Journal of Research and Development
A Multidisciplinary International Level Referred and Double Blind Peer Reviewed, Open Access
ISSN : 2230-9578 | Website: https://jrdrvb.org Volume-18, Issue-5| May-2026

Original Article

Study on Evaluation of Drinking Water Quality Of Rural Area Of Wada Taluka In Maharashtra (India): Part -2 (Year 2025)

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Manuscript ID:
JRD -2026-180505
ISSN: 2230-9578
Volume 18
Issue 5
Pp. 50-63
May- 2026
Submitted: 15 Apr. 2026
Revised: 25 Apr. 2026
Accepted: 10 May. 2026
Published: 31 May 2026

Abstract

Assessing the quality of drinking water in rural areas is important for protecting public health and managing water resources properly. This study examines the physical, chemical, and biological properties of drinking water collected from common rural sources such as borewells, open wells, and hand pumps from ten selected villages from Wada taluka, Palghar district. Water samples were collected carefully using standard procedures and tested using reliable methods recommended by the BIS, APHA and WHO. Key physicochemical parameters such as Temperature, pH, EC, turbidity, TDS, TSS, total hardness, alkalinity, chloride, sulphate, nitrate, phosphate, and fluoride concentrations were determined, along with microbiological indicators, including total coliform and fecal coliform counts. The results were compared with the permissible limits specified by the WHO and BIS. The findings reveal seasonal changes in water quality, with some sampling sites showing increased levels of TDS (S3, S4, S5, S10 in May 2025),total hardness (S4 in May 2025 and S2, S3, S4, S5 in July 2025), Chloride (S4 in May 2025) and microbial contamination (in all samples)beyond acceptable limits. This suggests potential impacts from agricultural runoff, inadequate sanitation, and natural geological factors. The study highlights the need for regular monitoring of water quality, the use of proper water treatment methods, and the improvement in sanitation practices in rural areas. These steps are important to reduce health risks and provide safe drinking water.

Key Words: *Water quality, Physicochemical parameters, DO, COD, BOD, Microbial assessment.*

Introduction

Wada taluka of Palghar district of Maharashtra state (India) is having about 90% of its population staying in Rural area. Access to safe and drinking water is a fundamental component of the Nations Sustainable Development Goal, which seeks to ensure the availability and sustainable management of water and sanitation for all[1].However, in many rural areas; people depend on groundwater and local surface water because proper water supply systems are limited[2]. The quality of this water can change due to natural and human activities. Studies show that water quality varies with seasons, as factors like rainfall, temperature, and farming activities affect it[3]. During rainy seasons, runoff can carry dirt, chemicals, and microbes into water sources, increasing turbidity and contamination[4].In dry seasons, water levels decrease, and dissolved substances become more concentrated, raising TDS levels[5].These seasonal changes play an important role in determining the safety of drinking water. Numerous studies have investigated water quality using physicochemical parameters; however, many of these are limited to short-term assessments[6,7,8].In our previous study[9], a one-year assessment of water quality in Wada Taluka was conducted, which established baseline data for key parameters. However, water quality is highly dynamic and is influenced by seasonal variability, climatic conditions, and human activities[10].A single-year assessment may not adequately capture inter-annual variations and long-term trends in water quality. Therefore, the present study extends the previous work by incorporating an additional year of data and performing a comparative analysis of water quality over two consecutive years. This approach enables a more comprehensive evaluation of temporal variations, trends, and factors affecting water quality.

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How to cite this article:
Pawar, S. B., & Samant, R. A. (2026). Study on Evaluation of Drinking Water Quality Of Rural Area Of Wada Taluka In Maharashtra (India): Part -2 (Year 2025). Journal of Research & Development, 18(5), 50–63. https://doi.org/10.5281/zenodo.20907493

Quick Response Code:
Website:
https://jrdrvb.org/
DOI:
10.5281/zenodo.20907493
OPEN ACCESS

Journal of Research and Development
A Multidisciplinary International Level Referred and Double Blind Peer Reviewed, Open Access
ISSN : 2230-9578 | Website: https://jrdrvb.org Volume-18, Issue-5| May-2026

Materials And Methods

Study Area and Sampling

The present investigation was conducted in Wada Taluka, situated in the Palghar district (exactly at same locations that of our previous studies[9]). The geographical representation Map (Figure 1) and parameters are given in Table 1. The taluka is predominantly rural, comprising dispersed villages that depend largely on groundwater sources such as borewells, open wells, and hand pumps for domestic drinking water supply. The area experiences a tropical monsoon climate characterized by distinct wet and dry seasons, with substantial rainfall during the monsoon period that may influence groundwater recharge and quality. For this study, representative water samples were collected from selected villages across different geographic locations within the taluka to ensure adequate spatial coverage. Sampling locations included commonly used public borewells, hand pumps, and open wells supplying drinking water to local residents. Samples were collected in pre-cleaned polyethylene bottles in accordance with standard procedures recommended for drinking water quality assessment.[5,11]and transported to the laboratory under controlled conditions for detailed physico-chemical and microbiological analysis.

Selection of sampling points:

The selection of sampling points was undertaken to ensure representative coverage of the principal drinking water sources across Wada Taluka in Palghar district. Sampling locations were determined based on criteria such as population density, type of water source, frequency of usage for drinking purposes, and spatial distribution within the rural region. Emphasis was placed on commonly utilized sources including borewells, open wells, hand pumps, and village-level water storage tanks supplying households. Consideration was also given to variations in hydrogeological conditions to capture potential spatial differences in groundwater quality[5,8].The identification of sampling sites was carried out in consultation with local authorities and community members to ensure that the selected locations accurately represented the primary drinking water sources used by the rural population.

Sampling Procedure:

Water samples were collected from selected drinking water sources in Wada Taluka in accordance with standard procedures recommended by the World Health Organization and the Bureau of Indian Standards for drinking water quality assessment[5, 11]**.** Prior to sample collection, all containers were thoroughly cleaned and rinsed with distilled water to prevent contamination. In the case of groundwater sources such as borewells and hand pumps, water was allowed to flow continuously for 3 to 5 minutes to flush out stagnant water and obtain a representative sample. The samples were then collected in clean, sterile polyethylene bottles and properly labelled with details including date, time, and sampling location. For microbiological analysis, separate sterilized bottles were used, and strict aseptic techniques were followed to avoid contamination[8]. Immediately after collection, the samples were preserved in ice boxes and transported to the laboratory within the prescribed holding time to maintain sample integrity. On-site observations were made for physical parameters such as temperature, colour, and odour, while detailed physico-chemical and microbiological analyses were conducted in the laboratory using standard analytical methods[5, 8].

Analytical Methods for Analysis:

Analysis of physical parameters of water samples:

The physical characteristics of the collected water samples, namely temperature, pH, turbidity, electrical conductivity, total dissolved solids (TDS), and total suspended solids (TSS), were determined using standard analytical procedures recommended for water quality assessment[5,8]**.** Temperature and pH were measured at the sampling site using a portable digital meter (Euro Lab 4-in-1 Water Quality Tester Pen) to obtain immediate and reliable readings. Turbidity was analyzed using a digital turbidimeter (Turbidimeter AVI-37A), which measures the scattering of light caused by suspended particles in water[8]. Electrical conductivity, an indicator of dissolved ionic content in water, was measured using a conductivity meter[5].Total solids, including total dissolved solids (TDS) and total suspended solids (TSS), were determined by evaporating a known volume of filtered water at 103°C and weighing the residual mass, following standard gravimetric methods[8,11]. The evaluation of these physical parameters is essential for assessing overall water quality and determining its suitability for drinking and other domestic purposes.[11]

Analysis of chemical parameters of water samples:

The determination of chemical parameters in water samples is vital for evaluating overall water quality and verifying compliance with public health and environmental standards.[2,11] Total alkalinity, which indicates the buffering capacity of water due to the presence of bicarbonates, carbonates, and hydroxides, was estimated by titration with a standard acid using phenolphthalein and methyl orange as indicators[8]. Total hardness, primarily attributed to calcium and magnesium ions, was determined through complexometric titration with ethylenediaminetetraacetic acid (EDTA) using Eriochrome Black T as an indicator[8,11]. Sulphate concentration was measured by the turbidimetric method, wherein the addition of barium chloride produces barium sulphate precipitate, and the resulting turbidity is quantified spectrophotometrically[8]. Chloride content was analyzed using Mohr's method, which involves titration with silver nitrate in the presence of potassium chromate as an indicator; the formation of red silver chromate identifies the endpoint[8]. Phosphate levels were determined using a colorimetric method based on the reaction with ammonium molybdate to form a blue-colored complex measured spectrophotometrically8.Nitrate concentration was assessed either

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by ultraviolet (UV) spectrophotometry or by the cadmium reduction method, both of which provide reliable quantification of this essential nutrient and potential contaminant5,8.Fluoride was analyzed using an ion-selective electrode method or the SPADNS colorimetric method, ensuring accurate measurement within permissible limits[8,11]. Collectively, these standardized analytical techniques provide a comprehensive evaluation of the chemical composition and potability of water.

Oxygen demand parameters (organic pollution indicators)

The parameters Dissolved Oxygen (DO), Biological Oxygen Demand (BOD), and Chemical Oxygen Demand (COD) were analyzed to evaluate the level of organic pollution and the overall quality of water samples. These parameters serve as important indicators of the presence of organic matter and microbial activity in water[8,11]. Dissolved Oxygen (DO) indicates the amount of oxygen in water available for aquatic organisms. DO was measured using the Winkler iodometric titration method, where oxygen reacts with chemical reagents and is then titrated with sodium thiosulfate solution. The results were expressed in mg/L[8]. Biological Oxygen Demand (BOD) measures the amount of oxygen needed by microorganisms to break down organic matter in water. The BOD_5 method was used, where the initial dissolved oxygen of the sample was measured, and the sample was then incubated at 20°C for five days. After incubation, the final DO was measured, and the BOD value was calculated from the difference between the initial and final DO measurements[11,12]. Chemical Oxygen Demand (COD) measures the amount of oxygen needed for the chemical oxidation of organic and inorganic substances in water. COD was determined using the dichromate reflux method, where potassium dichromate serves as a strong oxidizing agent under acidic conditions. The COD values are expressed in mg/L[8,11].

Microbial analysis:

The microbial quality of water was assessed by analysing the total bacterial count (TBC) and faecal coliforms. The TBC was determined using the standard plate count method, in which water samples were cultured on nutrient agar plates and incubated at 37°C for 24 to 48 hours. Colonies were counted and expressed as CFU/Ml[8].Fecal coliforms were detected with the Most Probable Number (MPN) method, where water samples were incubated in lactose broth at 44 to 45°C, and gas production indicated fecal contamination. Results were reported as MPN/100 mL[8,11].

Results and discussion

Physical Parameters

Temperature*:* The temperature recorded in ten samples (S1–S10) from May to December 2025 shows a clear seasonal change. In May, the temperature ranged between 25.1°C and 26.2°C. It increased slightly and reached the highest values in July (26.0–26.3°C). After July, the temperature gradually decreased and became lowest and more stable in December (25.2–25.3°C). All samples showed a similar pattern with very small differences between them, which indicates similar environmental conditions at all sampling sites. Overall, the results show that the water temperature remained fairly stable, with a slight increase in mid-year and cooler conditions toward December. (Table 2) (Fig.2)

pH : The pH values of all samples (S1–S10) recorded in May, July, and December 2025 were within the acceptable range of 6.5–8.5, indicating that the water quality was suitable during the study period. The pH values were close to neutral with small seasonal changes. In May, the pH values were slightly lower. In July, the pH increased a little and became mildly alkaline. In December, the pH values were more stable and similar in all samples. The small differences between samples and seasons show that the water had good buffering capacity and stable chemical conditions.(Table 2) (Fig.3)

Turbidity: The turbidity values in all samples during May, July, and December 2025 were very low, mostly below 1 NTU, with a few values between 1.0 and 1.2 NTU. This shows that the water was clear with very few suspended particles. There was very little seasonal change, indicating stable conditions and good water quality throughout the study period.
(Table 2) (Fig.4)

Electrical Conductivity (EC): The electrical conductivity (EC) values showed seasonal changes during the study period. The highest EC values were recorded in May 2025, indicating a higher amount of dissolved salts in the pre-monsoon season. In July 2025, EC values decreased, probably due to dilution caused by monsoon rainfall. In December 2025, the values were moderate, showing a slight increase after the monsoon. Some samples showed consistently high EC values, suggesting the presence of more dissolved minerals, while a few samples had lower EC values, indicating better water quality. Overall, the trend May > December > July shows that seasonal changes strongly affect water chemistry. (Table 2) (Fig.5)

Total Dissolved Solids (TDS): The Total Dissolved Solids (TDS) values showed seasonal variation during the study period. Higher TDS values were recorded in May 2025, due to evaporation and less dilution in the pre-monsoon season. In July 2025, TDS values decreased because monsoon rainfall diluted the dissolved salts. In December 2025, the values were moderate as salts started to concentrate again after the monsoon. Some samples were above the acceptable limit of

Journal of Research and Development
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ISSN : 2230-9578 | Website: https://jrdrvb.org Volume-18, Issue-5| May-2026

500 mg/L, especially in May and December, but all were within the permissible limit. Overall, the trend May > December > July shows that seasonal changes strongly affect the amount of dissolved solids in water. (Table 2) (Fig.6)

Total Suspended Solids (TSS): The Total Suspended Solids (TSS) values were low in all sampling periods, indicating clear water. In May 2025, some samples showed TSS values up to 6 mg/L, while a few samples had no suspended solids. In July 2025, most TSS values were below 1 mg/L due to dilution during the monsoon season. In December 2025, TSS values were slightly higher but still low (mostly ≤2 mg/L). Overall, the results show good water quality with very little suspended matter, with the lowest TSS during monsoon and slightly higher values in pre- and post-monsoon periods. (Table 2) (Fig.7)

Chemical Parameters

Total Alkalinity: In 2025, the total alkalinity levels at all ten sampling sites (S1–S10) stayed well below the safe limit of 200 mg/litre. The highest levels were seen in July, especially at sites S2 and S8, where alkalinity reached 80 mg/litre. This increase may be due to seasonal changes in summer that can raise the concentration of alkaline substances in water. By December, the levels mostly dropped, with S2 showing the lowest value of the year at 8.0 mg/litre. Overall, the water quality looks safe and has a good natural buffering ability. (Table 3) (Fig.8)

Total Hardness: In 2025, the total hardness (TH) levels at all sampling sites (S1–S10) showed clear seasonal changes. In May, the average hardness was about 95.4 mg/L, and only site S4 crossed the safe limit of 200 mg/L, reaching 214 mg/L. In July, hardness levels increased a lot because of higher mineral content in the water. The average went up to 164.4 mg/L, and four sites, S2, S3, S4, and S5, went above the limit. The highest value, 310 mg/L, was recorded at site S2. By December, hardness levels dropped sharply, with the average falling to 52.8 mg/L, and no site crossed the limit. This shows that hardness increases in summer due to more minerals in the water, while in winter the water gets diluted and hardness levels go down at all sites.(Table 3) (Fig.9)

Chlorides: In 2025, chloride levels in the water samples changed across the three sampling months. In May, the values ranged from 12.5 to 325 mg/L, and only site S4 crossed the safe limit of 250 mg/L. Some other sites like S10, S3, and S5 also showed relatively higher values. In July, chloride levels decreased and stayed within the safe limit. By December, the levels dropped further, showing the lowest concentrations. Overall, there was a clear decreasing trend in chloride from May to December, with only one case of limit exceedance. (Table 3) (Fig.10)

Sulphates: Sulphate levels in all water samples stayed very low during the whole study period and were far below the safe limit of 200 mg/L. In May 2025, the values ranged from 1.28 to 4.16 mg/L. A small increase was seen in July, with levels between 1.46 and 5.76 mg/L, and the highest value was at site S2. In December, sulphate levels dropped again, ranging from 1.34 to 2.52 mg/L. Overall, sulphate showed slight seasonal changes but remained safe and within acceptable limits at all sites. (Table 3) (Fig.11)

Phosphates: Phosphate levels in the water samples showed changes during May, July, and December 2025. In May 2025 and December 2025, phosphate concentrations at most sites (S1–S8 and S10) were very low and below the detection limit, while S9 showed a slightly higher but still low value in May. This indicates that phosphate was almost negligible during these two periods. In July 2025, measurable phosphate levels were recorded, ranging from 1.12 mg/L at S6 to 3.54 mg/L at S5. Sites S4 and S5 showed relatively higher values, whereas S6 and S1 had lower concentrations. Overall, phosphate levels were generally low across the study area, with a temporary increase observed only in July 2025. (Table 3) (Fig.12)

Nitrates: Nitrate levels in the water samples changed during May, July, and December 2025, but they remained much lower than the safe limit of 45 mg/L at all sites. In May 2025, nitrate values were low, ranging from 1.04 mg/L at S6 to 3.90 mg/L at S3. In July 2025, nitrate levels increased at some sites, especially S2, S3, and S1, but even then they were still within safe limits. By December 2025, nitrate concentrations dropped again, ranging from 1.08 mg/L at S6 to 2.24 mg/L at S5, showing that the levels became more stable toward the end of the study. (Table 3) (Fig.13)

Fluorides: The fluoride levels in water samples from sites S1 to S10 during May, July, and December 2025 were below the detection limit (BDL). This means the fluoride present was too low to be measured by the testing method and was far below the safe limit of 1.0 mg/L. There was no change in fluoride levels during the three seasons, showing that the water quality remained stable throughout the year. Since all values were within the safe limit, the water meets fluoride standards and does not pose any health risk such as dental or skeletal fluorosis.(Table 3)

Oxygen demand parameters (**organic pollution indicators):**

The dissolved oxygen (DO): The dissolved oxygen (DO) levels at the ten sampling sites (S1–S10) changed clearly with the seasons. In May 2025, the DO levels were fairly high, between 14.3 and 19.4 mg/L. In July 2025, the levels dropped significantly to between 3.0 and 6.5 mg/L, possibly due to higher temperatures, increased pollution, or monsoon effects. In December 2025, the DO levels were the highest, ranging from 14.0 to 27.0 mg/L, showing better water quality during the winter season. All values were below the limit of 40 mg/L. Overall, the results show that DO levels are lowest in July and higher in December, indicating seasonal changes in water quality. (Table 4) (Fig.14)

Chemical Oxygen Demand (COD): The Chemical Oxygen Demand (COD) levels at the ten sampling sites (S1–S10) showed changes across different seasons. In May 2025, COD values ranged from 12 to 36 mg/L, with the highest at S3. In July 2025, values were slightly lower, ranging from 8 to 30 mg/L; S3 again showed higher levels, whereas S9 had the lowest. In December 2025, COD ranged from 8 to 32 mg/L, with the highest at S5. Most values stayed between 10 and 24 mg/L, indicating low to moderate pollution. All COD levels were well below the 250 mg/L limit, indicating that water quality remained within safe standards. Overall, the changes suggest seasonal effects, but no serious pollution was observed.(Table 4) (Fig.15)

Biological Oxygen Demand (BOD): The Biochemical Oxygen Demand (BOD) levels at the ten sampling sites (S1–S10) showed some seasonal variation. In May 2025, BOD values ranged from 4.8 to 14.4 mg/L, with the highest recorded at S3. In July 2025, values ranged from 3.2 to 12.0 mg/L, with S3 again showing higher levels, whereas S4, S7, and S9 recorded the lowest values. In December 2025, BOD ranged from 3.2 to 12.8 mg/L, with the highest observed at S5. Most values were below 10 mg/L, indicating low to moderate pollution. All BOD levels were well below the permissible limit of 30 mg/L, indicating that water quality met safe standards. Overall, the variations are due to seasonal and site-specific differences, with no evidence of serious pollution. (Table 4) (Fig.16)

Microbiological Analysis:

The bacteriological analysis of the ten water samples (S1 to S10) showed the presence of total and faecal coliform bacteria in almost all samples, even though they should not be present. The total coliform levels were highest in May, followed by December and July, showing seasonal changes with more contamination before the monsoon. The highest value was found at S4 in May. Faecal coliform bacteria were also found in nearly all samples, except S6 in December, with slightly higher levels in July. The highest counts were recorded at S4 in May and S10 in December. Overall, the results show that the water was consistently contaminated with bacteria, which may indicate poor sanitation and possible health risks.(Fig.17)

Conclusion

The analysis of physical parameters across all sampling sites (S1 to S10) in 2025 shows that the water quality is generally good and within acceptable limits. Parameters such as temperature, turbidity, total dissolved solids (TDS), and electrical conductivity showed some seasonal changes, with slightly higher values observed during summer due to evaporation and lower water levels. However, these variations were not significant and remained within safe limits. During winter, most values decreased due to dilution and better water flow. Overall, the physical characteristics indicate that the water is stable, suitable for use, and not affected by major pollution, although regular monitoring is recommended to maintain quality. The study of chemical parameters at all sites (S1 to S10) in 2025 shows that the water quality is generally safe and within permissible limits. Most parameters, like alkalinity, sulphate, nitrate, phosphate, and fluoride remained low throughout the year. Some changes were seen in hardness and chloride, especially in summer, but they were mostly within safe levels. Overall, the water shows good quality with only small seasonal changes and no major health risk. Overall, the analysis of DO, COD, and BOD indicates clear seasonal variations in water quality across all sampling sites. Dissolved Oxygen (DO) levels were lowest in July and higher in May and December, showing changes in oxygen availability due to seasonal factors. Chemical Oxygen Demand (COD) and Biochemical Oxygen Demand (BOD) values remained within permissible limits throughout the study period, indicating low to moderate levels of organic pollution. Although some fluctuations were observed across different sites and seasons, there was no evidence of severe contamination. In general, the water quality was within acceptable standards, but the seasonal variations highlight the influence of environmental conditions on water quality. The microbial analysis shows that the water samples were contaminated with total and fecal coliform bacteria in most locations and seasons. Since these bacteria should be completely absent, their presence indicates poor sanitary conditions and possible contamination from sewage or waste sources. Although the levels varied slightly across months, contamination was consistently observed throughout the study period. This suggests a potential health risk for users, and proper treatment and improved sanitation measures are needed to ensure safe water quality.

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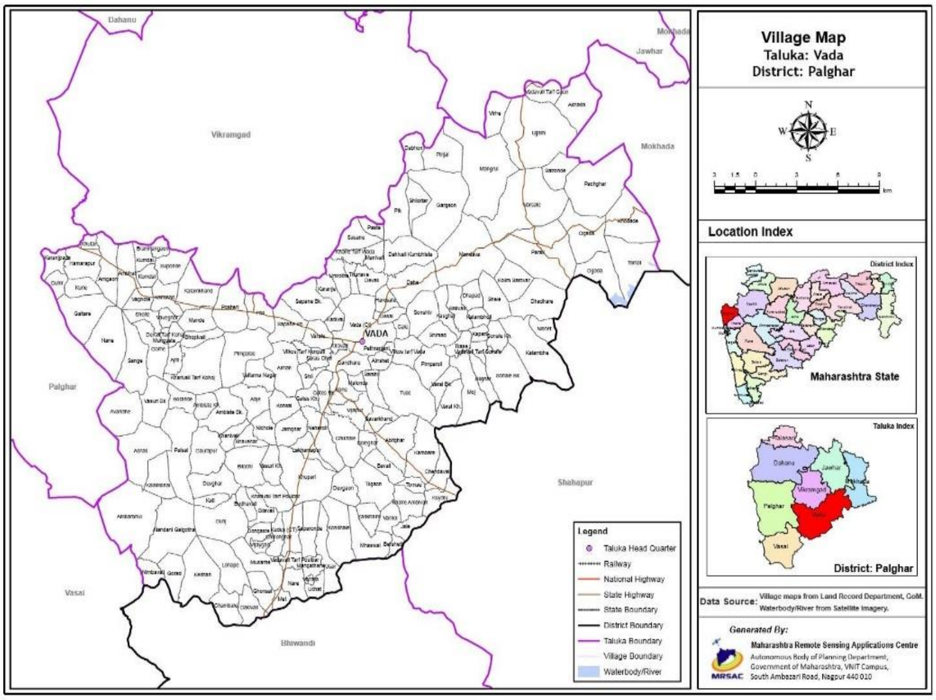

Figure 1: Wada Taluka Map (http://www.santoshdahiwal.in/2017/04/wada.html?m=1

Table 1: A brief description of the selected sampling sites

Sample Id	Water source type	Latitude	Longitude
S1	Tap	19.642891^0	73.142491^0
S2	Storage tank	19.667942^0	73.075349^0
S3	Bore well	19.699115^0	72.952056^0
S4	Hand pump	19.570005^0	73.10442^0
S5	Storage tank	19.530718^0	73.09851^0
S6	Well	19.70955^0	73.26234^0
S7	Well	19.64225^0	73.230626^0
S8	Tap	19.585554^0	73.166735^0
S9	Well	19.744389^0	73.207028^0
S10	Bore well	19.601662^0	73.11748^0

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ISSN : 2230-9578 | Website: https://jrdrvb.org Volume-18, Issue-5| May-2026

Table 2: Observations of Physical Parameters for the Year 2025.

Sample ID	**Temp.**			**PH**			**Turbidity**			**Electrical conductivity**			**TDS**			**TSS**		
	May 2025	July 2025	Dec 2025	May 2025	July 2025	Dec 2025	May 2025	July 2025	Dec 2025	May 2025	July 2025	Dec 2025	May 2025	July 2025	Dec 2025	May 2025	July 2025	Dec 2025
Limits	**--**			**6.50-8.50**			**1**			**--**			**500**			**100**		
S1	25.3	26.3	25.2	7.08	6.84	7.20	1.2	1.1	<1	600	169.2	206.2	390	110	134	6	4	<1
S2	25.4	26.2	25.3	6.96	7.10	7.14	1	<1	1.1	184.6	646.2	569.2	120	420	370	4	<1	2.0
S3	25.7	26.0	25.2	6.95	7.21	7.08	1	<1	<1	953.8	750.8	615.4	620	488	400	3	<1	<1
S4	26.2	26.2	25.3	6.98	7.10	7.15	<1	<1	1.1	1486.2	553.8	661.5	966	360	430	3	<1	2.0
S5	26.0	26.3	25.2	6.90	7.24	7.22	<1	<1	<1	784.6	738.5	692.3	510	480	450	ABSENT	<1	<1
S6	26.1	26.3	25.3	7.1	6.92	7.18	<1	1.1	<1	200	138	196.9	130	90	128	3	4	2.0
S7	25.8	26.0	25.2	7.1	7.23	7.14	<1	<1	<1	430	284.6	276.9	280	185	180	2	<1	<1
S8	25.4	26.3	25.3	6.85	7.11	7.10	<1	<1	<1	538.5	538.5	461.5	350	350	300	ABSENT	<1	<1
S9	25.1	26.3	25.2	7.15	7.20	7.12	<1	<1	1.1	307.7	230.8	286.2	200	150	186	2	2	2
S10	26.0	26.2	25.3	6.90	7.12	7.20	<1	<1	1.1	861.5	607.8	569.2	560	395	370	2	<1	2

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ISSN : 2230-9578 | Website: https://jrdrvb.org Volume-18, Issue-5| May-2026

Table 3. Observations of Chemical Parameters for the Year 2025.

Sample No.	Total Alkalinity (mg/litre)			Total Hardness (mg/litre)			Chlorides (mg/litre)			Sulphates (mg/litre)			Phosphates (mg/litre)			Nitrate (mg/litre)			Fluorides (mg/litre)		
	May 2025	July 2025	Dec 2025	May 2025	July 2025	Dec 2025	May 2025	July 2025	Dec 2025	May 2025	July 2025	Dec 2025	May 2025	July 2025	Dec 2025	May 2025	July 2025	Dec 2025	May 2025	July 2025	Dec 2025
Limit	200			200			250			200			---			45			1		
S1	30	20	24	54	34	42	20	12.5	11.5	2.88	3.12	1.55	<0.5	1.60	<0.5	2.53	11.0	1.3	BDL	BDL	BDL
S2	12	80	8.0	22	310	10	12.5	47.5	35.0	1.4	5.76	1.88	<0.5	2.12	<0.5	1.10	17.0	1.64	BDL	BDL	BDL
S3	40	76	40	74	242	74	140	105.5	72.5	4.13	4.70	1.92	<0.5	2.3	<0.5	3.9	13.2	1.7	BDL	BDL	BDL
S4	60	60	40	214	202	74	325	37.5	58.5	4.16	4.12	2.52	<0.5	3.18	<0.5	3.76	2.18	2.18	BDL	BDL	BDL
S5	42	74	62	94	282	118	120	105	112.5	2.68	5.72	2.3	<0.5	3.54	<0.5	2.41	2.40	2.24	BDL	BDL	BDL
S6	20	16	20	42	38	34	17.5	14.0	15	1.28	2.74	1.34	<0.5	1.12	<0.5	1.04	1.90	1.08	BDL	BDL	BDL
S7	50	40	24	98	94	66	30	18	15.5	2.52	1.50	1.68	<0.5	1.75	<0.5	2.34	1.35	1.5	BDL	BDL	BDL
S8	46	80	30	106	174	54	50	50	47.5	3.1	1.92	1.92	<0.5	2.2	<0.5	2.86	1.41	1.71	BDL	BDL	BDL
S9	40	50	26	74	122	46	27.5	22.5	12.5	1.6	1.46	1.56	<1.4	1.60	<0.5	1.4	1.62	1.40	BDL	BDL	BDL
S10	60	46	18	176	146	10	187.4	149.5	35	3.4	3.12	2.14	<0.5	2.42	<0.5	3.08	1.35	2.02	BDL	BDL	BDL

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A Multidisciplinary International Level Referred and Double Blind Peer Reviewed, Open Access
ISSN : 2230-9578 | Website: https://jrdrvb.org Volume-18, Issue-5| May-2026

Table 4. Observations of Biological Parameters for the Year 2025.

Sample No.	DO (mg/litre)			COD (mg/litre)			BOD (mg/litre)		
	May 2025	July 2025	Dec 2025	May 2025	July 2025	Dec 2025	May 2025	July 2025	Dec 2025
Limit	40 (mg/litre)			250 (mg/litre)			30 (mg/litre)		
S1	15.2	6.5	18.2	12	16.0	8.0	4.8	6.4	3.2
S2	15.1	3.5	18.0	12	20.0	8.0	4.8	8.0	3.2
S3	15.4	3.0	23	36	30.0	20	14.4	12.0	8.0
S4	16.6	4.50	14	12	10.0	28	4.8	3.20	11.20
S5	15.8	5.0	20	20	16.0	32	8	6.4	12.8
S6	15	5.6	18	12	12.0	12	4.8	4.8	4.8
S7	14.3	5.2	18	16	10.0	16	6.4	3.2	6.4
S8	17.1	4.6	24.8	24	12.0	12	9.6	4.8	4.8
S9	15.1	4.8	18	20	8.0	16	8	3.2	6.4
S10	19.4	3.6	27	16	12.0	12	6.4	4.8	4.8

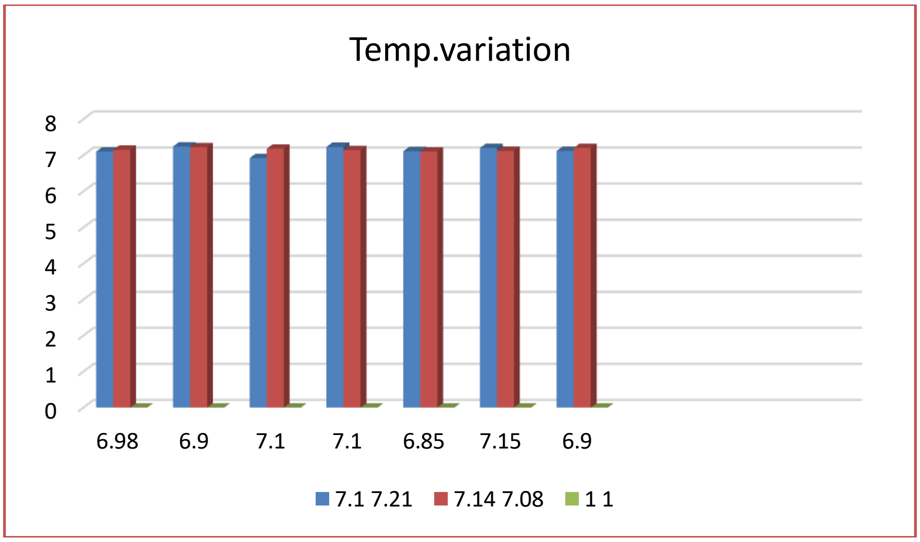

Figure 2. Seasonal variation in the temperature of water samples in the Year 2025

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ISSN : 2230-9578 | Website: https://jrdrvb.org Volume-18, Issue-5| May-2026

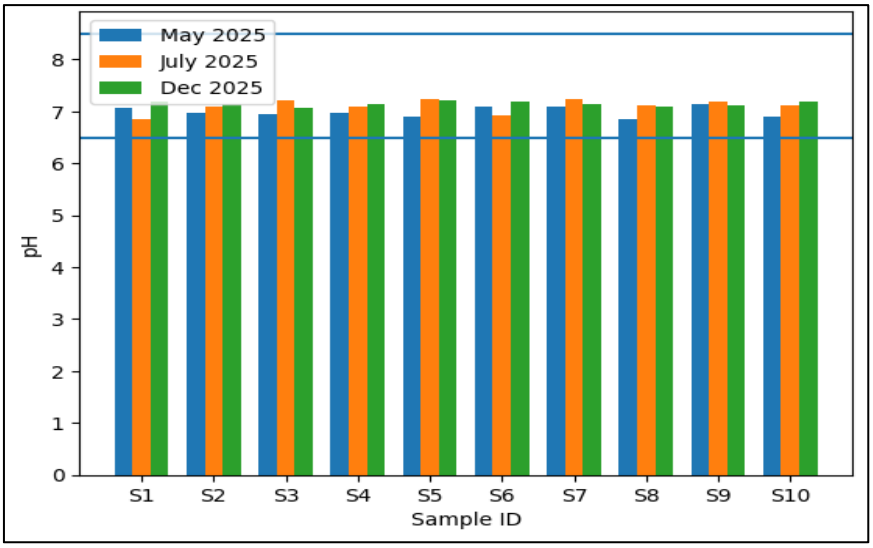

Figure 3. Seasonal variation in the pH of water samples in the Year 2025

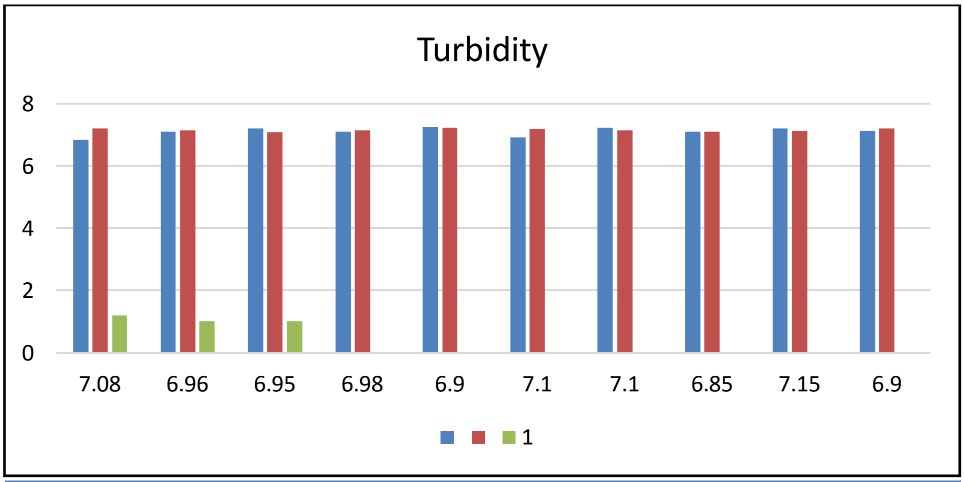

Figure 4. Seasonal variation in the Turbidity of water samples in the Year 2025

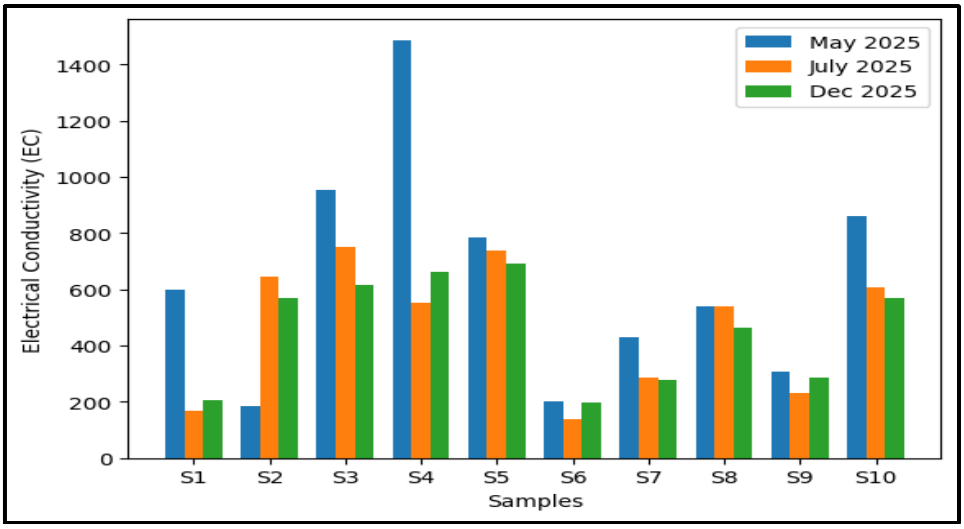

Figure 5. Seasonal variation in the EC of water samples in the Year 2025

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ISSN : 2230-9578 | Website: https://jrdrvb.org Volume-18, Issue-5| May-2026

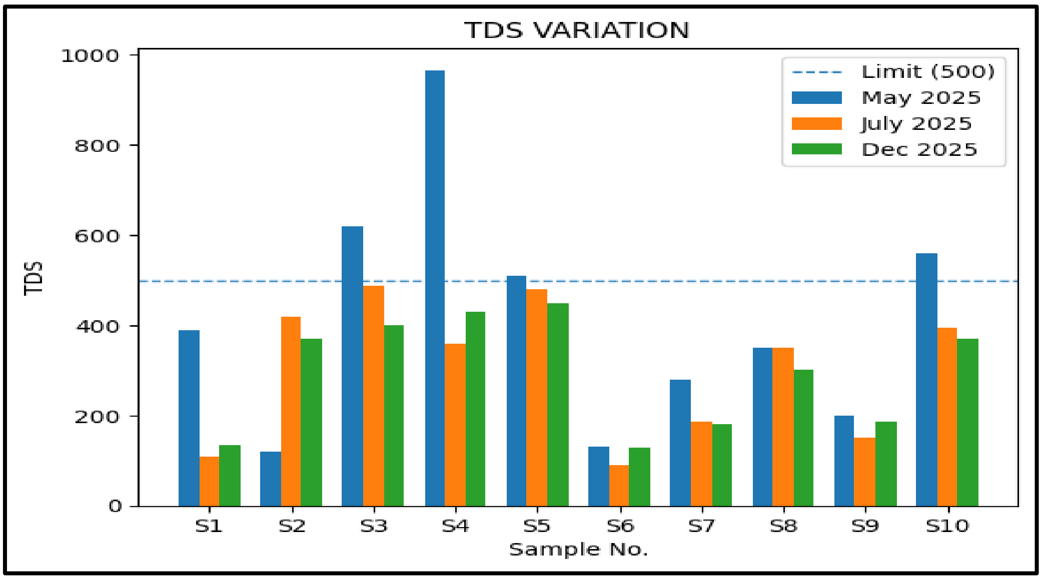

Figure 6. Seasonal variation in the TDS of water samples in the Year 2025

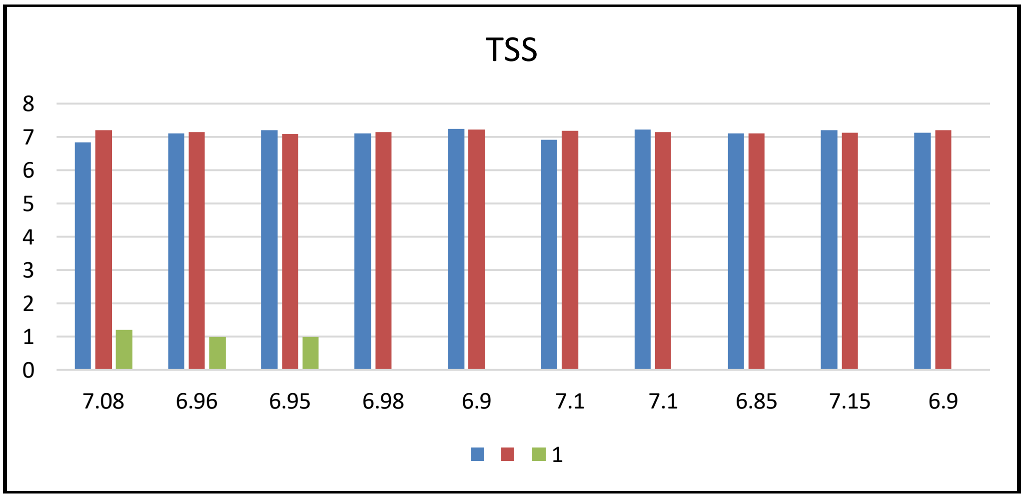

Figure 7. Seasonal variation in the TSS of water samples in the Year 2025

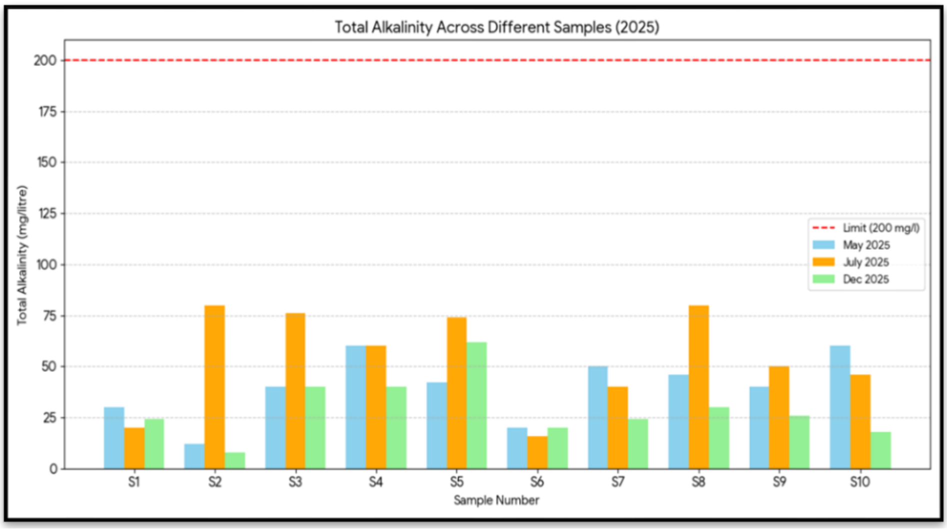

Figure 8. Seasonal variation in the Total Alkalinity of water samples in the Year 2025

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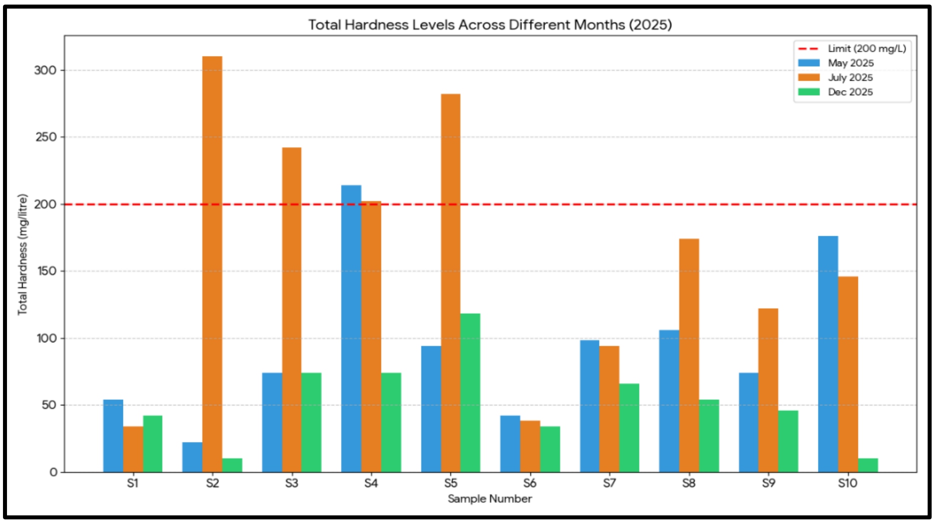

Figure 9. Seasonal variation in the Total Hardness of water samples in the Year 2025

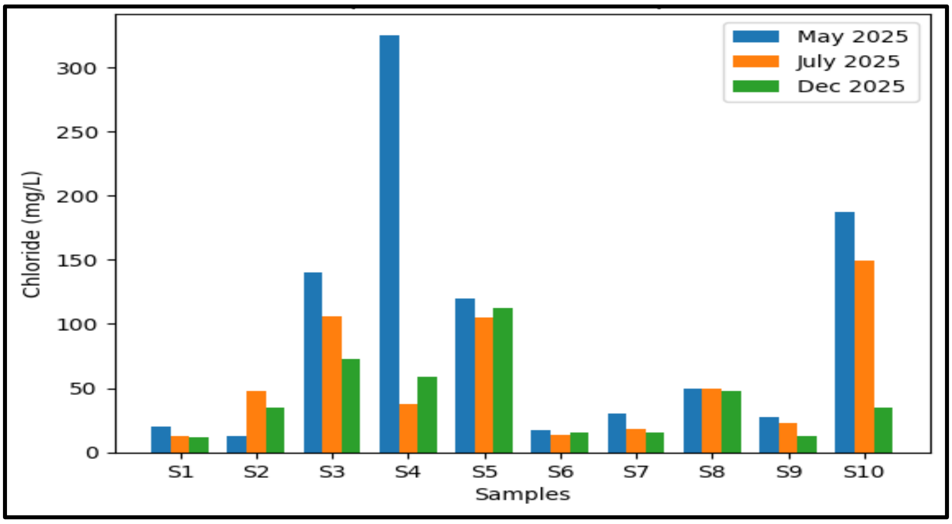

Figure 10. Seasonal variation in the Chloride of water samples in the Year 2025

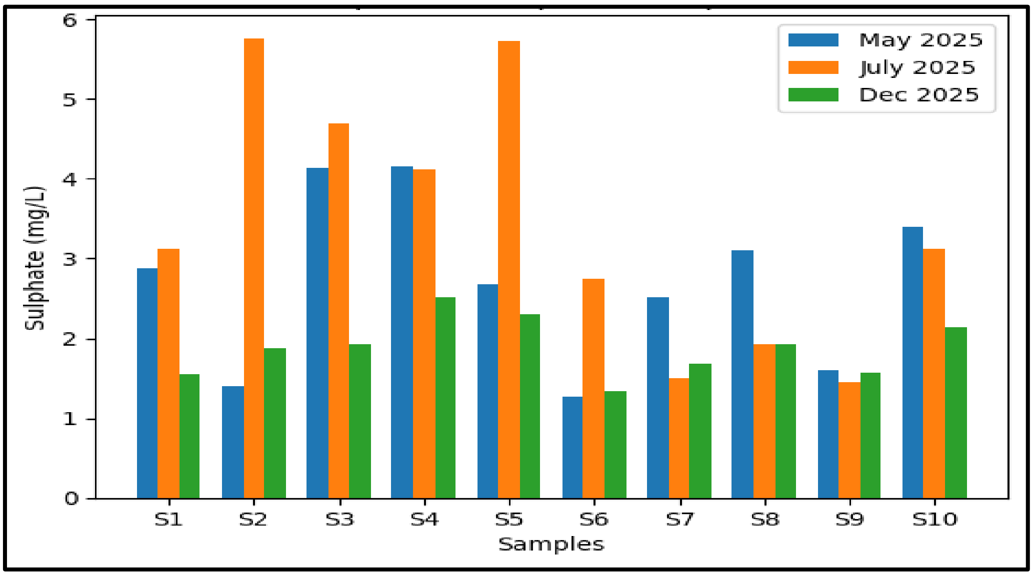

Figure 11. Seasonal variation in the Sulphate of water samples in the Year 2025

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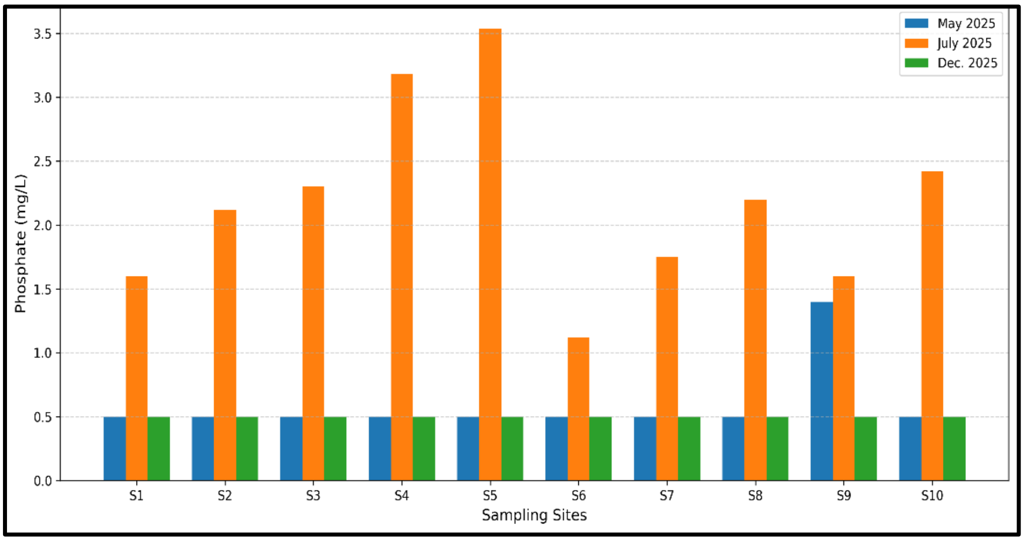

Figure 12. Seasonal variation in the Phosphate of water samples in the Year 2025

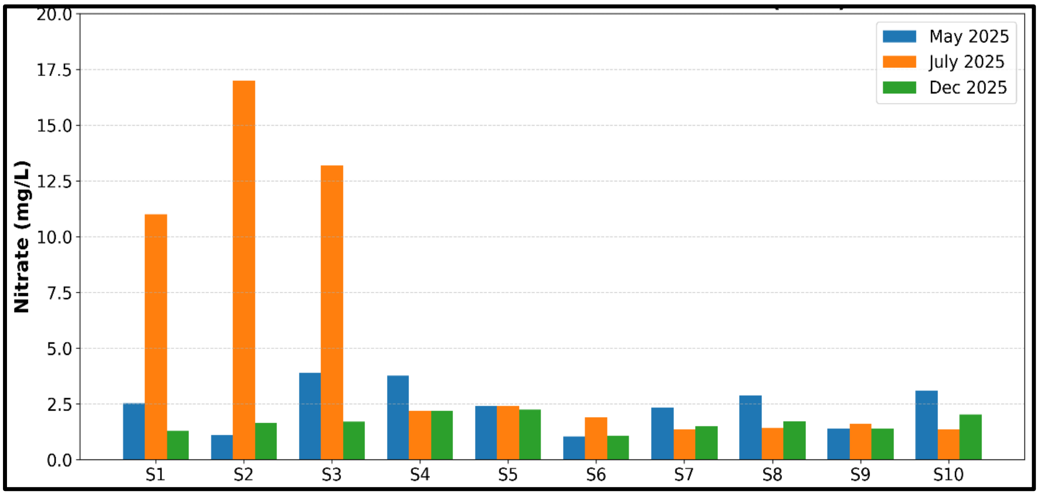

Figure 13. Seasonal variation in the Nitrate of water samples in the Year 2025

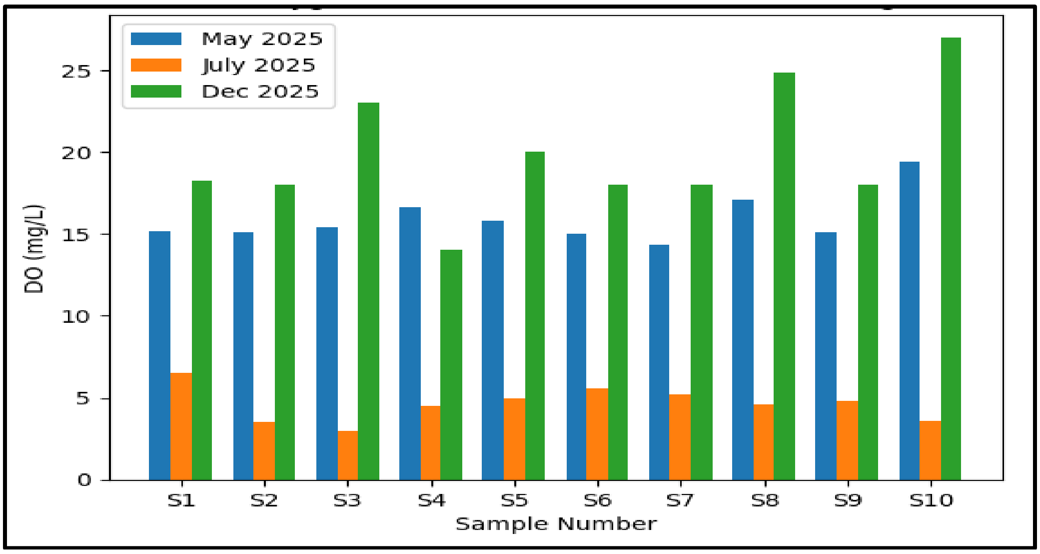

Figure 14. Seasonal variation in the Dissolved Oxygen of water samples in the Year 2025

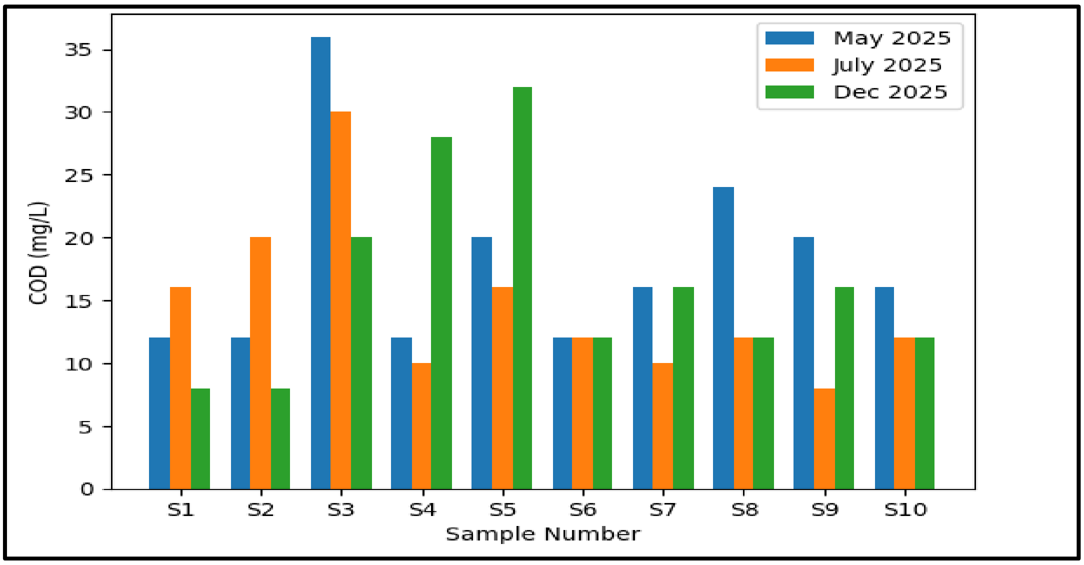

Figure 15. Seasonal variation in the COD of water samples in the Year 2025

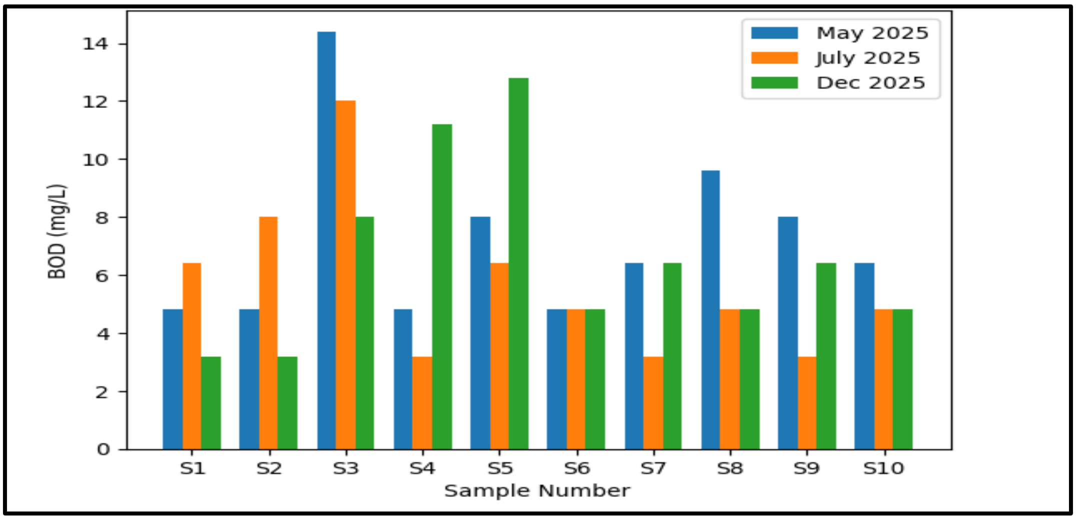

Figure 16. Seasonal variation in the BOD of water samples in the Year 2025

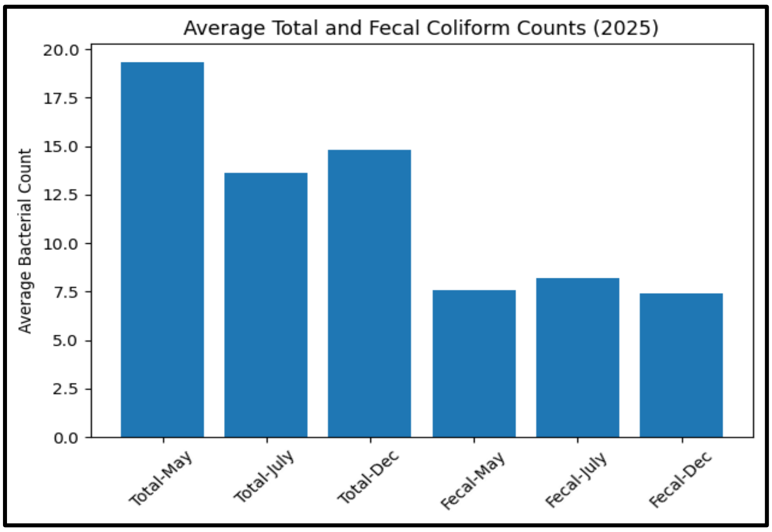

Figure 17. Seasonal variation in the total coliform and fecal coliform bacteria count of water samples in the Year 2025