ANALYSIS OF RIVER GODAVARI FOR DETERMINING WATER QUALITY INDEX (WQI)

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Abstract
Water samples from sampling sites were taken throughout the study period for analysis. Physical, chemical, and biological parameters such as Temperature(°C), turbidity (NTU), pH, Dissolved Oxygen mg/L (DO), Total Dissolved Solids mg/L (TDS), Total Suspended Solids mg/L (TSS), chlorides (mg/L), and Chemical Oxygen Demand (COD) were examined once a month. Analysing a water sample using the well-known Water Quality Index (WQI) is one of the most efficient ways to describe water quality. The Water Quality Index (WQI) is used in the current study to express changes in physico-chemical parameters. Biological evaluation is a useful substitute for assessing the ecological quality since biological communities take into account the environmental consequences of water chemistry.

Keyword: Physico-chemical parameters, Water Quality Index (WQI)

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INTRODUCTION

Water is essential to all living things in some way. It also provides unique and significant functions for the biosphere, ecology, and biogeochemical cycles of the earth. The rapid daily decline in water quality has made freshwater shortages a global problem. Accurate information on water quality is necessary for successful and efficient water management because rivers are also the main source of water in inland regions for drinking, agriculture, and industrial uses. According to Rajamanickam and Nagan (2016), the bulk of India's river-based water ecosystems have experienced extensive anthropogenic activity, which has caused a sharp drop in water quality. Physical and chemical factors, in addition to temperature, also significantly contribute to the improvement of aquatic variety in water bodies (Annalakshmi and Amsath 2012). The availability of nutrients has a big impact on aquatic productivity (Srinivasa and Aruna, 2018). Biological communities are a valuable option for assessing the ecological integrity of aquatic ecosystems because they take into account the environmental effects of water chemistry in addition to the physical and geomorphological properties of rivers (Stevenson and Pan, 1999).

Table-1: Parameters of both sites showing Minimum(Min), Maximum(Max) and Average values

S. No	Parameter	Site-I			Site-II		
		Min	Max	Average	Min	Max	Average
1	Temperature(°C)	22.3	35.4	28.93	20.6	32.4	26.44
2	Turbidity(NTU)	23.32	37.45	30.39	16.28	25.34	21.03
3	pH	7.2	9.6	8.3	6.2	8.2	7.38
4	BOD(mg/L)	2.2	31	10.58	3.1	17.4	7.17
5	COD(mg/L)	103	296	178.17	83	278	148.92
6	DO(mg/L)	8.5	14.9	10.34	6.75	19.5	11.06
7	TDS(mg/L)	121	373	206.33	131	283	189.04
8	TSS(mg/L)	203	656	405.17	241	631	377.42
9	Chlorides(mg/L)	88.4	139.7	102.67	85.3	154.8	105.36

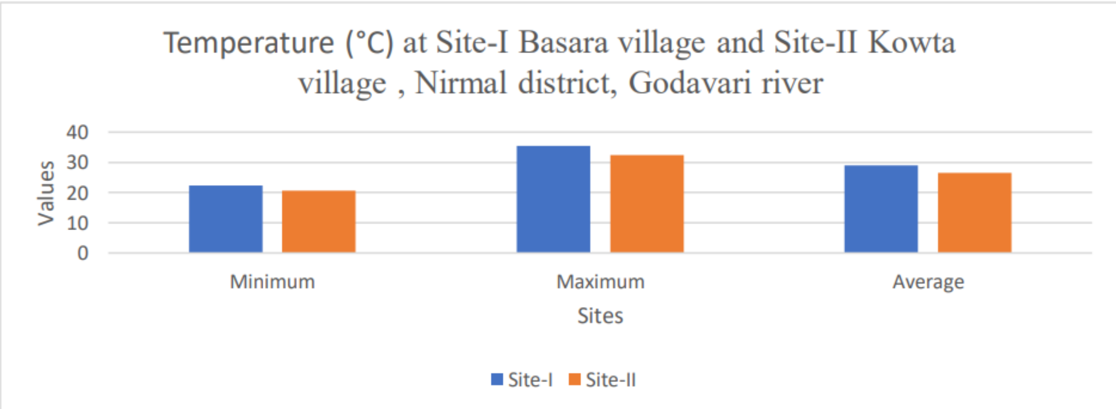

Figure-1: Variation of Temperature (°C) at Site-I Basara village and Site-II Kowta village, Nirmal district, Godavari river

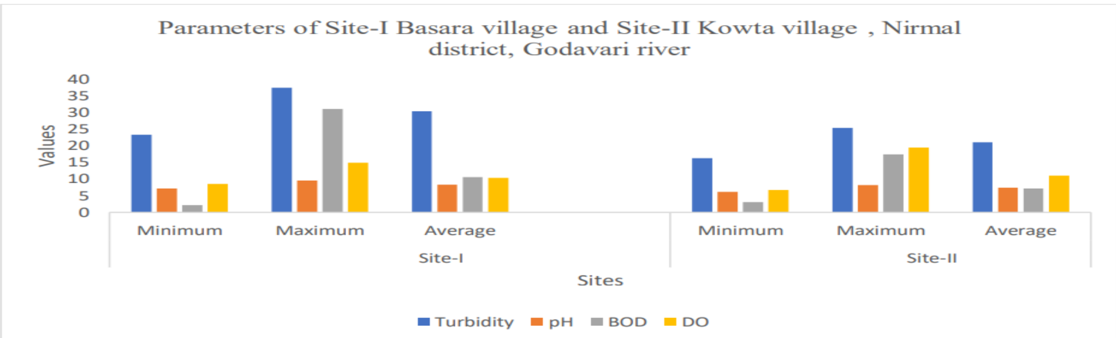

Figure-2: Parameters like Turbidity, pH, Biological Oxygen Demand(BOD) and Dissolved Oxygen(DO) of Site-I Basara village and Site-II Kowta village , Nirmal district, Godavari river

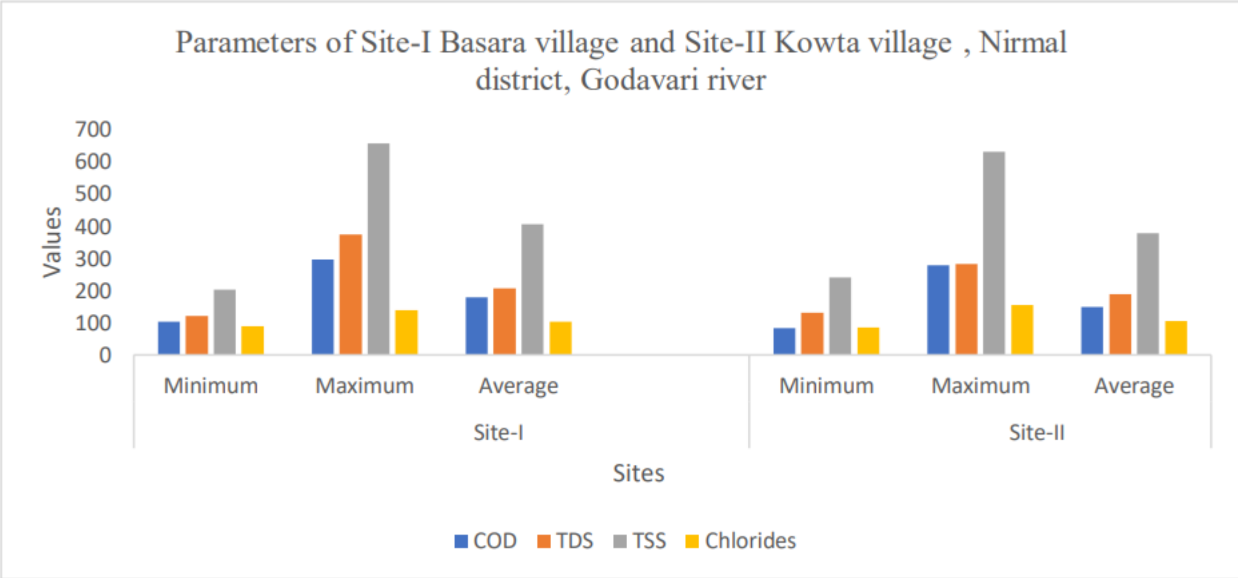

Figure-3: Parameters like Chemical Oxygen Demanad(COD), Total Dissolved Solids(TDS), Total Suspended Solids(TSS) and Chlorides of Site-I Basara village and Site-II Kowta village, Nirmal district, Godavari river

Temperature(°C):

Physical, chemical, and biological properties are necessary for maintaining a healthy aquatic habitat. At two sampling sites Site-I Bathing Ghats Basara and Site-II Kowta of the Godavari River in Nirmal district, the physico-chemical parameters were evaluated. The results shown in Table-1 illustrate that the quality of the Godavari River water is not the same at different sampling sites.

Basically, the temperature has an impact on the aquatic species. With the aid of a mercury thermometer (0-100 °C) submerged in the water, the temperature of the water sample was determined on the spot while sampling at river Godavari. Two sites temperature variation is shown in Figure-1. The readings taken were in track during one year of study period. Similar reports on temperature of aquatic ecosystems were produced by Bhalla et al. in 2006 and Chinnaiah et al. (2011).

Turbidity (NTU):

According to Ichwana et al. (2016), turbidity is a term used to describe the optical characteristics of water and is determined by the amount of light that water particles release and absorb. Turbidity average value of Site-I is 30.39 NTU and Site-II 21.03 NTU respectively. There is a rise steadily from Site-I 23.32 to 37.45 and at Site-II 16.28 to 25.34, (a distance of 20 km), peaking at Site-I 37.45 NTU in Table-1 and Figure-2 is attributed to organic pollutants like cremate and the discharge of human, as well as to the use of flower garlands for religious rituals and other solid waste that is added directly to the water.

pH

The value of pH serves as a gauge for hydrogen ion concentration. It is used to determine whether the water is acidic or basic. The maximum and minimum pH of water was between 6.2 and 9.6. Depending on the types of waste and chemical components present in them, sewage into water can modify the hydrogen ion concentration (pH) in the water, making it more alkaline, (Ichwana et al. 2016; Shinde et al. 2019). According to the current investigation, the water is alkaline at Site-I was 8.3 and Site-II 7.3, Table-1 and Figure-2.

Biological Oxygen Demand (BOD):

BOD is the amount of oxygen used during a 5-day period for the biodegradation of organic materials. Table 1 shows that the BOD value abruptly rise in average at Site-I was 10.58 mg/L, which may be the result of sewage entering the Godavari river through nalas and slums close to the river bank. Although no point sources are visible here, BOD is found to be Maximum and Minimum at Site-I with 31 mg/L and 2.2 mg/L and Site-II with 17.4 mg/L and 3.1 mg/L respectively, where a large amount of waste water from a weekly market is the main sources of contamination (Table-1 and Figure-2). Ramaswamy et al. (1991) linked physico-chemical characteristics with algal diversity and found that summer was the time of year with the highest BOD levels. According to Solanki et al. (2015), the monsoon season saw the lowest BOD levels and the summer months saw the highest levels.

Dissolved Oxygen mg/L (DO):

The level of dissolved oxygen has a significant impact on the health of the stream. Additionally, Bhattarai, K. K. et al. 2008 reported similar findings. DO averages for the two Sites range from 10.34 mg/L to 11.06 mg/L, respectively. Both location maximum and minimum values were 6.75 mg/L and 19.5 mg/L respectively shown in Table-1 and Figure-2. An important determinant of the water quality is the amount of dissolved oxygen present. The kind of organic stuff that can be found in water is described. DO is essential for the wellbeing of aquatic organisms. The Godavari River is getting worse, which may be a result of urban waste contamination along the river course (Bawa and Gaikwad 2013).

Chemical Oxygen Demand (COD):
The oxidation of the reduced chemical in water is measured by chemical oxygen demand. The amount of organic matter in water is calculated using the COD measurement. As a result, organic surface water pollution is indicated by COD (King et al., 2003; Faith, 2006). Site-I had an average COD value of 178.17 mg/L, whereas Site-II had 148.92 mg/L. Between the two locations, Site-I 103 mg/L to 296 mg/L and Site-II 83 mg/L to 278 mg/L respectively acquired the maximum and minimum values shown in Table-1 and Figure-3.

Total Dissolved Solids mg/L (TDS):
TDS exhibits comparable tendencies as a result of the river sewage contamination. Due to the high population density, which is to blame for the emanation of a significant amount of solid waste, discharge of household wastewater, and sewages, it has unexpectedly at Site-I the average was 206.33 mg/L and 189.04 mg/L at Site-II. The maximum and minimum values recorded for both sites was 373 mg/L and 121 mg/L(Table-1 and Figure-3). Given that drinking polluted water is known to cause the majority of major pathogenic diseases, hazards, and dermatological issues, Koli et al. 2018, the river is thought to be the most suitable location for garbage waste disposal, it is proven that doing so places a significant load on the river, increases TDS in the water, and results in an unhygienic environment and health issues like malaria and diarrhea.

Total Suspended Solids mg/L (TSS):
The TSS parameter was tested once a month for two years, from September 2019 to August 2021 specifically. TSS samples taken from Site-II varied from 241 mg/L to 631 mg/L with an average of 377.42 mg/L, while TSS at Site-I ranged from 203 mg/L to 656 mg/L with an average of 405.17 mg/L. The readings are 203 mg/L at the minimum and 656 mg/L at the maximum (Table-1 and Figure-3). The presence of organic and inorganic pollutants in surface runoff may cause TDS levels to rise throughout the rainy and autumnal seasons. Lalparmawii, 2007, Both Nduka et al. (2008) and Moniruzzaman (2009) discovered related results. Urban solid waste and industrial effluents have both had a major negative impact on the water quality of Bangladesh's rivers (Uddin and Jeong, 2021; Islam et al., 2013; Hasan et al., 2019).

Chlorides (mg/L):
The mean Chlorides concentration of the collected water samples at the two sites was within the range from 85.3 to 154.8 mg/L in 2019 and 2021, (Table-1 and Figure-3). The concentration of Chlorides at Site-I ranged from 88.4 to 139.7 mg/L and at Site-II from 85.3 to 154.8 mg/L. As reported by DoE (1997), WHO, 2017 and Whitehead et al., 2018, the permissible limits of Chlorides concentration in surface water for drinking purposes are 150 to 600 mg/L or 250 mg/L, respectively.

Table-2 WQI Legend(House and Ellis,1987)

91-100%	Excellent water quality
71-90%	Good water quality
51-70%	Medium water quality
26-50%	Fair water quality
0-25%	Poor water quality

Table-3 Water Quality Index(WQI) showing water quality status

River/ Year	Site-I	Water Quality status	Site-II	Water Quality status
July 2019-June 2020	49.22	Fair	61.42	Medium

Table-4 Water Quality Index of Central Pollution Control Board

Sr. No.	WQI	Class by CPCB	Remarks	Color Code
1	63-100	A	Non Polluted	
2	50-63	B	Non Polluted	
3	38-50	C	Polluted	
4	38 and less	D,E	Heavily Polluted	

Table-5 Water quality of the river Godavari at three sites by using Central Pollution Control Board Water Quality Index showing color code

River Sites	Year	Water Quality status	Class by CPCB	Remarks	Color Code
Site-I	July 2019-June 2020	26.48	D	Heavily Polluted	
Site-II	July 2019-June 2020	42.22	C	Polluted	

An important tool for assessing water quality is the Water Quality Index. The literature by Horton (1965), Landwehr and Deining (1976), Steinhart et al. (1982) and Cude (2001), provides a variety of methodologies for computing WQI and comparing physico-chemical and biological factors.

According to the water quality classification standard, the results for one year of Site-I 49.22 Fair water quality, Site-II 61.42 Medium water quality, shown in Table-2 and Table-3., Site-I was Heavily Polluted with 26.48 under Class D, Site-II 42.22 Polluted under Class C, Table-4 and Table-5 were both pollution and water quality declined. It could be caused by the amount of phytoplankton, environmental pollution, residential sewage discharge, or surface runoff from crop fields, Ligaswamy et al., (2016).

CONCLUSION

The parameters of the River Godavari varied between the two sampling sites, and the results indicate that the river contributes to nutrient concentration, which promotes the growth of algae. The pollution level and water quality were classified based on the values of the Water Quality Index (WQI) and water parameter of the River.

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