International Journal of Scientific Research and Engineering Development-– Volume 4 Issue 4, July- Aug 2021

Available at www.ijsred.com

RESEARCH ARTICLE OPEN ACCESS

Monitoring and Sustainability Assessment of Godavari River Water

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Abstract:

Since the independence of the India, mankind has been introducing numerous harmful pollutants into the environment. Rapid industrialization, urbanization, and other developmental activities pollute rivers, which are important in the nation's development and sustenance of life. The present research work represents the analysis of Godavari river water on the basis of physiochemical parameters at Paithan, Maharashtra. The evaluation of physiochemical parameters was carried by selecting five sampling stations. The parameters were analysed over a period of 10 months from July 2020 to April 2021 and ten physiochemical parameters were taken for water analysis. The physiochemical parameters selected temperature, pH, Totaldissolvedsolids(TDS), Turbidity, TH, Dissolved Oxygen (DO), Biological oxygen demand (BOD), Chemical oxygen demand (COD), Total Alkalinity (TA), Phosphate. The samples collected were carefully tested and compared with standardised databases. The results revealed that the samples collected were suitable for human consumption.

Keywords: Godavari River, Physiochemical parameters, water analysis, samples.

Introduction:

Degrading water quality is one of the major concerns atgloballevel. Both natural and anthropogenic activities are responsible for water qualitydegradation. Large number of factors directly or indirectly affect the water quality of the river. Water is one of the most precious resources on planet for human habitation. The Godavari River is the lifeline to Maharashtra, particularly to Marathwada region, in spite of its massive catchment zone; the discharge is not so potent because of moderate annual average precipitation. On account of high density of population, large number of industries, towns and cities in the river basin, large amount of domestic and industrial wastes are continually discharged into the river besides, waste water from agriculture source, animal care, domestic and industrial use also mixed into it; drainage and surface wash off during the monsoon season. Numerous aspects of river pollution such as physicochemical properties of different river water and changes in biological composition of rivers with respect to impact of pollutants *(Mitra, 1982; Raina et al., 1984, Bhatt et al., 1985; Nandan, 1985; Shukla, 1994)* have been reported in India. Rivers in India have been contaminated by organic and inorganic pollutants. Nearly all the sewage from cities enters the basin waterways sometimes partially treated or untreated, approximately 1.3 billion litres per day of the human waste, and approximately 260 million liters of industrial waste, mainly from agricultural fertilizers and the pesticides *(Markandya and Murty 2004)*.The pollution of river Godavari in India is more critical and severe as huge amount of pollution load discharged by bathing, washing of cloths and vehicles, sewage from municipality, garbage from vegetable market and mixing of cremation ash is directly with the water, resulted into the change in physic-chemical and biological characteristics of river water ultimately results into making it unsuitable for drinking purpose, agricultural use and posing serious threat to survival of aquatic biota and terrestrial life *(Bhalla and Sekhon, 2010).* The quality of water usually described according to its physic- chemical and biological characteristics. Rapid industrialization, urbanization and indiscriminate use of

chemical fertilizers and pesticides in the agriculture cause heavy pollutionload in aquatic environment leads to deterioration of water quality and affects aquatic biota. Due to contaminated water, human population suffers from varied water borne diseases. Therefore, it becomes crucial to assess the water quality at regular interval of time *(Khan et al., 2012).* Physicochemical properties of the water varies due to seasonal variation and also due to anthropogenic activities such as agriculture, urbanization, domestic sewage, etc. in the catchment area affects water quality *(Verma et al.,2012).*

Materials and Methods:

Aurangabad District is mainly located in the Godavari river basin and partly in the river Tapi basin. The district is from 19 to 20 degrees' north longitude and 74 to 76 degrees' east latitude. Aurangabad city is located on the bank of riverKham a tributary of the Godavari River. The entire city is situated at the latitude of 19° 53'50" N and longitude of 75° 22'46" E. It is located 512 meters above the Sea Level. The city is surrounded by hills of the Vindhya ranges and the river passes through it.

Fig 1: Satellite map showing location of Aurangabad city of Maharashtra state(India)
Source: Google map

Collection and analysis of water samples were carried out at regular interval, for a period of year. Five sampling stations (only average is given) along the course of river were selected for the study. Physical and chemical parameters of the samples were analysed. Physical parameters include temperature, pH and total dissolved solids (TDS). Water temperature was recorded with thermometer. pH was measured by a digital pH meter. TDS was measured with the help of a Portable Water Analyser Kit. Chemical parameters like free CO_2, dissolved oxygen (DO), biological oxygen demand (BOD), total hardness, chlorides, phosphate, sulphate, nitrate, calcium and magnesium were estimated by following APHA standard methods (APHA., 1985). Average has been tabulated in the table no. 1.

Result and Discussion:

The representative samples collected from the study area were analyzed for their physical and chemical properties for determining their designated best use of river water. The results obtained are given in Table 1.

Table 1: Average physico-chemical analysis of water sample at Godavari river

Parameters	Temp.	pH	TDS (mg/lit.)	Turbidity (NTU)	TH (mg/lit.)	DO (mg/lit.)	BOD (mg/lit.)	COD (mg/lit.)	TA (mg/lit.)	Phosphate (mg/lit.)
July	23	7.1	221	6.1	195	8.8	4.5	5.6	1.825	0.6
Aug.	24.5	5.9	356	5.8	265	9.5	6.5	5.5	2.9	0.5
Sept	26.5	6.2	358	5.6	305	9.6	4.8	3.6	3.3	0.3
Oct	25.3	6.5	328	4.5	206	10.4	4.9	5.9	3.1	0.8
Nov.	26.8	7.8	219	6.2	265	11.5	5.6	8.1	2.5	0.6
Dec.	24.1	7.9	291	5.7	278	11.8	6.8	3.6	2.6	0.7
Jan.	26	7.6	367	5.9	205	10.7	6.7	4.5	2.1	0.4
Feb.	27.9	8.1	365	4.8	262	9.6	2.7	5.8	3.2	0.5
Mar.	28.6	8.6	302	4.5	258	11.1	2.4	6.5	2.6	0.5
Apr.	28.5	8.4	354	4.1	193	10.9	2.8	6.1	2.9	0.36
Average	26.12	7.41	316.1	5.32	243.2	10.39	4.77	5.52	2.7025	0.526
Max.	28.6	8.6	367	6.2	305	11.8	6.8	8.1	3.3	0.8
Min.	23	5.9	219	4.1	193	8.8	2.4	3.6	1.825	0.3

It is observed that highest pH was recorded in March that is 8.6 and lowest was recorded in August that is 5.9. The average pH is 7.41 which fit within the permissible limits of WHO standards. Temperature is a critical water quality and environmental parameter because it governs the kinds and types of aquatic life, regulates the maximum dissolved oxygen concentration of the water, and influences the rate of chemical and biological reactions.

Table 2: Comparison between observed readings and standard WHO readings:

Parameter	Sample (Average)	WHO	Unit
Temperature	26.12	25	^{o}C
pH	7.41	7- 8.5	-
TDS	316.1	500	Mg/lit.
Turbidity	5.32	5	NTU
TH	243.2	300	Mg/lit.
DO	10.39	6	Mg/lit.
BOD	4.77	5	Mg/lit.
COD	5.52	10	Mg/lit.
TA	2.7025	20	Mg/lit.
Phosphate	0.526	1	Mg/lit.

It is observed that highest temperature was recorded in March that is 28.6^{o}C and lowest was recorded in July that is 23^{o}C. According to WHO standard the permissible value is 25^{o}C.The temperature may be seen higher in March due to change in season that is summer season. The average temperature is 26.12^{o}C which fits within the permissible limits of WHO standards. It is observed that highest TDS was recorded in January that is 367 (Mg/lit.) and lowest was recorded in November that is 219 (Mg/lit.). The average TDS is 316.1(Mg/lit.) which fits within the permissible limits of WHO standards. It is observed that highest Turbidity was recorded in November that is 6.2 (NTU) and lowest was recorded in April that is 4.1 (NTU). The average turbidity is 5.32 (NTU) which is very slightly higher than permissible limits of WHO standards. It is observed that highest TH was recorded in September that is 305 (Mg/lit.) and lowest was recorded in April that is 193

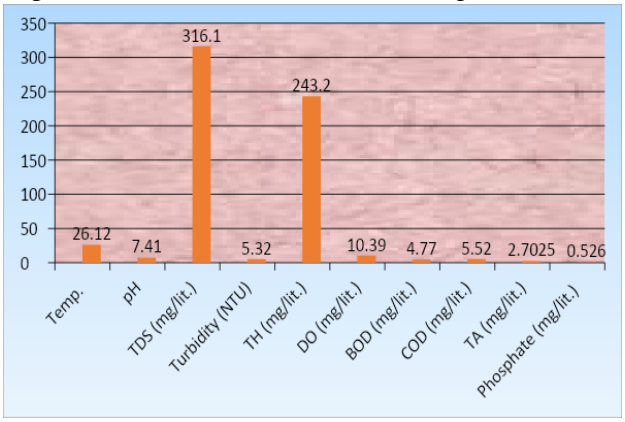

Fig: 2. Representative graph showing all parameters

(Mg/lit.). The average TH is 243.2 (Mg/lit.) which fits within the permissible limits of WHO standards.

Dissolved oxygen (DO) is the amount of O_2 that is present in water. Water bodies receive oxygen from the atmosphere and from aquatic plants. Oxygen enters in the water by direct absorption from the atmosphere, by rapid movement, or as a waste product of photosynthesis of plant. Water temperature and the volume of moving water affects severely dissolved oxygen levels. Running water, such as that of a swift moving stream, dissolves more oxygen than the stagnant water of a pond or lake. It is observed that highest DO was recorded in December that is 11.8 (Mg/lit.) and lowest was recorded in July that is 8.8 (Mg/lit.). The average DO is 10.39 (Mg/lit.) which is higher than the WHO standard prescribed limits. It is observed that highest BOD was recorded in December that is 6.8 (Mg/lit.) and lowest was recorded in March that is 2.4 (Mg/lit.). The average BOD is 4.77 (Mg/lit.) which fits within the permissible limits of WHO standards. High levels of wastewater COD indicate concentrations of organics that can deplete dissolved oxygen in the water, leads to negative environmental and regulatory consequences. It is observed that highest COD was recorded in November that is 8.1 (Mg/lit.) and lowest was recorded in September and December that is 3.6 (Mg/lit.). The average COD is 5.52 (Mg/lit.) which fits within the permissible limits of WHO standards. It is observed that highest TA was recorded in September that is 3.3 (Mg/lit.) and lowest was recorded in July that is 1.825 (Mg/lit.). The average total alkalinity was 2.7025 (Mg/lit.) which fits within the permissible limits of WHO standards.It is observed that highest Phosphate was recorded in October that was 0.8 (Mg/lit.) and lowest was recorded in September that was 0.3 (Mg/lit.). The average phosphate was 0.526 (Mg/lit.) which fits within the permissible limits of WHO standards. The parameters like **t**emperature, turbidity, nutrients, hardness, alkalinity and dissolved oxygen play a vital role for the growth of living organisms in the water body. Water quality indicates the relation of all hydrological properties including physical, chemical and biological properties of the water body. Hence, water quality assessment involves analysis of physicochemical, biological parameters which reflects the nature of ecosystem *(Smitha and Shivashankar, 2013).*

Sanap et al., 2006, Deshmukh et al., (2006) studied physico-chemical and biological aspects of river Godavari at different locations. As the quality of Godavari river water is getting depleted day by day, there is insufficient data is available on the pollution status.

Marle 2011; Nag et al. 2018, Patel et al. 2019, Tyagi et al. 2013 found unpleasant taste of drinking water, disgusting odour from lakes, river and beaches uncontrolled growth of aquatic weed and decrease in number of aquatic organisms are some of indicators of water pollution. To understand chemical inter-reactions occurring in the water body, certain criteria of water quality are applied such as pH, DO, BOD, TDS. pH is indicator of concentration H+ ions in water natural water containing HCO3–, CO_3^{-2} and OH^{-}. These are main contributors of pH of water. pH of natural water is in the range of 5-9. Total dissolved solids (TDS) comprise inorganic salts (principally calcium, magnesium, potassium, sodium, bicarbonates, chlorides and sulphates), and some small amounts of organic matter are dissolved in water. TDS in water originates from natural sources, sewage, urban run-of, industrial waste water and chemicals used in the water treatment process.

Conclusion:

Water is the fundamental part of life. Rivers plays great in the socioeconomic and ecological development. A well planned laboratory study was conducted to assess the physicochemical characteristics of water samples of Godavari River for a period of ten months during July 2019 to July 2020. The physiochemical parameters selected temperature, pH, Total dissolved solids(TDS), Turbidity, TH, Dissolved Oxygen (DO), Biological oxygen demand (BOD), Chemical oxygen demand (COD), Total Alkalinity (TA), Phosphate as per the standard methods given by APHA. The analysed values of physical and chemical parameters of water were compared with standard values. The research work demonstrates that the significant differences observed in the values of physico-chemical parameters of Godavari River water but within the standard values. During the study, it was observed that the water quality of River Godavari was good at almost all of the locations. The water of Godavari River is suitable for drinking purpose and other artificial uses. Water is most important

component. So it is very necessary to adopt the sustainable lifestyle so as to reduce the overburden of water demand. Present study provides fundamental data required for proper management of available water resources which may be used for policy design regarding the utilization of the water resource by various stakeholders.

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