

## Comparative Evaluation of Some Physico-Chemical and Microbiological Parameters in Godavari River Basin At Tapovan Area of Nashik



### Zoology

**KEYWORDS :** Godavari, Tapovan, microbiological, physico-chemical parameters

**Shinde S. M**

Department of Zoology, M.V.P's ACS College, Dindori- 422 009, Tal - Dindori, Dist - Nashik (M.S.) India

**\* Kolhe B. G**

Department of Zoology, P.G. Research Centre S. S. V. P. S's L. K. Dr. P. R. Ghogrey Science College, Dhule – 424 005 (M.S.) India \* Corresponding Author

### ABSTRACT

*In the present investigation the Physico-chemical parameters and Microbiological quality of the surface water sample from Godavari river basin at Tapovan area were evaluated for the levels of Total coliforms, faecal coliforms, temperature, pH, Electrical Conductivity (EC), Total Dissolved Solids (TDS), Total Hardness (TH), Total Alkalinity (TA). Average values for studied parameters were, Temperature = 27.81°C, pH = 7.75, EC = 418.54 µs/cm, TDS = 246.42 mg/L, TH = 210.46 mg/L, TA = 110.05 mg/L, Total coliforms = 359958.3 units/100ml, and Faecal coliforms = 230250 units/100ml during the study period (2009-2010). The correlation coefficient specifies positive and negative correlation among the studied physico-chemical and microbiological parameters.*

### INTRODUCTION

From ancient time Godavari river is famous for religious and cultural significance. It originates at Trimbakeshwar in Nashik district of Maharashtra State. It passes through Nashik city which is said to be residence of Lord Rama during his 14 years in exile. It is one of the four places in the world where Kumbh Mela is held. The city is site for more than 100 ancient temples. As Godavari passes through Nashik, extensive contamination of river has been evident in many areas. Industrial infrastructures and agriculture complexes have been built up in vicinity from last few decades. Population growth and pollution caused by discharge of organic wastes, human excreta, sewage waste, polythenes, municipal garbage and toxic liberated from the several industries not only resulting into the deterioration in water quality but also might be responsible for high level of pathogenic bacteria.

Clean and safe water is essential for healthy living though many people do not get clean and safe water for drinking and household use (WHO, 2008). Disposal of domestic, agricultural runoff and industrial wastes in Godavari river results into adverse alterations in physico-chemical and biological characteristics. The healthy aquatic ecosystem is depended on the biological diversity and physico-chemical characteristics (Venkatesharaju et al, 2010). Screening of Godavari river water is important in combating the problems related with public health owing to organic pollution. Fecal contamination is usually common in drinking water (PCRWR, 2005). Fecal coliform bacteria excreted in the feces of warm blooded animals, including humans (Leclerc et al, 2001). Coliforms are not only indicators of the presence of possible harmful pathogens (e.g. bacteria, viruses, and parasites) associated with human and animal waste but also shows water is potable or not.

However, there is no information concerning the analysis of microbiological parameters from Godavari river water. Therefore, the aim of this study was to determine, (1) the Microbial quality (total and faecal coliform counts), (2) monthly changes in the bacterial population as well as, (3) some physico-chemical parameters of the water in the Godavari river basin at Tapovan area of Nashik.

### MATERIALS AND METHODS

#### (i) Study area:

Tapovan area following just after the Ramkund downstream. This site was selected for the study because, this point receives large amount of agricultural runoff, sewage and industrial waste which is directly discharged without any proper treatment from Nashik City and from surrounding area.



**Figure 1: Map of the study area.**  
Sources: Google earth

#### (ii) Collection of samples:

During present study the water samples were collected monthly during May 2009 to April 2010. Water samples (1000 ml each) were collected manually between 8 am to 10 am at a depth of 35cm from Study Station Tapovan using acid-washed (10%, v/v HCl) Polyethylene bottles. The pre-washed bottles were rinsed thrice with water samples on the site before sample collection. Water in polyethylene bottles were preserved with 2 ml of concentrated hydrochloric acid (pH < 2.0). Then they were carefully sealed, labelled and kept cool using ordinary dry ice in the field and while on carrying to the laboratory. Chemical analyses were performed in the laboratory within four hours of their collection. The pH and Temperature of water was measured at the collection site, while Electrical conductivity (EC), Total dissolved solids (TDS), Total Hardness (TH) and Total Alkalinity (TA) were determined following the standard methods described by APHA (1985). All chemicals of Anal R grade were used for quantitative analysis.

#### (iii) Statistical analysis:

All the data obtained subjected to statistical analysis. In statistical analysis average, and correlation coefficients matrixes were estimated between all pairs of measured variables to understanding the dynamic distribution of different parameters under investigation.

### RESULTS AND DISCUSSION

The physico-chemical and microbiological characteristics are given in Table 1 and Figure 2 and 3. Correlation Coefficient between between each two pairs of physico-chemical and microbiological parameters are illustrated in Table 2.

• Physico-chemical parameters:

**Temperature:**

Temperature ranged from a minimum of 24.5°C to 33.25°C showing average value of 27.81°C. High temperature was observed in May and least in April.

**pH:**

During the present study period the alkaline pH was observed ranging from 7.35 to 8.45 showing average value of 7.75. Maximum pH value was recorded in the month of May while minimum in January.

**Electric conductivity (EC):**

During the present study EC values were in the range of 216 µs/cm to 557.5 µs/cm showing average value of 418.54 µs/cm. EC was high during month of September and low in May month.

**Total Dissolved Solids (TDS):**

TDS ranged with a minimum value of 127 mg/L and maximum of 329 mg/L showing average value of 246.42 mg/L. In the present investigation, the TDS was found maximum during the September and least during July.

**TABLE - 1 MONTHLY VARIATIONS IN PHYSICO-CHEMICAL PROPERTIES AND MICROBIOLOGICAL FORM (UNITS/100ML) OF GODAVARI RIVER WATER SAMPLES COLLECTED FROM TAPOVAN (2009-10).**

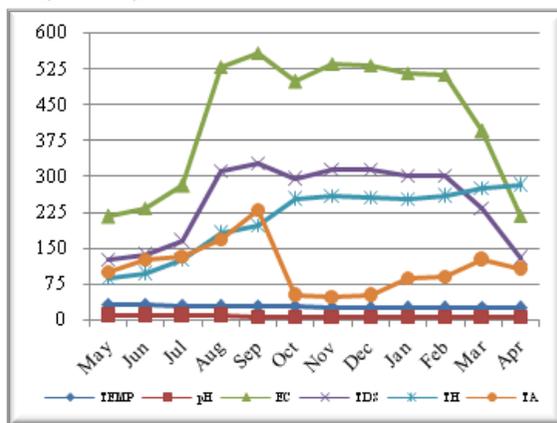
Month	Parameters							
	Physico-chemical						Microbial	
	TEMP (°C)	pH	EC (µs/cm)	TDS (mg/L)	TH (mg/L)	TA (mg/L)	TC (units/100ml)	FC (units/100ml)
May	33.25	8.45	216.0	127	87.50	101	60500	32000
Jun	32.10	8.35	234.0	135	96.50	127.1	43000	24000
Jul	28.25	7.95	280.5	164	127.5	133.5	139500	80000
Aug	28.10	7.95	528.0	312	180.0	168	400000	265000
Sep	30.00	7.80	557.5	329	198.0	230.5	550000	385000
Oct	29.40	7.65	498.5	294	252.0	50.75	900000	640000
Nov	26.00	7.40	535.5	316	259.5	49.2	625000	410000
Dec	27.25	7.45	531.5	314	256.0	50.1	585000	390000
Jan	24.65	7.35	517.0	303	252.5	89.0	265000	47500
Feb	24.65	7.40	513.0	301	258.0	91.0	365000	245000
Mar	25.60	7.85	394.0	234	277.0	125	300000	185000
Apr	24.50	7.40	217.0	128	281.0	105.5	86500	59500
Average	27.81	7.75	418.54	246.42	210.46	110.05	359958.3	230250

Temp = Temperature, EC = Electric conductivity, TDS = Total Dissolved Solids, TH = Total Hardness, TA = Total Alkalinity, TC = Total Coli form, FC= Faecal Coli form

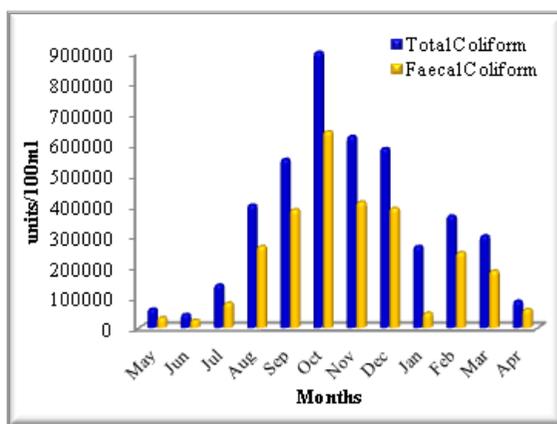
**TABLE - 2 CORRELATION COEFFICIENT (r) MATRIX AMONG THE STUDIED PHYSICO-CHEMICAL PARAMETERS OF GODAVARI RIVER WATER SAMPLES COLLECTED FROM RAMKUND (2009-10).**

Parameters	TEMP	pH	EC	TDS	TH	TA	TC	FC
TEMP	1.0000							
pH	0.8669	1.0000						
EC	-0.3634	-0.5784	1.0000					
TDS	-0.3647	-0.5784	0.9999	1.0000				
TH	-0.8443	-0.8934	0.5380	0.5427	1.0000			
TA	0.2772	0.4084	-0.0419	-0.4010	-0.3711	1.0000		
TC	-0.1261	-0.4662	0.7963	0.7993	0.5111	-0.2725	1.0000	
FC	-0.0392	-0.3774	0.7103	0.7142	0.4473	-0.2268	0.9812	1.0000

**Figure 2- Monthly variations of physico-chemical parameters of Godavari river water samples collected from Tapovan (2009-10).**



**Figure 3- Monthly variations in Total Coliform and Faecal Coliform of Godavari river water samples collected from Tapovan (2009-10).**



**Total Hardness (TH):**

The maximum value of TH was recorded as 87.50 mg/L in the month of May and minimum value observed in April i.e. 281.0 mg/L with a mean value of 210.40 mg/L.

**Total Alkalinity (TA):**

TA obtained shows a broad array of variations ranging from 49.20 mg/l to 230.5 mg/l and showing average value of 110.05 mg/l. The highest value observed in September and lowest in November month.

- **Microbiological parameters:**

**Total Coliforms (TC):**

During the present study, TC in water samples collected from Tapovan ranged between 43000 to 900000 units/100ml showing average value of 359958.3 units/100ml, maximum TC recorded in October and minimum value in the month of June.

**Fecal Coliforms (FC):**

FC ranged between 24000 to 640000 units/100ml, showing average value of 230250 units/100ml. Maximum FC recorded in the month of October and minimum recorded in the of June month.

Obtained data revealed elevated values of all studied physico-chemical parameters at studied site Tapovan may be attributed to a lot of chemical activities as a result of domestic sewage and waste discharge as well as its decomposition into the river, ejection of detergents by adjacent population, pollution by surface runoff (Chattopadhyaya et al, 1984, Sharma et al, 2008, Verma et al, 2012, Kadhim, 2014).

Assessment of indicator bacteria namely coliform bacteria is a convenient way to evaluate sanitary condition of any water body (Sharma et al, 2008). Detection of total coliforms as well as fecal coliforms at Tapovan recognized fecal contamination. This might be due to anthropogenic activities and direct discharge of wastewater from Nashik and area around the city. Higher bacterial population during monsoon due to increased land run off and higher faecal inputs in to river from various sources (Srivastava and Srivastava, 2011). An increase in the Faecal Coliform level after rainfall was also reported by (Shehane et al, 2005, Srivastava and Srivastava, 2011).

- **Correlation Coefficient (r) analysis:**

In the present study, the correlation coefficients (r) among various physico-chemical and microbiological parameters have been calculated. Out of the 36 correlation coefficients, 7 correlation coefficients (r) between the Temperature and pH (0.8669), between EC and TDS (0.9999), TC (0.7963), FC (0.7103), between TDS and TC (0.7993), FC (0.7142), between TC and FC (0.9812) [Table-2] are found to be with very strong positive levels ( $0.7 < r < 1.0$ ), furthermore 5 correlation coefficients confer the strong positive ( $0.4 < r < 0.69$ ) level of r values. 1 correlation coefficients give the value of r which belongs to the weak positive ( $0.2 < r < 0.29$ ) levels. 21 cases were calculated out positive correlation while 15 cases were calculated out negative.

**CONCLUSION**

Monthly fluctuation takes place among the physico-chemical as well as microbiological parameters. A total coliforms and fecal coliforms of Godavari river water at Tapovan were beyond the permissible limit. Consequently, water was not suitable for drinking purpose without pretreatment. The correlation coefficient specifies positive and negative correlation among physico-chemical and microbiological parameters which might be used to predict the levels of pollution and possibly offering a preventive measure prior in pollution monitoring and sustainable management of the Godavari river water.

**ACKNOWLEDGEMENTS**

Authors are sincerely thanks to, Prof S. P. Zambare, Head Department of Zoology, Dr. Babasaheb Ambedkar Marathwada University, Aurangabad, Maharashtra State for providing laboratory facilities to conduct the present work.

**REFERENCE**

- [1]APHA (1985). Standard method for the examination of water and waste water. 14th Ed. APHAWWAPCF. Washington, D.C. pp. 1193. | [2] Chattopadhyaya, S. N., Rauth, T., Sharma, V. P., Arora, H. C., and Gupta, R. K. (1984). A short term study on the pollution status of river Ganga in Kanpur region. *Indian Journal of Environ Health*, 26, 244-257. | [3]Kadhim, N. F. (2014). Monthly Variations of Physico-Chemical Characteristics and phytoplankton species diversity as index of water quality in Euphrates River in Al-Hindiya barrage and Kifil City region of Iraq. *Journal of Biology, Agriculture and Healthcare*, 4(3), 105-119. | [4]Leclerc, H., Mossel, D. A. A., Edberg, S. C., and Struijk, C. B. (2001). Advances in the bacteriology of the coliform group: their suitability as markers of microbial water safety. *Annu Rev Microbiol*, 55, 201-234. | [5]PCRWR (Pakistan Council for Research in Water Resources) 2005. National water quality monitoring programme water quality Islamabad. Report: 2003 – 2004. | [6] Sharma, R., Sharma, M. S., Sharma, V., and Malara, H. (2008). Study of limnology and microbiology of Udaipur Lakes. *Proc of Taal 2007: The 12th World Lake Conference*, 1504-1508. | [7]Shehane, S. D., Harwood, V. J., Whitelock, J. E. and Rose, J. B. (2005). "The influence of rainfall on the incidence of Microbial faecal Indicators and the dominant sources of faecal pollution in a Florida river." *Journal of Applied Microbiology*, 98, 1127-1136. | [8]Srivastava, A., and Srivastava, S. (2011). Assessment of physico-chemical properties and sewage pollution indicator bacteria in surface water of River Gomti in Uttar Pradesh. *International Journal Of Environmental Sciences*, 2(1), 325-336. | [9]Venkatesharaju, K., Ravikumar, P., Somashekar, R. K., Prakash, K. L. (2010). Physico-Chemical and Bacteriological Investigation on the river Cauvery of Kollegal Stretch in Karnataka. *Journal of Science, Engineering and Technology*, 6(1), 50-59. | [10]Verma, S., Tiwari, D., and Verma, A. (2012). Interrelationships between Physicochemical Water Pollution Indicators: A Case Study of River Pandu. *World Academy of Science, Engineering and Technology*, 6, 12-28. | [11]World Health Organization (WHO) (2008). Guidelines for Drinking-water Quality, Incorporating 1st and 2nd Addenda, Volume 1, Recommendations, 3rd edn.; WHO: Geneva, Switzerland. |