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Analysis and Correlation of Total Dissolved Solids (TDS) and Electrical Conductivity in Drinking Water Samples

Suyash Verma
Department of Science, Navambey Senior Secondary school, Jabalpur, India

Abstract: Water quality plays a critical role in human health, agriculture, and industrial use. One key indicator of water purity is the Total Dissolved Solids (TDS), representing the concentration of dissolved inorganic salts and small amounts of organic matter. This study investigates TDS levels across various local water sources (tap, borewell, filtered, and bottled) and analyzes their suitability based on WHO and BIS standards. Using a digital TDS meter and standard gravimetric method, readings were recorded and statistically analyzed. Results revealed that borewell and untreated sources had TDS levels above 500 mg/L, indicating potential hardness and contamination, whereas RO-purified and bottled water showed lower readings within permissible limits. The study concludes with insights into the health and environmental implications of excessive TDS and recommendations for sustainable water purification practices.
Keywords: TDS, Water Quality, WHO Standards, Conductivity, Groundwater, RO Filtration.

I. INTRODUCTION

Water is one of the most essential natural resources, and its quality directly impacts public health and ecosystem balance. The Total Dissolved Solids (TDS) content in water indicates the combined content of all inorganic and organic substances present in molecular, ionized, or micro-granular suspended form. According to the Bureau of Indian Standards (BIS, 2012), the acceptable limit of TDS in drinking water is 500 mg/L, while WHO suggests a maximum of 1000 mg/L. Higher levels may cause hardness, salty taste, or long-term health risks due to high mineral intake. This study focuses on measuring, comparing, and analyzing TDS levels in different water samples collected from various domestic and environmental sources.

II. AIM AND OBJECTIVES

A. Aim

To assess the Total Dissolved Solids (TDS) concentration in various water sources and evaluate its effect on water quality parameters as per BIS and WHO standards.

B. Specific Objectives

1) To collect water samples from different local sources (tap, borewell, filtered, bottled, etc.).
2) To measure TDS using both digital and laboratory methods.
3) To compare observed values against national and international standards.
4) To analyze correlations between TDS and electrical conductivity.
5) To suggest purification or treatment methods for sources exceeding safe limits.

III. LITERATURE REVIEW

Previous studies (e.g., Sharma et al., 2021; Patel & Singh, 2023) highlight that TDS values beyond permissible limits affect both water taste and long-term usability. Groundwater sources, particularly in urban and semi-urban areas, often show elevated levels due to leaching of minerals and industrial discharge.

Studies have also found that higher TDS values are associated with increased conductivity and alkalinity. WHO (2017) guidelines indicate that while moderate TDS contributes to mineral balance, extremely low TDS (below 100 mg/L) may lack essential minerals like calcium and magnesium.

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IV. METHODOLOGY

A. Sample Collection

Samples were collected from five different sources in [City Name]:

1) Tap Water
2) Borewell Water
3) River/Canal Water
4) RO Filtered Water
5) Packaged Drinking Water

Each sample was stored in clean polyethylene bottles and tested within 24 hours.

B. Equipment Used

1) Digital TDS Meter (Range: 0–9999 ppm)
2) Conductivity Meter
3) Analytical Balance
4) Filter Paper (for gravimetric analysis)

C. Experimental Procedure

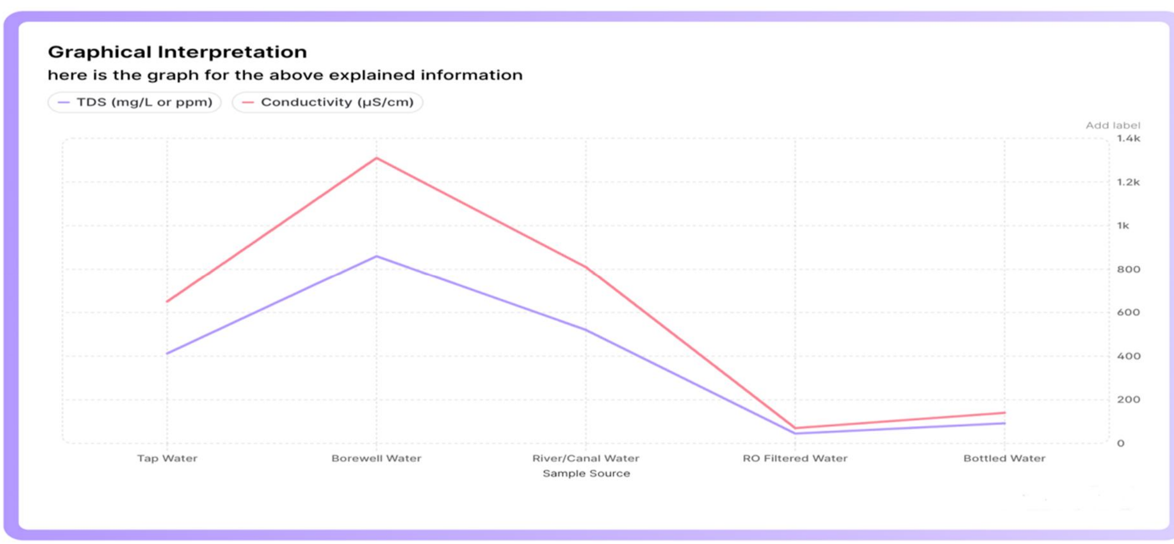
1) Calibrate the TDS meter using distilled water (0 ppm).
2) Measure TDS for each sample at room temperature.
3) For gravimetric validation, evaporate a known volume of sample and weigh the residue.
4) *Compare* both readings and calculate the mean TDS value.

D. Data Analysis

TDS results were compared with BIS (IS 10500:2012) and WHO guidelines. Statistical graphs were plotted to visualize differences among samples.

V. RESULTS AND DISCUSSION

Sample Source	TDS (ppm)	Conductivity (µS/cm)	Remarks
Tap Water	412	650	Within BIS limit
Borewell Water	860	1310	High mineral content
River Water	520	810	Slightly above limit
RO Water	45	70	Excellent quality
Bottled Water	92	140	Safe for consumption



A linear relationship was found between TDS and electrical conductivity ($R^2 = 0.98$), confirming the expected positive correlation.
TDS (mg/L)=k×Conductivity (µS/cm)
(where k typically ranges from 0.5 to 0.9, depending on the type of ions present.)
High TDS values in borewell samples suggest mineral dissolution (Ca^{2+}, Mg^{2+}, Na^{+}) and possible contamination. RO and bottled samples showed excellent compliance with drinking standards.

VI. CONCLUSION AND FUTURE SCOPE

The study concludes that TDS concentration varies widely across different water sources, with borewell and untreated surface water exceeding the recommended limits. High TDS can affect taste, cause scale deposition, and indicate potential contamination. Future work could include detailed ionic analysis using spectrophotometry or ICP, seasonal variation studies, and the development of smart IoT-based real-time water quality monitoring systems.

VII. ACKNOWLEDGEMENT

We would like to express our gratitude to [Your Guide's Name], Assistant Professor, Department of Environmental Engineering, [Your College Name], for guidance and support throughout this project.

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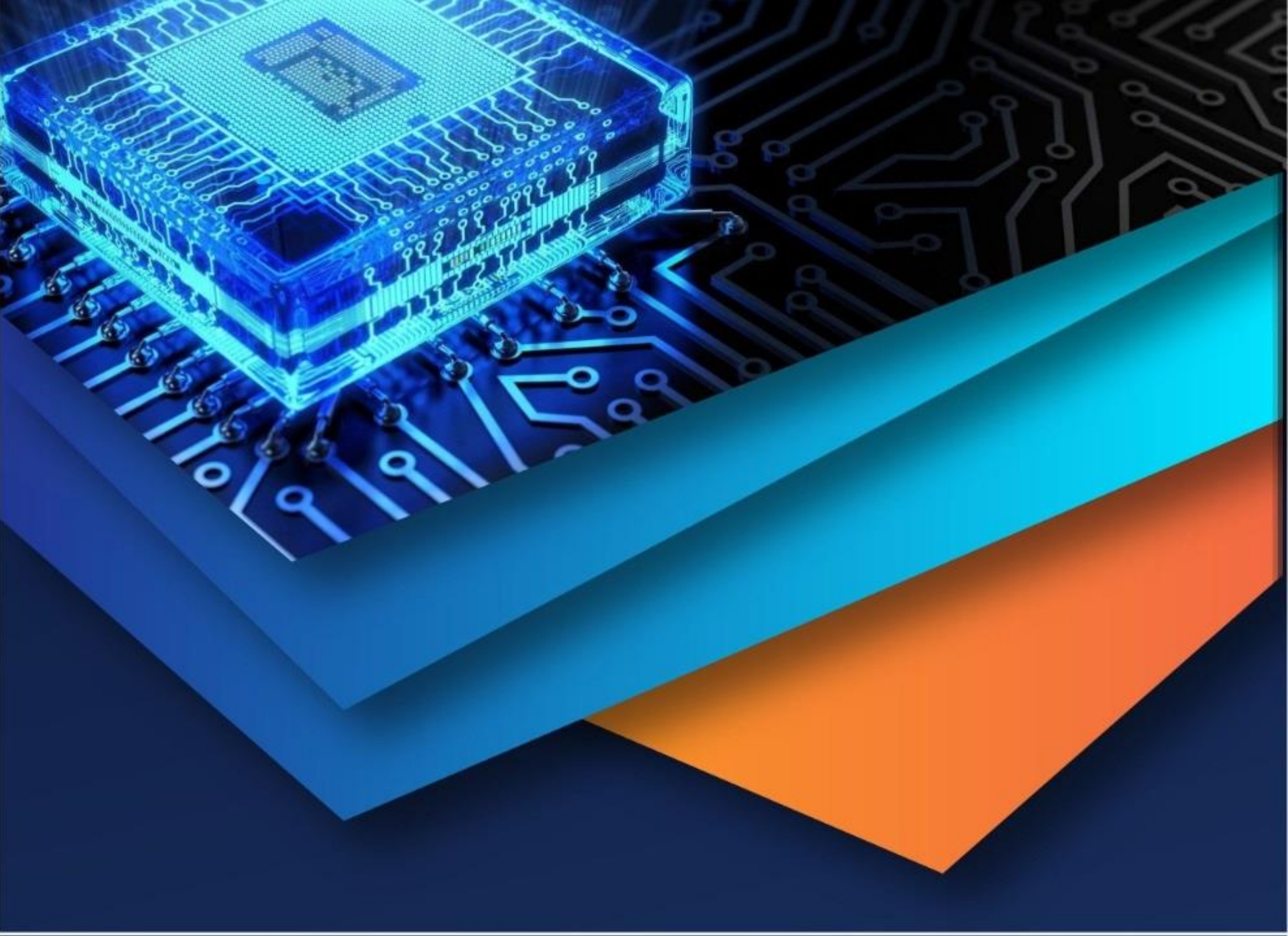

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