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PHYSICO-CHEMICAL ANALYSIS OF WAINGANGA RIVER WATER DURING RAINY SEASON AT BALAGHAT, DISTRICT BALAGHAT (MP)

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ABSTRACT

The primary requirement for human life and a healthy lifestyle is clean water. The availability and quality of water resources have an impact on the political, social, and economic development of society. In this present study, the Wainganga River flowing in Madhya Pradesh, has been the focus of research. Wainganga is the largest peninsular river in India. Wainganga River flows for 635.40 kilometers. Until its confluence with the Wardha River, the Wainganga River has a catchment area of 51,000 Sq. km. The basin spans the five districts of Maharashtra and three districts of Madhya Pradesh. It serves as a considerable supply of drinking water, irrigation, and hydropower. In this present study, water samples from five different sampling stations of Wainganga River were taken in the month of Sept. 2022 at Balaghat city, Madhya Pradesh to assess its appropriateness for drinking, domestic and irrigation purposes. The important physico-chemical parameters as 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 were taken into consideration for study. The study follows APHA recommended standard methodology. The present study reveals that, during the study period, the water quality of Wainganga River was adequate and safe for drinking and irrigation purposes as per the recommendation of WHO and BIS (10500) standards suggested.

Keywords: Physico-Chemical Analysis, Wainganga River, Balaghat City, District- Balaghat (M.P.), WHO, BIS.

INTRODUCTION

Water is a limited resource that is vital to human life, agriculture, industry, and other sectors. According to reports, insufficient water supply and quality harm sustainable development, of the earth's hydrosphere and the fluids of all known living things, water is inorganic, transparent,flavorless, odorless, and almost colorless. Even though it doesn't contain any calories or Organic nutrients, it is essential for all known forms of life. One of the most vital resources on Earth, water is used for human life. The quality of water is completely dependent on the

geological environment, how it is recovered, how it is used, and how it is used in various human activities, including domestic, industrial, commercial, mining, agricultural, etc., activities. Simply said, freshwater is directly related to human welfare because it is so important to humanity. However, the majority of surface and subterranean water bodies are sadly under environmental stress today. Stress is brought on by urbanization, population growth, and the use of advanced agrochemicals to meet food demand. Therefore, there is a substantial chance that percolation surface runoff will contaminate the water. The majority of agricultural development operations pose a hazard to human health, particularly in light of excessive fertilizer use and unhygienic circumstances. About 80% of all human diseases, according to the WHO, are brought on by water. When water is contaminated, it is impossible to restore its quality by removing the contaminant at the source. Therefore, it becomes crucial to constantly check the quality of the water and devise strategies to protect it. Putrescibility is the ability to break down through microbial activity and is increased by higher amounts of organic waste, which is also known as sewage, fungus, and this quality. There is a decrease in the amount of dissolved oxygen (DO) in the water as a result of increasing consumption (an indicator of pollution). The term "demand for oxygen" or "biochemical oxygen demand" refers to the relationship between rising organic waste input and the need for oxygen (BOD). Many delicate aquatic animals, such as plankton, mollusks, fish, etc. perish due to the decreasing oxygen content.

Study Area: The Wainganga River at Balaghat, District- Balaghat. The Wainganga River originates in the Mahadeo Hills in Mundara near the village Gopalganj in Seoni District- Seoni (M.P.). This River travels from west to east. The Wainganga River has a length of nearly 569 km and flows through the states of Madhya Pradesh and Maharashtra.

Material and Methods

The water samples were taken from five (05) selected pollution prone water sampling stations named S1, S2, S3, S4 and S5 from River Wanganga in Balaghat city, District Balaghat (M.P.) in the month of Sept. 2022.The samples were collected in the morning hours in between 8.00 am to 10.00 am. The collection of samples followed by the recommendations of APHA (2012) and in one-liter acid cleaned plastic containers. Water samples were brought to the laboratory right away for analysis and standard methods suggested by APHA were followed for the analysis of water samples.

Results and Discussion

The summary of observations of studied physico-chemical parameters of all the water samples from five water sampling stations are presented in table1-

Table1- Average Values of Studied Physico-Chemical Parameters of Wainganga River in the Month of Sept. 2022.

S.No.	Water Quality parameters	Unit	Average Values of Studied Physico-Chemical Parameters		
			Desirable limit	Permissible limit	Average Value of studied parameters
1.	Temperature	^{0}C	-	-	25^{0}C
2.	Turbidity	NTU	1.0	5.0	1.8
3.	pH	pH	6.5 to 8.5	6.5 to 8.5	7.22
4.	Electrical Conductivity (EC)	µmhos/cm	-	-	251
5.	Total Dissolve Solids (TDS)	mg/l	500	2000	148
6.	Nitrate as (NO_3^-)	mg/l	45	45	3.744
7.	Sulphate as (SO_4^{2-})	mg/l	200	400	6.347
8.	Total alkalinity (TA) (as $CaCo_3$)	mg/l	200	600	108
9.	Total Hardness (TH)	mg/l	300	200-600	124
10.	Calcium Hardness (Ca-H)	mg/l	75	200	32.8
11.	Magnesium Hardness (Mg-H)	mg/l	30	100	10.8

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 Wanganga River water temperature was recorded as 25^{0}C.

Turbidity : Turbidity in water is due to the presence of colloidal and extremely fine dispersion and indicates the extent of pollution in water body. The average value of turbidity was found as 1.8 NTU.

pH : The intensity of an acidic or basic feature in a solution at a specific temperature is known as pH. The pH (pH= -log [H+]) is the negative logarithm of hydrogen ion concentration. The pH of water is vital for biotic communities since most plant and animal species can only survive in a small pH range, from slightly acidic to slightly alkaline conditions. Since most biological life only survives in a very limited and important pH range. pH is a sign of biological life. The pH of water is a crucial factor in determining whether it is suitable for use in various processes like drinking, bathing, cooking, and cleaning. In this study, the average value of pH was found as 7.22.

Electrical Conductivity (EC): Water capability to transmit electric current is known as electrical conductivity and serves as tool to assess the purity of water. This ability depends on the presence of ions, their total concentration, mobility, valence, relative concentrations and temperature of measurement. The average value of electrical conductivity was recorded as 251µmhos/cm.

Total Dissolved Solids (TDS): Freshwater, usually has a TDS level of 10 to 500 mg/l. The concentration of cations and anions together make up the total dissolved solids (TDS). High solids content increases the density of water, decreases the solubility of gases like oxygen and diminishes the amount of water that may be used for irrigation, drinking, and other uses. For drinking water, 500 mg/l of TDS is the upper allowed limit. The average value of TDS was found as 148 mg/l during the rainy season.

Nitrate: Nitrates are introduced to fresh water by sewage discharge, industrial waste, and runoff from agricultural areas. The entrance of sewage-filled, nitrogen-rich floodwater may be the cause of the greater concentration. During the rainy season, nitrate concentrations increases and then they began to decline during the post-winter period. In this study, the average value of nitrates was recorded 3.744 mg/l.

Sulphate: Sulphates are widely distributed in nature and may be present in natural water in combined forms. The main source of sulphates is the rocks present near the water bodies and biochemical action of anaerobic bacteria. The average concentration of sulphates in Wainganga River water was found as 6.347 mg/l.

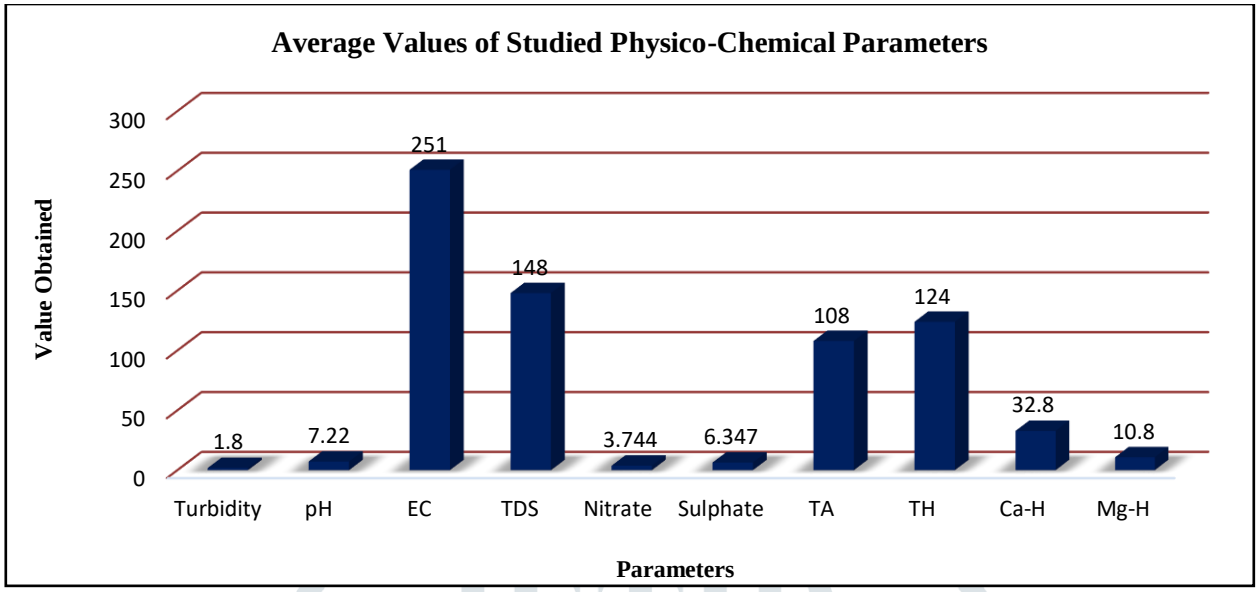
Total Alkalinity (TA): Alkalinity of water is its capacity to neutralize a strong acid and is characterized by the presence of hydroxyl ions capable of combining with hydrogen ions. In natural water most of alkalinity is caused due to the presence of free carbon dioxide. The average value of total alkalinity was found as 108.0 mg/l.

Total Hardness (TH): It has specified the total hardness of water to be 300 mg/l of $CaCo_3$.In the present study, the average value of total hardness was observed as 124 mg/l.

Calcium Hardness: Calcium is an important micronutrient in an aquatic environment. Hardness of the river water is of considerable significance in connection with the discharge of sewage and industrial effluent containing pollution, as indicated by variation in the concentration of hardness of the water. The average concentration value of the Ca hardness recorded in the present study was 32.8 mg/l.

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 Wainganga River was found 10.8 mg/l during study period.

Table2- Chart showing the Average Values of Studied physico-Chemical Parameters in September. 2022



Conclusion

The overall results of the current study give us useful information about water quality and show that the Wainganga River's water can be used as a good habitat. Because carbon dioxide is soluble in water, the pH value shows that the water is alkaline. The overall assessment of the Wainganga River's water quality Balaghat city, District Balaghat (M.P.) reveals that during the study period, most of the studied physico-chemical parameters analyzed were found within the allowable range recommended by WHO and BIS (10500) and Wainganga River water was found suitable for drinking and irrigation purposes and may be used after proper treatment.

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