

SCIENCE | ENGINEERING | TECHNOLOGY

e-ISSN: 2319-8753 | p-ISSN: 2347-6710

EDIA

INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN SCIENCE | ENGINEERING | TECHNOLOGY

Volume 10, Issue 9, September 2021

INTERNATIONAL STANDARD SERIAL NUMBER INDIA

Impact Factor: 7.569

9940 572 462

6381 907 438

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e-ISSN: 2319-8753, p-ISSN: 2347-6710 www.ijirset.com | Impact Factor: 7.569



|| Volume 10, Issue 9, September 2021 || | DOI:10.15680/LJIRSET.2021.1009051 |

Assessment of Physico-Chemical Parameters of Godavari River Water at Paithan, Maharashtra (India)

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ABSTRACT: Water resource is most essential basic resource for human being. Rapid growth of population and its repetitive activities along the river pose a concerned impact on the river system. Hydrosphere is a crucial segment of environment, it accounts 0.3% of the fresh water on Earth and it is easily accessible from reservoirs, lakes and river systems. A systematic study was carried out to assess the water quality of River Godavari at Paithan, for the analysis of physico-chemical parameters i.e. Temp, pH, TDS, Turbidity, Total hardness, Dissolved oxygen, C.O.D., B.O.D., Total alkalinity and phosphate from five sampling stations were collected. Physico-chemical parameters were analysed by standard method. Obtained results were compared with standard drinking water quality values given by WHO. The analysed results revealed that the water is suitable for human consumption. Water quality of the river was analysed for the identification of potability status and to suggest remedial measures for the mitigation of the deterioration and associated consequences in the future.

KEYWORDS: physico-chemical, water, quality, parameters, suitable

I. INTRODUCTION

The most crucial fresh water resources at the global level are the surface water and groundwater, the fresh water is of vital concern for humankind, since it is directly connected to human welfare (Kumar and Chakradhar, 2019). The quality of potable water completely depends on the composition of recharge the underground water, the reaction and interaction between the water and the soil, the various types of rocks with which it generally comes in contact in the unsaturated zone, and the overall residence time and reactions that occur within the aquifer system (Kharake and Raut, 2021; Fetter, 1994: Appelo and Postma, 2005). Water is an essential nutrient and is a crucial component of every cell, tissue, and organ (Potadar et al., 2021). The quality and quantity of water are under constant artificial pressure by the presence of various activities like industrial activities, removal of vegetation, encroachment, domestic and traditional activities (Kharake and Raut, 2021). All these activities resulted in overall reduction of water quality. These all issues are largely concentrated in and around urban centres (Kumar and Chakradhar, 2019). River has significant potential of economic change (Kharake and Raut, 2021; Patilet al., 2013). Many of the villages which are located along river experienced speedy economic changes; many of them were transformed into hightech towns and cities (Kharke, 2008). More than half of the population of the globe now lives in urban regions, and this figure will continue to increase approximately at a rate of 4% a decade by 2050(Potadar and Patil, 2017b). It has been observed that from past some decades population growth, urbanization (Kharake and Raut, 2021; Muhammad et al., 2018), industrialization (Isai and Shrivastava, 2015) and encroachments put significant pressure on the riverine network (Bora and Goswami, 2017). In the last four decades, various countries at the global level which have experienced major economic growth, improved welfare and significant poverty reduction (Potadar and Patil, 2017). Water has potential to dissolve organic as well as inorganic compounds in it; hence water is popularly known as universal solvent (Potadaret al., 2021). Many artificial activities related to economic development (Unde and Turkunde, 2008) are mostly responsible for water quality degradation (Zhaoshiet al., 2017). Water pollution not only affects physico-chemical and biological parameters but also threatens human health, socio-economic development, and prosperity (Jogdandet al., 2021). It leads to reduction of water quality (Kharake and Raut, 2021; Das, 2013). Rivers have great potential to detoxify a definite quantity of contaminants discharged into them (Koichi and Hong-Ying, 2010), but if the release of such kind of



| e-ISSN: 2319-8753, p-ISSN: 2347-6710| <u>www.ijirset.com</u> | Impact Factor: 7.569|

Volume 10, Issue 9, September 2021

DOI:10.15680/IJIRSET.2021.1009051

contaminants exceeds (Wu *et al.*, 2017), it results into water quality deterioration (Kharake and Raut, 2021; Govorushko, 2010). To protect the world from the adverse effects from the issues like climate change and the global warming, the well planned sustainable management is the need of the time (Potadar and Patil, 2017).

II. MATERIALS AND METHODS

The Godavari River is the lifeline to Maharashtra, especially to Marathwada region, in spite of its large catchment zone; the discharge of the river is not so potent because of moderate average precipitation annually (Chaudhari*et al.*, 2021). Godavari river is the largest river of all peninsular rivers in India (Ghorade*et al.*, 2011). Water quality assessment is very essential for the assessment of overall suitability of source of water (Zinjurde*et al.*, 2021). Aurangabad District is situated mainly in the Godavari river basin and partly in the Tapi river basin (Potadar and Patil, 2016b). The temperature observed in summer max 43°C and min. 28°C and winter temperature max 32°C to 5°C (Jogdand*et al.*, 2021). The study was carried out to observed water quality of Nathsagar. The study was carried out during the year July 2020 to by collecting water samples from 10 different Sites at the Nathsagar dam in the morning time 8 to 10 am. during the month of July. The parameters were analyzed by standard method (APHA 2005) .Water sample were immediately brought in the laboratory by using plastic bottle. Water samples were collected in 1000 ml plastic bottles in good quality screw-capped, well labelled, tightly packed bottles and transported immediately to the laboratory and stored at 4°C for chemical analysis (Jogdand*et al.*, 2021). The water temperature was recorded at the site by using thermometer.



Fig. 1: Satellite map showing location of Aurangabad city and study area (Source: Google map)

The pH was determined by using pocket digital pH meter. DO was determined by Winkler's method. Hardness of water was estimated by EDTA method. Alkalinity estimated by titration method as suggested by APHA (2005). Chloride estimated by titrimetric method and TDS were estimated by standard methods given by APHA (2005).

III. EXPERIMENTAL RESULTS AND DISCUSSION

The present investigation was carried out for the assessment of Physico-chemical parameters. The estimated parameters have been tabulated in the Table no.1 and graphically presented in figure no.1. Increasing demands on limited water resources coupled with lack of general awareness of the issues related to water pollution, has led to significant public debate about the environmental effects (Potadar*et al.*, 2021). During study period from it was observed that temperature was ranged in between 21.6 °C and 28.1°C.Minimum temperature was 21.6 °C of sample 5 in July 2020 and maximum was 28.1 °C of sample 10 in July 2020. Average temperature of July month was about 25.05 °C. Due to many reasons there is Temperature is increased at the global level which results into various changes including increase in atmospheric gaseous form of water (Potadar and Patil, 2016a).



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Parameter s	Temp ·	рН	TDS (mg/lit.	Turbidit y (NTU)	TH (mg/lit.	DO (mg/lit.	BOD (mg/lit.	COD (mg/lit.	TA (mg/lit.	Phosphat e (mg/lit.)
Sample 1	24.5	6.3	215	2.9	205	7.5	2.9	5.8	1.8	0.6
Sample 2	25.1	6.8	265	2.4	298	8.9	5.6	5.9	2.4	0.5
Sample 3	26.4	7.8	304	3.8	315	9.2	5.4	5.7	3.6	0.6
Sample 4	25.2	7.1	358	4.1	348	8.5	4.8	6.5	3.7	0.4
Sample 5	21.6	8.2	269	3.9	259	10.5	3.6	4.8	2.8	0.8
Sample 6	25.8	8.1	198	4.3	275	11.4	4.4	7.8	2.1	0.6
Sample 7	24.6	6.7	209	4.2	193	9.8	5.9	4.9	3.6	0.5
Sample 8	23.8	6.7	245	2.8	289	10.6	6.5	3.9	2.4	0.6
Sample 9	5.6	5.8	265	3.7	308	11.5	4.1	3.8	3.6	0.4
Sample 10	28.1	5.9	289	4.3	304	10.7	5.7	5.8	3.2	0.7
Average	25.07	6.9 4	261.7	3.64	279.4	9.86	4.89	5.49	2.92	0.57
Max.	28.1	8.2	358	4.3	348	11.5	6.5	7.8	3.7	0.8
Min.	21.6	5.8	198	2.4	193	7.5	2.9	3.8	1.8	0.4

Table 1: Average Physico-Chemical Analysis of Water Sample at Paithan

Temperature has a great impact on water ecosystems. Apart from temperature pH is also one of the major indicators of ionic concentration. H⁺ions (Nag *et al.*, 2018) in water natural water containing HCO³⁻, CO₃⁻² and OH⁻. These are major contributors to alter the pH of water. pH not only affects water quality, but also affects on the agricultural soil too (Ghorade*et al.*, 2011). pH of natural water should be in the range of 6.2-8.5. During study period it was observed that pH was ranged in between 5.8 and 8.2. The average minimum pH was 5.8 of sample 9, maximum was 8.2 of sample 5 in July 2020. In the present investigation pH at four sites were alkaline in nature and ranged in between 7.1 and 8.2. Average pH was 6.94.



Fig. 2. Average Values of parameters

The high concentration of pH, may be due to the presence of biological activity and temperature changes. According to WHO water pH should be within the range of 6.5 to 8.5 which is considered as most suitable for aquaculture. The high pH indicates higher productivity of water. Total dissolved solids (TDS) mainly comprise of inorganic salts like chlorides, sodium, bicarbonates, sulfates magnesium, potassium, calcium and also minute amounts of organic matter are dissolved in the water. Total dissolved solids in water generally originate from natural sources, industrial



| e-ISSN: 2319-8753, p-ISSN: 2347-6710| www.ijirset.com | Impact Factor: 7.569

Volume 10, Issue 9, September 2021

DOI:10.15680/IJIRSET.2021.1009051

waste water, sewage, run-off from the urban centres and chemicals used in the process of treatment of water (Patel *et al.*, 2019a, b; Tyagi*et al.*, 2013). Change in the TDS is an identifiable indicator of water pollution (Duan*et al.*, 2018).

Parameters	WHO standard Desirable limits	ISI standard Desirable limits	ICMR Acceptable limits
Temperature	-	-	-
pН	6.5-8.5	6.5-8.5	7-8.5
TDS	500	-	500
Turbidity	1 NTU	1 NTU	1 NTU
Total hardness	500	300	300
Dissolved oxygen	5.0	3.0	-
BOD	5.0	-	-
COD	10.0	-	-
Total alkalinity	120	-	-
Phosphate	0.1-1	0.5-1	-

Table 2: Standards of drinking water

During the study it was observed that the total dissolved solids were ranged in between 198 mg/l and 358 mg/l. The average minimum total dissolved solids was 261.7 mg/l in July 2020. In the present investigation the results indicates that the TDS at two site were maximum which is may be due to an increased run off of bicarbonate and carbonate. It was observed that the TDS values were within the safe limits. The permissible levels of T.D.S are 500 mg/liter in drinking water. During the study period it was observed that turbidity of water was about 2.4 NTU to 4.3 NTU. The average turbidity of water was about 3.64 NTU of July 2020. According to WHO water turbidity should be about 1-5 NTU. In the study period of July month it was observed that total hardness was ranged in between 193 mg/l and 348 mg/l. The average total hardness was 279 mg/l in July 2020. Basically total hardness is a contribution of calcium and magnesium salts dissolved in liquid. Generally these ions may not have negative effects but at higher concentration increases hardness. As per WHO standard TH upto500 mg/l is acceptable. Dissolved oxygen (DO), which is a measure of how much O_2 is dissolved in the water. DO reveal lot about water quality (Popovicet al., 2016). Concentration of dissolved oxygen (DO) was in between 7.5 mg/l and 11.5 mg/l. The average DO was 9.85 mg/l in July 2020. According to WHO standards minimum DO required should be of about 5.0 mg/l. During the study it was observed that the biochemical oxygen demand was ranged in between 2.9 to 6.9 mg/lit. The average BOD of July month was 4.89 mg/lit. As per desirable limits of BOD of drinking water should be 5.0 mg/ Lit. During the study it was observed that the Chemical oxygen demand was ranged in between 3.8 to 7.8 mg/lit. The average COD was about 5.49 mg/lit. As per desirable limits COD should be 5.0 mg/ lit. During the study period it was observed that, the total alkalinity was ranged in between 1.8 mg/l and 3.7 mg/l. The average total alkalinity was 2.92 mg/l. Concentration of Phosphate in the study ranged in between 0.4 mg/l and 0.8 mg/l. The average phosphate content was 0.58 mg/l in July 2020. Phosphate content of water was within limits specified by WHO i.e. 0.1 to 1 mg/lit.

IV. CONCLUSION

Rivers plays great role in the socioeconomic and ecological development. In the present investigation analysis of the physico-chemical parameters were carried out. A rigorous and scientific work was performed for the analysis of various physico-chemical parameters. It is found that the average concentration of Temperature was 25.07 ^oC, pH 6.94, TDS 261.7 (mg/lit.), Turbidity 3.64 NTU, Total hardness 279.4 (mg/lit.), Dissolved oxygen 9.86 (mg/lit.), Biochemical oxygen demand 4.89 (mg/lit.), Chemical oxygen demand 5.49 (mg/lit.), Total alkalinity 2.92 (mg/lit.) and Phosphate 0.57 (mg/lit.). It is revealed that the quality of Godavari river water is not so good for the drinking purpose. Treatment must be given so as to use the water for drinking purpose. On the basis of analysed results it is also recommended that the waste water from different sources need to be treated before discharge in the water bodies.

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