

Determination of the Quality of Water from Naung-Taung Pond, Laikha Township

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Abstract

In this research work, the determination of the quality of natural water sample from Naung-Taung pond, Laikha Township, Shan State was done. Physicochemical parameters of natural water sample such as pH, colour, turbidity, conductivity, total dissolved solids, total suspended solids, total alkalinity, and the content of calcium, magnesium, chloride, iron, manganese, nitrogen-nitrate and sulphate were conducted by conventional methods. Moreover, microbiological examination such as Coli- form and E- Coli were made by Multiple tubes method. As water is essential for daily- life, it must be pure and free from toxic substances, heavy metals and pathogenic bacteria. Therefore, determination of the content of toxic heavy metals of water from Naung-Taung pond, Laikha Township was done by using AAS. The results obtained were compared with the standard values of WHO. From the observed datas, the water sample from Naung-Taung pond is suitable for domestic uses but not suitable for drinking.

Key words : Natural water sample, Conventional method, Multiple tubes method, Pathogenic bacteria, AAS.

Introduction

Water is the most abundant and the most important liquid on earth. It is the only substance found on and around the earth in the solid, liquid and gaseous states. Although water is colorless, transparent, tasteless and odorless, as well as being common place, it is not an ordinary substance; it has remarkable and important physical and chemical properties.

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. Water is also used in increasing quantities for many purposes such as for domestic use, for industrial purposes, for the irrigation of crops and for the production of power.

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 for cooling or recreation is almost totally reusable. Even water for cleaning domestic and industrial wastes are reusable with proper treatment.

The important source of natural water are rain water, stream and river water, tube-well water, lake and pond water and sea water. These different sources of natural water may be classified into three types;

- (1) Primary source is rain water.
- (2) Secondary source is the water of lakes, rivers, ponds and wells and tube- wells.
- (3) Tertiary source is sea water.

Most of water on earth's, 97% to be exact, is salt water found in the oceans. Only about 3% of earth's water is fresh. 2% of the earth's water is in solid form, found in ice caps and glaciers. The fresh water in ice caps is not available for use by people or plants. That leaves about 1% of all the earth's water in a form useable to humans and land animals. This fresh water can be found in lakes, rivers, streams, ponds and tube-well in the ground.

Drinking water should be clear, bright, colorless, adequately aerated and with no objectionable taste, odor, suspended matter or turbidity and it also should have a reasonable

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temperature. Such water is termed “potable” meaning that it may be consumed in any desired amount without concerning for adverse effects on health (Rodier 1975).

In order to find out whether given water sample is pure, wholesome and suitable for domestic use or not, physical examination, chemical examination and bacteriological examination should be made. When a water supply is intended for a drinking water, it should be pleasant to drink and free from harmful organisms and should not contain excessive amounts of certain chemical substances.

The aim of this research work is to assess the quality of water in Naung- Taung pond in which the edible algae are grown well and the resident use this water as drinking water. They can earn a lot of money by selling the edible algae from this pond. In doing so, the quality of water can be preserved and the economy of the resident can be improved.



Fig(1)Naung- Taung pond in Laikha Township



Fig(.2) The Drinking Water Well in Naung- Taung pond

Materials and Methods

Collection and Preservation of Samples

In the present work , the two water samples were collected; one from drinking well near Naung-Taung pond and the other from the middle of Naung-Taung pond.The water sample from drinking well is named as sample (1) and the water from the middle of Naung-Taung pond is labeled as sample (2).

Preservation

Samples were collected in a plastic bottle of 1L from Naung -Taung pond, Laikha Township. Then each sample was divided into three portions. The first portion was used for analysis of physical properties and the presence of inorganic, non-metal constituents of water. The appropriate method of preservation was carried out for each parameter.

The second portion was used for the examination of dissolved metal ions. The third portion was intended for the toxic metals examination. For this purpose samples were analyzed at the water laboratory of Mandalay City Development Committee.

Estimation of pH value

Method : Direct measurement by pH meter

Principle

The basic principle of electrometric pH is the determination of the activity of the hydrogen ions by potentiometric measurement using a glass electrode and a reference electrode.

Apparatus

- (1) pH meter
- (2) Beakers
- (3) Stirrer

Procedure

Electrodes were rinsed with distilled water and dried by gently blotting with a soft tissue. The instrument was standardized with electrode immersed in a buffer solution of pH 7. Then the pH of sample was measured by dipping electrodes after cleaning into well stirred sample for 1 minute.

Estimation of Color (Apparent)

Method : APHA Platinum Cobalt Standard Method

Principle

Color is determined by comparison of the sample with known concentration of colored solutions. It is the standard method, the unit of color being that produced by 1 mg platinum per liter in the form of the chloroplatinate ion. The color of water is extremely pH dependent and invariably increases as the pH of the water is raised.

Apparatus

Hach spectrophotometer, DREL/5

Procedure

25ml sample was placed in the sample cell and the color was determined at 455nm against 25ml demineralized water blank.

Estimation of Conductivity

Method : Direct Measurement Method

Principle

The reciprocal of resistance is conductance. It measures the ability to conduct a current and expressed in reciprocal ohms or mhos. Specific resistance is the resistance of a tube 1 cm on an edge. Platinum electrodes measure a given fraction of the specific resistance, the fraction being the cell constant, C.

$$C = \frac{\text{Measured resistance, } R_m}{\text{Specific resistance, } R_s}$$

When the cell constant is known and applied, the measured conductance is converted to the specific conductance or conductivity, K_s , the reciprocal of the specific resistance.

$$K_S = \frac{1}{R_s} = \frac{c}{R_m}$$

Apparatus

Hach Conductivity Meter(range -0 to 20,000 μ mhos/cm).

Procedure

The conductivity of the sample was directly determined by the conductivity meter.

Estimation of Turbidity

Method : Absorptiometric Method

Principle

This method is based on a comparison of the intensity of light scattered by the sample under defined conditions with intensity of light scattered by a standard reference suspension under the same condition. The higher the intensity of scattered light, the higher the turbidity. Formazin polymer is used as the reference suspension. The turbidity of a specified concentration of formazin suspension is defined as 40 nephelometric unit (NTU). This suspension has an approximate turbidity of 40 Jackson unit (JTU) when measured on the candle turbidimeter.

Apparatus

Hach spectrophotometer, DREL / 5.

Procedure

The turbidity of 25ml sample was directly measured at 450nm against colorless distilled water blank.

Estimation of Total Dissolved Solids

Principle

A known volume of water is evaporated to dryness and the quantity of the soluble salts present is estimated gravimetrically.

Apparatus

- (1) Porcelain dish, (2) 100 ml pipette
- (3) Water bath, (4) Desiccator

Procedure

1. Take 100 ml of water into a pre-weighed clean, dry porcelain dish.
2. Evaporate the water in the basin to dryness over a water bath.
3. Clean the outside of the dish, dry it in an air oven at 105 C for an hour to remove moisture, cool and weigh.
4. The difference between the weights is the weight of total soluble salts.
Express the results in mg/L

Calculation

- Volume of the water taken = 100 ml
- Weight of empty dish = A grams
- Weight of dish + residue = B grams

$$\begin{aligned} \text{Weight of total dissolved} \\ \text{solids in 100 ml sample} &= (B-A)\text{gram} \\ \text{Total Dissolved Solids (mg/L)} &= \frac{(B-A)}{100} \times 10^6 \end{aligned}$$

Determination of Metal

Estimation of Calcium

Method : EDTA Titrimetric Method

Principle

When EDTA (ethylenediaminetetra acetic acid or its salt) is added to water containing both calcium and magnesium, it combines first with calcium. Calcium can be determined directly with EDTA, when the pH is made sufficiently high so that the magnesium is largely precipitated as the hydroxide and an indicator is used that combines with calcium only. Several indicators such as murexid. Eriochrome Blue Black R give a color change when all of the calcium has been complexed by the EDTA at a pH of 12 to 13.

Apparatus

- (1) Burette
- (2) Pipettes and
- (3) Conical flasks

Reagents

- (a) Sodium hydroxide solution, 1 N
- (b) Solid indicator mixture; 100g NaCl and 0.2 g murexide were ground to 40 to 50 mech.
- (c) EDTA titrant 0.01M(3.723g dry sodium ethylenediamine tetra-acetate dihydrate per 1 L distilled water).

Procedure

25 ml sample was mixed with 25ml distilled water. 50ml of distilled was taken as color comparison. 2 ml of NaOH solution and 0.2g of murexide indicator were added to the sample and blank. 2 or 3 drops of EDTA titrant were added to the blank to procedure an unchanging color.

Calculation

$$\text{mgCa / L} = \frac{(A \times B) \times 400.8}{\text{ml sample}}$$

(or)

$$\text{Cahardness asmgCaCO}_3 / \text{L} = \frac{(A \times B) \times 1000}{\text{ml sample}}$$

Were;

A = ml titrant for sample and

B = mg CaCO₃ equivalent to 100ml and titrant at the calcium indicator and point

Estimaion of Total Hardness

Method : EDTA Titrimetric method

Principle

EDTA can form a soluble chelated complex with certain metal ions. When a small amount of dye such as Eriochrome Black T or Calmagit added to an aqueous solution containing Ca and Mg ions at a pH of 10.0 ± 0.1, the solution becomes wine red. If EDTA titant is added, Ca and Mg will be complexed. When all of the Ca and Mg ions has been complexed

the solution turns wine red to blue. Mg^{2+} ions must be present to yield a satisfactory end point. So, a small amount of complexometrically neutral magnesium salt of EDTA is added to the buffer solution.

Apparatus

- (1) Burette
- (2) Pipette
- (3) Conical flasks

Reagents

- (a) Buffer solution : Dissolve 16.9g of NH_4Cl in 143ml conc; NH_4OH . Dissolve 1.179g of EDTA and 0.78g of $MgSO_4 \cdot 7H_2O$ or 0.644g of $MgCl_2 \cdot 6H_2O$ in 50ml distilled water. Mix these two solutions and diluted to 250ml with distilled water.
- (b) Solid indicator mixture 0.5g Eriochrome Black T dye and 100g NaCl were grounded.
- (c) EDTA titrant, 0.01M (3.732g drydisodium ethylene diamine tetra-acetate dihydrate per 1 L distilled water)

Procedure

25ml sample was diluted to 50 ml with distilled water, 2ml of buffer solution was added to the sample to obtain a pH of 10.0 to 10.1. After adding 1 to 2 drops of EBT indicator, the sample was slowly titrated by EDTA titrant with continuous stirring until the color turns reddish tinge to bright blue.

(50ml of distilled water was also treated as the sample and used as color comparison blank)

Calculation

$$\text{Hardness (EDTA) as mg CaCO}_3/\text{L} = \frac{A \times B \times 1000}{ml \text{ sample}}$$

(or)

$$\text{Ca as mg/L} = \frac{A \times B \times 400.8}{ml \text{ sample}}$$

Where; A = ml titrant for sample
B = mg $CaCO_3$ equivalent to 1.00ml EDTA titrant

Estimation of Magnesium

Method : Calculation Method

Magnesium can be calculated by the following formula $mg \text{ Mg/L} = \{ \text{Total hardness as } CaCO_3/\text{L} - \text{Ca hardness as } CaCO_3/\text{L} \} \times 0.244$.

Estimation of Iron and Manganese

Method: Atomic Absorption Spectrophotometric Method

Apparatus

Atomic Absorption Spectrophotometer

Determination

The samples were sent to the Mandalay City Development Committee Water and Sanitation Department Water Laboratory and the content of iron and manganese were determined by the Atomic Absorption Spectrophotometer.

Determination of Inorganic Non-metallic Constituents

Estimation of Alkalinity

Method : Titrimetric Method

Principle

Alkalinity of water is primarily a function of carbonate, bicarbonate and hydroxide content. Hydroxyl ions present in a sample as a result of dissociation or hydrolysis of solute react with standard acid added. All hydroxide alkalinity are neutralized at pH of about 8.3 and all the carbonate and bicarbonate are neutralized at about pH 4.

The volume of H_2SO_4 used to reach the end point in phenolphthalein titration is recorded as "P". Titration is continued using methyl orange indicator and the total volume from the beginning of the phenolphthalein titration gives the total alkalinity (T).

Apparatus

- (1) Burette
- (2) Pipette
- (3) Conical flask

Reagents

- (1) Standard Sulphuric Acid 0.02 N
- (2) Methyl Orange Indicator
- (3) Phenolphthalein Indicator

Procedure

25 ml sample was titrated with standard H_2SO_4 using phenolphthalein indicator until the color changed from pink to colorless. Then 2 drops of methyl orange indicator were added and the titration was continued until the color turned a faint red orange.

Calculation

$$\text{Phenolphthalein Alkalinity (P) as mg CaCO}_3/\text{L} = \frac{A \times N \times 50000}{ml \text{ sample}}$$
$$\text{Total Alkalinity (T) as mg CaCO}_3/\text{L} = \frac{B \times N \times 50000}{ml \text{ sample}}$$

A = ml standard acid used in phenolphthalein titration
B = Total ml titration used in both titration
N = normality of standard acid

Estimation of Chloride

Method: Argentometric Method

Principle

In a neutral or slightly alkaline solution potassium chromate can indicate the end point of the silver nitrate titration of chloride. Silver chloride is precipitated quantitatively before red silver chromate is formed.

Apparatus

- (a) Pipette
- (b) Burette
- (c) Conical flasks

Reagents

- (a) Potassium chromate indicator; 50g K_2CrO_4 was dissolved in a little water and $AgNO_3$ titrant was added until a definite red precipitate was formed. The solution was allowed to stand for 12 hours, filtered and diluted to 1L.
- (b) Standard silver nitrate titrant, 0.0141N. 2.395g $AgNO_3$ in 1L distilled water. $AgNO_3$ titrant was standardized against 0.0141N NaCl solution.

Procedure

10ml of sample was mixed with 90ml of distilled water. 1ml of K_2CrO_4 indicators solution was added and titrated with standard $AgNO_3$ solution to a pinkish yellow end points 100ml of distilled water was treated as above and used as color comparison blank.

Calculation

$$\text{mgCl/L} = \frac{(A-B) \times N \times 50000}{ml \text{ sample}}$$

Where;

A = ml titrant for sample

B = ml titrant for blank

N = normality of $AgNO_3$ solution

$\text{mgNaCl/L} = (\text{mg Cl/L}) * 1.65$

Estimation of Sulphate

Method : Gravimetric Method

Principle

Sulphate is precipitated in hydrochloric acid as barium sulphate by the addition of barium chloride. The precipitation is carried out near the boiling temperature, and after a period of digestion the precipitate is filtered, washed, ignited or dried, and weighed as $BaSO_4$.

Apparatus

- (1) Steam bath
- (2) Drying Oven
- (3) Analytical balance
- (4) Filter
- (5) Desiccators
- (6) Muffle-Furnace

Reagents

- (1) Hydrochloric acid, HCl 1:1
- (2) Barium Chloride Solution: 100g $BaCl_2 \cdot 2H_2O$ was dissolved in 1L distilled water and filtered through a membrane filter.
- (3) Silver nitrate-nitric acid reagent 8.5g $AgNO_3$, 0.5ml conc: HNO_3 were dissolved in 500 ml distilled water.

Procedure

The pH of 150 ml sample was adjusted with HCl to 4.5 to 5.1 to 2ml HCl was added and heated to boiling. Warmed $BaCl_2$ solution was added with stirring until precipitation appeared to be complete, then about 2ml in excess was added. A total of 5ml $BaCl_2$ solution was added whenever the amount of precipitate was small. The precipitate was digested to 80 C to 90C overnight. The precipitate was filtered and washed with warmed distilled water until

washing were free of chloride as indicated by testing with $\text{AgNO}_3 \cdot \text{HNO}_3$ reagent. The filter with precipitate was dried, ignited at 800 C for 1 hour, cooled in desiccators, and weighed.

Calculation

$$\text{mg SO}_4/\text{L} = \frac{\text{mg BaSO}_4 \times 411.5}{\text{ml sample}}$$

Estimation of Nitrogen- Nitrate

Method: Phenol Disulphonic Acid Method.

Principle

The yellow colour produced by the reaction between nitrate and phenol disulphonic acid obeys Beer's Law up to at least 12mg/L at 480 nm wavelength using 1cm light path. At 410 nm the point of maximum absorption determination may be made up to 2mg/L with 1cm light path.

Apparatus

(1) Nessler tubes

Reagents

- Phenol disulphonic acid : 25 g pure white phenol was dissolved in 50ml conc: H_2SO_4 , 75 ml fuming H_2SO_4 was added, stirred, and heated for two hours on a hot water bath.
- Potassium hydroxide 12 N.
- Stock nitrate solution: 1.180 g anhydrous KNO_3 was dissolved and diluted to 250ml in distilled water. (1.00ml=100 $\mu\text{g NO}_3^- - \text{N}$)
- Standard nitrate solution: 50 ml stock solution was evaporated to dryness and dissolved in 2ml phenol disulphonic acid and diluted to 500ml. (1ml=10 $\mu\text{NO}_3^- - \text{N}$)
- Sulphuric acid, 1N.
- Potassium permanganate solution, 0.1N.

Procedure

After 1ml H_2SO_4 had been added to 20 ml sample. KMnO_4 solution was dropped to the sample until a faint pink colour persists for 15 minutes. The sample was neutralized to attain a pH of about 7 and evaporated to dryness. After evaporating, the residue was extracted with 2ml phenol disulphonic acid by heating on the water bath and diluted with 20ml distilled water. Then, 8ml KOH was added and stirred until maximum colour was developed. The solution was filtered and diluted to 50 ml. Colour measurement is made by spectrophotometer.

For a photometric measurement, maximum absorption was at a wavelength of 410 nm. Calibration curve was drawn using standard nitrate solutions of 0.5, 1.0, 1.5, 2.0, 2.5, 3.0, 3.5 ml with the same the reagents. Readings were made against a blank prepared from the same volumes of phenol disulphonic acid reagent and NH_4OH or KOH was used for the sample.

Determination of Toxic Metals (Cd, Pb, Hg, Cu)

Method : Atomic Absorption Spectrophotometric Method

Apparatus

Atomic Absorption Spectrophotometer

Estimation of Dissolved Oxygen

Method : Winkler's Method.

Principle

The test is based on the addition of divalent manganese solution, followed by strong alkali, to the sample in a glass-stoppered bottle. Dissolved oxygen rapidly oxidizes an equivalent amount of the dispersed divalent manganous hydroxide precipitate to hydroxides of higher valency states. In the presence of iodide ions and acidification, the oxidized manganese reverts to the original DO content. The iodine is then titrated with a standard solution of thiosulphate. The titration end point can be detected visually with a starch indicator.

Reagents

- (a) Conc:sulphuric acid
- (b) 0.125 N KMnO_4 solution
3.94g KMnO_4 is dissolved in 1 L of distilled water.
- (c) Potassium oxalate solution
20 g of $\text{K}_2\text{C}_2\text{O}_4 \cdot \text{H}_2\text{O}$ is dissolved in 1 L of distilled water.
- (d) Manganous chloride solution 33g of $\text{MnCl}_2 \cdot 4\text{H}_2\text{O}$ is dissolved in 1 L of distilled water.
- (e) Mixed solution 70g of KOH and 10g of KI are dissolved in 100 ml of distilled water.
- (f) Hydrochloric acid, conc;
It is free from chlorine.
- (g) 0.05 N sodium thiosulphate solution
6.25 g of $\text{Na}_2\text{S}_2\text{O}_3 \cdot 5\text{H}_2\text{O}$ is dissolved in 500 ml of distilled water.

Procedure

Well-stoppered, narrow-mouth bottle was filled with 350 ml of the sample of water, carefully avoiding any unnecessary exposure of the water to the air. To this 0.9 ml of conc: H_2SO_4 and 1 ml of KMnO_4 solution were added to have the water slightly pink in colour. The liquids were mixed by repeatedly inverting the stoppered-bottle and allowed to stand for 10 minutes. The object of this procedure is to oxidize any nitrite present to nitrate. Then any excess of permanganate was destroyed by adding about 1 ml of the oxalate solution. The bottle in all these and subsequent operation was opened and re-stoppered as quickly as possible and the reagents were introduced to the bottom of the bottle by pipettes.

When the liquid had become decolourised, exactly 1 ml of the manganese chloride solution was added to the bottom of the bottle from a pipette and 3 ml of the mixed KOH and KI solution was added immediately. The bottle, which was full of liquid, was stoppered and taken care that no air bubbles formed in the bottle. Then, inverting the vessel several times mixed the liquids. The manganous hydroxide precipitate which forms will be more or less discoloured according to the amount of oxygen dissolved in the water.

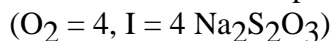
The bottle was allowed to stand, shielded from light, for about fifteen minutes. When the precipitate had completely settled, approximately the 100 ml of the clear liquor was removed with a pipette, without disturbing the precipitates and 5 ml of conc: HCl was added to dissolved the precipitate. The liquid was then coloured with free iodine and titrated with the standard sodium thiosulphate solution in the bottle.

Calculation

$$\text{DO}(\text{ppm}) = \frac{10^6 \times N \times S}{V}$$

N= the number of "ml" of thiosulphate used.

S = the concentration of thiosulphate expressed gram of equivalent oxygen per ml.



V = the volume of the bottle in "ml"

Estimation of Biochemical Oxygen Demand

Method : Iodometric Method

Reagents

- (a) Approximately 0.05% Urea Solution
0.05 g of Urea was dissolved in distilled water and the volume made up to 100 ml in a volumetric flask.
- (b) Phosphate Buffer Solution

Potassium hydrogen phosphate (0.8486 g). 2.1752 g of potassium dihydrogen 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 solution.

Procedure

Water sample was filled into glass bottle so that bubbling did not occur and the initially dissolved oxygen content was determined by Winkler's Method. After 1 ml solution of 0.05% urea and 1 ml of phosphate buffer solution had been added to the bottles, the bottles were incubated at 20°C for 5 days. After incubation, the oxygen concentration was measured by Winkler's Method. Finally, the 5 days biochemical oxygen demand was obtained from the difference between the initial DO content and DO after 5 days incubation.

Calculation

$$\text{BOD5 (mg/L)} = \frac{DO_I - DO_F}{V_S/V_B}$$

Where DO_I = initial dissolved oxygen (in mg/L)

DO_F = final dissolved oxygen (in mg/L)

V_S = volume (in ml) of water sample

V_B = volume (in ml) of the bottle

Estimation of Chemical Oxygen Demand

Method : Permanganate Method

Reagents

- Approximately 1.57% $KMnO_4$ Solution : 1.5713g of potassium permanganate was dissolved in 100 ml of distilled water in a brown glass bottle.
- Approximately 10 % KI Solution : 10 g of potassium iodide was dissolved in distilled water and the volume was made up to 100ml in a volumetric flask.
- 0.1 M sodium thiosulphate solution : 7.9112 g of $Na_2S_2O_3$ was dissolved in 500 ml of distilled water in a volumetric flask.
- 1 % Starch solution : Soluble starch (1g) was added to 100ml of boiled water and cooled until a clear solution was obtained.
- Approximately 0.2 M H_2SO_4 solution : H_2SO_4 1.11 ml (sp.gr. 1.84, 95% reagent grade from kanto) was added slowly to 100 ml of distilled water.

Apparatus

- 100 ml and 150 ml volumetric flasks
- 150 ml beaker
- 50 ml burette
- hot plate

Procedure

50 ml of water sample was placed in a 150 ml conical flask. 5 ml of $KMnO_4$ solution was added to the water sample and the flask was placed on the boiling water bath for 1 hr. Then the sample was cooled for 10 minutes 5 ml of KI solution was added. followed by 10 ml of H_2SO_4 solution. This solution was titrated with standard sodium thiosulphate solution until a pale yellow colour was obtained. 1 ml of starch solution was added to the above solution to

obtain a blue colour. The titration was continued until the blue colour disappeared completely. The whole of the above procedure was repeated for another two time. The blank determination using distilled water was carried out by the permanganate method.

Calculation

$$\text{COD} = \frac{(m_{\text{loftitrantforblank}}) - (m_{\text{titrantforsample}})}{m_{\text{loftitrantforsample}} \times m_{\text{lofsample}}} \times 100$$

Bacteriological Examination of Water

The routine tests generally used in bacteriological examination of water are

1. A quantitative test for all Coli- form bacilli known as presumptive Coli- form count.
2. A differential test of typical Coli- form bacilli (E-Coli) known as the differential Coli- form test.

Determination

The samples were sent at the laboratory of Public Health Laboratory Mandalay.

Results and Discussion

Determination of Physical and Chemical Parameters of Water Sample (1)

The experimental results for physical and chemical parameters of water sample collected from sample (1) , the drinking well of Naung- Taung pond were given in Table (4.1).

Table -1 The Physicochemical Results of Water Sample (1)

No	Characteristics	Sample (1) December 2014	Sample (1) March 2015	WHO standard	
				Highest Desirable level	Maximum permissible level
1	pH value (Scale)	7.2	7.5	7-8.5	6.5-9.2
2	Colour (Units)	5	5	5	50
3	Turbidity (NTU)	3	2.84	5	25
4	Conductivity ($\mu\text{mhos/cm}$)	285	300	800	4000
5	Total Dissolved solids (mg/L)	210	201	500	1500
6	Total Suspended solids (mg/L)	3	3	-	-
7	Calcium as Ca (mg/L)	73	72	75	200
8	Total Hardness as CaCO_3 (mg/L)	245	240	100	500
9	Magnesium as Mg (mg/L)	15	15	30	150
10	Chloride as Cl (mg/L)	8	8	200	600
11	Total Alkalinity as CaCO_3 (mg/L)	250	244	200	500
12	Manganese as Mn (mg/L)	0.01	0.01	0.05	0.5

13	Iron, Total as Fe (mg/L)	0.01	0.01	0.1	1.0
14	Sulphate as SO ₄ (mg/L)	<200	<200	200	400
15	Nitrogen Nitrate (N-NO ₃) (mg/L)	8.8	8.8	-	45
16	Dissolved Oxygen	3.4	3.3	-	-
17	Biochemical Oxygen Demand	4.5	5.0	-	-
18	Chemical Oxygen Demand	9	9	-	-

From the study of Table-1, the pH value for sample on December and March are 7.2 and 7.5 respectively. Hence, the water samples are said to be little alkaline. The colour of this sample do not exceed the WHO highest desirable limit, 5 (Pt-Co).

Turbidity data for the sample (1) in December and March are less than 5 N.T.U. It is in conformity with WHO, standard limits.

For sample the conductivity values in December and March are 285 mhos/cm and 300 mhos/cm. According to the 1980 EEC value, the standard guide level for conductivity is 400 μ mhos/cm at 20°C. The conductivity value of the water sample (1) from Naung-Taung pond is not beyond this limit and found to be low mineralized.

WHO assigns the following classification with respect to total dissolved solids (TDS) value.

- Excellent -----less than 300 mg/L
- Good-----between 300 and 600 mg/L
- Fair-----between 600 and 900 mg/L
- Poor-----between 900 and 1200 mg/L
- Unacceptable-----greater than 1200 mg/L

The Total Dissolved Solids value of sample (1) in December and March are 210 and 201 mg/L and is found to be in excellent class.

By studying the chemical analysis of sample (1) the content of Ca and Mg is low with WHO standard values. The degree of hardness of drinking water has been classified in terms of its equivalent CaCO₃ concentration as follows.

- Soft-----0.60 mg/L
- Medium soft -----60 - 120 mg/L
- Hard -----120-180 mg/L
- Very hard -----180 mg/L and above

Therefore, the water sample (1) is very hard water for drinking.

The values of chloride for water sample (1) in December and March lie much below WHO desirable limit 200 ppm. High chloride concentrations in water are not known to have toxic effects on human, though large amounts may be harmful to plant life.

Total alkalinity values of water sample (1) in these month lie within the range 200-250 mg/L.

Both iron and manganese are detected in sample (1) but little amount and lie below the desirable level.

The sulphate content in water sample (1) from Naung- Taung pond is observed below the WHO desirable level, 200 mg/L. The sulphate present in water above standard limit may cause laxative effect to consumers.

WHO has established a level of 45 mg/L nitrate as the maximum allowable concentration of nitrate. The nitrogen nitrate content of the water sample (1) is 8.8 and found to be less than the allowable limit.

Determination of Dissolved Oxygen, Biochemical Oxygen Demand and Chemical Oxygen Demand for Water Sample (1)

Dissolved Oxygen indicates that the water is fresh or not. Dissolved Oxygen values of water sample (1) are 3.4 and 3.3 in December and March, respectively. These values are markedly lower than the WHO standard. There are many disadvantages in water of low Dissolved Oxygen. According to European standards for drinking water proposed by WHO, preferable Dissolved Oxygen value for drinking water should be at least 5 ppm. Therefore the water sample in Naung-Taung pond has objectionable dissolved oxygen values.

Biochemical oxygen demand indicates biochemically oxidizable organic matters and 5 days biochemical oxygen demand of domestic water should be less than 2 mg/L. However, the water sample (1) is found to have high biochemical oxygen demand value of 4.5 mg/L. This means that the water sample contains high oxidizable organic matter.

Chemical Oxygen Demand (COD) is the amount of oxygen equivalent to oxidize the organic matter in water and a pollution indicator. COD values of the water sample (1) are 9.2 mg/L in both December and March. Higher values of BOD and DOD indicate that the water in Naung-Taung pond is polluted with organic wastes.

Determination on Physical and Chemical Parameters of Water Sample (2)

The experimental results for physical and chemical parameters of water sample collected from the sample (2), the middle of Naung-Taung pond were given in Table (4.2)

Table-2 The Physicochemical Results of Water Sample (2)

No	Characteristics	Sample (2) December 2014	Sample (2) March 2015	WHO standard	
				Highest Desirable level	Maximum permissible level
1	pH value (Scale)	7.4	7.5	7-8.5	6.5-9.2
2	Colour (Units)	5	5	5	50
3	Turbidity (NTU)	3.7	3.4	5	25
4	Conductivity (µmhos/cm)	275	280	800	4000
5	Total Dissolved solids (mg/L)	208	195	500	1500
6	Total Suspended solids (mg/L)	3	2	-	-
7	Calcium as Ca (mg/L)	70	72	75	200
8	Total Hardness as CaCO ₃ (mg/L)	260	248	100	500
9	Magnesium as Mg (mg/L)	16	16	30	150
10	Chloride as Cl (mg/L)	8	8	200	600

11	Total Alkalinity as CaCO ₃ (mg/L)	290	240	200	500
12	Manganese as Mn (mg/L)	0.01	0.01	0.1	1
13	Iron, Total as Fe (mg/L)	0.01	0.01	0.05	0.5
14	Sulphate as SO ₄ (mg/L)	<200	<200	<200	400
15	Nitrogen Nitrate (N-NO ₃) (mg/L)	8.8	8.8	-	45
16	Dissolved Oxygen	3.4	3	-	-
17	Biochemical Oxygen Demand	4.5	5.0	-	-
18	Chemical Oxygen Demand	9.0	9.2	-	-

From the study of Table-2 the pH values for sample (2) in December and March were 7.2 and 7.5. These values were between the desirable limit of WHO standard. The colour of sample (2) on December and March are 5 unit. These values were not beyond the maximum acceptable limit 5-unit by W.H.O. Conductivity values of sample in December and March are 275 and 280. So these values were lower than the maximum acceptable limit and it indicates the lower value of soluble minerals.

The TDS value of sample (2) in December and March are 210 and 201 mg/L and is found to be in excellent class.

Turbidity values for this sample (2) were less than the maximum acceptable limit. The total hardness of this water sample (2) on December and March were 260 and 248. These values lie between the range of W.H.O desirable and permissible values.

The total alkalinity values of sample (2) were higher than permissible value. Calcium, magnesium, iron and manganese values for sample (2) were less than desirable limit. The nitrogen nitrate content of the water sample (2) is 8.8 and found to be less than the allowable limit.

The chloride values of sample (2) in December and March, were less than the desirable limit. The observed concentrations of sulphate value were found to be less than 200. These values were lower than the standard recommendation limit (200-400 mg/L).

Determination of Dissolved Oxygen, Biochemical Oxygen Demand and Chemical Oxygen Demand for Water Sample (2)

Dissolved Oxygen(DO) values of water sample (2) are 3.4 and 3.0 in December and March, respectively. These values are markedly lower than the WHO standard. Therefore the water sample (2) in Naung-Taung pond has objectionable DO values.

The water sample (2) is found to have high BOD value of 5.0 mg/L. This means that the water sample contains high oxidizable organic matter.

COD values of the water sample (2) are 9.2 mg/L in both November and December. Higher values of BOD and COD indicate that the water in Nuang-Taung pond is polluted with organic wastes.

Determination of Toxic Heavy Metals by Atomic Absorption Spectrophotometer

The toxic metals, As, Cu, CN and Pb of two samples by Atomic Absorption Spectrophotometer (AAS) and the results were presented in Table-3.

Tabel -3 Determination of the Toxic Heavy Metals Present in Water Sample by AAS

No	Characteristics	Results (ppm)		WHO Standard (ppm)	
		Sample(1)	Sample(2)	Highest Desirable level	Maximum Permissible level
1	As	Nil	Nil	-	0.01
2	Cu	Nil	Nil	-	2.0
3	CN	Nil	Nil	-	0.07
4	Pb	Nil	Nil	1.0	0.01

According to these results, the two samples of Naung-Taung pond are found to be absence of heavy toxic metals.

Bacteriological Results

The observed value for Coli- form count in MPN/ 100 ml and the presence of *E- Coli* are shown in Table -4.

Table -4 Bacteriological Quality in Water Sample

No	Location	Time	Probable Coli-form Count	<i>Escheria</i> Coli Count	Remark
1	Sample (1)	December	5/5	isolated	un- satisfactory
2	Sample (2)	December	5/5	isolated	un- satisfactory

According to these results, the two samples are un-satisfactory for drinking.

Conclusion

From this research work, the qualities of drinking water from the well near Naung-Taung pond and the water from Naung- Taung pond have been known and the following conclusion can be drawn.

All the physical parameters of the two water samples lie within the desirable level proposed by WHO. Low conductivity value is consistent with the low value of TDS and indicates that the two water samples contain low dissolve minerals. Due to low TDS values, both the two water samples may be regarded as excellent class.

From the determination of inorganic constituents of water, both the two water samples are chemically potable because all chemical parameters such as Ca, Mg, Mn, Fe, total alkalinity, total hardness, chloride, sulphate and nitrogen- nitrate are not beyond the highest permissible level proposed by WHO.

Moreover, any toxic heavy metals are not detected in both of two water samples. Therefore, it can be said that the water from drinking water well and water from Naung- Taung pond are suitable for drinking from the physicochemical point of view.

However, the assessments of the organic constituents of the two water samples show that both of the water samples are polluted with organic wastes. The reason for this may be due to the growth of aquatic plants. Therefore, these aquatic plants should be removed in order to be able to use the water in Naung- Taung pond as drinking water. However, the income of the

resident can be lower and lower by doing so because they earn by selling the edible algae grown in this pond.

The assessment of the quality of the two water samples showed the predominant counts of Coli- forms and *E- coli* and so the water from drinking well and Naung- Taung pond are unsatisfactory for drinking. Therefore, it needs prior treatments such as chlorination or boiling for drinking purposes.

On conclusion, the water from Naung- Taung pond and the water from drinking well near it are not suitable for drinking without any prior treatment although they are chemically potable. Nevertheless, these water are still suitable for domestic uses and for growing edible algae. Therefore, the quality of water from Naung- Taung pond should be preserved to grow edible algae well so that the economy of the resident can be well developed.

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