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ASSESSMENT OF WATER QUALITY THROUGH TOTAL DISSOLVED SOLIDS MONITORING IN TIRUPATTUR SURROUNDING VILLAGES

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Abstract

Water quality assessment is critical for ensuring public health and sustainable development. This study evaluates water quality by measuring Total Dissolved Solids (TDS) in samples collected from various villages surrounding Tirupattur, Tamil Nadu. TDS is a key indicator of water purity and potability. Using a digital TDS meter, the study analyses water from six locations and compares the results against World Health Organization (WHO) standards. The findings highlight both acceptable and borderline TDS levels, prompting discussions on possible contamination sources and purification technologies. The study concludes with recommendations for ensuring safe water for domestic and agricultural use.

Keywords: Water quality, Total Dissolved Solids, TDS meter, Drinking water standards, Rural water assessment.

1. Introduction

Water is an essential resource for all forms of life and plays a pivotal role in maintaining environmental and human health. Access to clean and safe drinking water is not only a fundamental human right but also a cornerstone for sustainable development. In recent decades, increasing urbanization, industrial activities, and agricultural runoff have contributed significantly to the degradation of water quality, especially in rural and semi-urban areas.

One of the most important indicators of water quality is Total Dissolved Solids (TDS). TDS refers to the combined content of all inorganic and organic substances present in a liquid in molecular, ionized, or micro-granular suspended form. It includes a wide range of constituents such as calcium, magnesium, potassium, sodium, bicarbonates, chlorides, and sulfates. High levels of TDS in water may result from natural sources like mineral springs, seawater intrusion, or the dissolution of rocks, as well as from anthropogenic sources such as industrial discharge, sewage effluents, and excessive use of chemical fertilizers in agriculture.

Monitoring TDS levels is essential for ensuring that water is suitable for drinking, domestic, agricultural, and industrial use.

Elevated TDS levels can influence water taste, contribute to scaling in pipes and appliances, and even pose serious health risks, including gastrointestinal irritation, kidney stress, and cardiovascular disorders. On the other hand, water with excessively low TDS may lack essential minerals necessary for human nutrition and could lead to electrolyte imbalances.

This study focuses on evaluating TDS levels in water samples collected from various villages in and around Tirupattur, Tamil Nadu — including Mookanur, Thiriyalam, Palnangkuppam, Jolarpet, Jondrampalli, and Jondrampalli borewell. These areas represent a typical semi-urban and rural setting where water sources are primarily groundwater or borewell-based, making them vulnerable to both geogenic and anthropogenic contamination.

Using a digital TDS meter, the project aims to provide an accessible and cost-effective approach to assessing water quality in the field. The TDS readings are then com-

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pared with the World Health Organization (WHO) guidelines and national drinking water standards to determine the safety and usability of the sampled water. Additionally, the study investigates possible sources of contamination and discusses various water purification methods, including eco-friendly alternatives, to enhance community-level water safety and sustainability. By emphasizing the importance of TDS monitoring, this research aims to raise awareness, support better water management practices, and contribute to public health protection in the studied region.

2. Objectives

- To measure TDS levels in water from various local sources.
- To compare these values with WHO and national water quality standards.
- To identify potential sources and impacts of elevated TDS levels.
- To discuss effective purification techniques based on findings.

3. Applications

- Household and municipal water safety monitoring.
- Agricultural and industrial water quality assessment.
- Field-based portable water testing.

4. Materials and Methods

4.1 Sample Collection

Water samples were collected from six locations around Tirupattur:

- Mookanur
- Thiriyalam
- Palnangkuppam
- Jolarpet
- Jondrampalli
- Jondrampalli borewell

4.2 TDS Measurement

A digital TDS meter was used for on-site measurement. TDS values were recorded in parts per million (ppm), equivalent to mg/L.

4.3 Data Analysis

Collected data were compared with WHO recommended TDS limits for safe drinking water (50–600 mg/L). Observations were presented in both tabular and graphical formats.

5. Results and Discussion

TDS Analysis of Collected Water Samples

The TDS levels of water samples collected from six different locations surrounding Tirupattur were measured using a digital TDS meter. The results are tabulated in **Table 1** and visually represented nnd allowing for easy comparison and interpretation.

Table 1: TDS Levels in Water Samples

S.No	Sample ID and Location	TDS (ppm)
1	S. Vanathi-1 – Mookanur	109
2	G. Pavithra-2 – Thiriyalam	326
3	M. Karthika-3 – Palnangkuppam	397
4	M. Sakthivel-4 – Jolarpet	135
5	P. Poovendhan-5 – Jondrampalli	267
6	B. Subash-6 – Jondrampalli Borewell	317

These values reveal noticeable variations in TDS across different sources:

- **Lowest TDS Level:** Mookanur (109 ppm) – indicates relatively clean water, with minimal dissolved solids.
- **Highest TDS Level:** Palnangkuppam (397 ppm) – although within the WHO safe range, it is relatively high, suggesting the presence of more dissolved salts or minerals.

The results indicate that all samples fall within the **WHO recommended range of 50–600 ppm** for drinking water. However, differences among the samples may reflect varying degrees of natural mineral content, ground-

water recharge characteristics, agricultural activity, or proximity to potential pollution sources.

Correlation Between TDS Levels and Water Quality

TDS levels are an important indicator of the overall chemical quality of water:

- **Low TDS (< 150 ppm):**
  - Observed in Mookanur and Jolarpet.
  - Suggests low concentrations of dissolved ions and organic matter.
  - While aesthetically pleasing, such water may lack essential minerals (e.g., calcium, magnesium) necessary for human health.
- **Moderate TDS (150–400 ppm):**
  - Seen in Thiriyalam, Jondrampalli, and the borewell sample.
  - These values indicate a balanced level of dissolved solids and are generally considered optimal for both health and taste.
- **Higher Range within Safe Limits (> 350 ppm):**
  - Palnangkuppam sample is at the upper end of the safe range.
  - May warrant further investigation to check for long-term suitability and trends, especially if values continue to rise over time.

Health Implications of TDS Levels

The TDS concentration in drinking water affects not only taste but also human health and appliance efficiency:

- **< 50 mg/L:** Not observed in this study; however, such water can cause mineral deficiencies if consumed regularly.
- **50–600 mg/L:** All samples fall in this category and are considered **safe and acceptable for consumption**.
- **> 600 mg/L:** Not present in this study, but above this threshold, water may start to affect sensitive individuals and equipment.

Possible Sources of Variation in TDS

Several factors may contribute to the differences in TDS levels observed among the sampled locations:

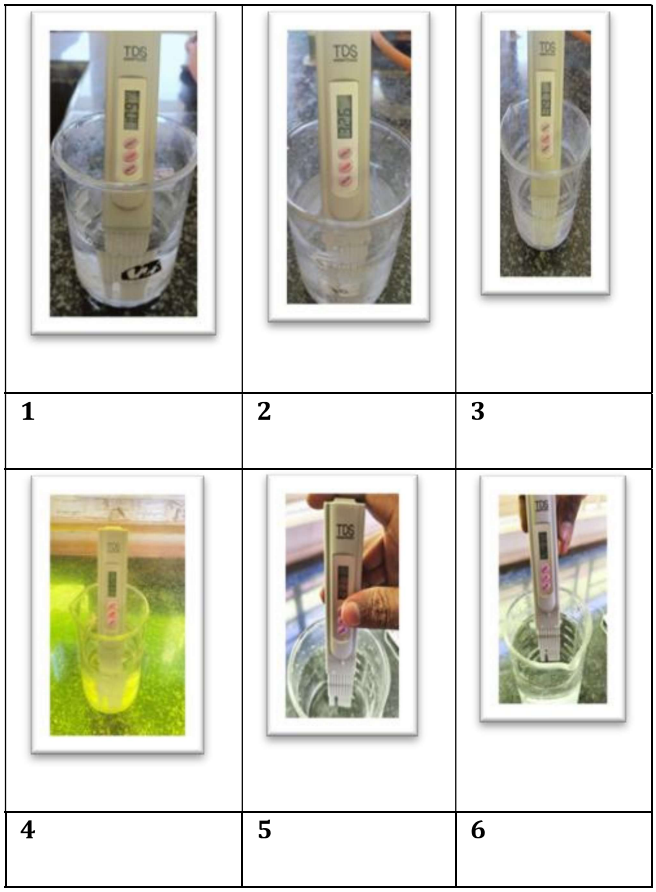
- **Geological Composition:** Natural dissolution of minerals from surrounding rocks and soil.
- **Agricultural Runoff:** Fertilizers, pesticides, and herbicides could increase the load of dissolved solids.
- **Borewell Depth and Usage:** Deep borewells (e.g., in Jondrampalli) may extract water rich in minerals.
- **Sanitation and Infrastructure:** Leaky sewage or old pipelines can introduce contaminants.

Discussion on Purification Methods

Given the TDS levels recorded in this study, different purification strategies can be recommended:

- **Reverse Osmosis (RO):**
  - Most effective for high-TDS water.
  - Can reduce TDS by 90–99%.
  - May remove beneficial minerals; hence post-treatment remineralization may be needed.
- **Activated Carbon Filters:**
  - Effective for removing organic pollutants and improving taste.
  - Less effective for reducing inorganic TDS.
- **Ion Exchange:**
  - Good for softening water by replacing calcium and magnesium with sodium.
  - Can increase sodium concentration, which is a concern for individuals on low-sodium diets.
- **Natural and Eco-Friendly Methods:**
  - Coagulants made from plant-based materials (e.g., *Melia dubia*) and nano-beads can offer promising results in reducing impurities without harmful chemical residues.
  - Sustainable, low-cost, and suitable for rural communities.

- All water samples tested were within WHO safe limits for TDS.
- Some samples approached the upper limit, indicating the need for regular monitoring.
- Mookanur and Jolarpet had the best water quality among the tested sites.
- Palnangkuppam, with the highest TDS, may need further analysis or treatment before large-scale consumption.
- Selection of appropriate purification methods should be based on local water chemistry, cost, and infrastructure availability.



1	2	3
4	5	6

Figure 1 (TDS Meter): Device used for measurement.

5.2 Interpretation

- All water samples fall within the WHO recommended range (50–600 mg/L), with Palnangkuppam (397 ppm) showing the highest value.
- Mookanur (109 ppm) and Jolarpet (135 ppm) exhibit low to moderate TDS levels, indicating relatively pure water.
- Elevated TDS levels in Thiriyalam, Jondrampalli, and the borewell suggest mineral leaching or anthropogenic contamination.

Table-2: Health Impacts of TDS

TDS Range (mg/L)	Health Implication
< 50	May lack essential minerals; risk of mineral deficiency
50–600 (Safe)	Balanced mineral content, ideal for drinking
600–900	Slight taste, acceptable
900–1200	Potential digestive issues
> 1200	Unfit for consumption, health risks like kidney stress

5.3 Purification Technologies

- **Reverse Osmosis (RO):** Removes 90–99% TDS, effective but expensive.
- **Activated Carbon Filters:** Good for organic compounds; limited TDS reduction.
- **Ion Exchange Resins:** Reduce hardness, may increase sodium.
- **Eco-Friendly Solutions:** Natural coagulants, biobeads (e.g., *Melia dubia*) offer sustainable, low-cost options.

6. Conclusion

The assessment of Total Dissolved Solids (TDS) in water samples collected from various villages around Tirupattur reveals critical insights into the region's water quality status. Through systematic sampling and analysis using a digital TDS meter, this study successfully identified variations in TDS levels among different water sources, offering a clear picture of the water's suitability for drinking and other purposes.

All the samples measured were found to fall within the acceptable limits recommended by the World Health

Organization (50–600 mg/L), which suggests that the sampled water is generally safe for human consumption. However, some sources—particularly those from Palnangkuppam, Thiriyalam, and Jondrampalli—show relatively higher TDS values, nearing the upper safety threshold. These elevated levels may indicate potential sources of contamination such as natural mineral leaching, agricultural runoff, or inadequate sanitation infrastructure. Such findings highlight the need for continuous monitoring and proactive water quality management.

TDS levels not only influence the taste and palatability of water but also have broader implications for human health, plumbing infrastructure, and agricultural productivity. Water with excessively high TDS can lead to long-term health risks, including kidney stress and mineral imbalances, while very low TDS water might lack essential nutrients. Therefore, maintaining TDS within the optimal range (150–300 mg/L) ensures both safety and nutritional balance.

Furthermore, the discussion on water purification methods emphasizes the need for context-specific solutions. While advanced technologies like Reverse Osmosis (RO) are effective, they may not always be accessible or affordable in rural communities. In this context, the promotion of cost-effective and environmentally friendly alternatives such as bio-based nano-beads, natural coagulants, and decentralized filtration systems could offer sustainable pathways for clean water access.

In conclusion, this research demonstrates the effectiveness of simple field-based tools like TDS meters in conducting grassroots water quality assessments. It underscores the importance of community involvement, regular monitoring, and informed decision-making to safeguard public health. Future work may include seasonal monitoring, correlation with other water quality parameters (such as pH, hardness, and microbial content), and the implementation of pilot purification projects in high-TDS regions.

Key Findings and outcomes

- Water sources like Mookanur and Jolarpet have excellent TDS levels.
- Locations like Palnangkuppam and Jondrampalli warrant further investigation for contamination control.
- Sustainable purification methods should be promoted, especially in remote areas.
- Classification of water sources by TDS levels for targeted intervention.
- Enhanced public awareness on water safety.
- Suggestions for policy-makers to support community water treatment systems.

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