

# Chemical Analysis of Drinking Water from Some Communities in Coimbatore

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**Abstract:** *Drinking water parameters would state that assessing the quality of drinking water involves analyzing various physical, chemical and biological parameters such as pH, conductivity, Total dissolved solids (TDS), hardness, alkalinity, dissolved oxygen, turbidity, nitrate, chloride and sulphide etc. Which are crucial for ensuring the water is safe for consumption and meets established health standards, with deviation from these parameters potentially indicating contamination and posing health risk. Data were collected using a cross - sectional research design for a household survey, and water quality samples were collected from improved and unimproved alternative sources. The result shows that esthetic water quality parameters had a potential interpretation of water quality as of the laboratory analysis. Finally, there suggests that due consideration of esthetic factors as measured parameters is fundamental for the sustainable use of drinking water infrastructures.*

**Keywords:** Ultra violet spectroscopy analysis

## I. INTRODUCTION

Water is one of the basic needs and is required by all life on earth. It dominates a majority of the space on our planet, covering about 71% of the total surface area of Earth. Water, a substance composed of the chemical elements hydrogen and oxygen and existing in gaseous, liquid, and solid states. It is one of the most plentiful and essential of compounds. It is an essential source for the existence of life on the planet earth. It is widely used for various purposes such as drinking, washing, bathing, cleaning, cooking, irrigation, and other industrial and domestic uses. Drinking water or potable water is water that is safe for ingestion, either when drunk directly in liquid form or consumed indirectly through food preparation. The quality of your drinking water depends on where it came from and how it has been treated. The role of a drinking water supplier is to provide adequate water for the community and prevent/mitigate risk of water contamination in different elements/points of the water supply system such as source, treatment and distribution. They also should assure the delivery of a safe and esthetically pleasing drinking water to the consumer's point. The pH level of the water sources should be between 6.5 and 8.5 on a scale ranging from 0 to 14. The best pH for drinking water sits at a 7 right in the middle. IS 10500:2012 – Drinking Water – Specification, this standard specifies the requirements for the quality of drinking water, covering a range of physical, chemical, and microbiological parameters.

## II. EXPERIMENTAL SECTION

### 2.1 pH

pH stands for hydrogen (H) potential and it represents the measure of concentration of H<sup>+</sup> 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.

In a 100 ml beaker take a pH 7.0 buffer solution and place it in an electrode, and stir well. Now place the electrode in the beaker containing the stirred buffer and check the reading in the pH meter. If the instrument is not showing a 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. After we used to calibrate that using buffer 4.01 solution. The pH range of the sample (EHS360/TR/2024-25/N13723) was 7.25.

### 2.2 ELECTRICAL CONDUCTIVITY (EC)

Connected the conductivity meter to AC to avoid the effect of polarisation. Dipped the cell and thermistor (temperature probe) in a beaker containing 0.1N KCl. (EC = 1413  $\mu\text{S} / \text{cm}$  at 25°C). Adjusted the temperature to 25°C. Read the specific conductivity. Adjusted the cell constant screw until the display reads the correct specific conductivity of the solution, and Removed the cell and temperature probe and rinsed it with distilled water.

### 2.3 TOTAL DISSOLVED SOLIDS

Total dissolved solids (TDS) is the amount of dissolved solids in a liquid, such as water. TDS includes inorganic salts, small amounts of organic matter, and other dissolved substances. The sample is filtered and the filtrate evaporated in a tare dish on a steam-bath. The residue after evaporation is dried to constant mass at 103-105°C or 179 - 181°C.

Heat the clean evaporating dish to 180°C for 1 hour. Cool in the desiccator, weigh and store in the desiccator until ready for use..Pipette the volume to a weighted evaporating dish placed on a steam-bath. Evaporation may also be performed in a drying oven. The temperature shall be lowered to approximately 98°C to prevent boiling and splattering of the sample. After complete evaporation of water from the residue. transfer the dish to an oven at 103-105°C or 179-181°C and dry to constant mass, that is, till the difference in the successive weighings is less than 0.5 mg. Weigh the dish as soon as it has cooled, avoiding residue to stay for a long time as some residues are hygroscopic and may absorb water from desiccant that is not absolutely dry.



### 2.4 TOTAL SUSPENDED SOLID (TSS)

The total suspended solids (TSS) procedure involves filtering a water sample through a glass fiber filter and then drying and weighing the filter. The increase in weight is the TSS. Weight a glass fiber filter and Dry the filter in an oven at 103–105°C. Let the filter cool in a desiccator. Place the filter in a funnel or crucible then attach the funnel or crucible to a vacuum system. Rinse the filter with deionized water and Pour a measured volume of the sample into the funnel or crucible. Allow the sample to drain through the filter and wash the sides of the funnel with deionized water. Dry the filter and pan in an oven at 103–105°C. Let the filter and pan cool in a desiccator then weigh the filter to the nearest 0.0001 g .



### 2.5 TOTAL HARDNESS

To determine the total hardness of water, we generally perform a titration method using EDTA (Ethylenediaminetetraacetic acid) as the titrant. The hardness is primarily due to the presence of calcium ( $\text{Ca}^{2+}$ ) and magnesium ( $\text{Mg}^{2+}$ ) ions in water. Measure a known volume of the water sample (usually 50 mL) using a pipette and

transfer it to a clean conical flask. Add 2 ml of Ammonia buffer and add a pinch of Eriochrome Black T solution to the sample. The water will turn Pink colour. Fill a burette with the standard EDTA solution. Slowly titrate the water sample with the EDTA solution while constantly swirling the conical flask. The EDTA will bind to the calcium and magnesium ions, and the color of the solution will change from red to blue, indicating the endpoint.

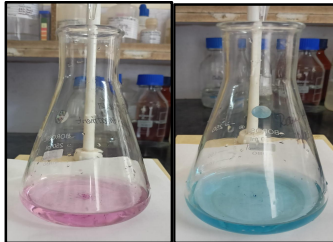


Figure- 1 End point of hardness pink turns into steel blue.

## 2.6 TOTAL CALCIUM

The procedure for determining total calcium in water is typically done through a complexometric titration using EDTA (Ethylenediaminetetraacetic acid) as the titrant and an appropriate indicator such as Muroxide indicator or Patton Reeders. Measure a known volume of the water sample (usually 50 mL) using a pipette and transfer it to a clean conical flask. Add a 2 ml of NaOH buffer solution to the sample. Add a pinch of Patton Reeders indicator to the sample. Patton Reeders are commonly used for calcium titrations. The solution will initially be pink in color. Fill a burette with the standard EDTA solution (0.01 M or as required). Calcium ions ( $\text{Ca}^{2+}$ ) will react with EDTA, and the color of the solution will gradually change from pink to steel blue as the calcium. The endpoint is reached when the solution turns from pink (indicating calcium is present) to steel blue (indicating the calcium has been complexed with EDTA).

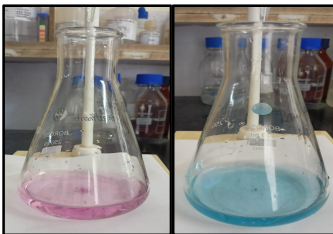


Figure - 2 End point of calcium pink turns into steel blue.

## 2.7 PHENOLPHTHALEIN ALKALINITY

The phenolphthalein alkalinity procedure is used to determine the concentration of hydroxide ( $\text{OH}^-$ ) and carbonate ( $\text{CO}_3^{2-}$ ) ions in a water sample. Pipette 50 mL of the water sample into a clean 250 mL conical flask. Addition of Phenolphthalein indicator to the sample. Typically, 1-2 drops of 0.1% phenolphthalein solution are sufficient for 50 mL of sample. Observe the color: Initially, the solution will be colorless in acidic or neutral conditions and will turn pink if alkaline (above pH 8.3). Fill the burette with the 0.02 N or 0.1 N Sulphuric acid solution. Record the initial volume in the burette. Continue until the pink color disappears, indicating that the hydroxide alkalinity has been neutralized.

## 2.8 TOTAL ALKALINITY

The purpose of this procedure is to determine the total alkalinity in a water sample, which reflects the concentration of alkaline substances (such as hydroxides, carbonates, and bicarbonates) that can neutralize acids. Use a pipette to transfer exactly 50 mL of the sample into a clean 250 mL conical flask. Add 1-2 drops of methyl orange indicator to the same sample. Methyl orange will turn green in alkaline conditions and pink in acidic conditions. Add the acid slowly while swirling the sample until the solution changes color from green to pink.

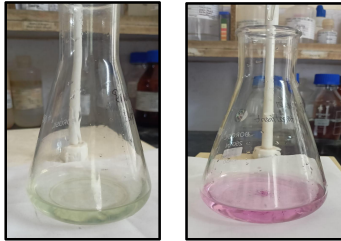


Figure- 3 End point of Alkalinity green turns into pink.

## 2.9 UV- SPECTROMETER ANALYSIS

### 2.9.1 SILICA

To measure sulfate using UV spectroscopy, a common procedure involves reacting sulfate ions with barium ions to form a precipitate of barium sulfate, which then creates turbidity in the solution, and this turbidity is measured by its light scattering properties at a specific wavelength (usually around 420nm) using a UV-Vis spectrophotometer. Add a known excess of barium chloride solution to the sample to precipitate the sulfate as barium sulfate. Mix the solution well and allow sufficient time for the barium sulfate precipitate to form and settle. **Spectrophotometric analysis** Blank measurement- Use a solution containing all reagents except the sample to zero the spectrophotometer. Sample absorbance reading: Measure the absorbance of the sample solution at a predetermined wavelength (typically around 420nm). Prepare a series of standard sulfate solutions with known concentrations, treat them with barium chloride as described above, and measure their absorbance to create a calibration curve.

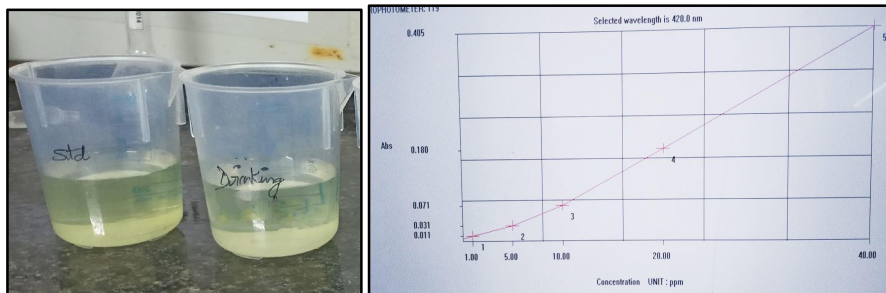
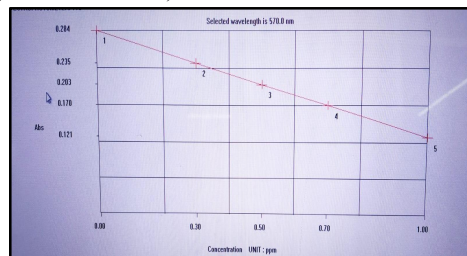


Figure- 4 Absorbance of drinking water at (420 nm).

### 2.9.2 FLUORIDE

To analyze fluoride using UV spectroscopy, a common method is to react with fluoride ions with a metal-dye complex, like a zirconium-dye complex (e.g., zirconium-xylenol orange). Prepare the sample - Take 50 ml of sample. Mix 5 ml of Spands and 5 ml of Zirconyl oxychloride in 1:1 ratio. Measure the absorbance of the sample solution at a predetermined wavelength (typically around 570 nm).



### 2.9.3 PHOSPHATE

Total Dissolved Phosphorus or Phosphate (PO<sub>4</sub>). Prepare phosphate standard solutions of known concentrations (e.g., 0.1, 0.2, 0.5, 1.0, 2.0 mg/L) by diluting the stock phosphate solution with distilled water. Take 100 ml of the water sample in a 100ml beaker. Add 1 ml of conc. Sulfuric acid and 5 ml of conc. Nitric acid and mix well. Place the beaker

in the hot plate and boil the solution until reduced to 20 ml. Transfer the sample to 100 ml SMF and make up to the mark by distilled water. Transfer the sample to the Nessler tube. Add 3 drops of phenolphthalein indicator. If pink colour appears add conc.  $H_2SO_4$  till the colour disappears. Add 4 ml of ammonium molybdate and 0.5 mL of stannous chloride solution, mix, and allow the color to develop for 10 minutes. Place the treated sample in a Nessler tube and compare it with the prepared standard solutions in identical tubes. Read at a spectrophotometer (around 690 nm) for improved accuracy.

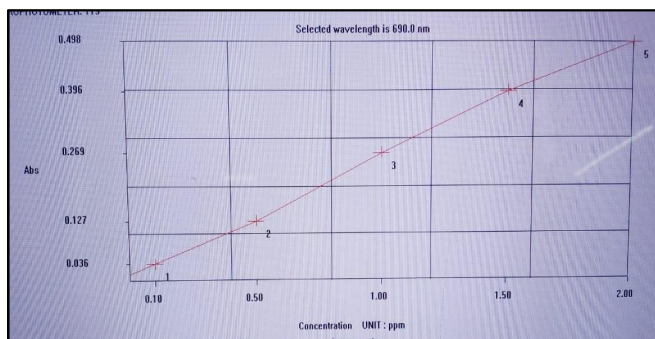


Figure - 5 Absorption of phosphate for drinking water (around 690 nm)

### III. RESULT AND DISCUSSION

S.No	Parameters	Unit	Results	Limit as per IS 10500: 2012
1.	pH @ 25 C		7.25	6.5 - 8.5
2.	Conductivity @ 25 C	$\mu S / cm$	31.6	-
3.	Total dissolved solids	mg/l	28.1	500
4.	Phenolphthalein Alkalinity	mg/l	Nil	-
5.	Total Alkalinity as $CaCO_3$	mg/l	18.4	200
6.	Total Hardness as $CaCO_3$	mg/l	1.9	200
7.	Calcium as Ca	mg/l	0.7	75
8.	Sulphate as $so_4$	mg/l	BDL (DL:1.0)	200
9.	Fluoride	mg/l	BDL (DL:0.1)	0.2
10.	Silica	mg/l	BDL (DL:0.1)	-

BDL - Below Detection Limit, DL - Detection Limit

### IV. CONCLUSION

In conclusion, the analysis of drinking water under various quality parameters plays a critical role in ensuring its safety, potability, and suitability for human consumption. The comprehensive assessment of physical, chemical, and microbiological parameters allows for the identification of contaminants that could pose health risks to consumers. By evaluating factors such as pH levels, turbidity, hardness, heavy metals, microbial contamination, and the presence of toxic substances, we can determine whether the water meets national and international standards (such as those set by WHO or EPA) All the parameters are involved in the limited range as per IS:10500:2012. In this sample are analysed heavy metals using UV-VIS Spectroscopy in various nm and parameters already discussed in result and discussion.

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