ASSESSMENT OF TUBE WELL WATER AND RESERVOIR FROM THANLYIN TECHNOLOGICAL UNIVERSITY CAMPUS

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Abstract

In the present work, the tube well water samples were collected from two different sampling sites of Thanlyin Technological University Campus in the months of July and December, 2016. The collected water samples were tube well water from Information Technology (IT) hall as sample (S1), tube well water in the Campus and reservoir as sample (S2). Determination of some physicochemical properties such as temperature, turbidity, conductivity, pH, total dissolved solids, total suspended solids, total alkalinity, total hardness, PO_4-P, NO_2-N, NH_3-N, DO, BOD, COD, chloride and sulphate of all water samples were carried out by conventional methods. The contaminations of trace metals (Cd, Pb, Zn, Ca, Cu, Mg, Cr, Mn and Hg) in all water samples were determined by Atomic Absorption Spectrometer. Some microorganism were determined by Standard Plate Account and Most Probable Number method. The values of temperature, turbidity, total alkalinity, total hardness, TDS, TSS, conductivity, total phosphate, total nitrate, chloride, sulphate, COD and BOD of collected water samples were found to be lower than the EPA standard values. The trace elements of all water samples were found to be lower than EPA standard values. All water samples were not polluted but it can be used for cooking, bathing and other activities. However, It is safe for drinking purpose only after suitable treatment of water.

Keywords: Tube well water, reservoir, physicochemical properties, trace metals

Introduction

Water is vital for all known forms of life. All living organisms on the earth need water for their survival and growth. On a normal, a person expends around two litres of water each day. Water plays an important role in the world economy. Fresh water bodies is a major source of food for many parts of the world. Large quantities of water, ice and steam are used for cooling and heating in industry and homes. Water is also central to many sports and

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other forms of entertainment such as swimming. Water is essential for proper circulation in the body (Santosh, 2005).

The rapid growth in human population, industrial development, urbanization, intensifying land use and aquaculture and agriculture in coastal areas globally has led to increased stress on the natural environment from numerous sources. The tube well is a type of water well in which a long, 100-200 mm wide, stainless steel tube or pipe is bored into an underground acquired. A reservoir is a lake that is used for storing water before it is supplied to people (Prabhata, 2008). Primary pH standard values are determined using a concentration cell by measuring the potential difference between a hydrogen electrode and a standard electrode (Olivares, 2000). The pH of aqueous solutions can be measured with a glass electrode and a pH meter. Drinking Water Quality suggest that the pH of drinking water should be between 6.5 and 8.5. In drinking water, the higher the turbidity level, the higher the risk that people may develop disease. High turbidity levels can also affect the ability of fish gills to absorb dissolved oxygen (Anastasiou, 2010).

The temperature of surface waters is influenced by latitude, season, time of day, air circulation, cloud cover and the flow and depth of the water body. In turn temperature affects physical, chemical and biological processes in water bodies. As water temperature increases, Increased temperature also decreases the solubility of gases in water. As temperature has an influence on so many other aquatic variables and processes (Robert, 2011). Alkalinity not only helps regulate the pH of a water body, but also the metal content. Alkalinity is often related to hardness, water with less hardness indicates low alkalinity. Total alkalinity is defined as the amount of acid required to lower the pH of the sample. As hardness increases, more soap is needed to achieve the same level of cleaning due to the interactions of the hardness ions with the soap. Hardness is usually divided into two categories: carbonate hardness and non-carbonate hardness. Total hardness equals the sum of carbonate and non-carbonate hardness (Palanna, 2011). Chloride is a highly important, vital mineral required for both human and animal life. Without chloride, the human body would be unable to maintain fluids in blood vessels conduct nerve transmissions, move muscles or maintain proper kidney function. Replacement of chloride is essential on a daily basis to maintain regular metabolic function (Stinder, 2015). Nutrients such as phosphorous and

nitrogen are essential for the growth of algae and other plants. In aquatic ecosystems, because phosphorous is available in the lowest amount, it is usually the limiting nutrients for plant growth. This means that excessive amounts of phosphorous in a system can lead to an abundant supply of vegetation and cause low dissolved oxygen. The forms of nitrogen found in surface water are nitrate, nitrite and ammonia (Smith, 2003). Lead pollution in drinking water can cause brain damage especially to young children. Symptoms may be different in adults and children; the main symptoms in adults are headache, male reproductive problems and weakness. Cadmium is certainly a dangerous water pollutant which consists of a major water quality problem. Cadmium can be taken in to the body by eating food, drinking, breathing air or smoking a cigarette. The effects of acute cadmium poisoning are very bad. Among them are high blood pressure, kidney damage, destruction of testicular tissue and destruction of red blood cells (Arias and Barral, 2001). The aquatic environment can be disturbed directly or indirectly by both organic and inorganic pollutants, as pollutants often enter into river systems and are ultimately transported to the environment. Contamination of water resources available for household and drinking purposes with heavy elements, metals ions and harmful microorganisms is one of the serious major health problems (Deborah, 1996). Calcium is largely responsible for water hardness and may negatively influence toxicity of other compounds. Water hardness influences aquatic organisms concerning metal toxicity. Various calcium compounds may be toxic. Calcium carbonate interacts with detergents and cleansing agents. Magnesium occurs in many organometallic compounds and in organic matter, since it is an essential element for living organisms. Magnesium is a relatively abundant element in the earth's crust and hence a common constituent of natural water (Frank, 1988). Coliform bacteria are present in the environment and feces of all warm-blooded animals and humans. Coliform bacteria are unlikely to cause illness. *E. coli* is the name of a type of bacteria that lives in your intestines and in the intestines of animals (Ndamitso, 2013).

Aim

To assess the water quality for, washing, bathing, cooking and other purpose of tube well water and reservoir from Thanlyin Technological University Campus

Materials and Methods

(a) Collection of samples

In this research work, water samples are collected from two different points from Thanlyin Technology of University Campus, in the months of July and December in 2016. The collected water samples were tube well water from Information Technology (IT) hall as sample (S1), tube well water in the Campus and reservoir as sample (S2). The water samples were collected by mean of a polyethylene bottle for physical and chemical determinations. The samples were stored in analytical laboratory, chemistry department at university of yangon and temperature was maintained at 25 ºC.

(b) Sample handling

The sampling bottles and stoppers were carefully cleaned prior to each experimental run. The sampling bottles had been washed with a detergent and rinsed with water, 1:1 nitric acid solution and distilled water. The data of water analysis is mainly dependent on correct sampling.

(a) Tube well water, (S1) (b) Reservoir, (S2)

Figure 1: Photographs of water samples two different sampling sites from TTU Campus

Determination of some physicochemical parameters of water

Some physicochemical properties such as temperature, turbidity, pH, total dissolved solids, total suspended solids, conductivity, total alkalinity, total hardness, some dissolved gases (DO), chloride, sulphate, phosphate, nitrite nitrogen, ammonium nitrogen and trace elements were analyzed.

Determination of temperature

The temperature of water samples were determined by using thermometer (G pharm PTE Ltd (Singapore) CE 0197).

Determination of turbidity

The turbidity of water samples were determined by using turbidity meter (Model- HI 88703, Hanna instrument for turbidity).

Determination of pH

Beaker (250 mL) and a pH meter (Senso Direct 150, Lovibond. Ltd., Germany) were used. Water samples were obtained from Thanlyin Technological University Campus. The pH of water samples was measured with by using a pH meter after adjusting with 4.0 and 7.0 buffer solutions.

Determination of total suspended solids

100 mL of water sample was filtered and the residue was weighed. The filter with residue was put into an oven and dried for 2 hours can be dry at 35 °C. After this, it was weighed.

Determination of total alkalinity by titrimetric method

The total alkalinity of water samples were determined by using titrimetric method.

(a)Preparation of solutions

0.01 M Sulphuric acid solution

Approximately 1 M sulphuric acid stock solution was prepared by adding slowly 5.5 mL of acid to 15 mL of distilled water and the volume make up to 100 mL in a volumetric flask. The resulting solution (1 mL) was added to distilled water and the volume made up to 100 mL in a volumetric

flask. A 10 mL solution of 0.01 M sodium carbonate solution (0.105 g dissolved in distilled water and the volume made up to 100 mL in a volumetric flask) was pipetted into a 200 mL conical flask and 1 drop of methyl orange was added. The solution was titrated with the above approximately 0.01 M sulphuric acid solution using a 50 mL burette. From the titrant volume, the concentration of sulphuric acid solution was found to be 0.0105 M.

Phenolphthalein indicator solution

Phenolphthalein (0.2505 g) was dissolved in 25 mL of 95 % ethanol in a volumetric flask.

Methyl orange indicator solution

Methyl orange (0.05 g) was dissolved in distilled water and the volume made up to 100 mL in a volumetric flask.

(b)Procedure

A 100 mL of water sample was pipetted into a conical flask and 2 drops of phenolphthalein indicator were added. This solution was titrated with 0.01 M sulphuric acid solution. The end point was reached when the solution just turned colourless from red purple. This titration was noted as p = 0 mL of titrant volume used for phenolphthalein indicator. And then 2 drops of methyl orange were added and the titration was continued until the colour turned from yellow to orange. The total volume of titrant was noted and used for both titrations.

Determination of total dissolved solids

TDS of the water samples were determined by TDS meter (Senso Direct 150, Lovibond. Ltd., Germany) were used.

Determination of chlorinity

Chlorinity of the water samples were determined by Mohr's modified method.

Determination of nitrite-nitrogen

The nitrite-nitrogen was determined by the colorimetric method using a spectrophotometer (Model-UV 240, Shimadzu) at a wavelength of 530 nm.

Determination of ammonia-nitrogen

The ammonia-nitrogen was determined by the UV-spectrophotometric method using a spectrophotometer (Model-UV 240, Shimadzu) at a wavelength of 640 nm.

Determination of total phosphate

The amount of total phosphate in water sample was determined by the colorimetric, molybdenum blue method.

Determination of biochemical oxygen demand

BOD was measured by incubating the sample at 20 °C for five days.

(a) Preparation of solutions (Phosphate buffer solution, pH=7.2)

Potassium hydrogen phosphate (0.8486 g), 2.175 g of potassium hydrogen phosphate and 0.1712 g of ammonium chloride were dissolved in 80 mL of distilled water and the volume made up to 100 mL. This solution was adjusted to pH 7.2 with approximately 0.1 M hydrochloric acid.

(a) Procedure

Water samples were filled into glass bottle so that bubbling did not occur and initially dissolved oxygen (DO) content was determined by DO meter. A 1 mL solution of 0.05 % urea and phosphate buffer solution were added to the bottles. The bottles were incubated at 20 ºC for 5 days. After incubation, the oxygen concentrating was measured again by DO meter. The 5 days biochemical oxygen demand was obtained from the difference between initial DO content and DO after 5 days incubation.

Determination of trace elements in water samples

Trace elements (Cd, Pb, Zn, Ca, Cu, Mg, Cr, Mn and Hg) in water samples were determined by using Perkin Elmer atomic absorption spectrophotometer.

Determination of some microbiological in water samples

Some microbiological such as coliform and *E. coli* in water samples were analyzed by using most probable number methods.

Results and Discussion

Sample Collection

The present study was carried out in the month of July and December in 2016. The water samples were collected from two different sites in Thanlyin Technological University Campus. There are sample (1) is IT hall tube well water, sample (2) is reservoir, sample of the collected water sampling sites.

Physicochemical Characteristics of Water

Physicochemical parameters such as temperature, turbidity, conductivity, pH, total dissolved solids, total suspended solids (TSS), total alkalinity, total hardness, total phosphate, nitrite nitrogen, ammonia-nitrogen, dissolved oxygen, biochemical oxygen demand, chemical oxygen demand, chloride, sulphate, trace elements were determined by using conventional methods and modern instrumental techniques. These results were compared with the EPA drinking water standards.

Temperature of water samples

Temperature in two different sites of water samples were found to observe < 30 °C in all samples. The temperatures of all water samples were found within the range of EPA standard value of 2013 (< 40 °C).

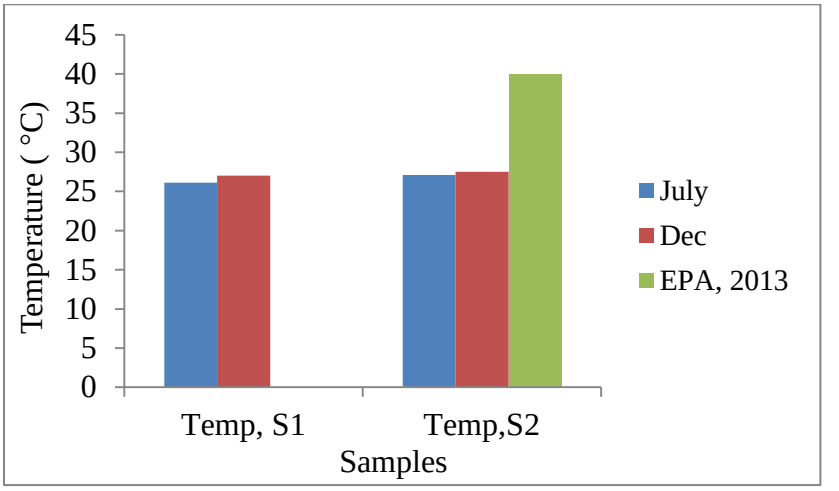

Figure 2: Observe values of temperature of water samples from two different sites (S1, S2) in TTU campus, 2016

Turbidity of water samples

The turbidity of all water samples were found to be five and less than five in all samples. These values of all water samples were found lower than the EPA standard value 2013 (< 5 NTU).

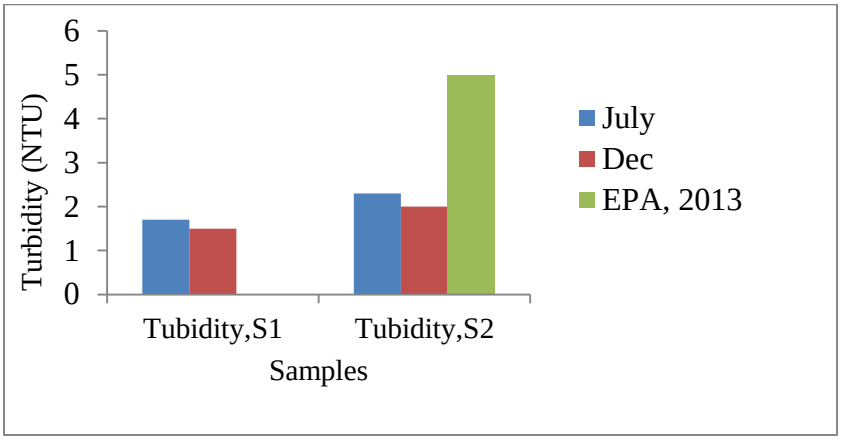

Figure 3: Observe values of turbidity of water samples from two different sites (S1, S2) in TTU campus, 2016

Total dissolved solids of water samples

The total dissolved solid values of two different sites (S1and S2) of water samples were found to be 96, 187, ppm in July and 16, 18, ppm in December respectively. TDS values of all samples were found within the acceptable range of EPA standard. The EPA standard value 2013 is 500 ppm.

Total suspended solids of water samples

These values of total suspended solids values of two different sites (S1and S2) of water samples were found to be 5.1, 15.1 ppm in July and 5.0, 10.0 ppm in December. It was found that TSS value of all collected water samples from two different sites were lower than the acceptable level of EPA guideline standard value 2013 (150 ppm).

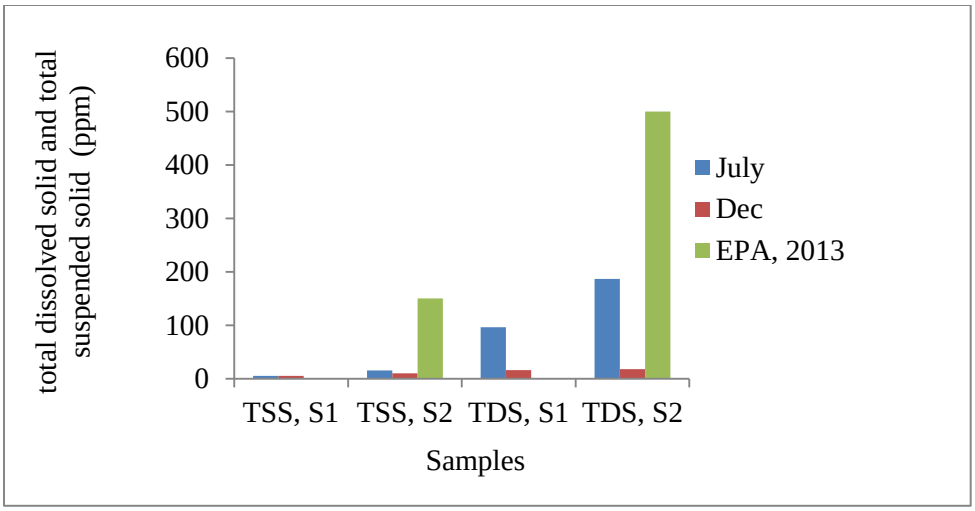

Figure 4: Observe values of total dissolved solid and total suspended solid of water samples from two different sites (S1,S2) in TTU campus, 2016

Total alkalinity of water samples

The total alkalinity values of two different sites (S1, S2) water samples were found to be 112, 100, ppm in July and 70, 50, ppm in December respectively. All of the water samples were lower than the EPA guideline standard 2013(200 ppm).

Total hardness of water samples

Total hardness values of values of two different sites (S1and S2) water samples were found to be 116, 106, ppm in July and 80, 56, ppm in December respectively. The total hardness values of all collected water samples were lower than the EPA standard values 2013 (300 ppm).

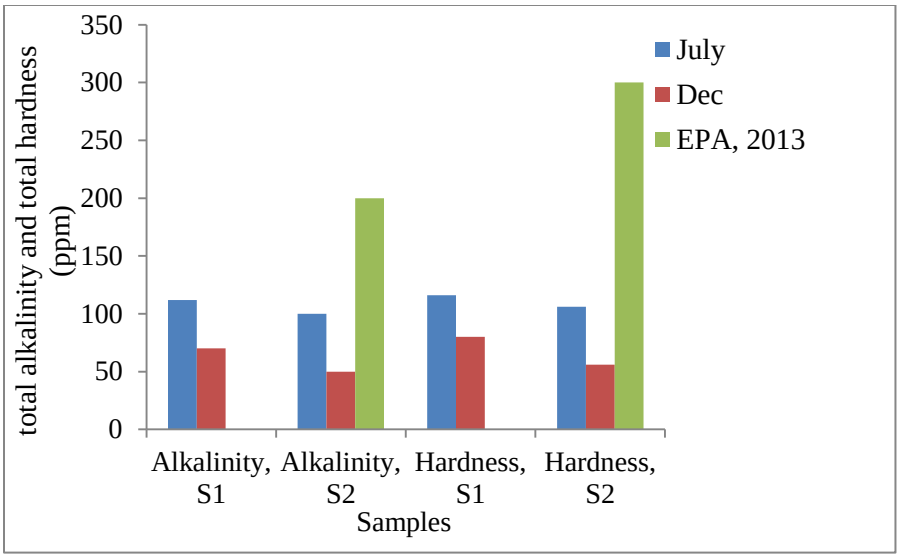

Figure 5: Observe values of total alkalinity and total hardness of water samples from two different sites (S1, S2) in TTU campus, 2016

Table 1: Nutrients of the Collected Water Samples from Two Different Sites (S1, S2) in TTU Campus, 2016

Samples	Nutrients (ppm)					
	PO_4-P		NO_2-N		NH_3-N	
	July	Dec	July	Dec	July	Dec
S1	0.05	0.02	0.06	0.04	0.03	0.02
S2	0.06	0.04	0.05	0.02	0.10	0.06
EPA Standard 2013	< 0.12		0.08		0.10	

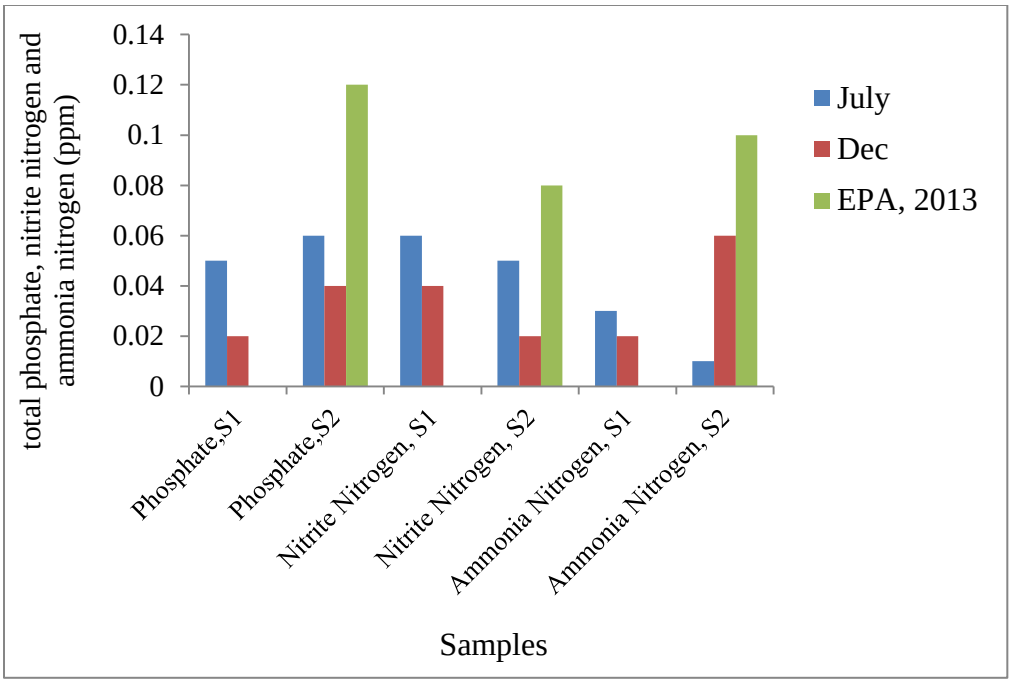

Figure 6: Observe values of total phosphate, nitrite nitrogen and ammonia nitrogen of water samples from two different sites (S1, S2) in TTU campus, 2016

Dissolved Oxygen Gases of Water Samples

Dissolved gases of DO, BOD and COD values of collected water samples. The observed DO values of all water samples were found in acceptable level of the EPA standard range in December. When temperature decreases, more oxygen dissolves in water. The values of COD in the collected water samples are observed to be lower than EPA standard value. Biochemical oxygen demand in water samples were determined by incubation method. BOD is a measure of the combined biological and chemical demand on dissolved oxygen in a system.

Table 2: Dissolved Gases of the Collected Water Samples from Two Different Sites (S1, S2) in TTU Campus, 2016

Samples	Dissolved gases (ppm)					
	DO		BOD		COD	
	July	Dec	July	Dec	July	Dec
S1	5.1	4.7	1.5	1.5	5.5	5.5
S2	5.5	4.9	1.5	1.0	6.1	6.5
EPA Standard 2013	5.0		< 5.0		< 7.5	

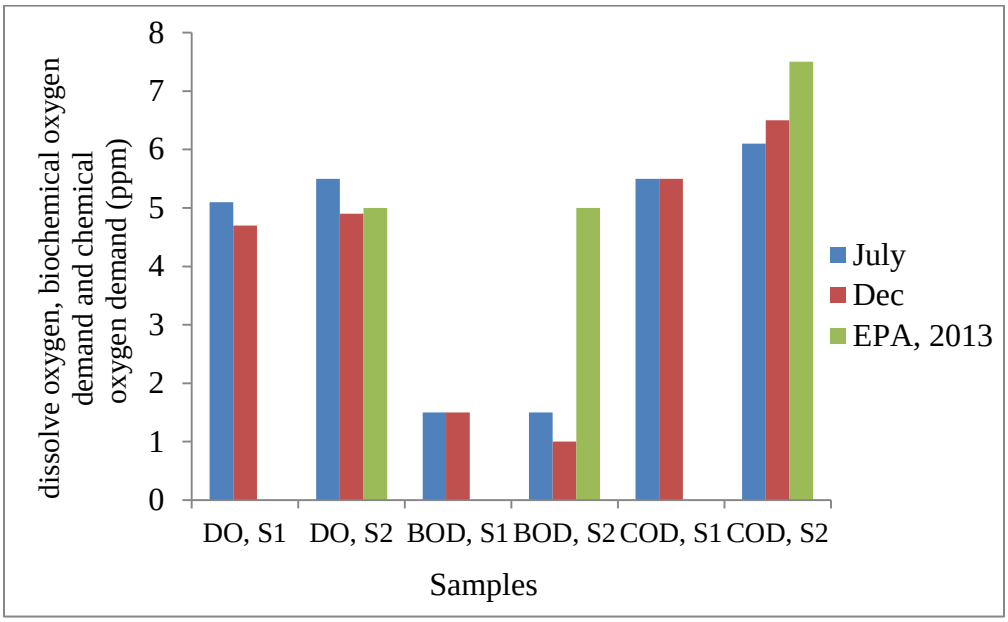

Figure 6: Observe values of dissolve oxygen, biochemical oxygen demand and chemical oxygen demand of water samples from two different sites (S1, S2) in TTU campus, 2016

Trace Elements of Water Samples

According to the AAS results, the trace elements (Cd, Pb, Zn, Ca, Cu, Mg, Cr, Mn and Hg) of the collected water samples from two different sites were lower than the EPA guideline standard values.

Table 3: Comparisons of Trace Elements Contents of Water Samples from Two Different Sites (S1, S2) in TTU Campus, 2016

Elements (ppm)	S1 (Tube Well Water)		S2 (Reservoir)		EPA standard 2013
	July	Dec	July	Dec	
Ca	1.32	2.76	2.60	3.67	75.00
Mg	9.50	8.94	8.05	8.93	50.00
Zn	0.05	0.04	0.04	0.01	5.00
Cu	ND	ND	ND	ND	1.00
Pb	ND	ND	ND	ND	0.05
Hg	ND	ND	ND	ND	0.002
Cd	ND	0.002	ND	0.003	0.005
Cr	0.004	ND	0.001	ND	0.100
Mn	0.002	ND	0.001	ND	0.050

ND= not detected

Some Microbiological of Water Samples

Total coliform

The coliform of all water samples from two different sites (S1, S2) were found 3, 3 in July and 0, 3, (M.P.N) in December. The values of coliform found in all water samples were not agree with WHO standard 2008. High coliform can be removed by chlorination, UV irradiation and distillation.

E.coli

The *E.coli* of all water samples from two different sites (S1 and S2) were found to be *E-coli* positive in July. The samples (S1, S2) were found to be *E-coli* negative in December. The *E.coli* of all water samples were negative with WHO standard 2008.

Table 4: Some Microbiological of Collected Water Samples from Two Different Sites (S1, S2) in TTU Campus, 2016

Samples	Total coliform (M.P.N)		*E.coli*	
	July	Dec;	July	Dec;
S1	3	0	+	-
S2	3	3	+	-
WHO Standard 2008	None		Negative	

- Most Probable Number (M.P.N)
- Negative (-), Positive (+)

Conclusion

In Thanlyin Technological University Campus, so many tube well exist in this area. Almost people use tube well water for cooking, bathing etc. Therefore, quality of drinking water is necessary to check regularly at time interval. The observed values of temperature, turbidity, conductivity, total suspended solids, total dissolved solids, total alkalinity, total hardness, total phosphate, nitrite nitrogen, ammonia nitrogen, biochemical oxygen demand, chemical oxygen demand, chloride and sulphate in the collected water samples were found to be within the acceptable levels of EPA guideline standard value for 2013. According to the AAS results, the trace elements of Cd, Pb, Zn, Ca, Cu, Mg, Cr, Mn and Hg in collected water samples from two sampling sites were found to be lower than the EPA guideline standard value for 2013. The presence of Cr and Mn was not detected in all water samples in December while Cd was not detected in all water samples in July. The contents of Cu and Pb were not determined in all water samples in July and December. The coliform of all water samples from two different sites (S1, S2) were found 3, 3 in July and 0, 3, (M.P.N) in December. The *E.coli* of all water samples from two different sites (S1 and S2) were found to be *E-coli* positive in July. The samples (S1, S2) were found to be *E-coli* negative in December. The *E.coli* of all water samples were negative with WHO standard 2008. All water samples are not polluted but it can be used for washing, bathing, cooking and other activities. However, to safe for drinking water

purpose, it must be taking a suitable treatment of water. High concentration of mineral can be removed by chlorination, UV irradiation and distillation methods. Most of the people are using water sample for cooking, washing and bathing but also reservoir is algae greater than tube well water. Therefore, reservoir is cleaned regularly a time per month.

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