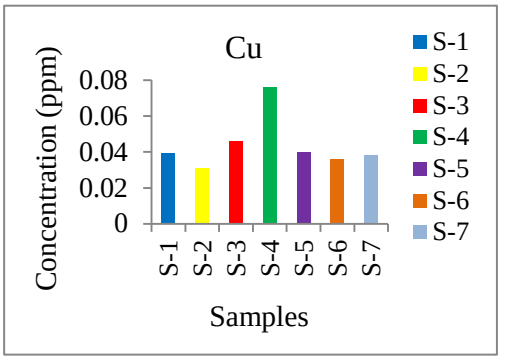

Figure 5: Comparison of Copper (Cu) concentration of artesian water samples by AAS

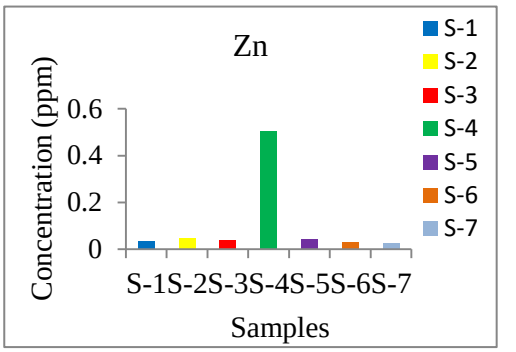

Figure 6: Comparison of Zinc (Zn) concentration of artesian water samples by AAS

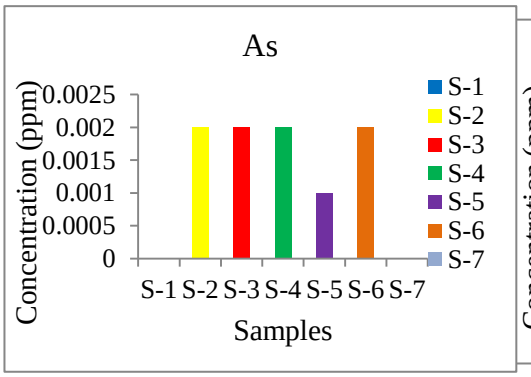

Figure 7: Comparison of Arsenic (As) concentration of artesian water samples by AAS

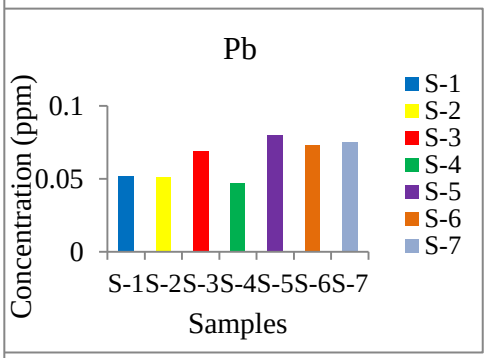

Figure 8: Comparison of Lead (Pb) concentration of artesian water samples by AAS

Table 3: pH Values of Samples from Different Regions

Artesian Water Samples	pH value
Sample -1 (North Okkalapa Township)	6.5
Sample -2 (South Okkalapa Township)	6.7
Sample -3 (Yankin Township)	6.4
Sample -4 (Thingangyun Township)	6.9
Sample -5 (Tamwe Township)	6.9
Sample -6 (Thaketa Township)	6.2
Sample -7 (Mingalartaungnyunt Township)	6.8

Conclusion

Seven artesian water samples collected from North Okkalapa, South Okkalapa, Yankin, Thingangyun, Tamwe, Thaketa and Mingalartaungnyunt were analyzed using Shimadzu EDX-720 spectrometer and Perkin Elmer AA-900H spectrometer at the Universities' Research Centre (URC) in University of Yangon. The results of this study indicate that Arsenic and Lead concentration exists in all artesian water samples. The concentration of toxic element Arsenic (As) is lower than the guideline values of World Health Organization standard (As-0.01 ppm). The concentrations of Lead (Pb) in all samples were above World Health Organization guideline value (Pb-0.015 ppm). The concentration of toxic element Cadmium (Cd) was not found in all samples. The normal range for pH in surface water systems is 6.5 to 8.5 and for ground water systems is 6 to 8.5. The results of pH values measurement indicate that pH values of artesian water samples lie in the range of 6.2 to 6.9. From the pH values results, the artesian water from Thingangyun Township and Tamwe Township can be used as drinking water although the elemental concentration of Lead is slightly greater than (WHO) guideline value.

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