WATER QUALITY ASSESSMENT OF NARMADA RIVER WATER, GUJARAT, INDIA.

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ABSTRACT:
Narmada river water is used for drinking, domestic and for irrigation purposes in Gujarat, due to its wide application its water quality is an important aspect. In the present study water sample of Narmada River from five regions has been assessed twice a month to evaluate its suitability for drinking, domestic and irrigation purposes. The important parameters selected for this study are Temperature, Turbidity, pH, Conductivity, T.D.S, Suspended Solid, Alkalinity, Acidity, Total hardness, Calcium hardness, Magnesium hardness, Chloride, Dissolved Oxygen, B.O.D, C.O.D and microbiological parameters were determined in the laboratory. The Physico- Chemical parameters were determined as per standard methods. Analysis results showed that the overall water quality is suitable and safe for domestic and irrigation purposes.

Keywords: Narmada, River, Water, Quality, Assessment, Gujarat.

INTRODUCTION:

Rivers are very important natural resource for every living organism. River water quality is a key concern as it is used for drinking and domestic purpose, irrigation and aquatic life including fish and fisheries (Miah M.A. *et al.,* 2014). Water is also crucial for the quality of life (River Water Quality Report 2015). The ecological balance maintained by the quantity and quality of water determines the way of life of people. On the other hand, polluted water is the greatest source of disease. Today the problem is not only of water availability but of environmental quality and ecological balance. With increasing industrialization, urbanization and technological advance in all fields, sources of water are getting more and more polluted. The survival of life on earth will be threatened if the present rate of pollution continues unabatedly (Miah M.A. *et al.,* 2014). Natural waters are discharged with a wide variety of inorganic, organic, and biological pollutants that consumes oxygen during its degradation and thus prevents the water from supporting fish life.

The Narmada River, also called the Reva and previously also known as Narbada, is the 5th longest river and overall longest west-flowing river in India. Narmada is one of the most important rivers in India which originates from the Amarkantak, Madhya Pradesh in central India and flows through the Maikal and Satpura hills (Mishra V.K *et al.* 2020). It flows 1,312 km west through the states of Madhya Pradesh, Maharashtra, and Gujarat of which 1,077 km is within Madhya Pradesh (Gupta, Chakrapani, Selvaraj, & Kao, 2011). It runs from the hills of Amarkantak, toward Dindori, Mandala, Jabalpur, Narsinghpur, and Hoshangabad fulfilling the water demands of the large population as it passes. The banks are high between the layers of old alluvial deposits, hardened mud, gravels of nodular limestone and sand. The width of the river spans from about 1.5 km at Makrai to 3 km near Bharuch and also it forms an estuary of 21 km at the Gulf of Cambay. The Karajan and the Orsing are the most important tributaries in the original course. The former joins at Rundh and the latter at Vyas in Vadodara district of Gujarat, opposite each other and form a Triveni on the Narmada. The Amaravati and the Bhukhi are other tributaries of significance. Opposite the mouth of the Bhukhi is a large drift called Alia Bet or Kadaria Bet.

MATERIAL AND METHODOLOGY:

Study Area:

The study was performed at five different location along the stretch of river Narmada from 01st February 2023 to 15th March 2023. The sampling locations were 1) Tilakvada 2) Mangrol 3) Garudeshwar 4) Navagam and 5) Sardar Sarovar Dam.

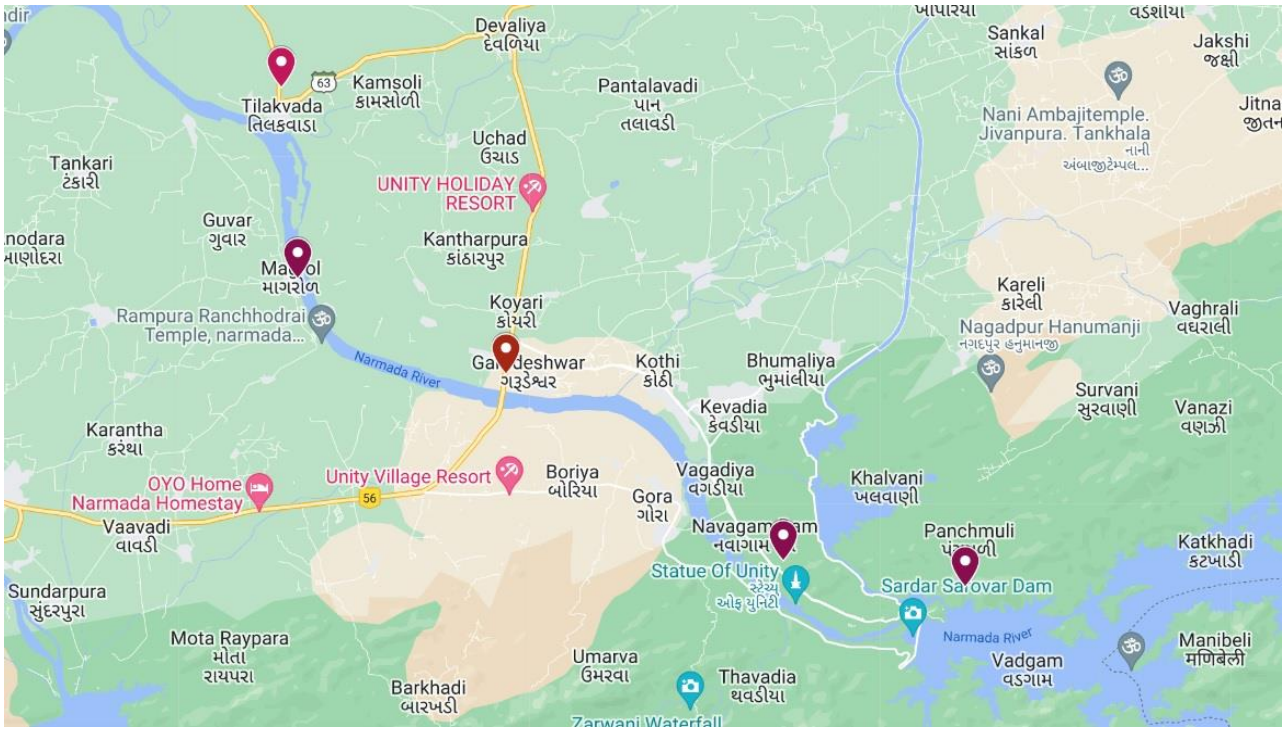

Figure: Sampling Location

Water samples were collected for the study from the site Tilakwada, Garudeshwar, Mangrol, Navagam, Sardar Sarovar Dam. The samples were collected in clean 1 liter bottles for physio-Chemical analysis and in two 300 ml BOD bottles for bacteriological studies and for estimation of dissolved oxygen at site. Samples were transported to laboratory at $4^{O}C$ in thermocol box. Water analysis was done as per APHA 2017.

RESULTS AND DISCUSSION:

Average Results of Physio-Chemical Parameters:

	Garudeshwar	**Tilakwada**	**Sardar Sarovar Dam**	**Mangrol**	**Navagam**
pH	7.80	7.30	7.38	7.25	7.39
Temperature(^{O}C)	26.7	26.1	26.2	26.5	26.8
Conductivity	240	320	240	280	320
Turbidity(NTU)	8.4	7.8	6.1	8.4	9.1
Acidity(mg/l)	120	140	160	150	145
Alkalinity(mg/l)	150	172	150	160	145
TDS(mg/l)	210	163	220	242	186
TSS(mg/l)	5.1	4.1	7.5	6.2	6.1
Total Hardness(mg/l)	80	90	85	95	100
DO(mg/l)	5.8	5.3	5.9	5.2	6.9
Chloride(mg/l)	77.97	89.96	48.98	68.63	40.98
BOD(mg/l)	38.68	20.68	56.29	59.48	48.9
COD(mg/l)	97.55	51.56	155.3	160.44	127.76

Discussion:

Temperature: Water Temperature is a key water quality parameter, which regulates the biogeochemical activities in the aquatic environment and was relatively easy to measure at the sampling site. The temperature of River Narmada ranges between $25^{0}C$ to $29^{0}C$. The maximum temperature of $26.57^{0}C$ was noted at Garudeshwar while Tilakwada, Sardar sarovar dam Mangrol and Navagam showed 26.35, 26.45, 26.52 and 26.4 respectively.

pH: pH of a water body is very important in determination of water quality since it affects other chemical reactions such as solubility and metal toxicity. The fluctuation in optimum pH range may lead to an increase or decrease in toxicity in water bodies (Ali, 1991). The pH value recorded ranges from 7.1 to 8.0. The pH value of Narmada water were in the permissible range asprescribed by BIS and IS: 10500 – 2012.

Conductivity: It is a measure of water capability to transmit electric current and also it is a tool to assess the purity of water. Electrical conductivity recorded in River Narmada at all the five regions ranges between 200 to 350 mg/l. The EC

values in the Narmada waters were in the permissible range as prescribed by BIS and IS: 10500 – 2012.

Turbidity: High concentrations of particulate matter affect light penetration and ecological productivity, recreational values, and habitat quality. In streams, increased sedimentation and siltation can occur, which can degrade the habitat areas of fish and other aquatic life. For this reason, turbidity readings can be used as an indicator of potential pollution in a water body. Turbidity is measured in NTU (Nephelometric Turbidity Units). The instrument used for measuring it is called a nephelometer or turbidimeter. Turbidityrecorded in River Narmada water at all the five regions ranges between 6 to 10 mg/l. The turbidity values in the Narmada were in the permissible range as prescribed by BIS and IS: 10500 – 2012.

Total Dissolved Solid: Higher TDS in the water depicts more ionic concentration, which is of inferior palatability and causes an unfavorable physico-chemical reaction in the consumers. (Kataria et al., 1996) reported that increase in value of TDS indicate pollution by extraneous sources. The amount of TDS recorded in the water of river Narmada ranges between 150 to 250 mg/l. Lower values of TDS indicates that the water at regions have less scope of organic matter mixing into the river.

Total Suspended Solids: The amount of TSS recorded in the water of river Narmada ranges between4 to 7 mg/l. Lower values of TSS indicates that the water at regions have less scope of organic matter mixing into the river.
Acidity: Acidity is the capacity to resist change in pH that would make water more basic. The amount of Total Acidity recorded in the water of River Narmada ranges between 100 to 200 mg/l. Values of Total acidity in all the regions were in permissible limit.

Total Alkalinity: Total Alkalinity of water is its capacity to neutralize a strong acid and it is normally due to the presence of bicarbonate, carbonate and hydroxide compound of calcium, sodium and
potassium. The amount of Total Alkalinity recorded in the water of river Narmada ranges between 100 to 200 mg/l. Values of Total alkalinity in all regions were in permissible limit.

Chloride: The chlorides concentration serves as an indicator of pollution by sewage and industrial effluent. People accustomed to higher chloride in water are subjected to laxative effects. The amount of chloride recorded at regions ranges between 50 mg/l to 100 mg/l. The amount of chloride in the water of river regions was under permissible level.

Total Hardness: Hardness is the parameter of water quality used to describe the effect of dissolved minerals (mainly Ca and Mg), determining suitability of water for domestic, industrial, and drinking purpose attributed to presence of bicarbonates, sulphate, chlorides of calcium and Magnesium. The amount of Hardness recorded in the water of river Narmada at all five regions ranges between 80 mg/l to 100 mg/l. Agriculture runoff, urban discharge, Industrial effluent and Clothes washing in water bodies causes increase in the value of hardness in river water. Narmada River water quality is moderately hard with average value of Total Hardness.

Dissolved Oxygen: One of the important parameter in water quality assessment is Dissolved Oxygen. Its presence is essential to maintain variety of forms of life in the water and the effect of waste discharge in a water body are largely determined by the oxygen balance system. It can be rapidly depleted from water by discharge of oxygen demanding waste. The amount of dissolved oxygen recorded in the Narmada water ranges between 5.0 mg/l to 7.0 mg/l. The DO study of data shows thatthe river water is in acceptable.

Biochemical Oxygen Demand: BOD determination is still the best available test for assessing organic pollution. High value of BOD indicates higher organic pollution. The amount of BOD recorded in the water of river ranges between 20 mg/l to 60 mg/l. The BOD study of data shows that the river water is in acceptable.

Chemical Oxygen Demand: COD test is quite useful in assessment of pollution strength of industrial waste and domestic sewage. COD is the amount of O_2 required to oxidize organic and inorganic matter under standard condition. The amount of COD recorded in the water of river ranges between 20mg/l to 80 mg/l .

Total Coliform and Fecal Coliform: Total coliform and Fecal coliform were studied as microbiological pollution indicators. The data from the analysis depicts that the Fecalcoliform are under the permissible limits.

CONCLUSION:

The analysis result data for different parameters at five regions for time period 01st February to 15th March 2023 shows that the water quality is satisfactory when compared to IS 1050:2012. From the above study, in the five regions, it can be concluded that all the physio–chemical parameters are in permissible limit and there were no toxicity problem. Water samples showed no extreme variations in the concentrations of cations and anions. In addition, bacteriological analysis was also conducted, the study revealed samples contained less than 1.8 fecal coliforms per 100ml by the Most Probable Number method. Standard plate count method showed that no pathogenic microorganisms were present

in the Narmada River.

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