Analysis of Water Quality from Selected Areas in Mandalay Region, Myanmar

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***Abstract*: Four sites of water samples were collected from Pyikyidagon Township, Industrial Zone(1), Mandalay Region on February and June, 2018. Firstly, physical properties of water samples such as color, pH, total dissolved solid and turbidity were determined. Then, the chemical properties of water samples such as total hardness, total alkalinity, calcium, magnesium, sulphate, chloride and iron were carried out. Bacteriological examination of the water samples were also studied. In addition, heavy toxic metals such as arsenic, lead and cadmium were determined in water samples. Furthermore, some organic pollutant parameters DO, BOD, COD of the water samples were also determined. The results obtained from the analysis were compared with WHO(World Health Organization) standards for drinking water.**

***Keywords*: ground water, physiochemical properties, DO, BOD, COD**

I. INTRODUCTION

World Health Organizaiton (WHO) and its member states has its objectives to all people, in respect to their stages in progress and their social and economic circumstances have right to have access to enough supply of safe drinking water. At the beginning of 2000, about 1.1 billion people in the world were without access to improved supply of clean water. Africa has the lowest water supply coverage with only 62.0 % of the population having access to improved water supply. The continent contains 28.0 % of world's population without access to improved water supply. Ethiopia is one of the ten African countries, which have less than 50.0 % water supply coverage, with only 24.0 % of the population having access to improved water supply. In Ethiopia the situation is much worse in rural areas where coverage is only 13.0 % compared with 77.0 % in urban areas. Water is considered one of the most important and sensitive issues in the Middle East, where increasing water deficiency and deteriorating of the available water are imminent [1].

Water is the main constituent in the formation of all living things and its special properties are vital to the existence and growth of animals and plants. The amount of water used for drinking and household supplies varies greatly. In modern days due to the increase in population and the greater awareness among the people of the importance of hygiene in their daily life, the amount of water for domestic use has greatly increased. Water is essential to human life and must be provided even if it does not meet all the desirable water quality standards. Water for drinking as well as food preparation and bathing must be free from organisms which can cause disease and from minerals and organic substances producing adverse physiological effects[3].

There are variety of trace elements present in virtually all drinking water, some of which play a role in metabolism. Drinking water should be clear, bright, colorless, adequately aerated and with no objectionable taste, order, suspended matter or turbidity and it also should have a reasonable temperature. Such water is termed “potable” meaning that it may be consumed in any desired amount without concerned for adverse effects on health [4].

II. MATERIALS AND METHODS

Sample Collection

The tube well water samples were collected from Pyikyidagon Township, Industrial Zone (1), Mandalay Region on February and June, 2018.

Sites of Water Samples

Four sites were chosen, site (1) 62 Street, site (2) 64 Street, site (3) 66 Street and Site (4) 68 Street. All sites of the water samples were lie between Yawminkyi Street and Phoe Yazar Street, respectively. All of the tube-well waters were found to be the range of (120-180 fts). Before collected the water samples, the glass bottles were rinsed with nitric acid and washed with water which was to be collected. For collecting the samples only well cleaned glass bottles of 10 liters were used.

Analysis of Physical Properties of Water Samples on February 2018 and June 2018

Estimation of color

The color of water samples were determined by platinum coboalt standard method, spectrophotometer.[2]

Determination of pH

The water samples were determined by electrometric method direct measurement with pH meter. [2]

Determination Total Dissolved Solid

The total dissolved solid of water samples were determined by evaporation method. [2]

Determination of Turbidity
The turbidity of water samples were determined by turbidimetric method. [2]

Chemical Properties of Water Samples on February 2018 and June 2018
Estimation of Total Hardness
The total hardness of water samples were determined by EDTA titrimetric method. [2]

Estimation of Total Alkalinity
The total alkalinity of water samples were determined by (acid-base titration) titrimetric method. [2]

Estimation of Calcium
The calcium of water samples were determined by EDTA titrimetric method. [2]

Estimation of Magnesium
Method: Calculation Method
Magnesium can be calculation by the following formula
Mg mg/L= (Total hardnessas $CaCO_3$/L-Ca hardnessas $CaCO_3$/L) × 0.244× 1000

Estimation of Sulphate
The sulphate of water samples were determined by turbidimetric method. [2]

Estimation of Chloride
The chloride of water samples were determined by argentometric method. [2]

Estimation of Iron
The iron of water samples were determined by phenanthroline method. [2]

Bacteriological Examination of Water Samples Collected from Site 1, Site 2, Site 3 and Site 4 on February 2018 and June 2018
The samples were sent to the Public Health Laboratory, Mandalay to determine the bacteriological examination of water.

Analysis of Heavy Toxic Metals of Water Samples on February and June, 2018
Estimation of Arsenic, Lead, Cadmium
The content of heavy toxic metal (arsenic, lead, cadmium) of water samples were examination by Atomic Absorption Spectrophotometer at Water Laboratory, Chemical Technology Department, Taunggyi University.

Analysis of Organic Pollutants of Water Samples on February and June, 2018
Determination of DO, BOD, COD
The dissolved oxygen of water samples were determined by Winkler's method. [2]
Dissolved oxygen of the water samples were measured from Ministry of Agriculture, Livestock and Irrigation, Department of Fisheries, Aquaculture Division, Fresh water Aquaculture Research, Water and Soil Examination Laboratory, Yangon City.

III. Results and Discussion

Table 1 Physical Properties of Water Samples on February, 2018

No	Parameters	Water samples				WHO Recommendation	
		Site 1	Site 2	Site 3	Site 4	Highest desirable level	Maximum permissible level
1	Color (platinum Cobalt Scale)	5	5	5	5	5	50
2	pH	7.7	7.6	7.6	7.6	7.0 to 8.5	6.5 to 9.2
3	Total Dissolved Solid (mg/ L)	1002	1167	1107	1280	500	1,500
4	Turbidity (NTU)	-	-	-	-	5	25

NTU = Nephlometric Turbidity Units
According to the physical properties of water samples in February, 2018 the color of water samples agreed with the highest desirable level. The pH values of all water samples lie between 7 to 8 and hence they are said to be slightly alkaline.
The total dissolved solid amount of water samples were higher than the highest desirable level. All water samples were clear by turbidity results.

Table 2 Chemical Properties of Water Samples on February, 2018

No	Parameters	Water samples				WHO Recommendation	
		Site 1	Site 2	Site 3	Site 4	Highest desirable level	Maximum permissible level
1.	Total Hardness (mg/L)	260	420	320	280	100	500
2.	Total Alkalinity (mg/L)	585	650	650	845	600	950
3.	Calcium(mg/L)	104	64	112	104	75	200
4.	Magnesium(mg/L)	24	62	10	5	30	150
5.	Sulphate (mg/L)	216	255	235	196	200	400
6.	Chloride(mg/L)	40	80	40	80	200	600
7.	Total Iron	Nil	Nil	Nil	Nil	0.3	1

According to the chemical properties of water samples, the amount of total hardness, magnesium and sulphate of water sample in site 2 was greater than other sites. The content of total alkalinity of water sample in site 1 (585 mg/L) was within highest desirable level. The content of calcium of water sample in site 2 was lower than other sites. Iron was not observed in all sites.

Table 3 The results of Bacteriological Examination of Water Samples on February, 2018

No	Test	Site 1	Site 2	Site 3	Site 4
1.	Probable Coliform Count	0/5	0/5	0/5	0/5
2.	*Escherichia coli*	Not- Isolated	Not-Isolated	Not-Isolated	Not-Isolated

E.coli was not isolated from all water samples. From the point of view of the bacterial, those were found to be satisfactory for drinking purpose.

Table 4 The Results of Arsenic, Lead and Cadmium Contents of Water Samples February, 2018

No	Test	Units	Site 1	Site 2	Site 3	Site 4	Highest desirable level	Maximum permissible level
1	Arsenic	mg/L	ND	ND	ND	ND	0.05	0.01
2	Lead	mg/L	ND	ND	ND	ND	0.01	0.43
3	Cadmium	mg/L	ND	ND	ND	ND	0.01	0.45

ND = Not Detected

According to this table arsenic, lead and cadmium contents were not found in all water samples.

Table 5 Results of Some Organic Pollutants in Water Samples on February, 2018

No	Parameters	Units	Site 1	Site 2	Site 3	Site 4	WHO standard	EPA Std**
1	DO	mg/L	3.0	3.5	2.5	2.0	-	4-6
2	BOD	mg/L	2.0	1.0	1	0.5	6	5
3	COD	mg/L	2.575	1.104	1.472	0.736	10	5

According to this table, dissolved oxygen (DO), biochemical oxygen demand (BOD), and chemical oxygen demand (COD) values of site 4 water sample was lower than other sites.

Table 6. Physical Properties of Water Samples on June, 2018

No	Parameters	Water samples				WHO Recommendation	
		Site 1	Site 2	Site 3	Site 4	Highest desirable level	Maximum permissible level
1	Color (platinum Cobalt Scale)	5	6	6	5	5	50
2	pH	7.7	7.8	7.9	7.8	7.0 to 8.5	6.5 to 9.2
3	Total Dissolved Solid (mg/ L)	877	996	1124	1182	500	1,500
4	Turbidity (NTU)	-	-	-	-	5	25

NTU = Nephlometric Turbidity Units

On the June 2018, the color of water sample in site 2 and site 3 were higher than other sites. Like February 2018, the pH values of all water samples were found to be alkaline. The total dissolved solid amounts of water sample in site 4 was higher than other sites.

Table 7 Chemical Properties of Water Samples on June, 2018

No	Parameters	Water samples				WHO Recommendation	
		Site 1	Site 2	Site 3	Site 4	Highest desirable level	Maximum permissible level
1.	Total Hardness (mg/L)	280	420	360	300	100	500
2.	Total Alkalinity(mg/L)	520	520	650	780	600	950
3.	Calcium(mg/L)	48	72	56	48	75	200
4.	Magnesium(mg/L)	38	58	53	43	30	150
5.	Sulphate(mg/L)	176	216	255	176	200	400
6.	Chloride(mg/L)	40	80	60	80	200	600
7.	Total Iron	Nil	Nil	Nil	Nil	0.3	1

According to the chemical properties of all water samples on June 2018, the total hardness, calcium and magnesium amount of water samples in site 2 were higher than other sites. Total alkalinity, sulphate and chloride amounts of all water samples were within WHO standard value. Iron was not observed in all water samples.

Table 8 The results of Bacteriological Examination of Water Samples on June, 2018

No	Test	Site 1	Site 2	Site 3	Site 4
1	Probable Coliform Count	0/5	0/5	0/5	0/5
2	*Escherichia coli*	Not- Isolated	Not – Isolated	Not – Isolated	Not- Isolated

E.coli was not isolated from site 1, site 2, site 3 and site 4 water samples. In this observation water samples were found to be satisfactory for drinking purpose.

Table 9 The Results of Arsenic, Lead and Cadmium Contents of Water Samples June, 20018

No	Test	Units	Site 1	Site 2	Site 3	Site 4	Highest desirable level	Maximum permissible level
1	Arsenic	mg/L	ND	ND	ND	ND	0.05	0.01
2	Lead	mg/L	ND	ND	ND	ND	0.01	0.43
3	Cadmium	mg/L	ND	ND	ND	ND	0.01	0.45

ND = Not Detected

According to this table, arsenic, lead and cadmium contents were not observed in all water samples.

Table 10 Results of Some Organic Pollutants in Water Samples June, 20018

No	Parameters	Units	Site 1	Site 2	Site 3	Site 4	WHO standard	EPA Std**
1	DO	mg/L	3.0	3.4	2.0	2.4	-	4-6
2	BOD	mg/L	2.0	1.0	1	0.5	6	5
3	COD	mg/L	2.565	1.103	1.470	0.735	10	5

In this data, dissolve oxygen (DO), biological oxygen demand (BOD) and chemical oxygen demand (COD) values of site 4 water sample was lower than other sites.

IV. Conclusion

In the present study, the physical properties, chemical properties and biological examination of water samples were carried out to assess the quality of water from different sites. The pH of water samples measures its hydrogen ion concentration. The pH values of water samples 7.6 and 7.7 respectively.

In February, 2018 and June 2018, the physicochemical data of all water samples were fallen within WHO standard value, color, pH, turbidity, chloride and iron amounts of water samples were nearly equal. In February, 2018 the total dissolved solid, total alkalinity, calcium, sulphate amounts of water samples were higher than water samples in June, 2018. In June, 2018, total hardness and magnesium amounts of water samples were higher than in February, 2018. Iron was not observed on both seasons.

In bacteriological examination of all these samples , the probable coliform count were not observed in all samples and *E.coli* counts were not isolated from site 1, site 2, site 3 and site 4 water samples. Therefore, the bacteriological examination results indicate that the quality of water sample is satisfactory for drinking purpose.

The dissolve oxygen (DO) test measure the current oxygen level in water. The DO level varies with temperature. DO is lower by an increase in temperature. BOD was the amount of oxygen consumed by bacterial as they oxidized organic matter in water. The value of DO, BOD and COD of water samples were within WHO standard value. The heavy toxic metals such as Arsenic, Lead and Cadmium were not found in all water samples on February and June, 2018.

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