Physicochemical Investigation of Wainganga River water Tirora Maharashtra

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Abstract: Clean water is essential to human life and a healthy way of living. The political, social, and economic advancement of a society is influenced by the quantity and quality of its water resources. The Wainganga River, which flows through Maharashtra, has been the subject of this study. India's greatest peninsular river is the Wainganga. The length of the Wainganga River is 635.40 kilometers. 51,000 square kilometers make up the Wainganga River's watershed area until it joins the Wardha River. In order to determine whether the water is suitable for drinking, domestic use, and irrigation, samples were collected from Wainganga River sampling stations in Tirora, Maharashtra, in September 2025. A number of significant physico-chemical parameters were considered for the investigation, including pH, turbidity, specific conductivity, total dissolved solids (TDS), total alkalinity (TA), total hardness (TH), calcium hardness (Ca-H), magnesium hardness (Mg-H), nitrate, and sulphate. The study adheres to the conventional technique advised by APHA. According to WHO recommendations and BIS (10500) criteria, the current study shows that the Wainganga River's water quality was sufficient and safe for drinking and irrigation during the study period.

Keywords: Wainganga river, physicochemical analysis, water quality, alkalinity, TDS.

I. INTRODUCTION

A finite resource, water is essential to industry, agriculture, human life, and other fields. Water, which is inorganic, transparent, flavorless, odorless, and nearly colorless, is said to be detrimental to sustainable development, the earth's hydrosphere, and the fluids of all known living beings. It is necessary for all known forms of life, despite having no calories or organic components. Human existence depends on water, one of the planet's most essential resources. The geological environment, how water is recovered, how it is used, and how it is used in different human activities—such as mining, agriculture, household, industrial, and commercial—all have a direct impact on the quality of the water. Simply put, because fresh water is so vital to humanity, it has a direct bearing on human welfare. Unfortunately, environmental stress currently affects most surface and underground water bodies. Urbanization, population increase, and the use of sophisticated agrochemicals to meet food demand all contribute to stress. As a result, the likelihood of percolation surface runoff contaminating the water is high. Most agricultural development activities are hazardous to human health, especially when it comes to overuse of fertilizers and unsanitary conditions. The WHO estimates that water causes about 80% of all human diseases. The quality of contaminated water cannot be restored by eliminating the contamination at its source. Therefore, it becomes crucial to constantly check the quality of the water and devise strategies to protect it.

The demand for clean drinking water is rising as a result of unchecked development and an ever-increasing population. It is evident that the non-eco-friendly activities taking place nearby have a negative impact on several streams, lakes, ponds, and even wells. One of the most significant and prevalent elements in the environment is water. Water is essential to the survival and flourishing of all living things on Earth. As a result, it is imperative that the drinking water quality be examined on a regular basis. An essential component of disease prevention and life quality enhancement is the availability of high-quality water. As a result of various human activities, such as mining, processing, and the use of metal-based materials, as well as the weathering of rocks and leaching of soils, as well as the dissolution of aerosol particles from the atmosphere, natural water contains a variety of impurities. Awokunmi (2010). Testing the water before it is used for drinking, household, agricultural, or industrial purposes is crucial. It is necessary to test water for several physico-chemical properties. The parameters chosen for water testing are entirely dependent on the intended use of the water and the degree of purity and quality required. Numerous kinds of floating, dissolving, suspended, and microbiological organisms can be found in water (Patil P.N, 2012).

Study Area:

The Tirora Village, District- Gondia.

Experimental

Material and Methods

Based on the method's and analysis's instrument availability, eight (08) drinking water parameters were chosen for the study. All techniques were calibrated using blanks and standard solutions prior to the analysis. Only analytical-grade reagents were utilized. The analysis's efficiency falls between 95 and 99%. The various drinking water parameters were analyzed using the following techniques (Table 1):

Methods used for analyzing the different drinking water parameters in samples water		
Sr. No.	Parameters	Method used
1	Temperature	Thermometer
2	pH	pH Meter
3	Electrical Conductivity (EC)	Conductance measurement
4	Total Dissolve Solids (TDS)	Desiccator
5	Total alkalinity (TA) (as CaCo3)	Methyl Orange & Phenolphthalein Titrimetric
6	Total Hardness (TH)	EDTA Titration
7	Calcium Hardness (Ca-H)	EDTA Titration
8	Magnesium Hardness (Mg-H)	EDTA Titration

Sampling

Water samples were collected from 5 stations located in and around Wainganga River during the month of September, 2025 (Rainy Season).

II.RESULT AND DISCUSSION

Water Quality parameters			Average Values of Studied Physico-Chemical Parameters		
			Desirable limit	Permissible limit	Average Value of studied parameters
Sr. No.		Unit			
1	Temperature	°C	-	-	28 °C
2	pH	pH	6.5 to 8.5	6.5 to 8.5	6.28
3	Electrical Conductivity (EC)	µmhos/cm	-	-	500
4	Total Dissolve Solids (TDS)	Mg/l	500	2000	1400
5	Total alkalinity (TA) (as CaCo3)	Mg/l	200	600	400
6	Total Hardness (TH)	Mg/l	300	200-600	525
7	Calcium Hardness (Ca-H)	Mg/l	75	200	175
8	Magnesium Hardness (Mg-H)	Mg/l	30	100	50

1. Temperature

The temperature of the water has a significant impact on the physiological and metabolic processes that accompany the eating, reproducing, migrating, and dispersing of aquatic species. The surface temperature was a good indicator of the air temperature. In the present study, the average value of water temperature was recorded as 28 °C.

2. pH

According to the current investigation, the water's pH values varied from a minimum of 3.74 to a maximum of 6.28, with a mean of 5.01. Most natural water sources have pH values between 6.5 and 8.5, with a variation from the neutral point of 7.0 possibly due to changes in the CO2/bicarbonate/carbonate balance (Awokunmi, 2010). The majority of the samples have pH values below the 6.5–8.5 range that the Bureau of Indian Standards (BIS) recommends (BIS, 2012). The high concentration of free CO2 may be the cause of the low pH values found in the water samples. According to a 2013 study by P. Kerketta et al., the pH range of the drinking water in Ranchi, Jharkhand, India, was 6.3–7.4. Six water samples were found to be below the recommended threshold of 6.5. Their results are still higher than the pH found in the current investigation, though. (P. Kerketta, 2013). Fadaei and Sadeghi (2014) conducted similar pH measurements in Shahrekord, Iran, on untreated drinking water (from well and surface water). The pH range they reported was 7.3 to 8.4, with a mean value of 7.6±0.21, which is significantly higher than what was found in this study. Human health is not directly impacted by the pH of drinking water, although there are some indirect impacts by bringing changes in other water quality parameter such as solubility of metal and survival of pathogen. (Abdolmajid, 2014)

3. Conductivity

According to the current study, the water samples' conductivity values range from a minimum of 17 µS/cm to a maximum of 500 µS/cm, with a mean value of 258.5 µS/cm. Additionally, it was noted that the conductivity values varied from one place to another. Water's total ionized constituent can be determined with the help of electrical conductivity. The sum of the cations and anions has a direct bearing on it. The six conductivity classes were proposed by Christiansen in 1942.

These are as follows:

C1 - 0.00 to 250 µS/cm – Low salinity water

C2 - 250 to 750 µS/cm – Moderate salinity water

C3 - 750 to 2250 µS/cm – Medium High salinity water

C4 - 2250 to 4000 µS/cm – High salinity water

C5 - 4000 to 6000 µS/cm – Very high salinity water

C6 - Above 6000 µS/cm – Water should not be used

4. Total dissolved solid (TDS)

The TDS in water samples varied from a minimum of 1400 mg/L to a maximum of 290 mg/L, according to the current study. BIS states that 500 mg/L of TDS is the permissible maximum (BIS, 2012). Low TDS denotes a low level of pollutant inflow. The water supply is protected in several of the sample locations by being well-insulated from the nearby surroundings. According to Kerketta et al. (2013), the TDS of drinking water can range between 67 to 1846 mg/L. (Kerketta P, 2013) The mean values varied from 73±1. These results are far greater than those found in the current investigation.

5. Alkalinity

According to the current study, the alkalinity values of water have a mean of 286 mg/L and range from a minimum of 172 mg/L to a maximum of 400 mg/L. Carbonate (CO32-) and bicarbonate (HCO32-) make up the majority of alkalinity. The pH is stabilized by alkalinity. The toxicity of numerous compounds in water is influenced by alkalinity, pH, and hardness. Water becomes beneficial and aids in coagulation when it is alkaline. For home use, it is less desirable at less than 100 mg/L (Gupta, 2017). According to Kerketta et al. (2013), the mean values of the alkalinity ranged from 35±1 to 144.75±40.359 mg/L, whereas the entire range of the drinking water they tested was from 22 to 256 mg/L (Kerketta P, 2013). According to BIS the permissible limit, the alkalinity in drinking water is 600 mg/L (BIS, 2012). The values observed from the present study were lower than the permissible limit of 600mg/L.

6. Total Hardness

With a mean of 297.5 mg/L, the total hardness values of the water samples in this study varied from a minimum of 70 mg/L to a maximum of 525 mg/L, suggesting that the majority of the water samples are soft water. The BIS states that 200 mg/L is the maximum amount of total hardness that can be present in drinking water (BIS, 2012). Every total hardness value falls within the BIS-recommended range for drinking water. The amount of calcium and magnesium is primarily to blame for the water's hardness. A high magnesium content gives the portable water an unpleasant flavor. Depending on the amount of calcium and magnesium present, water can be categorized as soft (<75 mg/L), moderately hard (75-150 mg/L), hard (150-300 mg/L), or very hard (>300 mg/L). It is a crucial factor in assessing the suitability of water for drinking, household use, and numerous industrial uses. Water with a hardness of less than 300 mg/L is regarded as portable, but more than this causes irritation of the gastrointestinal tract (Patil P.N, 2012).

7. Calcium Hardness
In aquatic environments, calcium is a crucial micronutrient. Variations in the water's hardness concentration suggest that the discharge of sewage and industrial effluent containing pollutants is significantly impacted by the river's water's hardness. In the current investigation, the average Ca hardness concentration value was 175 mg/l.

8. Magnesium Hardness (Mg-H)
Magnesium is a co-factor for various enzymatic transformation within the cell especially in the trans-phosphorylation in algal, fungal and bacterial cell. The average value of Magnesium Hardness of Bela village was found 50 mg/l during study period.

III.CONCLUSION

According to BIS or WHO guidelines, practically all of the drinking water parameters being examined in the water samples fall within the acceptable or recommended range, as demonstrated by the current study. Given the high water consumption rate (let's say at least 2 liters per day), certain characteristics can still pose a risk to the customer. Consequently, a research for a health risk assessment ought to be undertaken. A bacteriological analysis is necessary to comprehend the dangers of eating untreated drinking water, even though the water sample is frequently ingested after boiling.

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REFERENCES

[1] Abdolmajid, F. a. (2014). Evaluation and Assesment of Drinking Water Quality in Shahrekord, Iran. Resources and Environment, 168-172.

[2] Adimasu, W. (2015). Physicochemical and biological water quality assessment of Lake Hawassa for multiple designated water uses. Journal of Urban and Environmental Engineering, 146-157.

[3] Awokunmi, S. O. (2010). Determination of physico-chemical parameters and heavy metals in water samples from Itaogbolu area of Ondo-State, Nigeria. African Journal of Environmental Science and Technology, 145-148.

[4] BIS, I. 1. (2012). Indian Standard Drinking Water Specitication. New Delhi: Publication Unit, BIS New Delhi India.

[5] Canada, H. (2020). Canada.ca. Retrieved from https://www.canada.ca/content/dam/hc-sc/documents/programs/consultation-boron-drinking-water/document/boron-gtd-consultation-09-12-2019-eng.pdf

[6] Christiansen, J. E. (1942). Irrigation by Sprinkling, California Agricultural Experiment Station Bulletin 670, University of California, Berkeley.

[7] Gupta, G. B. (2017). Analysis of total alkalinity in drinking water in Kotputli Town, Rajasthan. Indian Streams Research Journal, 1-3.

[8] Kerketta P, S. l. (2013). Analysis of Physico-chemical properties and heavy metals in drinking water from different sources in and around Ranchi, Jharkhand, India. Veterinary World, 370-373.

[9] Manjesh, K. a. (2012). Assessment of Physico-chemical Properties of Ground Water in Granite Mining Areas in Jhansi, U.P. International Journal of Engineering Research & Technology.

[10] Patil P.N, S. D. (2012). Physico-chemical parameters for testing of water - A Review. International Journal of Environmental Sciences, 1194-1205.

[11] Police, S. (2023, August 1). https://meghalaya.nic.in. Retrieved from https://shillongpolice.gov.in: https://shillong police.gov.in/map_shg.html

[12] USEPA. (2023, MARCH 15). epa.gov. Retrieved from www.epa.gov: https://www.epa.gov/region8-waterops/nitrate-rule-maximum-contaminant-level-mcl-public-notification-template.

[13] WHO. (1998). Health criteria and other supporting information - Guidelines for drinking-water quality, 2nd ed. Geneva: WHO.