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NARMADA REVER WATER OBSERVATION AND ANALYSIS IN JABALPUR, MADHYA PRADESH, INDIA

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ABSTRACT

The study looked at various physical evidence to assess whether the water quality of the Narmada, river was of primary value. Finally, the water quality index (WQI) was created by mathematical calculations based solely on physicochemical properties. Using the proposed method, the test measures the number of errors. These ideas are then compared with standards set by international organizations such as the Indian Standards Institute (ISI) and the World Health Organization (WHO).

Water size index (wqi) is an expression given by the calculation used to obtain the test. The Water Quality Index of Excellence provides a simple and practical way to assign a numerical value to the achievement of water quality. This number acts as a signal.

Key Words: Physicochemical parameters, standard procedure, drinking water, toxicity, danger.

1. INTRODUCTION

India boasts a remarkable social history. The world's experiences contain its inclinations. The world's most extensive watercourse is the Narmada Circulation. The earth's non-romantic evolution causes it to spill out. The setting of the novel Narada is Amarkantak, a small town in Madhya Pradesh with undulating hillsides. " This paper holds both financial value and strict importance. ' It is still considered a Shiva woman. It moves through the sloping and changing terrain, and its immense strength is converted into energy for use by many states. ' Water for drinking, farming, and other modern purposes is also utilized. The banks have given rise to both small settlements and large urban centers. The extensive range of physical endeavors undertaken by humans commenced an extraordinary social history in India. ' The world's experiences are infused with its tendencies. The Narmada Circulation is the world's most extensive watercourse that has been maintained. It permeates the gaps left by the uninvited growth of earth. ' The small town of Amarkantak in Madhya Pradesh, where the novel Narada is set and has beautiful hills, is a great place to explore. It is important, economically and rigorously. It is still referred to as a female Shiva. The creature moves through the sloping and changing terrain, harnessing the energy it generates from its immense strength. Moreover, its water finds application in drinking, agriculture and other modern contexts. Its banks have given rise to the development of both modest cities and massive metropolitan areas.

2. MATERIALS & METHODS

Numerous parameters, such as total hardness, calcium and magnesium ions, pH, alkalinity, total dissolved solids, electric conductivity, etc., were thoroughly examined. The results were then compared to the standards outlined by the Indian Standards Institute (ISI) and the World Health Organization (WHO) [9]. Analytical reagents of analytical reagent (AR) grade were utilized for chemical analysis while distilled water was used to calibrate the reagents. Using a sophisticated systronics conductometer and pH meter, the electrical conductivity and pH levels were measured. The temperature at the designated sampling sites was recorded for each sample. As outlined in table 1, established procedures [10] were followed to determine the various parameters, and the experimental results were subsequently compared to the WHO and ISI guidelines.

Weighted arithmetic water quality index method

Currently, the water quality index (WQI) has become a popular method in scientific research for indicating the purity level of water based solely on physico-chemical parameters [11–16]. In order to determine the WQI [17], the following formula is utilized, utilizing the physico-chemical parameters.

$$WQI = \frac{\sum W_i Q_i}{\sum W_i}$$

Where, Q_i = quality rating, and W_i = Unit weight

The following expression is used to determine the quality rating scale (Qi) for each parameter:

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$$Q_i = \frac{(V_{actual} - V_{ideal})}{(V_{standard} - V_{ideal})} \times 100$$

Where, V_{actual} is the estimated concentration of the ith parameter in the tested water

V_{ideal} is the ideal value of this parameter in pure waterV_{ideal} = 0 (except pH =7.0 and DO = 14.6 mg/l)

Vstandard is the ith parameter's suggested standard value. For every water quality parameter, the unit weight (Wi) can be computed using the formula below.

$$W_i = \frac{K}{S_i}$$

Where, K= proportionality constant and is taken as the unity.

3. RESULTS & DISCUSSION

Temperature

Changes in temperature have a significant impact on both chemical and biochemical reactions. Higher water temperatures lead to faster chemical reactions, but also result in a decrease in the solubility of gases in water. The variations in water temperature have a direct effect on aquatic organisms. The three water samples (s1, s2, and s3) had temperatures that were considered safe according to the data in table 1.

The pH levels of natural water typically range from six to eight. These levels can be influenced by the hydrolysis of salt compounds from strong or weak acids, as well as dissolved gases such as carbon dioxide, hydrogen sulfide, and ammonia. The samples S1, S2, and S3 all fell within the recommended range, as shown in table 1 and figure 1.

Alkalinity refers to the ability of water to neutralize acids, and is quantitatively measured. Water that contains bicarbonates, carbonates, and hydroxides can help decrease the concentration of h+ ions, which results in a higher pH level. The sources of alkalinity in streams can include the breakdown of rocks and soil, plant activities, and discharge from industrial facilities. The alkalinity levels found in all three samples (S1, S2, and S3) fell within the recommended range according to WHO standards, but were at the upper boundary of ISI's requirements. This indicates a potential issue that needs to be addressed, as shown in table 1 and figure 1.

Electrical conductivity:

The conductive nature of water is known as its conductivity and is affected by factors such as temperature, ion mobility, and the presence of electrolytes like dissolved inorganic solids. When analyzing samples S1, S2, and S3 (as shown in table 1, figure 1), their electrical conductivity is considered within the accepted standard range.

Total, temporary, and everlasting hardness:

Water hardness is a significant element that greatly affects both the general population and various industries. It is primarily affected by the presence of calcium and magnesium in the form of bicarbonates, chlorides, and sulfates. The standard unit of measure for hardness is caco3 equivalents. WHO regulations state that the hardness level was determined to be exceedingly high in all three samples (s1, s2, and s3), yet it remained within the acceptable limits set by the ISI. This highlights the need for a consistent monitoring schedule for minerals that contribute to hardness, particularly in light of the various tourist attractions located along the Narmada River (table 1, figure 1).

Calcium ions and magnesium ions:

In conjunction with magnesium ions, the presence of calcium, an essential element in rocks, plays a role in water hardness. Elevated amounts of calcium and magnesium ions can build up in the fragile tissues of organisms, leading to various health problems. According to all measurements, the levels of calcium ions were found to be excessively high. In contrast, magnesium ions were within the accepted limits, though slightly above the standards set by ISI (see table 1, figure 1).

Total dissolved solids:

General dissolved solids refer to the cumulative concentration of chemical residue that has been dissolved in water, caused by the breakdown of different substances like gypsum, rocks, and soil. Table 1 and figure 1 demonstrate that the total dissolved solids in each sample consistently fell within the required specifications.

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TABLE I: Water Quality Parameters and Their WHO & ISI Standards

Parameters	Method	WHO Standards	ISI Standards	Samples of Narmada river water		
				S_1	S_2	S_3
Temperature	Thermometric	-----	-----	20°C	20°C	20°C
pH	pH metery	7.0 – 8.0	6.5 – 8.5	7.9	8.1	8.0
Electrical Conductivity (µs / cm)	Conductometry	1400	-------	196	200	198
Total Dissolved Solid (mg/L)	Filtration Method	1000	500	128	130	132
Total Hardness (mg/L)	EDTA titration	100	300	182	185	184
Temporary hardness (mg/L)	EDTA titration	-----	-----	62	64	64
Permanent hardness (mg/L)	EDTA titration	-----	------	120	121	120
Calcium ions (mg/L)	EDTA titration	75	75	126	127	126
Magnesium ions (mg/L)	EDTA titration	150	30	56	58	58
Alkalinity (mg/L)	Titration Method	120	200	163	164	162

TABLE 2: Calculation of WQI for S_1 sample

Parameters	Observed values	Standard values	Unit Weight (W_i)	Quality rating (Q_i)	Weighted value (W_iQ_i)
pH	7.9	8.5	0.117647	60.0	7.05882
Electrical Conductivity(µs / cm)	196	300	0.003333	65.3333	0.217775
Total Dissolved Solid (mg/L)	128	500	0.002	25.6	0.0512
Total Hardness (mg/L)	182	300	0.003333	60.6666	0.20222
Calcium (mg/L)	126	75	0.01333	168	2.23999
Magnesium (mg/L)	56	30	0.03333	186.6666	6.22159
Alkalinity (mg/L)	163	120	0.008333	135.8333	1.13189
			$\sum W_i =$ 0.181306		$\sum W_iQ_i =$ 17.123485

Water Quality Index (WQI) = $\sum W_iQ_i / \sum W_i$ = 94.44521

TABLE 3: Calculation of WQI for S_2 sample

Parameters	Observed values	Standard values	Unit Weight (W_i)	Quality rating (Q_i)	Weighted values (W_iQ_i)
pH	8.1	8.5	0.117647	73.3333	8.62744
Electrical Conductivity(µs/cm)	200	300	0.003333	66.6666	0.22219
Total Dissolved Solid(mg/L)	130	500	0.002	26.0	0.052
Total Hardness (mg/L)	185	300	0.003333	61.6666	0.20553
Calcium(mg/L)	127	75	0.01333	169.3333	2.25721
Magnesium(mg/L)	58	30	0.03333	193.3333	6.443798
Alkalinity (mg/L)	164	120	0.008333	136.666	1.138837
			$\sum W_i =$ 0.181306		$\sum W_iQ_i =$ 18.947005

Water Quality Index (WQI) = $\sum W_iQ_i / \sum W_i$ = 104.5034

Water Quality Index (WQI) = $\sum W_iQ_i / \sum W_i$ = 104.5034

TABLE 4: Calculation of WQI for S_3 sample

Parameters	Observed values	Standard values	Unit Weight (W_i)	Quality rating (Q_i)	Weighted values (W_iQ_i)
pH	8.0	8.5	0.117647	66.6666	7.84312
Electrical Conductivity(µs/cm)	198	300	0.003333	66.0	0.21999
Total Dissolved Solid(mg/L)	132	500	0.002	26.4	0.0528
Total Hardness (mg/L)	184	300	0.003333	61.3333	0.20442
Calcium(mg/L)	126	75	0.01333	168.0	2.23944
Magnesium(mg/L)	58	30	0.03333	193.3333	6.44379
Alkalinity (mg/L)	162	120	0.008333	135.0	1.124955
			$\sum W_i =$ 0.181306		$\sum W_iQ_i =$ 18.128515

Water Quality Index (WQI) = $\sum W_iQ_i / \sum W_i$ = 99.98850

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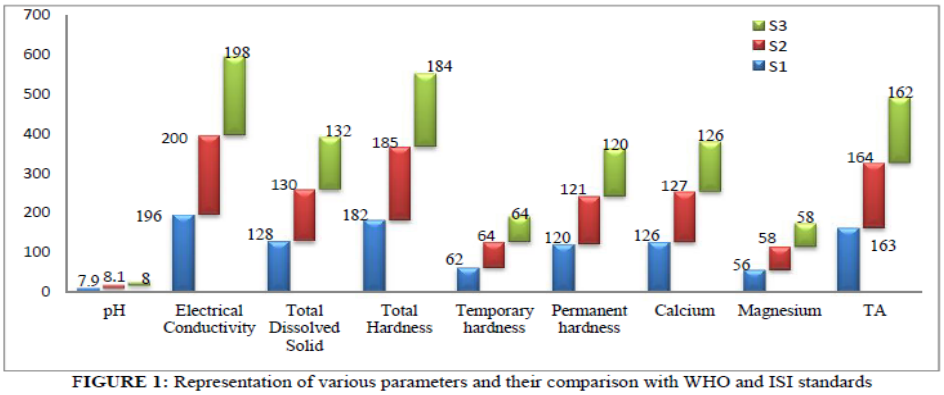

FIGURE 1: Representation of various parameters and their comparison with WHO and ISI standards

WQI of Narmada River Water

TABLE 5: water Qaulity Index (WQI) status of water quality [18]

Water Quality Index Level	Water Quality Status
0 – 25	Excellent water quality
26 – 50	Good water quality
51 – 75	Poor water quality
76 – 100	Very poor water quality
> 100	Unsuitable for drinking

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4. CONCLUSION

Water Quality Index Level Narmada Rivr in Jabalpur District

The study analyzed the water quality index of samples s1, s2, and s3 in tables 2 - four and found their values to be 94.44, 104.5, and 99.99, respectively. According to the results of the study conducted on the Narmada River, the water quality (table 5) [18] was deemed considerably poor. As the Narmada River water serves as a vital source for both consumption and irrigation purposes, it is imperative that it is contaminant-free. The consumption of untreated water carries significant health risks, especially in rural and tribal areas. Moreover, the Narmada water is crucial for supplying power to the states of Madhya Pradesh and Gujarat, making it essential for the water to be free of impurities and hardness in order to efficiently produce energy.

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