“ANALYSIS OF WATER QUALITY PARAMETERS IN ALIMUR VILLAGE, LAKHIMPUR DISTRICT”

A DESSERTATION SUBMITTED TO
ASSAM SCIENCE AND TECHNOLOGY UNIVERSITY
IN PARTIAL FULFILMENT OF THE DEGREE OF

MASTERS OF TECHNOLOGY
IN
CIVIL ENGINEERING
(**Water resource Engineering**)

SUBMITTED BY-
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3RD semester
(Roll no- PG/CE/23/35)

UNDER THE GUIDANCE OF
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JALUKBARI, GUWAHATI-13

DECLARATION

I hereby declare that the work presented in the dissertation “

I hereby declare that the work presented in the dissertation “ANALYSIS OF WATER QUALITY PARAMETERS IN ALIMUR VILLAGE, LAKHIMPUR DISTRICT” in partial fulfillment of the requirement for the award of the degree of “MASTER OF TECHNOLOGY” in Civil Engineering (with specialization in Water Resource Engineering), submitted in the Department of Civil Engineering, Assam Engineering College, Jalukbari, Guwahati – 13 under Assam Science & Technology University, is a real record of my work carried out in the said college under the supervision of Dr. PANKAJ GOSWAMI, Professor, Department of Civil Engineering, Assam Engineering College, Jalukbari, Guwahati – 13.

Do hereby declare that this project report is solemnly done by me and is my effort and that no part of it has been plagiarized without citation.

Date: SHREYA KARKI

This is to certify that the above statement made by the candidate is correct to the best of my knowledge.

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CERTIFICATE

his is the certified that the work presented in the project report entitled “ANALYSIS OF WATER QUALITY PARAMETERS IN ALIMUR VILLAGE, LAKHIMPUR DISTRICT” is
submitted by Shreya Karki, Roll No: PG/C/23/35, a student of M.Tech 3th semester, Department of Civil Engineering, Assam Engineering College, to the Assam Science and Technology University in partial fulfillment of the requirement for award of the degree of Master of Technology in Civil Engineering with Specialization in Water Resources Engineering under my guidance and supervision.

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CERTIFICATE FROM HEAD OF THE DEPARTMENT

This is to certify that the project report entitled "ANALYSIS OF WATER QUALITY PARAMETERS IN ALIMUR VILLAGE, LAKHIMPUR DISTRICT" has been submitted by SHREYA KARKI , bearing Roll No: PG/C/23/35, a student of M.Tech. 3th Semester, Water Resource Engineering (Civil Engineering Department), Assam Engineering College, in partial fulfillment of the requirements for the award of the degree of Master of Technology in Water Resource Engineering of Assam Science & Technology University.

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ABSTRACT

Water is the most important for every living organism and regulating the climate, shaping the land and regulating the climate It is one of the most important compounds that profoundly influence life. The quality of water usually described according to its physical and chemical characteristics. Rapid industrialization and indiscriminate use of chemical fertilizers and pesticides in agriculture are causing heavy and varied pollution in aquatic environment leading to deterioration of water quality and depletion of aquatic biota. Due to use of contaminated water, human population suffers from water borne diseases. It is therefore necessary to check the water quality at regular interval of time. Parameters that may be tested include taste, odour, pH, nitrates, iron, fluoride, calcium and magnesium, alkalinity. So present scenario case study about Alimur village, Lakhimpur_ water quality parameters.

Contents

Abstract

CHAPTER 1

INTRODUCTION

1.1 Introduction

All plants and animals need water to survive. There can be no life on earth without water. Because 60 percent of our body weight is made up of water. Our bodies use water in all the cells, organs, and tissues, to help regulate body temperature and maintain other bodily functions. Because our bodies lose water through breathing, sweating, and digestion, it's crucial to rehydrate and replace water by drinking fluids and eating foods that contain water.

1.2 Drinking water

Fluids and hydration are crucial for the bodily functions of humans, especially when it comes to drinking water. 60-80 percent of the human body is water. However, the amount of fluid in our bodies varies, depending on certain factors, such as age, condition of internal organs, and health.

1. Delivering essential nutrients to all organs.

2. Oxygen supply to the lung and maintaining heart function.

3. Release of recycled substances and ensuring the stability of the internal environment.

4. Maintaining the normal body temperature.

5. Helping the immune system resist diseases.

Other Benefits of Drinking Water:

It improves the condition of nails, skin, and hair, while dehydrated skin always looks dry and may cause acne problems together with aging.

Water prevents urinary infections: directly, water does not improve the kidney function, it helps remove toxins, when those accumulate and start corroding the mucous membrane, causing inflammation and pain.

Improved digestion: the stomach produces the necessary amount of gastric juice, with the right amount of water in the body.

Lower blood pressure: the body can compress blood vessels, when it lacks water, which could lead to increased pressure.

water relieves joint pain: it helps to stay in good shape and does not allow cartilage to wear out.

Less headaches: if the body is dehydrated, headache is the first signal.

1.3 Distribution of water on earth

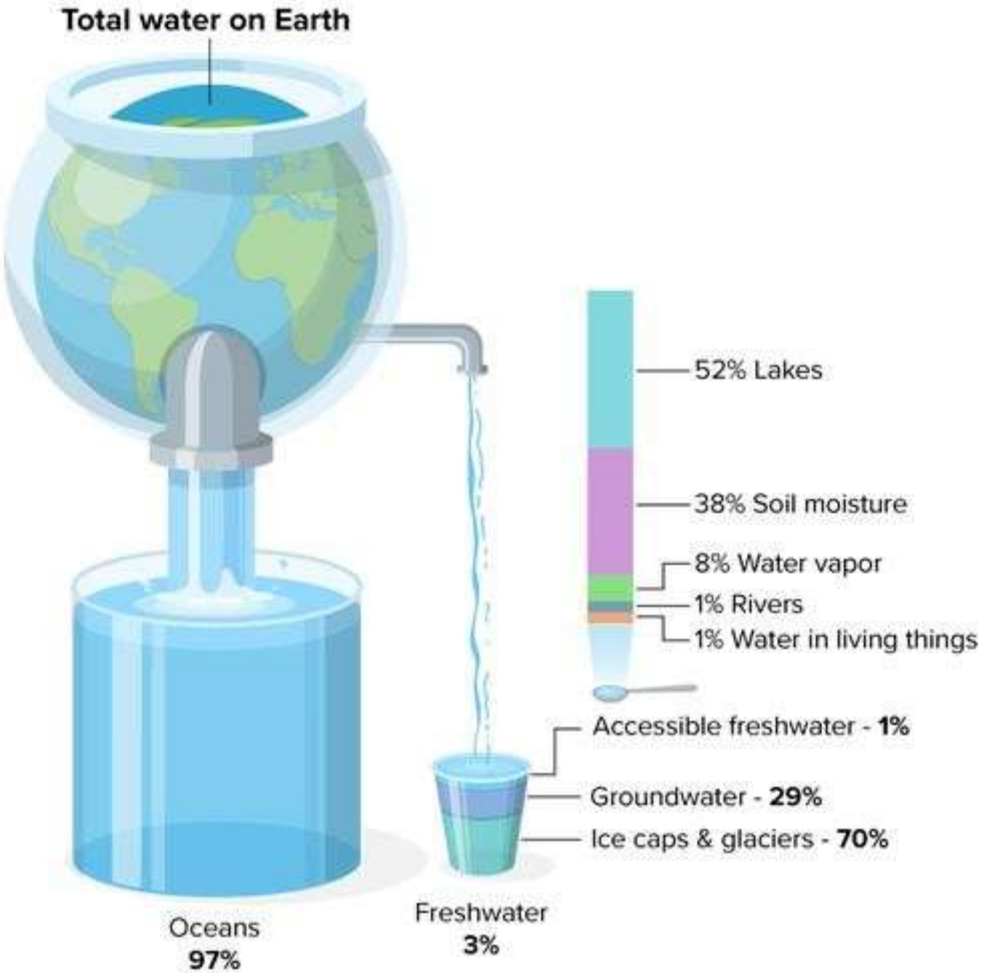


Figure 1.1: Distribution of water

Source: https://www.ck12.org/flexi/biology/water-and-life/what-percentage-of-water-on-earth-is-freshwater/

1.4 Study area

- Alimur is a village in Dhakuakhana in Lakhimpur district of Assam state, India.
- It belongs to Schedule tribe region.
- It is located 30 km from Lakhimpur Town.
- The total geographical area of village is 618 hectares.
- There are about 312 houses in Alimur Village.
- Average consumption of water is 55 lpcd so an average village requires almost 32 million litres per year.

Aim and Objective of Study

Based on the above discussed information the present minor project titled "**ANALYSIS OF WATER QUALITY PARAMETERS IN ALIMUR VILLAGE, LAKHIMPUR DISTRICT"** is selected. The objectives of the project are:

To determine the physical parameters like taste and odour, colour, solids and electrical conductivity.

To determine the chemical parameters like pH, acidity, alkalinity, chloride, nitrogen, etc.

CHAPTER 2

LITERATURE REVIEW

Assessment of Water Quality Parameters, G.G JADHAO (8th Aug,2023), Department of Chemistry, Arts, Commerce & Science College, Dharangaon Dist. Jalgaon, Maharashtra, India

India is facing a serious problem of natural resource scarcity, especially that of water in view of population growth and economic development. Most of fresh water bodies all over the world are getting polluted, thus decreasing the portability of water. All life is depend on water and exists in nature in many forms like ocean, river, lake, clouds, rain, snow and fog etc. A lake is a large body of water surrounded by land, inhabited by various aquatic life forms, for all practical purpose, pure water is considered to that which has low dissolved or suspended solids and obnoxious gases as well low in biological life. Of all the water quality issues facing lakes everywhere, eutrophication is of great concern. Eutrophication is a term used to describe the aging of a lake, resulting due to the accumulation of nutrients, sediments, silt and organic matter in the lake from the surrounding watershed. The role of vegetation and sediments as sources and sink of nutrients has been demonstrated. It describes the biological reaction of aquatic systems to nutrient enrichment, the eventual consequence of which is the development of primary production to nuisance proportions. The main cause is excessively adding of phosphorus and nitrogen resulting in high algal biomass, dominance by cyanobacteria and loss of macrophytes.

Source: https://ijcrt.org/papers/IJCRT2308158.pdf

Assessment of Water Quality Parameters: A Review S. P. Gorde , M. V. Jadhav (2013)

The seasonal values of WQI indicate that during summer season, lake water is more affected than during winter. This could be due to the fact that the microbial activity get reduced due to low temperature, thereby keeping DO level at a very satisfactory range during entire winter season. The suggested measures to improve the lake water quality includes total ban on the activities that causes pollution. Result of water quality assessment clearly showed that most of the water quality parameters slightly higher in the wet season than in the dry season. Water quality is dependent on the type of the pollutant added and the nature of self-purification of water.

Source: https://www.ijera.com/papers/Vol3_issue6/LV3620292035.pdf

B. N. Tandel, Dr. J. Macwan, C. K. Soni have studied, the water quality index is a single number that expresses the quality of water by integrating the water quality variables. Its purpose is to provide a simple and concise method for expressing the water quality for different usage. The present work deals with the monitoring of variation of seasonal water quality index of some strategically selected surface water bodies. The index improves the comprehension of general water quality issues, communicates water quality status and illustrates the need for and the effectiveness of protective practices. It is found that in all cases the change in WQI value follow a similar trend throughout the study period. The lake water is found of good quality (WQI - 67.7 to 78.5) during both seasons. However, it is found that water quality of lake deteriorates slightly from winter to summer season on account of the increase in microbial activity as well as increase in pollutants concentration due to water evaporation.

Source: *B. N. Tandel, Dr. J. Macwan and C. K. Soni - "Assessment of Water Quality Index of Small Lake in South Gujarat Region, India."*

T. M. Heidtke, A. M. Asce and W. C. Sonzogni (1986) have studied, results from a study of water quality planning and management alternatives for the Great Lakes are used to identify cost-effective pollution control strategies. Mathematical models and other systems analysis techniques are applied to estimate pollutional loadings, specific water quality problem areas, costs and pollutant reductions offered through alternative management strategies. A determination of how these alternatives may be expected to achieve water quality objectives for the Great Lakes is made. Data from a diversity of Great Lakes research efforts are compiled, integrated, and used to project local and lake wide water quality conditions over the next twenty years. A set of management tools, including a near shore water quality index and a series of environmental quality maps, are developed to promote communication and interpretation of Great Lakes water quality data among technical and nontechnical interests. Findings from the study support a staged approach to pollution control, whereby the most cost effective programs are implemented and their results assessed before more expensive control measures are undertaken.

Source: *T. M. Heidtke, A. M. Asce and W. C. Sonzogni - "Water Quality Management: for the Great Lakes", J. Water Resour. Plann. Manage. 112:48-63, 1986.*

V. Pradhan, M. Mohsin, B. H. Gaikwad (2012) has studied, water quality of Chilika Lake was determined during the month of January 2012. It was observed that all the parameters are above permissible limit except at the sample site S2. The results are discussed in the light of findings of other workers.

Source: *V. Pradhan, M. Mohsin, B. H. Gaikwad - "Assessment of physico chemical parameters of Chilika Lake water", International Journal of Research in Environmental Science and Technology.*

M. Pejaver and M. Gurav(2008) have explained, the two lakes namely Kalwa and Jail lake of Thane city are eutrophicated and hence the study were done to find the quality of water for the period of 6 months for various physico-chemical parameters to study the pollution status of the lakes. The Jail lake is found to be relatively more organically polluted and greater degree of eutrophication the Kalwa lake. Among water quality parameters, a positive correlation was found between chlorophyll and temperature, suspended solids, pH, dissolved oxygen (not with chlorophyll c), Co2 (only with chlorophyll C). A negative correlation was seen between Chlorophyll and light penetration. The Chlorophyll a and b showed negative correlation with Co2 silicates and Phosphates.

Source*: M. Pejaver, M. Gurav - "Study of Water Quality of Jail and Kalwa Lake, Thane, Maharashtra", J. Aqua. Biol. Vol. 23(2), 44 -50, 2008.*

CHAPTER 3

METHODOLOGY AND PROCEDURES

3.1 DETERMINATION OF SAMPLE PARAMETERS

Water sample is collected from the area of **ALIMUR VILLAGE, LAKHIMPUR DISTRICT, ASSAM** and its tested for drinking purpose .The different parameters which are determined in this project are :

1. pH of water
2. Alkalinity
3. Dissolved oxygen (DO)
4. Electrical conductivity (EC) of water
5. Total dissolved solids
6. Taste and odour
7. Total Hardness
8. Nitrates
9. Chlorides
10. Calcium
11. Magnesium
12. Flourides
13. Iron

3.1.1 pH

Introduction

pH stands for hydrogen (H) potential and it represents the measure of concentration of H^+ ions in a solution. A mathematical consequence of the formula that defines pH, the units on the pH scale range from 0 to 14. A value of 7 indicates neutrality, values less than 7 are called acidic, and values greater than 7 are called basic or alkaline. Values close to 0 to 14 represent extremes acidity and basic, respectively. Temperature will also affect the equilibrium and the pH. In pure water, a decrease in pH of about 0.45 occurs as the temperature is raised by 25 °C. In general, the pH of water for drinking purpose should be between 6.5 and 8.5.

Figure 3.1: pH meter

APPARATUS

pH meter - With glass and reference electrode (saturated calomel)preferably with temperature compensation.

Magnetic stirrer - With polytetrafluoroethylene coated stirring bar.

Thermometer – with least count of 0.5 0C

PROCEDURE

Calibration

Using the buffer solutions calibrate the instrument.

Step 1:In a 100 ml beaker take pH 7.0 buffer solution and place it in a magnetic stirrer, insert the Teflon coated stirring bar and stir well.

Now place the electrode in the beaker containing the stirred buffer and check for the reading in the pH meter. If the instrument is not showing pH value of 7.0, using the calibration knob adjust the reading to 7.0.

Take the electrode from the buffer, wash it with distilled water and then wipe gently with soft tissue.

Step 2: In a 100 ml beaker take pH 9.2 buffer solution and place it in a magnetic stirrer, insert the Teflon coated stirring bar and stir well. Now place the electrode in the beaker containing the stirred buffer and check for the reading in the pH meter.

If the instrument is not showing pH value of 9.2, using the slope knob adjust the reading to 9.2.

Take the electrode from the buffer, wash it with distilled water and then wipe gently with soft tissue.

TESTING OF SAMPLE

In a clean dry 100 mL beaker take the water sample and place it on a magnetic stirrer, insert the Teflon coated stirring bar and stir well.

Now place the electrode in the beaker containing the water sample and check for the reading in the pH meter. Wait until you get a stable reading.

The pH of the given water sample is given.

Take the electrode from the water sample, wash it with distilled water and then wipe gently with soft tissue.

3.1.2 Alkalinity

Alkalinity

Introduction

Alkalinity is a measure of the capacity of water to neutralize acids. Alkaline compounds in the water such as bicarbonates (baking soda is one type), carbonates, and hydroxides remove H+ ions and lower the acidity of the water (which means increased pH). They usually do this by combining with the H+ ions to make new compounds. Without this acid-neutralizing capacity, any acid added to a stream would cause an immediate change in the pH. Measuring alkalinity is important in determining a stream's ability to neutralize acidic pollution from rainfall or wastewater. It's one of the best measures of the sensitivity of the stream to acid inputs. The types of rocks surrounding the stream affect alkalinity. Phosphates, limestone, and borates give the water a higher alkalinity and buffering capacity. Rain can increase runoff which generally also increases acidity, in turn decreasing alkalinity. Acids from mines can wash into rivers and streams and increase the acidity, which requires more alkalinity. The particles from cement and other urban construction materials can wash into streams and affect alkalinity.

Figure 3.2: Starting point of alkalinity

Figure 3.3: End point of alkalinity

Principle

Alkalinity of water is the capacity of the water to accept protons. It may be defined as the quantitative capacity of an aqueous medium to react with hydrogen ions to pH 8.3 (phenolphthalein alkalinity) and then to pH 3.7 (total alkalinity or methyl orange alkalinity). The equation in its simplest form is as follows: $CO_3^{2-} + H^+ = HCO_3^-$ (pH 8.3) From pH 8.3 to 3.7 the following reaction may occur: $HCO_3^- + H^+ = H_2CO_3$

PROCEDURE

Take 100ml of sample in a conical flask. Add 3-4 drops of phenolphthalein indicator. If no color is produced, then phenolphthalein alkalinity is absent. If the sample turns pink, titrate with N/50 H_2SO_4 till the pink colour disappears. Record the ml of acid used (P).

We will add 1 drop of methyl orange to same sample to the titrated mixture and retitrate with N/50 H_2SO_4 untilfirst change from yellow to orange colour is noted (T).

$$Alkalinity(mg/lit) = \frac{m * N * 50 * 1000}{vol.ofsample} \quad (3.1)$$

3.1.3 Dissolved Oxygen

Introduction

The term Dissolved Oxygen is used to describe the amount of oxygen dissolved in a unit volume of water.Dissolved oxygen (DO) is essential for the maintenance of healthy lakes and rivers. It is a measure of the ability of water to sustain aquatic life. The dissolved oxygen content of water is influenced by the source,raw water temperature,treatment and chemical or biological processes taking place in the distribution system.

The presence of oxygen in water is a good sign. Depletion of dissolved oxygen in water supplies can encourage the microbial reduction of nitrate to nitrite and sulfate to sulfide. It can also cause an increase in the concentration of ferrous iron in solution, with subsequent discoloration at the tap when the water is aerated.

In a healthy body of water such as a lake, river, or stream, the dissolved oxygen is about 8 parts per million.The minimum DO level of 4 to 5 mg/L or ppm is desirable for survival of aquatic life.The wastes serve as the food for certain aerobic bacteria. as it moves downstream,the conc. of bacteria increases. Because these bacteria remove oxygen from water, their population increase causes a decline in the amount of DO.

Beyond certain point, most of the wastes break down. The conc. of DO rises as the river recovers oxygen from the atmosphere and aquatic plants. Thus DO test is the basis for BOD test which is an important parameter to evaluate organic pollution potential of a waste.

Procedure

We take 300 ml glass stoppered BOD bottle and fill it with sample to be tested. Avoid any kind of bubbling and trapping of air bubbles.

We take the sample collected from the field. It should be collected in BOD bottle filed up to rim.

We add 2 ml of manganese sulfate to the BOD bottle by inserting the calibrated pipette just below the surface of the liquid.

We add 2 ml of alkali-iodide-azide reagent in the same manner.

If oxygen is present, a brownish-orange cloud of precipitate or flocc will appear.

It is then allowed to settle for sufficient time then add 2 ml of concentrated sulfuric acid via a pipette held just above the surface of the sample.

At this point, the sample is ”fixed” and can be stored for up to 30 minutes if kept in a cool,dark place.

Rinse the burette with sodium thiosulphate and then it with sodium thiosulphate. Fix the burette to the stand.

Measure out 203 ml of the solution from the bottle and transfer to an conical flask.

Titrate it against sodium thiosulphate using starch as indicator (add 3-4 drops of starch indicator solution).

End point of the titration is first disappearance of blue color to colorless.

Note down the volume of sodium thiosulphate solution used.

$$\text{DO(mg/lit)} = \text{Vol.of Sodium thiosulphate} * \frac{1000}{\text{Vol. of sample used}}$$

Figure 3.4: Starting point of dissolved oxygen

Figure 3.5: End point of dissolved oxygen

3.1.4 Electrical Conductivity

Introduction

This method is used to measure the conductance generated by various ions in the solution/water.

Rough estimation of dissolved ionic contents of water sample can be made by multiplying specific conductance (in S/cm) by an empirical factor which may vary from 0.55 to 0.90 depending on the soluble components of water and on the temperature of measurement.

Conductivity measurement gives rapid and practical estimate of the variations in the dissolved mineral contents of a water body.

Procedure

We switch ON the instrument half an hour before the conduction of experiment. Electrode probe is to be washed with Distilled water and do not dip in any solution.

Press ENTER for getting SELECTION MODE. Select mode as (EC) using direction keys(^ or _) and presses ENTER.

Enter Cell constant value as 1.00 (Press ESC key, if cell of different cell constant say 0.5., is being used and enter the cell constant value) and press Enter.

Figure 3.6: Electrical conductivity

If automatic temperature meant is desired and thermo probe is not connected in which case connect it and press Enter key to get temperature.

If the temperature is desired to be entered manually, press ESC key and enter temperature.

If the actual temperature is not what is displayed as default, measure the temperature with a thermometer, press ESC key and enter the temperature.

Keep the sample-filled-container near the cell/probe stand and lower the holding clamp to dip the sensor part of the cell in the sample. Insert thermo- probe also into the sample.

Press ENTER key and it display cell constant value as 1.00 and then dip the cell in the sample and press Enter. There temperature and EC values are displayed.

3.1.5 Total Dissolved Solids

Introduction

The term solid refers to mater either filterable or non-filterable that residue upon evaporation and subsequent drying at a defined temperature. Further categorization depends upon the temperature employed for drying and ignition. Different forms of solids are defined on the basis of method applied for their determination.

Solids may affect water or effluent quality adversely in number of ways. Water with high dissolved solids may induce an unfavorable physiological reaction in the transient consumer and generally are of inferior palatability. Highly mineralized water are unsuitable for many industrial applications. High suspended solids in waters may be aesthetically unsatisfactory for such purposes as bathing. Analysis of total solids is important to decide upon the various unit operations and processes in physical and biological waste water treatment and to assess its performance evaluation. For assessing compliance with regulatory agency, waste water effluent Limitation for various forms of solid act as indicating parameters.

Procedure

- Switch ON the instrument half an hour before the conduction of experiment.
- Electrode/probe is to be washed with Distilled water and do not dip in any solution.
- Press ENTER for getting SELECTION MODE. Select mode as (TDS) using direction keys(^ or _) and presses ENTER.
- Enter TDS Factor as 0.50. (Press ESC if it is desired to enter a different TDS Factor say 0.56.,) and press Enter.
- Enter Cell constant value as 1.00. (Press ESC key, if cell of different cell constant say 0.5.,is being used and enter the cell constant value) and press Enter.
- If automatic temperature meant is desired and thermo probe is not connected in which case connect it and press Enter key to get temperature.
- If the temperature is desired to be entered manually, press ESC key and enter temperature.
- If the actual temperature is not what is displayed as default, measure the temperature with a thermometer, press ESC key and enter the temperature.
- Keep the sample-filled-container near the cell/probe stand and lower the holding clamp to dip the sensor part of the cell in the sample. Insert thermo-
- Probe also into the sample. Press ENTER key and it display cell constant value as 1.00 and then dip the cell in the sample and press Enter. There temperature and TDS values are displayed.

Figure 3.7: Electrical conductivity

3.1.6 Taste and Odour

Taste

Introduction

The ”Flavour Threshold Number”[FTN] is calculated corresponding to the greatest dilution of the sample with taste free water yielding a definitely perceptible change in taste.

FTN is defined as:

$$FTN = \frac{(A+B)}{A}$$

Where:

A = ml of sample

B = ml of odour free water

Procedure

A sample of water was diluted in a solution and eight aliquots of different dilutions were prepared.

Taste the individual samples in ascending order starting from sample no eight.

3. Determine the sample for which a perceptible taste is first noticed.

4. Report the corresponding FTN.

Odour

Introduction

The ”Threshold Odour Number” (TON) is calculated corresponding to the greatest dilution of the sample with odour-free water yielding a definetly perceptible odour.

$$TON = (A+B)/A$$

Where:

A = ml of sample

B = ml of odour free water

Procedure

A sample of water was diluted in a solution and eight aliquots of different dilutions were prepared.

We taste the individual samples in ascending order starting from sample no eight.

Determine the sample for which a perceptible taste is first noticed. We report the corresponding TON.

3.1.7 HARDNESS OF WATER

INTRODUCTION

Hardness is caused due to the presence of multivalent cations, mainly Ca^+

and Mg^+ in water.

Hard water have many dis advantages capacity to precipitate soap. Thus measurement of water hardness is very necessary.

Total hardness of water is the sum of Ca^+ and Mg^+ concentration of water. The results are expressed as calcium carbonate, in mg/L,that is , ”mg/L as $CaCO3$

When total hardness is numerically greater than the sum of carbonate and bicarbonate alkalinity for a water sample, the amount of hardness equivalent to the carbonate plus bicarbonate alkalinity is called ”carbonate hardness”. The amount of hardness in excess of this is called ”non carbonate hardness”. When hardness numerically is equal to or less than the sum of carbonate and bicarbonate alkalinity, all hardness is carbonate hardness, and non carbonate hardness is absent.

Procedure (TOTAL HARDNESS)

1) We take 50 ml well mixed sample in conical flask.
2) Add 1-2 ml buffer solution of ammonia.
3) To each aliquot add a pinch of Eriochrome Black-T powder (indicator) or 2 drops of Eriochrome Black-T. The aliquots are wine-red in colour.
4) We titrate each aliquot using the standard EDTA(0.01M)solution (in burette).
5) volume of EDTA required is noted down.(A).
6) Run a reagent blank if buffer is not checked properly. Note the volume of EDTA required for blank (B). c
7) We calculate the volume of EDTA required for sample i.e., (A-B).

Figure 3.8: Starting point of hardnes

Figure 3.9: End point of hardness

CALCIUM HARDNESS DETERMINATION

1) We take a 50 ml of sample in conical flask.
2) 1 ml NaOH to raise PH to about 12.0 is added.
3) Add a pinch of ammonium purpate (murexide) powder (indicator).
4) Titrate using the standard EDTA solution (in burette) untill colour change occurs from pink to purple.
5) We note the volume of EDTA used(C).

3.1.8 NITRATES

INTRODUCTION

Determination of nitrate (NO3) is difficult because of the relatively complex procedure required, the high probability that interfering constituents will be present and the limited concentration ranges of th various techniques. Nitrate is the most highly oxidized from the nitrogen compounds commonly present in natural waters significant source of nitrate are chemical fertilizers, decayed vegetable and animal matter, domestic effluents, sewage sludge disposal to land, industrial discharge, and leachates from refuse dumps and atmospheric washout. Depending on the situation, these sources can contaminate streams, rivers, lakes and ground water. unpolluted natural water contains minute amounts of nitrate. Excessive concentration in drinking water is considered hazardous for infants because of its reduction to nitrate in intestinal track causing methenoglobinaemia. In surface water, nitrate is a nutrient taken up by plants and converted into cell protein. The growth stimulation of plants, especially of algae may cause objectionable eutrophication.

Figure 3.10: UV-spectrophotometer

Calibration procedure of UV-Spectrophotometer

Switch on the instrument and wait for 10-15 minutes.

Select the source as ”UV”. clear water (colourless)-UV

UV sample press the source button such that the light makes visible on the source.

Select 6th filter”Dark” and then close the door.

Press the ”%T” mode.

Again wait for 10-15 minutes.

Set zero(000)using ”SETZERO”knob.

Select wave length by pressing ”CLEAR” and then enter wave length of 220(nm)(desirable).

Take blank water sample (distilled water)and keep in 1st hole and select 1st filter by taking the filter wheel and close the door.

Set the ”COARSE” knob to very high.

By rotating the ”FINE”knob clockwise set to 100.

press ”ABS”(absorbance)button.

Again using the ”FINE”knob set to zero(000).

Place the sample in the 4th filter hole and note the reading.

3.1.9 CHLORIDE

Chlorides are widely distributed in nature as salts of sodium (NaCl), potassium (KCl), and calcium ($CaCl_2$). The taste threshold of the chloride anion in water is dependent on the associated cation. Chlorides are leached from various rocks into soil and water by weathering. The chloride ion is highly mobile and is transported to closed basins or oceans. Chloride in surface and groundwater from both natural and anthropogenic sources, such as run-off containing road de-icing salts, the use of inorganic fertilizers, landfill leachates, septic tank effluents, animal feeds, industrial effluents, irrigation drainage, and seawater intrusion in coastal areas. Chloride in water may be considerably increased by treatment processes in which chlorine or chloride is used.

Chloride concentrations in excess of about 250 mg/litre can give rise to detectable taste in water, but the threshold depends upon the associated cations. Consumers can, however, become accustomed to concentrations in excess of 250 mg/litre. No health-based guideline value is proposed for chloride in drinking-water by WHO.

Figure 3.11: Starting point of chloride

Figure 3.12: End point of chloride

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 before red silver chromate is formed.

PROCEDURE:

1) We use 100 ml sample or a suitable portion diluted to 100 ml. If the sample is highly coloured, add 3 ml of aluminium hydroxide suspension, mix, let settle and filter.
2) If sulphide, sulphite or thiosulphate is present, add 1 ml of hydrogen peroxide and stir for 1 minute. Directly titrate the samples in the pH range 7 to 1 0
3) We adjust sample pH to 7-10 with 1 N sulphuric acid or 1 N sodium hydroxide if it is not in the range.
4) We add 1.0 ml of potassium chromate indicator solution.
5) Titrate with standard silver nitrate solution to a pinkish yellow end point. Standardize silver nitrate solution and establish reagent blank value by titration method. A blank of 0.2 to 0.3 mL is usual.

Calculation: Chloride, mg/L = $(V1-V2) \times N \times 35450\ V3$ Where, V1 = Volume in ml of silver nitrate used by the sample

Where, V1 = Volume in ml of silver nitrate used by the sample

V2 = Volume in ml of Silver nitrate used in the blank titration

V3 = Volume in ml of sample taken for titration

N = Normality of silver nitrate solution 24

3.1.10 Calcium and Magnesium

Introduction

Over 99% of total body calcium is found in bones and teeth, where it functions as a key structural element. The remaining body calcium functions in metabolism, serving as a signal for vital physiological processes, including vascular contraction, blood clotting, muscle contraction and nerve transmission.

Magnesium is the fourth most abundant cation in the body and the second most abundant cation in intracellular fluid. It is a cofactor for some 350 cellular enzymes, many of which are involved in energy metabolism. It is also involved in protein and nucleic acid synthesis and is needed for normal vascular tone and insulin sensitivity.

Alcoholism and intestinal mal-absorption are conditions associated with magnesium deficiency. Certain drugs, such as diuretics, some antibiotics and some chemotherapy treatments, increase the loss of magnesium through the kidney.

Principle

In a solution containing both calcium and magnesium, calcium can be determined directly with EDTA (ethylenediamine tetra-acetic acid or its salts) when the pH is made sufficiently high (pH: 12 to 13) so that the magnesium is largely precipitated as the hydroxide and an indicator is used which combines, only with calcium.

Procedure

Pre-treatment- Mix the sample pretreated, if so required and transfer a suitable volume (50 to 100 ml) to 250 ml conical flask or a beaker. Add 5 ml of concentrated nitric acid and evaporate on a hotplate at a slow boil to the lowest volume possible (about 15 to 20 ml) before precipitation or salting occurs. Add 5 ml of concentrated nitric acid, cover with a watch glass and heat to obtain a gentle refluxing action. Continue heating and adding concentrated nitric acid as necessary until digestion is complete as shown by a light-colored clear solution. Do not let sample dry during digestion. Add 1 to 2 ml of concentrated nitric acid and warm slightly to dissolve any remaining residue. Wash down beaker walls and watch glass with water and then filter, if necessary. Transfer the filtrate to a 100 ml volumetric flask. Cool, dilute to mark and mix thoroughly. Take a portion of this solution for the determination of calcium.

Sample Preparation: Because of the high pH used in this procedure, the titration should be performed immediately after the addition of the alkali and indicator. Use 50 ml of sample or a smaller portion diluted to 50 ml so that the calcium content is about 5 to 10 mg. Analyze hard waters with alkalinity higher than 300 mg/L$CaCO_3$ by taking a smaller aliquot and diluting to

50 ml or by neutralization of the alkalinity with acid, boiling for one minute and cooling before beginning the titration. Add 2.0 ml of sodium hydroxide solution or a volume sufficient to produce pH of 12 to 13. Stir. Add 0.1 to 0.2 g of the indicator murexide sodium chloride mixture selected (or 1 to 2 drops if a solution is used). Add EDTA titrant slowly with continuous stirring to the proper 40 end point. Check the end point by adding 1 to 2 drop of titrant in excess to make certain that no further color change occurs.

Calculation: Calcium ($CaCO_3$), mg/L =$(A \times CF \times 1000)/V$

Calcium (Ca^{2+}), mg/L = $(A \times CF \times 1000 \times 0.4004) /V$

Where, A = Volume in ml of EDTA solution used for titration.

CF= Mass in mg of calcium equivalent to 1 ml of EDTA solution,

(X1/X2 correction factor for standardize ion of EDTA)

X1 = Volume in ml of standard calcium solution taken for standardization

X2 = Volume of ml of EDTA solution used in the titration

V= Volume in ml of the sample taken for the test.

3.1.11 Flouride

Introduction

Fluorine is a common element that does not occur in the elemental state in nature because of its high reactivity. It accounts for about 0.3 g/kg of the Earth’s crust and exists in the form of fluorides in a number of minerals, of which fluorspar, cryolite and fluorapatite are the most common. Inorganic fluorine compounds are used in industry for a wide range of purposes. They are used in aluminium production and as a flux in the steel and glass fibre industries. They can also be released to the environment during the production of phosphate fertilizers (which contain an average of 3.8% fluorine), bricks, tiles and ceramics. Fluorosilicic acid, sodium hexafluorosilicate and sodium fluoride are used in municipal water fluoridation scheme. Traces of fluorides are present in many waters; higher concentrations are often associated with underground sources. In areas rich in fluoride-containing minerals, well water may contain up to about 10 mg of fluoride per litre. The highest natural level reported is 2800 mg/litre. Fluorides may also enter a river as a result of industrial discharges. In groundwater, fluoride concentrations vary with the type of rock the water flows through.

This standard method prescribes two methods of test for determination of fluoride content in water.

A. SPADNS Method [APHA 4500 – F- D]

B. Electrochemical probe method [IS: 3025 (Part 60) – 2008]

A. SPADNS Method

Principle:

The SPADNS colorimetric method is based on the reaction between fluoride and a zirconium-dye lake. Fluoride reacts with the dye lake, dissociating a portion of it into a colourless complex anion (ZrF62-); and the dye. As the amount of fluoride increases, the colour produced becomes progressively lighter. The reaction rate between fluoride and zirconium ions is influenced greatly by the acidity of the reaction mixture. If the proportion of acid in the reagent is increased, the reaction can be made almost instantaneous.

Procedure:

1. Preparation of standard curve: Prepare fluoride standards in the range of 0 to 1.40 mg F/L by diluting appropriate quantities of standard fluoride solution to 50 mL with distilled water. Pipet 10.00 mL mixed acid-zirconyl-SPADNS reagent, to each standard and mix well. Avoid contamination. Set photometer to zero absorbance with the reference solution and obtain 54 absorbance readings of standards. Plot a curve of the milligrams fluoride-absorbance relationship. Prepare a new standard curve whenever a fresh reagent is made or a different standard temperature is desired. As an alternative to using a reference, set photometer at some convenient point (0.300 or 0.500 absorbance) with the prepared 0 mg F/L standard.

2. Sample pre-treatment: If the sample contains residual chlorine, remove it by adding 1 drop (0.05 mL) NaAsO2 solution per 0.1 mg residual chlorine and mix. (Sodium arsenite concentrations of 1300 mg/L produce an error of 0.1 mg/L at 1.0 mg F/L.)

3. Colour development: Use a 50.0-mL sample or a portion diluted to 50 mL with distilled water. Adjust sample temperature to that used for the standard curve. Add 5.00 mL each of SPADNS solution and zirconyl-acid reagent, or 10.00 mL acidzirconyl-SPADNS reagent; mix well and read absorbance, first setting the reference point of the photometer as above. If the absorbance falls beyond the range of the standard curve, repeat using a diluted sample.

Calculation:

$$\text{mg F / L} = (\text{A}/\,mL\ of\ Sample) \times B\,/C$$

Where, A = µg F- determined from plot curve.

B = Final volume of diluted sample, mL, and

C = Volume of diluted sample used for colour development, mL

3.1.12 Iron

Introduction

Iron is most commonly found in nature in the form of its oxides. In drinking-water supplies, iron(II) salts are unstable and are precipitated as insoluble iron(III) hydroxide, which settles out as a rust-coloured silt. Anaerobic groundwaters may contain iron(II) at concentrations of up to several milligrams per litre without discoloration or turbidity in the water when directly pumped from a well, although turbidity and colour may develop in piped systems at iron levels above 0.05–0.1 mg/litre. Staining of laundry and plumbing may occur at concentrations above 0.3 mg/litre. Iron also promotes undesirable bacterial growth ("iron bacteria") within a waterworks and distribution system, resulting in the deposition of a slimy coating on the piping. The median iron concentration in rivers has been reported to be 0.7 mg/litre. In anaerobic groundwater where iron is in the form of iron(II), concentrations will usually be 0.5–10 mg/litre, but concentrations up to 50 mg/litre can sometimes be found.

Phenanthroline Method (APHA 3500-Fe B)

Principle:

Iron is brought into solution, reduced to the ferrous state by boiling with acid and hydroxylamine, and treated with 1, 10-phenanthroline at pH 3.2 to 3.3. Three molecules of phenanthroline chelate each atom of ferrous iron to form an orange-red complex. The coloured solution obeys Beer’s law; its intensity is independent of pH from 3 to 9. A pH between 2.9 and 3.5 ensures rapid colour development in the presence of an excess of phenanthroline. Colour standards are stable for at least 6 months.

Procedure:

1. Sample preparation: We mix sample thoroughly and measure 50.0 mL into a 125-mL Erlenmeyer flask. If this sample volume contains more than 200 µg iron use a smaller accurately measured portion and dilute to 50.0 mL. We add 2 mL conc HCl and 1 mL $NH_2OH.HCl$ solution. Then a few glass beads and heat to boiling is added . To ensure dissolution of all the iron, continue boiling until volume is reduced to 15 to 20 mL (If the sample is ashed, take up residue in 2 mL conc HCl and 5 mL water). Cool to room temperature and transfer to a 50- or 100-mL volumetric flask or Nessler tube. Add 10 mL $NH_4C_2H_3O_2$ buffer solution and 4 mL phenanthroline solution, and dilute to mark with water. We mix thoroughly and allow a minimum of 10 min for maximum colour development.

2. Measurement: We prepare a standard curve in the UV-Vis spectrophotometer at 510 nm, with the help of standard iron solution following the procedure described in 5.1. Measure the concentration of iron from the standard curve itself.

Calculation:

$$\text{mg Fe/L} = \mu g\ Fe\ (in\ 100\ mL\ final\ volume)/mL\ of\ Sample$$

CHAPTER 4

RESULTS

RESULTS:-

The results obtained after conducting the above mentioned test (As per BIS 10500-2012)

Sample 1- At Alimur Chapori Water Supply Scheme Deep Tubewell untreated water

Sample 2- At treated Tap water of water supply scheme

Sample 3- At Alimur Anganwadi Centre

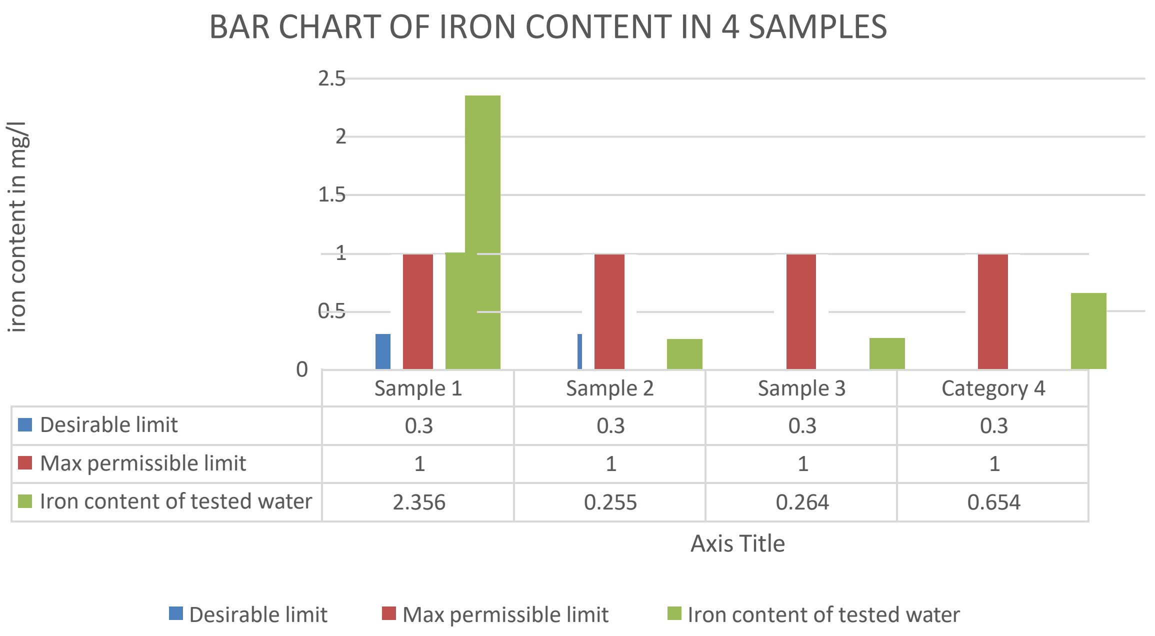
Sample 4- At Hand Tubewell of Bijoy Medok's house .

Table 1: Results of test performed

Sl. No.	**Parameter**	**Sample 1**	**Sample 2**	**Sample 3**	**Sample 4**	**IS: 10500:2012 (Second Revision)**		**Unit**	
						Desirable limit	**Max. Permissible limit (in absence better alternate source)**		Remarks
1	pH	6.67	6.75	6.71	6.85	6.5 – 8.5	6.5 – 8.5	pH Units	
2	**Total Dissolved Solids**	114	120	120	144	500	2000	mg/L	
4	**Iron**	2.356	0.255	0.264	0.654	0.3	1	mg/L	Raw water above permissible limit
5	**Nitrate**	3.254	0.124	0.128	0.684	45	45	mg/L	
6	**Chloride**	48.212	34.032	29.778	34.032	250	1000	mg/L	
7	**Total**	164	62	68	84	200	600	mg/L	

	Hardness							
8	**Alkalinity**	98	12	26	22	200	600	mg/L	
9	**Fluoride**	0.188	0.124	0.124	0.124	1.0	1.5	mg/L	
10	**Sulphate**	2.356	0.129	0.264	0.328	200	400	mg/L	
11	**Arsenic**	0.000	0.000	0.000	0.000	0.01	0.05	mg/L	
12	**Colour**	10	0	1	2	5	15	Hazen	
13	**Odour**	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable		
14	**Taste**	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable		
15	**Calcium**	21.643	20.040	16.833	22.444	75	200	mg/L	
16	**Magnesium**	26.730	2.916	6.318	6.804	30	100	mg/L	

As it can be seen in the above table there is only variation in iron content ,so a bar graph is prepared showing the variation in iron content in this 4 samples



CHAPTER 5

CONCLUSIONS

Conclusions-

From the result of this study it can be concluded that :-

Maximum Parameters of ground water samples are within the permissible limit only iron content from raw Water of deep tube well exceeds the permissible limit which need to be treated using proper aerator and Rapid sand filter or Pressure filter (Iron removal filter) .

A study related to Ground water quality has been taken up by Public Health Engineering Department Assam in the district of Lakhimpur .

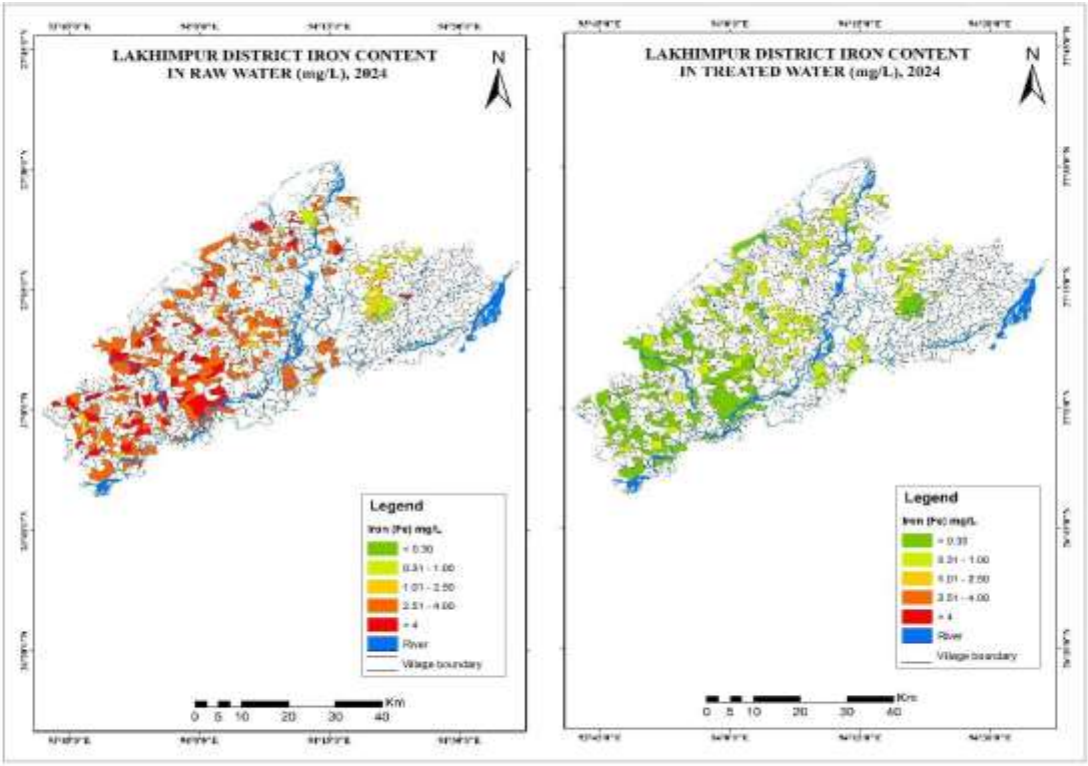


Fig:- Map of Lakhimpur district differentiating Raw and Treated water
Source: Public heath engineering dept, govt. of Assam

Table showing Iron affected villages in Lakhimpur district Assam

District	Total Village	Iron affected village
Lakhimpur	1105 (As per IMIS govt of India)	724

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