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DISSERTATION

ANALYSIS OF WATER QUALITY PARAMETERS

A DISSERTATION REPORT SUBMITTED IN PARTIAL FULLFILLMENT OF THE REQUIREMENT FOR THE DEGREE OF

BACHELOR OF SCIENCE

IN

CHEMISTRY

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DECLARATION

I hereby declare that DISSERTATION entitled ANALYSIS OF WATER QUALITY PARAMETERS submitted to the Department of Chemistry, SJM college of Arts, Science and Commerce, Chitradurga is record of an original work done by us under the guidance of Dr.Harshavardhan A , Assistant Professor of chemistry. This dissertation submitted in partial fulfillment of the requirements of for the award of Bachelors Degree in Science by Davangere University.

I also declare that the report is the outcome of our own efforts.

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CERTIFICATE

This is to certify that the DISSERTATION entitled "ANALYSIS OF WATER QUALITY PARAMETERS" that is being submitted by

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In partial fulfillment of the requirement for the award of Bsc in Chemistry in the S.J.M. COLLEGE OF ARTS , SCIENCE AND COMMERCE is a bonafide record of confide work carried out by them under our guidance and supervision. The results embodied in this mini dissertation report have not been submitted to any other university or institute for the award of any Degree.

Signature of the Guide:	Signature of the HOD:
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Examiner:

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Abstract

Water is the most important in 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 and alkalinity. An assessment of the aquatic macro invertebrates can also provide an indication of water quality.

KEYWORDS: Alkalinity, Dissolved Oxygen , Acidity, Chloride, pH, Total hardness, Nitrates.

Contents

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 of water through breathing,sweating and digestion, its crucial to rehydrate and replace water by drinking fluids and eating foods that contain water.

Drinking Water

Fluids and hydration are crucial for the bodily functions of humans,especially when it comes to drinking water. As you probably remember, 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.

- Delivering essential nutrients to all organs.
- Oxygen supply to the lung and maintaining heart function.
- Release of recycled substances and ensuring the stability of the internal environment.
- Maintaing the normal body temperature.
- 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 mucuos 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.

Distribution of Water on earth

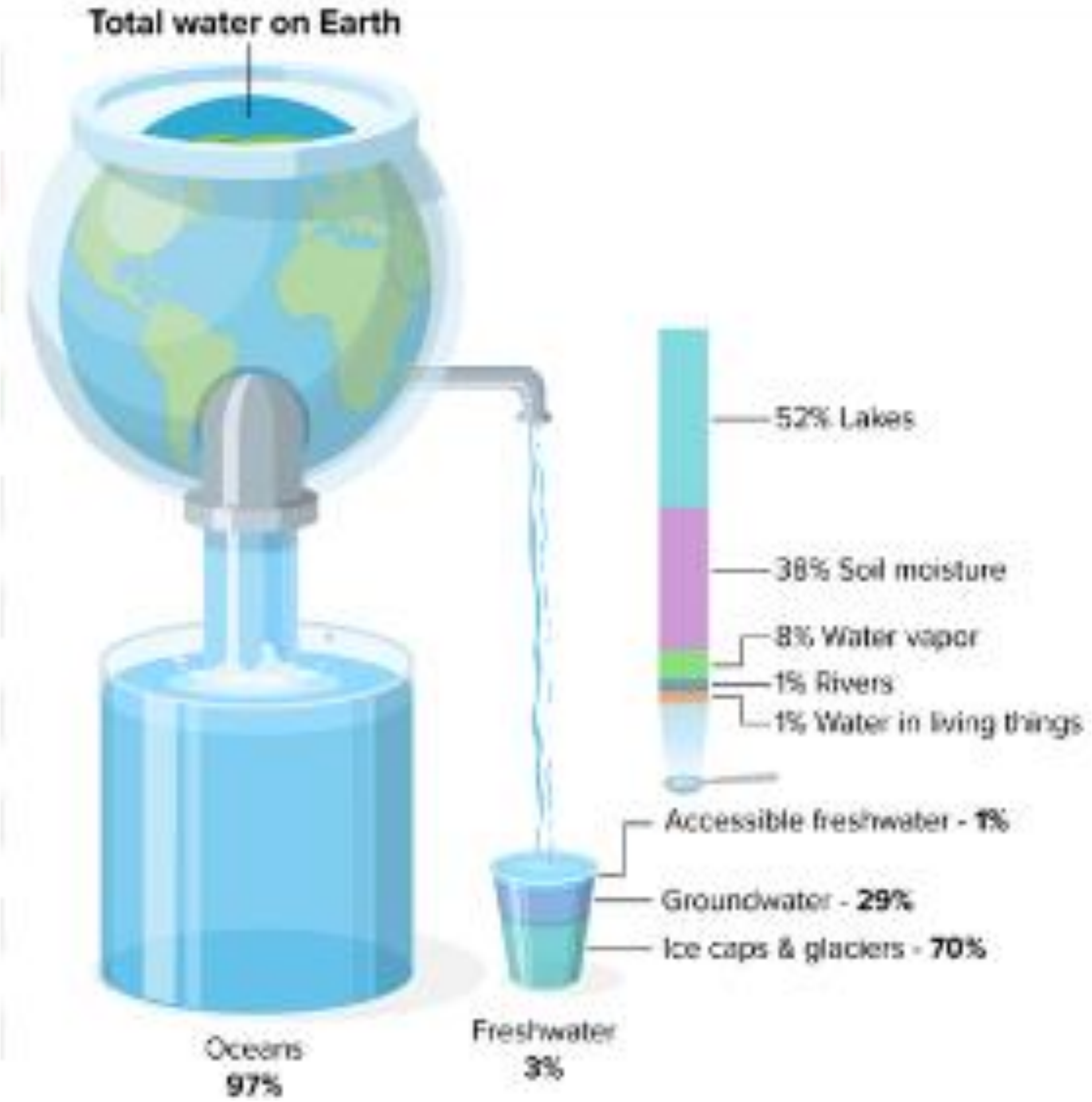


Figure 1.1: Distribution of Water

MEASUREMENT OF POLLUTANTS IN WATER

There are 3 kinds of water:

- drinking water
- waste water
- surface water

Drinking water or **potable water** is water of sufficiently high quality that can be consumed or used without risk of immediate or long term harm. It is provided by water supply networks or may be found in deep wells or springs.

Waste water or **sewage** comprises liquid waste discharged by domestic residences, commercial properties, industry, and/or agriculture and can encompass a wide range of potential contaminants and concentrations. In the most common usage, it refers to the municipal wastewater that contains a broad spectrum of contaminants resulting from the mixing of wastewaters from different sources.

Surface water is water collecting on the ground or in a stream, river, lake, wetland, or ocean; it is related to water collecting as groundwater or atmospheric water.

MEASUREMENT OF POLLUTANTS IN WATER

Regulations

Drinking water

Law 311/2004, completion of Law 458/2002

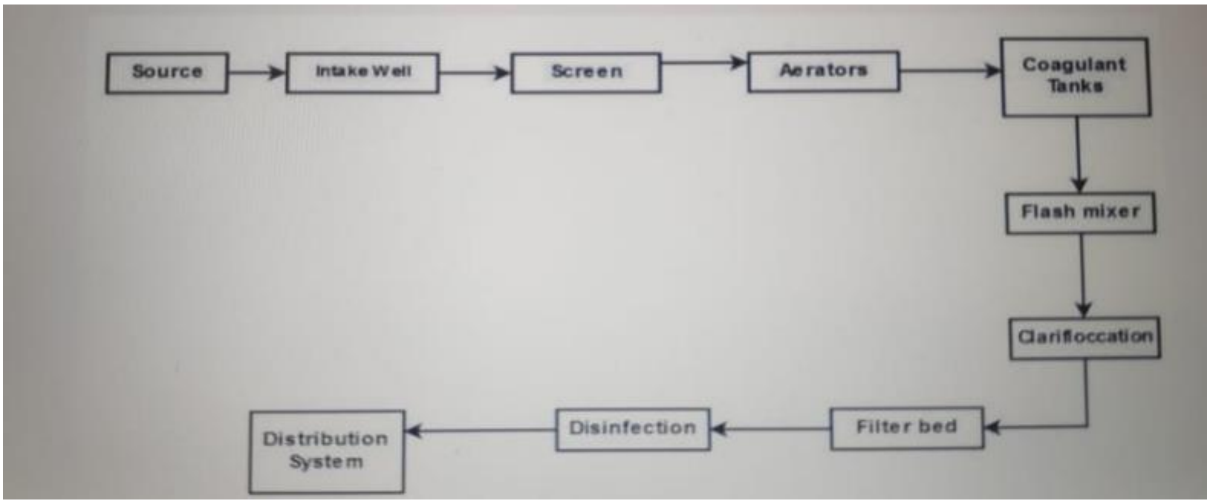
Microbiological parameters

Parameter	Limit value (number/100 ml)
Escherichia coli (E.coli)	0
Enterococi	0

Chemical parameters

parameters	Limit value	Unit
Ammonia	0,50	mg/l
Chlorine	250	mg/l
Conductivity	2.500	µS cm^{-1} la 20^0C
Nitrate	50	mg/l
Nitrite	0.5	mg/l
pH	≥ 6,5; ≤ 9,5	unităţi de pH
Sulphate	250	mg/l
Sulphyde	100	µg/l
Turbidity	≤ 5	UNT
Chromium total	50	µg/l
Zinc	5.000	µg/l
Iron	200	µg/l
Manganese	50	µg/l
Copper	0.1	mg/l
Alpha global activity	0,1	Bq/l
Beta global activity	1	Bq/l

METHODOLOGY



Block Diagram of Water Purification

Source

The source water for a municipal surface water treatment plant is typically a local river,lake, or reservoir. There must be a method to get this water to the water treatment plant. Quite often,a series of pumps and pipelines transport the water to the treatment plant. Sometimes, as is the case of San Angelo, water from a reservoir such as Twin Buttes can be transported to the water treatment plant via a river. Twin Buttes Reservoir is one of the water sources for San Angelo. The water is released into Lake Nasworthy where it is transported down the Concho River to the water treatment plant. At the water plant, large pumps are used to transfer the water up to the treatment facility. Treatment facilities are often engineered to utilize gravity water flow as much as possible to reduce pumping costs.Many water treatment plants utilize water from more than one source. Blending groundwater with surface water is a method often used to improve the quality of the final product.

Screening and Straining

If you think about surface water sources, i.e., lakes, rivers, and reservoirs, you realize they contain varying amounts of suspended and dissolved materials. This material may include turbidity, color, taste, odour, microorganisms, fish, plants, trees, trash, etc. The material may be organic or inorganic, suspended or dissolved, inert or biologically active, and vary in size from colloidal to a tree trunk. Some of these larger items can impede equipment in the treatment process, such as a tree limb getting stuck in a water pump impeller. So the first process in conventional water treatment is to screen or strain out the larger items. This is often accomplished using a large metal screen, often called a bar screen, which is placed in front of the water source intake. Large items are trapped on the screen as the water passes through it. These screens must routinely be raked or cleaned off.

Chemical Addition

Once the pre-screened source water is received into the treatment plant, chemicals are added to help make the suspended particles that are floating in the water clump together to form a heavier and larger gelatinous particle, often called floc. In this process, a chemical is added that reacts with the natural alkalinity in solution to form an insoluble precipitate. There are many different chemicals on the market that are used in this process. These chemicals are called coagulants. One of the most common that has been used for many years is aluminium sulphate, or alum. Some other very popular coagulants are ferrous sulphate, ferric chloride, sodium aluminate, activated silica, and com pounds called polymers that are manufactured chemicals made up of repeated small units of low molecular weight combined into molecules with very large molecular weights. These polymers are classified as cationic polymers (positively charged), anionic polymers (negatively charged), and nonionic polymers (neutrally charged). Regardless of which coagulant or combination of coagulants is used, they must be mixed very well with the water before they can form a heavier floc.

Coagulation and Flocculation

A rapid mix unit is usually used where the coagulant is added to the water to provide a very quick and thorough mixing. The water mixing is then slowed to allow the water to come in contact with the forming floc and allow it to increase in size. The continued mixing must be gentle to allow the floc to grow and gain weight, but fast enough to keep it in suspension until you are ready for it to settle in the clarifiers. The process of adding a chemical to cause the suspended material to “clump” into larger particles is called flocculation or coagulation. The treatment unit where coagulation and flocculation is performed is called the “flocculator”.

Sedimentation and Clarification

Once the flocculation process is complete, the water then passes over the weir in the flocculator and travels to the center of the clarifier, or sedimentation basin. Here, the water makes its way from the center of the clarifier to the saw tooth weir at the perimeter of the unit. As the water makes its way towards the weir, the large floc particles are allowed to settle out to the bottom of the clarifier. A rake continuously travels across the bottom of the clarifier and scrapes the settled floc to the center of the unit. Pumps are used to pull the settled “sludge” out of the clarifier and send it to a sedimentation / disposal pond. The water that passes over the weir is collected and transferred to the filters. The reason clarification occurs before filtration is so the majority of suspended material can be removed prior to filtration, which avoids overloading the filters and thus allowing much more water to be filtered before the filters must be backwashed.

Filtration

Clarified water enters the filters from the top. Gravity pulls the water down through the filters where it is collected in a drain system at the bottom of the unit. There are many different types of materials (media) used in filters. The most common being sand and gravel. Many conventional plants are now using granular activated carbon as the media of choice because it not only provides excellent mechanical filtration of particulate matter, but also removes organic compounds which can cause taste and odor problems.

Disinfection

Once the water has gone through the filtration process, it is about as clear and clean as it can get. However, there may still be bacteria and viruses remaining. To ensure these are destroyed, there must be a disinfection process employed. The most common disinfection process used in the United States is chlorination. Chlorine comes in many different forms including chlorine gas (most common), chlorine dioxide, hypochlorite (bleach), and others. Whichever method is used, chlorine is added to the water in an amount to ensure all microorganisms are destroyed. Water plants monitor the chlorine levels continuously and very carefully in the treated water. They must add enough chlorine to ensure thorough disinfection of the water, but avoid adding excesses that can cause taste and odor problems when delivered to the consumer.

Storage

Once the disinfection process is complete, the water is stored. Storage usually takes place in an underground storage tank called a “clear well”, and also in elevated storage tanks that are visible around town. There must always be an ample supply of water available in the event of emergencies. These can include power outages, fires, floods, etc.

Distribution

So how does the water come out of your kitchen tap? The stored water is pushed through underground pipelines all over town in what is called a “distribution system”. The distribution system consists of large water pumps at the treatment plant, overhead water storage tanks, large pipelines, smaller pipelines, fire hydrants, valves, and water meters in your front yard.

DETERMINATION OF SAMPLE PARAMETERS

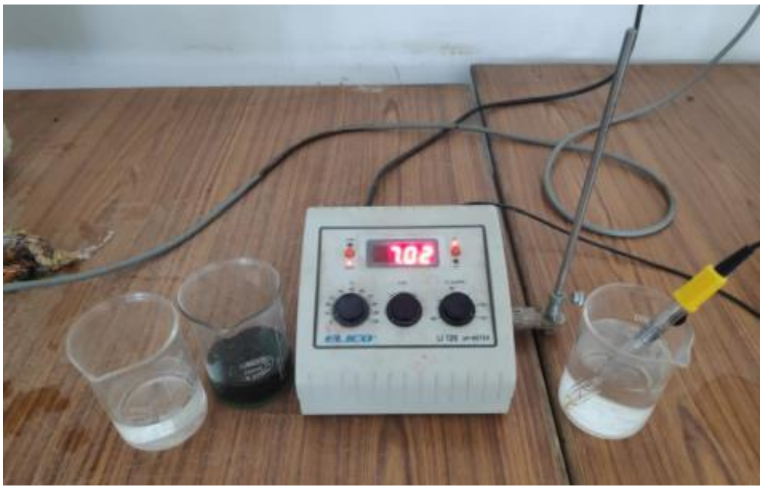
Water sample is collected from the area of KAMINENIPALLE VILLAGE,SIRIVELLA MANDAL,NANDYALA DISTRICT and its tested for drinking purpose.The different parameters which are determined in this project are :

1. pH of water
2. . Alkalinity and acidity of water
3. Dissolved oxygen(DO)
4. Electrical conductivity(EC) of water
5. Hardness of water
6. Total dissolved solids
7. Total solids
8. Chloride
9. Taste and odour

❖ *PH*

Introduction

pH stands for hydrogen (H) potential and it represents the measure of concentration ofH+ ions in a solution.As 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. In general, the pH of water for drinking purpose should be between 6.5 and 8.5.



pH meter

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

1. 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.
2. 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.
3. The pH of the given water sample is given.
4. Take the electrode from the water sample, wash it with distilled water and then wipe gently with soft tissue.

Results of pH

Sample No	Sample Description	Temperature of Sample (C)	pH
1	Sample 1	27°	6.99
2	Sample 2	27°	7.2

- ***Alkalinity and Acidity***

- Alkalinity

Introduction

Water alkalinity is a measure of the concentration of bases in a solution or the ability to neutralize acids in water.It can also be referred to as the buffering capacity of water.Examples of bases are carbonates,bicarbonates,magnesium bicarbonate,ammonia,borates, phosphates,silicates,and organic bases.For all practical purposes, carbonates and bicarbonates are the main contributors to the alkalinity of water.Since corrosion is caused by calcium carbonate,the corrosion process is dependent on the pH and alkalinity of the water.

Starting point of alkalinity

End point of alkalinity

PROCEDURE

Take 100ml of sample in a conical flask.Add 3-4 drops of phenolphthalein indicator. If no color is produced,the phenolphthalein alkalinity is absent.If the sample turns pink, titrate with N/50 H2SO4 till the pink colour disappears.Record the ml of acid used (P). Add 1 drop of methyl orange to same sample to the titrated mixture and retitrate with N/50 H2SO4 until first change from yellow to orange colour is noted (T).

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

Results of alkalinity

Sample detailed source	Volume (ml)	pH	Phenolphthalein			Methyl Orange		
			Initial	Final	Final H2SO4	Initial	Final	Final H2SO4
Sample 1	100	6.99	0	0	0	0	5.8.	5.8
Sample 2	100	7.2	0	0	0	0	6	6

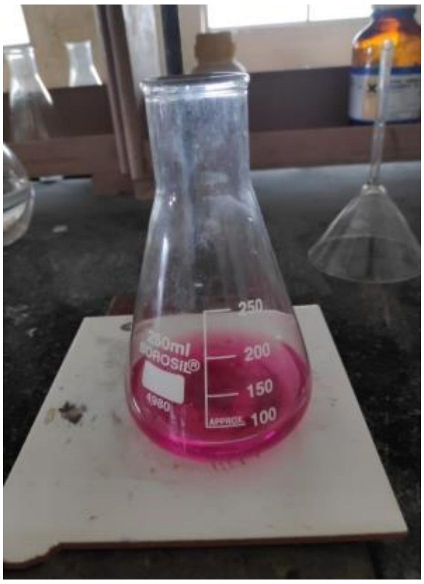
❖ *Acidity*

Introduction

The acidity of natural water is primarily due to dissolved CO2 and is defined as the capacity to neutralize bases.However in water polluted by trade wastes acidity may be because of mineral acids (below pH 4). Acidity due to CO2 is present within a pH range 4.5-8.3.When the pH of a Sample is more than 8.3,acidity is absent.

Procedure

Starting point of Acidity



End point of Acidity

Place 100 ml water in a conical ask and add to it one drop of Methyl orangeindicator.If it gives an organish red colour,mineral acidity is present.Titrate it with N/50 NaOH to a yellow end point.Note the ml of N/50 NaOH used.In another ask place 100 ml water and add 0.5 ml phenolphthalein indicator.If it does not give any color, titrate with N/50 NaOH to light pink(first permanent change) end point.Note the ml of solution used.If Phenolphthalein gives a pink color on addition of the sample,acidity is not available.

Results of acidity

Sample detailed source	Volume (ml)	pH	Phenolphthalein			Methyl Orange		
			Initial	Final	Final H2SO4	Initial	Final	Final H2SO4
Sample 1	100	6.99	0	10.6	10.6	0	0	0
Sample 2	100	7.2	0	9.6	9.6	0	0	0

❖ 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.

Starting point of dissolved oxygen

End point of dissolved oxygen

Procedure :

1. 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.

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

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

4. Add 2 ml of alkali-iodide-azide reagent in the same manner.

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

6. Allow it to settle for sufficient time then add 2 ml of concentrated sulfuric acid via a pipette held just above the surface of the sample.

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

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

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

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

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

12. Note down the volume of sodium thiosulphate solution used.

Results of Dissolved oxygen

Trial No	Temperature (˄.C)	Volume of sample (ml)	Burette Reading (ml)		Volume of Titrant (ml)	Dissolved Oxygen (mg/l)
			Initial	Final		
1	27◦	203	0	9	9	9
2	27◦	203	0	8.6	8.6	8.6

❖ *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.

Electrical conductivity

Procedure

1. 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.
2. 2. Press ENTER for getting SELECTION MODE. Select mode as (EC) using direction keys(^ or _) and presses ENTER.
3. 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.
4. If automatic temperature meant is desired and thermo probe is not connected in which case connect it and press Enter key to get temperature.
5. If the temperature is desired to be entered manually, press ESC key and enter temperature.
6. If the actual temperature is not what is displayed as default, measure the temperature with a thermometer, press ESC key and enter the temperature.
7. 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 thermoprobe 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.

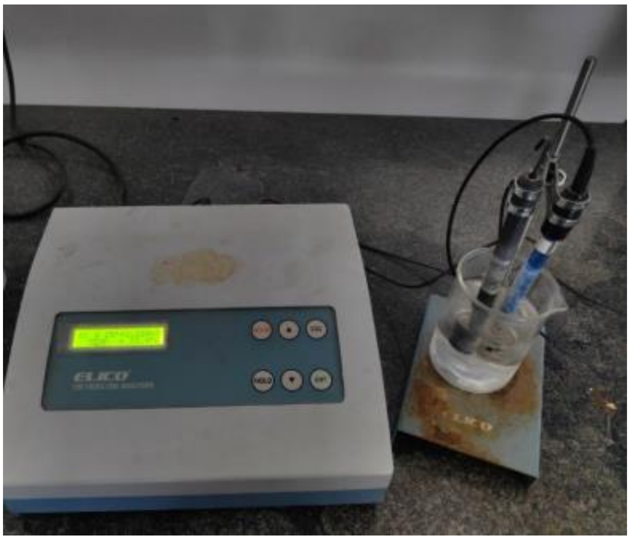
❖ *Total Dissolved Solids*

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

1. Switch ON the instrument half an hour before the conduction of experiment.



Electrical conductivity

2. Electrode/probe is to be washed with Distilled water and do not dip in any solution.

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

4. Enter TDS Factor as 0.50. (Press ESC if it is desired to enter a different TDS Factor say 0.56.,) and press Enter.

5. 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.

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

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

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

9. 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.

❖ *Chloride Concentration*

Introduction

Chlorides are widely distributed as salts of calcium, sodium and potassium in water . In potable water, the salty taste produced by chloride concentrations is variable and dependent on the chemical composition of water.

The major taste producing salts in water are sodium chloride and calcium chloride. The salty taste is due to chloride anions and associated cations in water. In some water which is having only 250 mg/L of chloride may have a detectable salty taste if the cat-ion present in the water is sodium. On the other hand, a typical salty taste may be absent even if the water is having very high chloride concentration for example 1000 mg/L. This is because the predominant cation present in the water is not sodium but either calcium or magnesium may be present.

Starting point of chloride

End point of chloride

Procedure

1.Before starting the titration rinse the burette with silver nitrate solution. Fill the burette with silver nitrate solution of 0.0141 N. Adjust to zero and fix the burette in stand.

Results of Chloride concentration

Sample	No Volume of Sample (ml)	Burette Reading (ml)		Volume of $AgNO_3$ (ml)
		Initial	Final	
Sample 1	20	0	11.8	11.8
Blank	20	11.8	13.2	1.4

2.Take 20 mL of the sample in a clean 250mL conical flask.Add 1 mL of Potassium Chromate indicator to get light yellow color.

3.Titrate the sample against silver nitrate solution until the color changes from yellow to brick red. i.e., the end point.

4.Note the volume of Silver nitrate added (A).

5.Repeat the procedure for concordant values.

Blank Titration

1.Take 20 mL of the distilled water in a clean 250mL conical flask.

2.Add 1 mL of Potassium Chromate indicator to get light yellow color.

3.Titrate the sample against silver nitrate solution until the color changes from yellow to brick red. i.e., the end point.

❖ *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

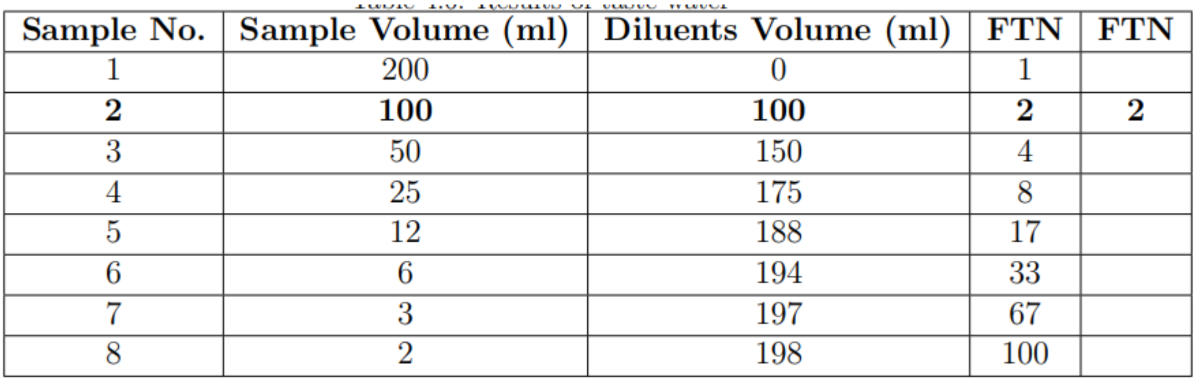
1.A sample of water was diluted in a solution and eight aliquots of different dilutions were prepared.

2.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.

Results of taste water



Sample No.	Sample Volume (ml)	Diluents Volume (ml)	FTN	FTN
1	200	0	1	
2	**100**	**100**	**2**	**2**
3	50	150	4	
4	25	175	8	
5	12	188	17	
6	6	194	33	
7	3	197	67	
8	2	198	100	

- ***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.

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

Where:

A = ml of sample

B = ml of odour free water

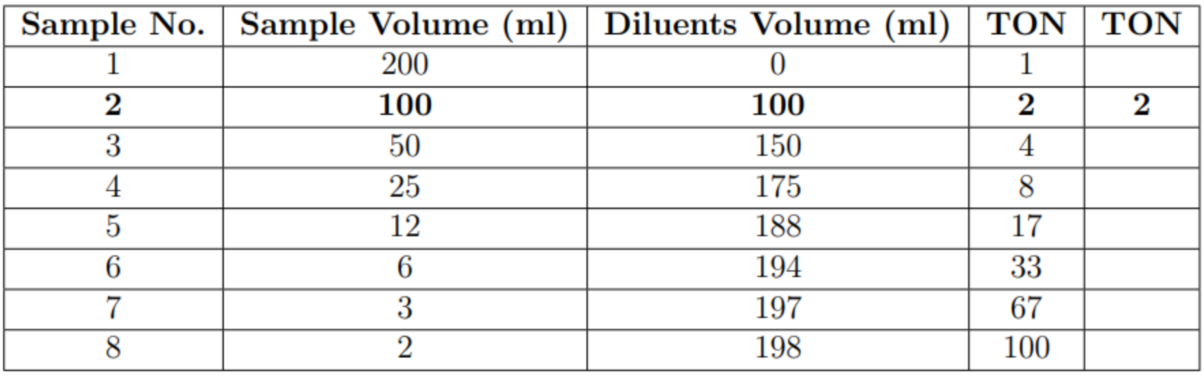
Procedure

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

2.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 TON.

Results of odour water



Sample No.	Sample Volume (ml)	Diluents Volume (ml)	TON	TON
1	200	0	1	
2	**100**	**100**	**2**	**2**
3	50	150	4	
4	25	175	8	
5	12	188	17	
6	6	194	33	
7	3	197	67	
8	2	198	100	

❖*Hardness of water by EDTA titration method*

INTRODUCTION

1.Hardness is caused due to the presence of multivalent cations, mainly Ca+ and Mg+ in water.

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

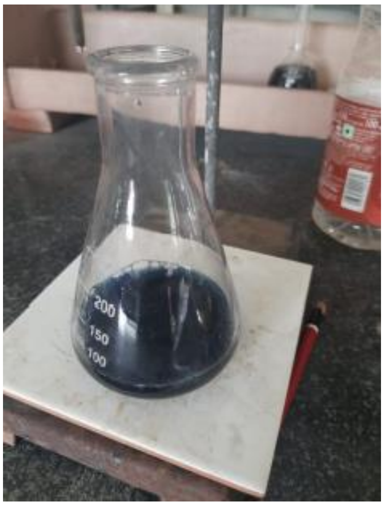
3.Total hardness of water is the sum of Ca+ and Mg+ concentration of water. The results are expressed as calcium carbonate, in mg/L,that is , ”mg/L as CaCO3

4.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 DETERMINATION

Starting point of hardness



End point of hardness

1.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.Titrate each aliquot using the standard EDTA(0.01M)solution (in burette).

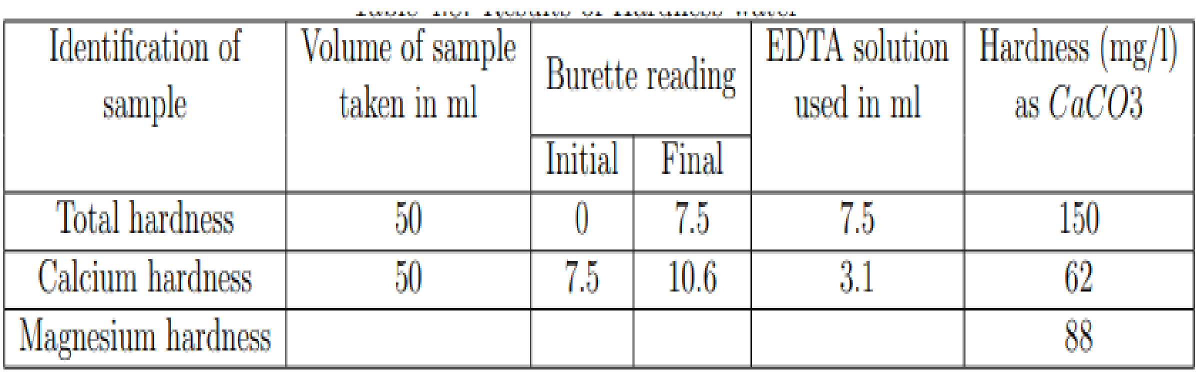
5.Not down the volume of EDTA required(A).

6.Run a reagent blank if buffer is not checked properly. Note the volume of EDTA required for blank (B).

7.Calculate the volume of EDTA required for sample i.e., (A-B).

8.Value B may taken as 0 , if double distilled water and ”A R” grade chemicals are used.

Results of Hardness water



Identification of sample	Volume of sample taken in ml	Burette reading		EDTA solution used in ml	Hardness (mg/l) as $CaCO3$
		Initial	Final		
Total hardness	50	0	7.5	7.5	150
Calcium hardness	50	7.5	10.6	3.1	62
Magnesium hardness					88

- *CALCIUM HARDNESS DETERMINATION*

1.Take a 50 ml of sample in conical flask.

2.Add 1 ml NaOH to raise PH to about 12.0.

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.Note the volume of EDTA used(C).

Total Solids

INTRODUCTION

All matter except the water content in liquid materials classified as “solidwaste”. The usual definition of solids however refers to the matter that remains as residue upon evaporation and drying at 103°C to 105°C

Total Solids (W1)

Total Solids (W2)

PROCEDURE:

Determination of total solids and dissolved solids

1. Take an evaporating dish and clean it properly to remove all the impurities.

2. 2. Dry it 103°C In an oven for 1hr and weigh [W1]. Weighing should be carried out after transferring the evaporation dish in the desiccator. 3.Take 20ml of water sample and transfer it in an evaporating dish. 4. put it on a steam bath and allow the to evaporate. 5. After complete evaporating dry the evaporating dish with residue in oven at 103°C for 1 hour. 6. cool the evaporating dish in desiccator and take weight (W2). 7. Take another 50 ml sample and filter it on filter paper to remove suspended solids. 8. collect the filtrate in evaporating dish. 9.

put it on stream bath and allow the sample to evaporate. 10. Dry the evaporating dish in oven at 180°C FOR 1 hour. 11. Cool the evaporating dish in desiccator and take weight (W4).

$$Totalsolids = \frac{W2 - W1}{mlofsample} * 10^6 \tag{4.10}$$

❖ *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 methemoglobinaemia. 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.

Procedure

UV-spectrophotometer

Calibration procedure of UV-Spectrophotometer
1.Switch on the instrument and wait for 10-15 minutes.

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

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

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

5.Press the ”%T” mode.

6.Again wait for 10-15 minutes.

7.Set zero(000)using ”SETZERO”knob.

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

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

10.Set the ”COARSE” knob to very high.

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

12.press ”ABS”(absorbance)button.

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

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

Study Area

Water sources of the college are bore well and the water supplied by municipality. Municipality water is stored in a sump. The analysis of this water will be carried out to confirm that water is suitable for drinking and general usage. For daily consumption, water is stored in the overhead tanks. An RO plant is installed for drinking water.

WATER STORAGE CAPACITY

SL.NO	PARTICULARS	CAPACITY
1	Bore well two	250 feet depth
2	Sump	5000 liters
3	Overhead Tank	1000+5000 =6000 liters
4	Rain water for distilled water tanks	1000 liters
5	R O filter Tank	500 liters
6	Water usage per day	10000 liters

Bore Well

OVER HEAD TANK

RAIN WATER HARWESTING TANK

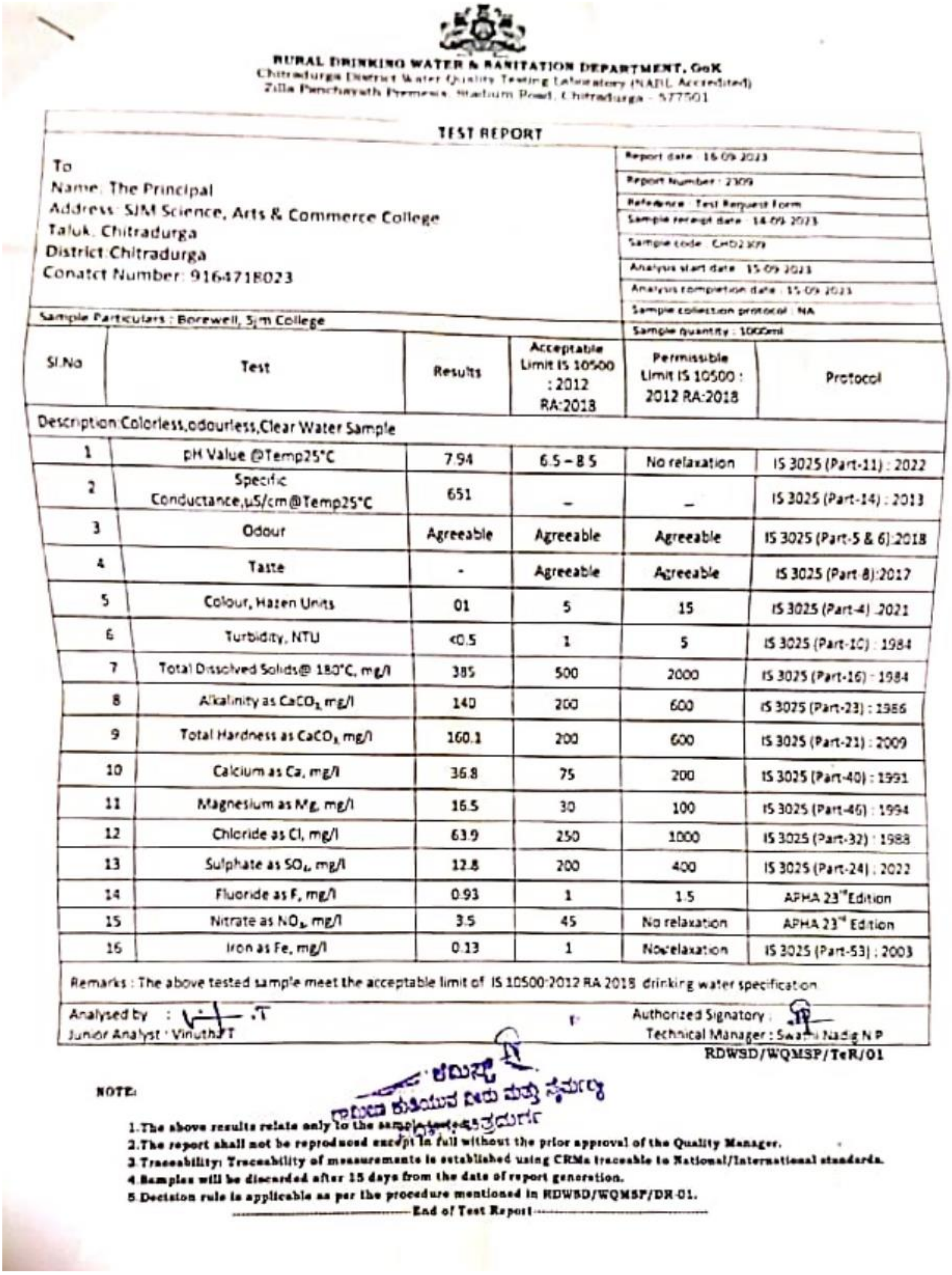
RO PLANT


NAAC ACCREDITED A GRADE (CGPA 3.05)
ಶುದ್ಧ ಕುಡಿಯುವ ನೀರಿನ ಘಟಕ


NDRAVALLI, CHITRADURGA-577501

WATER ANALYSIS

SL.NO	TEST	BOREWELL WATER	RO WATER
01	PH	7.94	8.04
02	CONDUCTANCE	651	36
03	ODOUR	AGREEABLE	AGREEABLE
04	TASTE	-	-
05	COLOUR	01	<1
06	TURBIDITY	<0.5	<0.5
07	TDS mg/l	385	21
O8	ALKALINITY AS CaCo3 mg/l	140	8.0
09	TOTAL HARDNESS AS CaCo3 mg/l	160.1	6.7
10	CALCIUM mg/l	36.8	1.6
11	MAGNESIUM mg/l	16.5	0.9
12	CHLORIDE mg/l	63.9	4.0
13	SULPHATE mg/l	12.8	0.7
14	FLUORIDE mg/l	0.93	<0.1
15	NITRATE mg/l	3.5	0.8
16	IRON mg/l	0.13	<0.1



RURAL DRINKING WATER & SANITATION DEPARTMENT, GoK
Chitradurga District Water Quality Testing Laboratory (NABL Accredited)
Zilla Panchayath Premesis, Stadium Road, Chitradurga - 577501

TEST REPORT

To
Name: The Principal
Address: SJM Science, Arts & Commerce College
Taluk: Chitradurga
District: Chitradurga
Conatct Number: 9164718023

Report date : 16.09.2023
Report Number : 2309
Reference : Test Request Form
Sample receipt date : 14.09.2023
Sample code : CHD2309
Analysis start date : 15.09.2023
Analysis completion date : 15.09.2023
Sample collection protocol : NA
Sample quantity : 1000ml

Sample Particulars : Borewell, Sjm College

Description: Colorless, odourless, Clear Water Sample

Sl.No	Test	Results	Acceptable Limit IS 10500 : 2012 RA:2018	Permissible Limit IS 10500 : 2012 RA:2018	Protocol
1	pH Value @Temp25°C	7.94	6.5 – 8.5	No relaxation	IS 3025 (Part-11) : 2022
2	Specific Conductance, µS/cm@Temp25°C	651	–	–	IS 3025 (Part-14) : 2013
3	Odour	Agreeable	Agreeable	Agreeable	IS 3025 (Part-5 & 6):2018
4	Taste	-	Agreeable	Agreeable	IS 3025 (Part 8):2017
5	Colour, Hazen Units	01	5	15	IS 3025 (Part-4) :2021
6	Turbidity, NTU	<0.5	1	5	IS 3025 (Part-10) : 1984
7	Total Dissolved Solids@ 180°C, mg/l	385	500	2000	IS 3025 (Part-16) : 1984
8	Alkalinity as $CaCO_3$, mg/l	140	200	600	IS 3025 (Part-23) : 1986
9	Total Hardness as $CaCO_3$, mg/l	160.1	200	600	IS 3025 (Part-21) : 2009
10	Calcium as Ca, mg/l	36.8	75	200	IS 3025 (Part-40) : 1991
11	Magnesium as Mg, mg/l	16.5	30	100	IS 3025 (Part-46) : 1994
12	Chloride as Cl, mg/l	63.9	250	1000	IS 3025 (Part-32) : 1988
13	Sulphate as SO_4, mg/l	12.8	200	400	IS 3025 (Part-24) : 2022
14	Fluoride as F, mg/l	0.93	1	1.5	APHA 23rd Edition
15	Nitrate as NO_3, mg/l	3.5	45	No relaxation	APHA 23rd Edition
16	Iron as Fe, mg/l	0.13	1	No relaxation	IS 3025 (Part-53) : 2003

Remarks : The above tested sample meet the acceptable limit of IS 10500:2012 RA 2018 drinking water specification

Analysed by :
Junior Analyst : Vinutha T

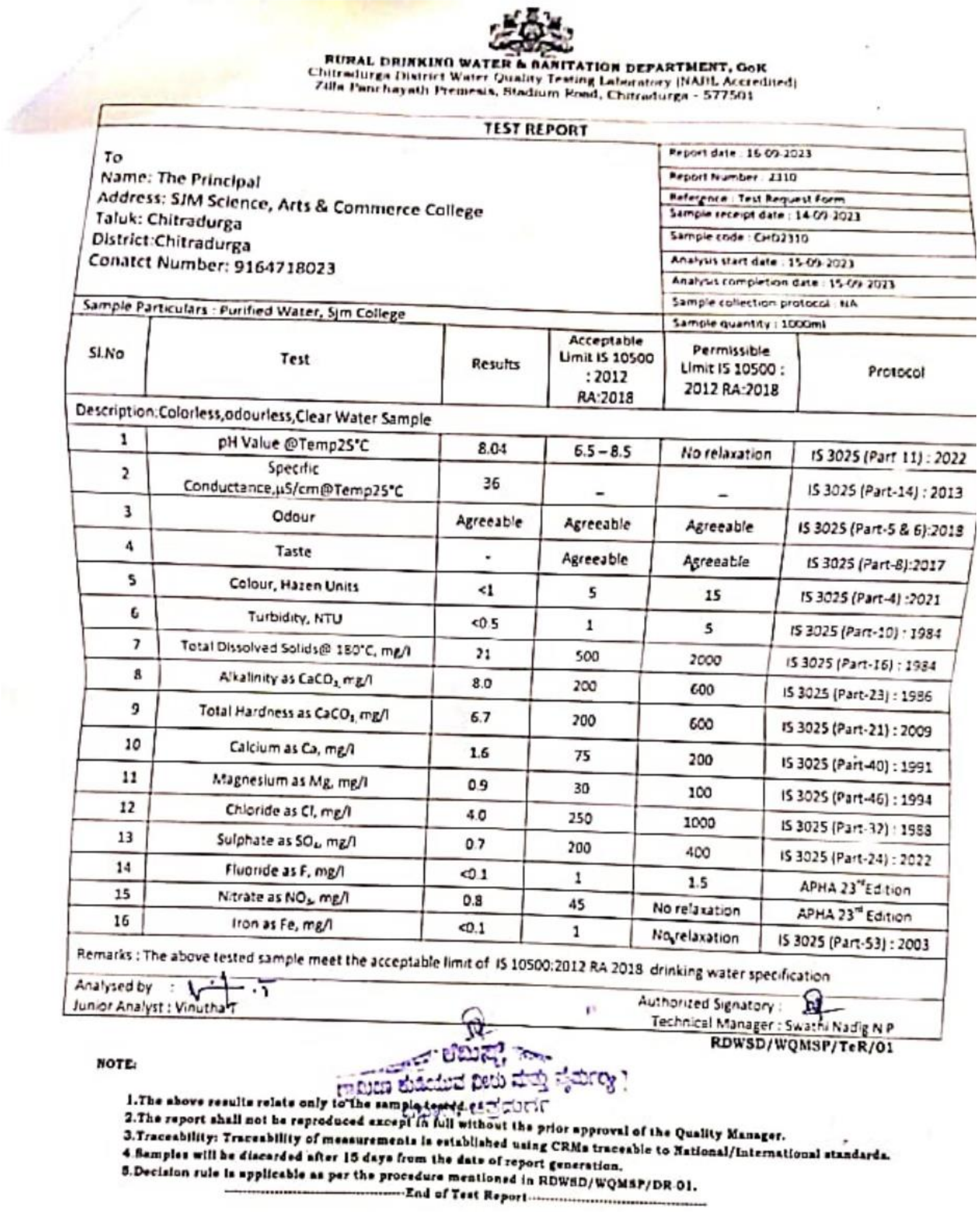
Authorized Signatory :
Technical Manager : Swathi Nadig N P

RDWSD/WQMSP/TeR/01

NOTE:

1. The above results relate only to the sample tested.
2. The report shall not be reproduced except in full without the prior approval of the Quality Manager.
3. Traceability: Traceability of measurements is established using CRMs traceable to National/International standards.
4. Samples will be discarded after 15 days from the date of report generation.
5. Decision rule is applicable as per the procedure mentioned in RDWSD/WQMSP/DR-01.

--------------- End of Test Report ---------------



RURAL DRINKING WATER & SANITATION DEPARTMENT, GoK
Chitradurga District Water Quality Testing Laboratory (NABL Accredited)
Zilla Panchayath Premesis, Stadium Road, Chitradurga - 577501

TEST REPORT

To
Name: The Principal
Address: SJM Science, Arts & Commerce College
Taluk: Chitradurga
District:Chitradurga
Conatct Number: 9164718023

Report date : 16-09-2023
Report Number : 2310
Reference : Test Request Form
Sample receipt date : 14-09-2023
Sample code : CHD2310
Analysis start date : 15-09-2023
Analysis completion date : 15-09-2023
Sample collection protocol : NA
Sample quantity : 1000ml

Sample Particulars : Purified Water, Sjm College

Sl.No	Test	Results	Acceptable Limit IS 10500 : 2012 RA:2018	Permissible Limit IS 10500 : 2012 RA:2018	Protocol
Description:Colorless,odourless,Clear Water Sample					
1	pH Value @Temp25°C	8.04	6.5 – 8.5	No relaxation	IS 3025 (Part 11) : 2022
2	Specific Conductance,µS/cm@Temp25°C	36	–	–	IS 3025 (Part-14) : 2013
3	Odour	Agreeable	Agreeable	Agreeable	IS 3025 (Part-5 & 6):2018
4	Taste	-	Agreeable	Agreeable	IS 3025 (Part-8):2017
5	Colour, Hazen Units	<1	5	15	IS 3025 (Part-4) :2021
6	Turbidity, NTU	<0.5	1	5	IS 3025 (Part-10) : 1984
7	Total Dissolved Solids@ 180°C, mg/l	21	500	2000	IS 3025 (Part-16) : 1984
8	Alkalinity as $CaCO_3$, mg/l	8.0	200	600	IS 3025 (Part-23) : 1986
9	Total Hardness as $CaCO_3$, mg/l	6.7	200	600	IS 3025 (Part-21) : 2009
10	Calcium as Ca, mg/l	1.6	75	200	IS 3025 (Part-40) : 1991
11	Magnesium as Mg, mg/l	0.9	30	100	IS 3025 (Part-46) : 1994
12	Chloride as Cl, mg/l	4.0	250	1000	IS 3025 (Part-32) : 1988
13	Sulphate as SO_4, mg/l	0.7	200	400	IS 3025 (Part-24) : 2022
14	Fluoride as F, mg/l	<0.1	1	1.5	APHA 23rd Edition
15	Nitrate as NO_3, mg/l	0.8	45	No relaxation	APHA 23rd Edition
16	Iron as Fe, mg/l	<0.1	1	No relaxation	IS 3025 (Part-53) : 2003

Remarks : The above tested sample meet the acceptable limit of IS 10500:2012 RA 2018 drinking water specification

Analysed by :
Junior Analyst : Vinutha T

Authorized Signatory :
Technical Manager : Swathi Nadig N P

RDWSD/WQMSP/TeR/01

ಗ್ರಾಮೀಣ ಕುಡಿಯುವ ನೀರು ಮತ್ತು ನೈರ್ಮಲ್ಯ
ಚಿತ್ರದುರ್ಗ

NOTE:

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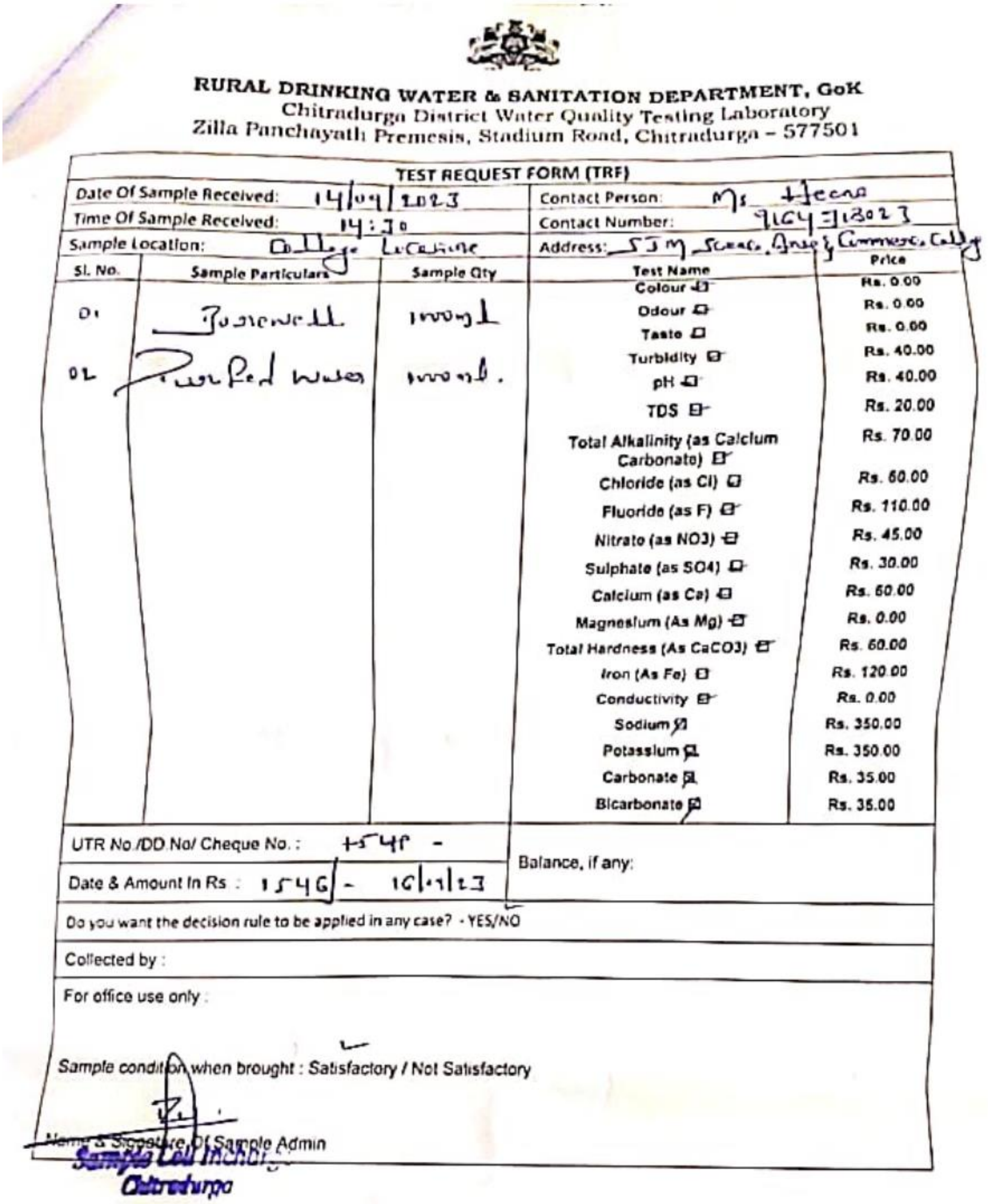
5. Decision rule is applicable as per the procedure mentioned in RDWSD/WQMSP/DR 01.

------------End of Test Report------------



RURAL DRINKING WATER & SANITATION DEPARTMENT, GoK
Chitradurga District Water Quality Testing Laboratory
Zilla Panchayath Premesis, Stadium Road, Chitradurga – 577501

TEST REQUEST FORM (TRF)

Date Of Sample Received: 14/09/2023
Time Of Sample Received: 14:30
Sample Location: College Location
Contact Person: Ms Heena
Contact Number: 9164713023
Address: SJM Science, Arts & Commerce College

Sl. No.	Sample Particulars	Sample Qty	Test Name	Price
01	Borewell	1000ml	Colour ☑	Rs. 0.00
02	Purified water	1000ml.	Odour ☑	Rs. 0.00
			Taste ☑	Rs. 0.00
			Turbidity ☑	Rs. 40.00
			pH ☑	Rs. 40.00
			TDS ☑	Rs. 20.00
			Total Alkalinity (as Calcium Carbonate) ☑	Rs. 70.00
			Chloride (as Cl) ☑	Rs. 60.00
			Fluoride (as F) ☑	Rs. 110.00
			Nitrate (as NO3) ☑	Rs. 45.00
			Sulphate (as SO4) ☑	Rs. 30.00
			Calcium (as Ca) ☑	Rs. 60.00
			Magnesium (As Mg) ☑	Rs. 0.00
			Total Hardness (As CaCO3) ☑	Rs. 60.00
			Iron (As Fe) ☑	Rs. 120.00
			Conductivity ☑	Rs. 0.00
			Sodium ☑	Rs. 350.00
			Potassium ☑	Rs. 350.00
			Carbonate ☑	Rs. 35.00
			Bicarbonate ☑	Rs. 35.00

UTR No./DD No/ Cheque No.: 1546 -
Date & Amount In Rs.: 1546/- 16/09/23
Balance, if any:

Do you want the decision rule to be applied in any case? - YES/NO

Collected by :

For office use only :

Sample condition when brought : [✓ Satisfactory] / Not Satisfactory

Name & Signature Of Sample Admin

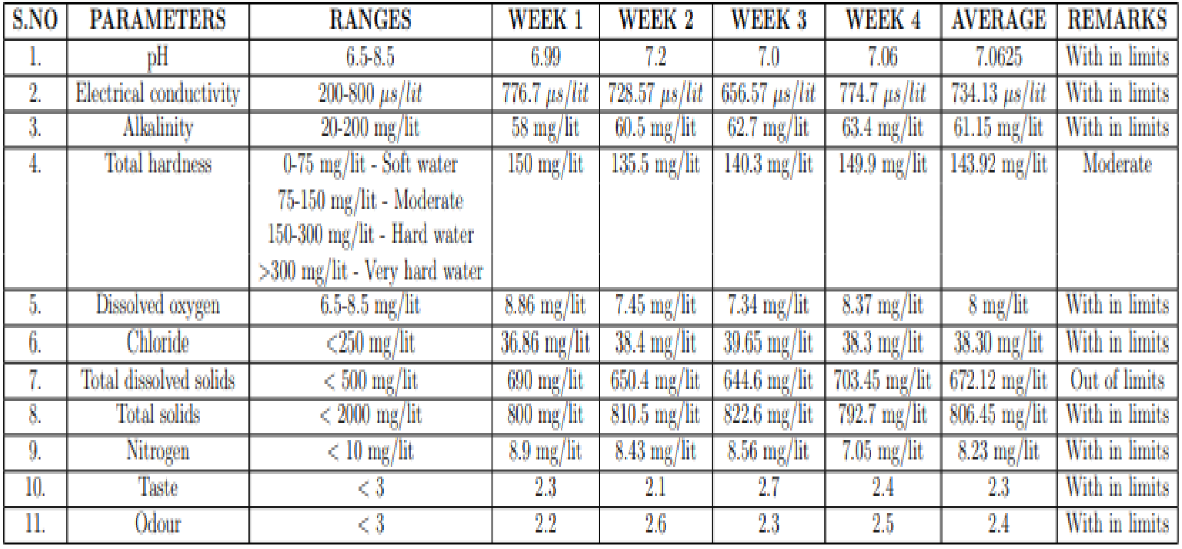
Sample Cell Incharge
Chitradurga

➢RESULTS AND CONCLUSIONS

Results

As per BIS for drinking water(IS 10500-2012)

Table 5.1: Results of parameters



S.NO	PARAMETERS	RANGES	WEEK 1	WEEK 2	WEEK 3	WEEK 4	AVERAGE	REMARKS
1.	pH	6.5-8.5	6.99	7.2	7.0	7.06	7.0625	With in limits
2.	Electrical conductivity	200-800 µs/lit	776.7 µs/lit	728.57 µs/lit	656.57 µs/lit	774.7 µs/lit	734.13 µs/lit	With in limits
3.	Alkalinity	20-200 mg/lit	58 mg/lit	60.5 mg/lit	62.7 mg/lit	63.4 mg/lit	61.15 mg/lit	With in limits
4.	Total hardness	0-75 mg/lit - Soft water 75-150 mg/lit - Moderate 150-300 mg/lit - Hard water >300 mg/lit - Very hard water	150 mg/lit	135.5 mg/lit	140.3 mg/lit	149.9 mg/lit	143.92 mg/lit	Moderate
5.	Dissolved oxygen	6.5-8.5 mg/lit	8.86 mg/lit	7.45 mg/lit	7.34 mg/lit	8.37 mg/lit	8 mg/lit	With in limits
6.	Chloride	<250 mg/lit	36.86 mg/lit	38.4 mg/lit	39.65 mg/lit	38.3 mg/lit	38.30 mg/lit	With in limits
7.	Total dissolved solids	< 500 mg/lit	690 mg/lit	650.4 mg/lit	644.6 mg/lit	703.45 mg/lit	672.12 mg/lit	Out of limits
8.	Total solids	< 2000 mg/lit	800 mg/lit	810.5 mg/lit	822.6 mg/lit	792.7 mg/lit	806.45 mg/lit	With in limits
9.	Nitrogen	< 10 mg/lit	8.9 mg/lit	8.43 mg/lit	8.56 mg/lit	7.05 mg/lit	8.23 mg/lit	With in limits
10.	Taste	< 3	2.3	2.1	2.7	2.4	2.3	With in limits
11.	Odour	< 3	2.2	2.6	2.3	2.5	2.4	With in limits

Conclusions

- From this results of this study it has been conclude that: The physicochemical analysis of the study revealed that. All the groundwater samples collected were having the concentrations of many parameters are within the standard limits and few parameters are below and above the permissible limits.
- By using pressure filters and double filteration we can reduce the total dissolved solids
- The quality of groundwater is objectionable in few parameters and most of the parameters are good for drinking and domestic uses.

➢ References

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7. BIS 10500:2012, Indian Standard for drinking water-specification IS 10500:2012, https://cpcb.nic.in, retrieved on 11 November 2021.

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