# Assessment of Water Quality of Godavari River at Nashik

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Abstract-Water is the essence of life to all human beings and all living things on the planet. But, it has been that the majority of water sources such as rivers contaminated at quicker rate, as a result of unchecked increase in population and industrialization. The current study has been conducted for water quality evaluation of Godavari river in and around Nashik city, since the Godavari is considered as a holy river and also known as 'Dakshin Ganga'. Thousands of peoples take a sacred bath in the Godavari at Nashik and during Kumbh Mela.Once in every twelve year 'Kumbh Mela' festival is celebrated at the banks of Godavari at Nashik and Triambakeswar. The study has been carried out to investigate the water quality at five number of sampling stations located along the course of river. In the study, five water quality parameters named pH, DO,BOD, turbidity and total solids were selected and National sanitation water quality index (NSFWQI) values at concerned stations were determined.

*Keywords*—Water Quality, National sanitation foundation water quality index (NSFWQI), pH, DO, BOD, Total Solids, Turbidity.

### I. INTRODUCTION

As we know that water is colourless, tasteless and odourless and contains only two elements, but it is a substance that nobody can survive without it and is, hence, the foundation of survival and growth not just of human beings but all plants, animals and microorganisms on the planet. All the known ancient civilizations flourished along the banks of mighty rivers. Water plays a significant role in our religious beliefs as well. A number of festivals like Kumbh Mela are celebrated while wading in water. Water has now become the force behind the economy through its application in agriculture, industry and hydroelectricity generation. Pollution of river Godavari in India is more serious and grave because massive amount of pollution load released by bathing, washing of cloths and vehicles, sewage from municipal corporation, waste from vegetable market and infilteration of cremation ash in the river water. This has led to the alteration of physic-chemical and biological properties of river water, render water unfit for drinking, bathing and irrigation purpose. Water quality of the surface water bodies of the majority of the developing world is deteriorating and unsuitable for consumptive applications such as drinking and outdoor bathing etc. Overrun of full or partially treated wastewater, dumping of solid wastes, percolation of agricultural runoff of high nutrient loads, have been identified as the primary causes of surface water body contamination like rivers. The water quality index (WQI) is the single parameter, which can reflect the overall water quality status of the water body in a comprehensive manner. Traditional approaches of determination of WQI have been established by the researchers according to local requirements to determine the water quality status of regional surface water bodies, but are plagued with inherent limitations. In the current study, National Sanitation Foundation water quality index (NSFWQI) have been used to check the Godavari river water quality.

#### II. STUDY AREA

The Godavari River is one of central India's sacred rivers, to which pilgrims from all across the nation come to visit for taking holy bath. Godavari originates at Triambakeshwar near Nashik and with a total distance of 1,412 km flows eastward course through the Maharashtra state and joins Bay of Bengal near Narsapuram in Andhra Pradesh. Nasik, an industrial hub located at Latitude 190– 33' and 200– 53' North and Longitude 730– 16' and 750– 6' East is situated in Northern Maharashtra on Western edge of the Deccan Plateau on the banks of the

Godavari.Kumbha mela is organized every twelve years on the banks of the river. The Location chosen for taking water sample is S1-Someshwar (whrere pilgrims take bath), S2- Anandwali Bridge, S3-Suyojit Bridge, S4- Ramghat (a sacred place where majority of rituals are being carried out also a site for human activities such as bathing, washing, disposal of wastes occur),S5-Tapovan ghat (where the sewage discharge from STP).

## III. LITERATURE REVIEW

A literature survey shows that physio-chemical characteristics and water quality of various rivers have been studied by many Authors :

Said et al., (2004) proposed a New water quality index based on five WQ parameters namely DO, specific conductivity, total phosphorus, turbidity and fecal coliform. The advantages of this index cited were simple, fast, no need to standardize the WO variables or to compute the values of sub indices. This index gave results, which were similar to the results of the NSFWOI and Watershed enhancement programme index. This index contains only five variables as compared to eight or nine variables for other indices. But, the limitation of the index was that it can not be used to make regulatory decisions or to indicate water quality for specific uses. This index can not be used for WQ measurements on the downstream side of a wastewater treatment plant or where a large quantity of human or animal waste is disposed of in the stream. This index was more sensitive to the elevated values of phosphorus and turbidity and decreased values of DO as compared to the remaining variables

Avvannavar and Shrihari S. (2008)[8] carried out the investigation of water quality of Netravathi River, Mangalore (India). The authors used the Bhargava WQI method and the Harmonic mean WQI method to find out overall WQI in the selected stretch of the river basin. It was commented by authors that the arithmetic mean method of WQI determination does not allow in the reduction in the value of the index, if any parameter value exceeds it permissible limit. This limitation was quoted as the 'eclipsing' issue by the subsequent researchers. The authors used the Bhargava method, since with simplicity it can handle small to the large quantity of data for various beneficial uses. The harmonic mean of the WQI method was employed in the study, since if the quality index of the parameter is on the lower side, then the weightage to that parameter should be on the higher side. Six WQ parameters named as DO, TDS, Turbidity, BOD, pH and MPN were measured at eight different WQ monitoring stations, along the river stretch. The value of MPN was found to be more than permissible limits at all stations.

# IV. MATERIALS AND METHOD

In this study five number of river water sampling stations named as S1 to S5 have been selected. Sampling stations have been selected based on the type of human activity and its intensity at the station, in the selected area of study. For analysis of water quality, water samples have been collected from the river's surface water. In the current study five water quality parameters viz. pH,DO,BOD, Turbidity and total soilds have been considered to investigate the water quality at the selected sampling stations. pH of water sample has been measured in the field at the time of sample collection. Water samples were tested at Environmental engineering Laboratory, Nashik at Sandip Institute Of Technology And Research Centre. The laboratory tests were conducted as per standard methods recommended by American public health association (i.e. APHA). Some physio-chemical properties like total solids (TS), dissolved oxygen (DO), biological oxygen (B.O.D.), turbidity and total demand solids were measured to assess the effect of urban waste addition on river water quality.



# FIG.1 SAMPLE LOCATION AND MAP OF STUDY AREA

In the Fig.1, S1,S2,S3,S4 and S5 shows the location of water quality station, while P1,P2,P3 and P4 shows the location of wastewater addition points like Nalas, which are discharging wastewater into the river.

Sampling	Location of	Distance	
Station	Water Quality Sampling	from the Ist	Remarks
Code	Station	Sampling	
		Station	
<u>S1</u>	SOMESHWAR	0.0 KM	Bathing activity and Puja material
51	SOMESTIWAR	0.0 KW	thrown
\$2	ANANDAWALI BRIDGE	25 KM	Sewage from MIDC area, hotels,
52	ANANDAWALI DRIDGL	2.5 KW	anandwalli slum area meets to river
\$3	SUVOUT BRIDGE	4 K M	Part of untreated sewage of Gangapur
	Serent Babel	7 18171	area meets to river
54		105 VM	Mass bathing activities, Dashkriyavidhi
54	KAMKUND	10.3 KIVI	material thrown
65	ΤΑΡΟΥΑΝ	12 5 VM	Treated sewage from 78 and 52 MLD
	IAFUVAN	13.3 KM	STP meets the river

Table No. 1 Details of River	er Water Quality Station
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Table No. 2 Details of Sewage/Wastewater Addition Points

Wastewater	Name of Wastewater
Infiltration	Infiltration Point
Point Code	(Point Source of Pollution)
P1	Anandwali Nala
P2	Suyojit Colony Nala
Р3	Chopada Lawns Nala
P4	Tapovan STP

# V. RESULTS AND DISCUSSION

The analysis of water quality has been carried out as per standards method of APHA, we identified the

water quality by determining the value of parameters named as pH, DO, BOD, Total Solids, Turbidity. Data shows that water pollution increases as the river flows through the urban area in which pH values show alkaline or acidic behavior of water, Total Solids(TS) affecting turbidity of water.The higher values of BOD reflect the biological activity of the waste waters and are the principal organic pollution indicator. The figure no.1 shows the waste water addition points like Nalas which add the sewage to Godavari river. Wastewater addition from Nalas into Godavari causes pollution of River and it ultimately affects the change in water quality of Godavari River, Hence the River goes to urban area and the water

quality gets deterioted due to untreated and partially treated sewage added to river.

#### рΗ

pH is a measure of the concentration value of hydrogen ions present in water. It is utilized to show acidic and basic nature of the water. Normal water has pH ranging from 6.5 to 7.5. Sewage into water may alter the hydrogen ion concentration (pH) of the water, and it became more alkaline based on the waste types and chemical compounds are held within them (Ichwana et al. 2016). pH change may alter the heart rate, curvature spin and shape of the head (Shinde et al. 2019). The current research indicates that at different stations, water pH lies between 7.5 to 8.5 so the water quality is acceptable , as per the Indian standards.Change in pH value of drinking water may alter the heart rate.

#### Total Solids

Total solids(TS) are dissolved solids present in the water, including suspended and settleable solids. Total solids varied between 266 and 702 mg/l at different sampling points. TS has been suddenly raised from S2 to S5 (distance 9.5 km), and it is because of the direct contribution of huge quantity of wastewater discharge from city. It is all accountable to make water unpalatable.

#### Dissolved Oxygen

Dissolved oxygen(DO) in water is an essential indicator in determining water purity. It provides nature of organic matter available in water. DO is necessary for healthy aquatic organisms. The DO values varied from 4.2 to 6.74 at selected sampling stations. It is noted that DO of river water from station S2 to S5 is lower than 5 mg/l, and it is due to addition of urban waste water along the course of river. Godavari river worsens (Bawa and Gaikwad 2013).

#### Turbidity

Turbidity is definition of the optical characteristics of water which is determined by quantity of light emitted and absorbed by particles in water (Ichwana Table No. 3 NSFWQI Water Quality Index et al. 2016).It is seen that turbidity continues to increase from station S3 to S5 and it is highest at S4 Ramghat (40.82 NTU) once again because of bathing pilgrims in ramghat and release of human dead bodies ash along with other religious activities. Flower, garlands and other solid waste directly added to water causes the increase in turbidity of river water.

# BOD

BOD is the quantity of oxygen utilized in biodegradation of organic material within five days period. It can be observed from table no 4 to 8, that there is rise of BOD value from S1 to S5 due to nalas emerging from industrial locations, hotels and slums around the river bank. BOD seems to be more at every sampling location because the nalas are directly discharging sewage in Godavari river and plenty of wastewater mixed in river due to vehicle washing in river and weekly market which are responsible for contribution of high BOD at every sampling station.

#### NSFWQI

NSFWQI stands for National Sanitation Foundation Water Quality Index. It is a standard method for assessing river water quality based on nine parameters. It provides a single numerical score that represents overall water quality. In the present study out of Nine, only Five water quality parameters named as pH,DO,BOD,Turbidity and Total solids have been used.Water quality is considered as Excellent to Very Bad depending upon the NSFWQI value, as mentioned in table no.3. In the present study, it is observed that only at S1 station water quality is good, since the average NSFWQI value is 70.11. At Station S2 and S3 NSFWQI values are 53.70 and 52.48 respectively, so water quality is medium at these stations. But at Stations S4 and S5, NSFWQI values are 41.44 and 40.72 so water quality is Bad at these stations.At S4 and S5 stations (i.e at Raghat and at Tapovan), pilgrims take bath and also releases human dead bodies ashes along with other religious activities , which are responsible for degradation of water quality.

Sr. No.	NSFWQI Range	Water Quality
1	90-100	EXELLENT
2	70-90	GOOD
3	50-70	MEDIUM
4	25-50	BAD
5	0-25	VERY BAD

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	Date	pН	Turbidity	Total Solids	DO	BOD	NSFWQI	
ſ	1/3/2025	7.71	7.20	200	4.5	36	67.66	
	8/3/2025	7.90	6.20	200	7.8	33	69.5	
ſ	15/3/2025	7.63	9.60	200	6.6	8	73.18	
	22/3/2025	8.10	7.60	530	7.9	15	64.48	
	29/3/2025	7.90	10.2	200	6.9	7	75.76	
ſ	Average	7.84	8.16	266	6.74	19.8	70.11	

Table No. 4 Godavari River Water Quality Characteristics at Station 1: Someshwar

Table No. 5 Godavari River Water Quality Characteristics at Station 2 Anandawali Bridge

Date	pН	Turbidity	Total Solids	DO	BOD	NSFWQI
1/3/2025	6.69	4.5	520	2.5	35	55.11
8/3/2025	7.40	5.1	610	4.5	13	41.24
15/3/2025	6.83	5.7	400	5.4	16	60.81
22/3/2025	7.10	8.6	200	6.3	47	61.11
29/3/2025	6.97	9.2	500	4.6	9	50.24
Average	6.99	6.62	446	4.66	24	53.70

Table No. 6 Godavari River Water Quality Characteristics at Station 3: Suyojit Bridge

Date	pН	Turbidity	Total Solids	DO	BOD	NSFWQI
1/3/2025	7.8	42.5	600	4.0	21	51.88
8/3/2025	8.05	21.60	400	3.8	40	45.77
15/3/2025	8.12	14.80	300	4.4	22	53.38
22/3/2025	8.03	15.20	1000	7.9	45	58.79
29/3/2025	8.34	18.3	600	4.9	21	52.60
Average	8.06	22.48	580	5	29.8	52.48

Table No. 7 Godavari River Water Quality Characteristics at Station 4: Ramghat

Date	pН	Turbidity	Total Solids	DO	BOD	NSFWQI
1/3/2025	7.86	44.2	610	2.7	12	42.03
8/3/2025	7.86	39.45	700	3.6	19	43.90
15/3/2025	7.88	40.62	700	3.4	28	40.68
22/3/2025	8.1	37.6	800	7.9	47	39.75
29/3/2025	8.14	42.26	700	3.5	28	40.87
Average	7.96	40.82	702	4.2	26.8	41.44

Table No. 8 Godavari River Water Quality Characteristics at Station 5: Tapovan

Date	pН	Turbidity	Total Solids	DO	BOD	NSFWQI
1/3/2025	7.9	41.46	700	4.5	38	39.81
8/3/2025	8.0	29.6	600	2.6	34	42.75
15/3/2025	8.12	34.6	600	3.6	27	40.42
22/3/2025	7.9	40.2	900	6.9	23	38.55
29/3/2025	7.8	37.12	600	3.4	28	42.11
Average	7.94	35.59	680	4.2	30	40.72



#### VI. CONCLUSION

The present study identifies that the quality of water in the Godavari River decreases considerably as it passes through urban regions. The water quality at Station S1 is "Good", with tolerable pH levels, low BOD, and high DO, which is appropriate for domestic and recreational purposes . However, at Station S2 and S3, pollution is augmented by the dumping of sewage, market waste, and other urban wastes into the river. The water quality is "Medium" at station S2 and S3 as per NSFWQI.

Around Stations S4 and S5, particularly near Ramghat, the water gets extremely contaminated as a result of religious activities, bathing, and immersion of burnt bodies. These stations have high BOD, low DO, high turbidity, and water quality comes under the "Bad" category as per NSFWQI and thus the water is not fit for use for any purpose without treatment. The major sources of pollution are nalas sewage, urban runoff, industrial effluent, and religious waste, all of which have a very negative effect on the health of the river. Immediate action must be taken to avoid infiltration of Untreated or partially treated wastewater in river, enhance sewage treatment capacity, and create public awareness to safeguard the Godavari River.

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