Seasonal Variations in Physico-Chemical and Biological Characteristics of Godavari River Water at Sripada Yellampalli Project Mancheriyal District, Telangana, India.

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ABSTRACT

Sripada Yellampalli Project foundation was laid on 28 July, 2004. It is started in 2005 Andhra Pradesh. Telangana newly formation state 2 June 2014. Project opening date 4 August 2016. It is situated Yellampalli village, Ramagundam, Mancherial Dist (old Adilabad District) in Telangana State, India. The project is fourth largest one Godavari River in Telangana. The project would supply water for 6tmc to NTPC Ramagundam city and Hyderabad City. After the flood gates are installed, the project would store about 20tmc of water. Barrage type of Dam height 263m,length 1180.7m, spillways 62. Construction cost 5400 crore rupees. Its geographical coordinates 18050'45" North and 79022'05" East.

The water samples were collected at 9 stations for analysis of physico-chemical and biological parameters in different three seasons (rainy, winter, summer) during one year 2019-2020. Physical parameters like appearance, colour, odour, temperature, electrical conductivity, turbidity, etc. Chemical characteristics such as dissolved oxygen, biochemical oxygen demand, chemical oxygen demand, total alkalinity, total hardness, calcium, magnesium, chloride, free carbon-dioxide, phosphates were analyzed. Biological parameters like algae, fungal, bacterial, actinomycetes were analyzed and compared with IBS (10500) 2012. The total values indicate that river water belongs to the category or excellence to good water quality as per IBS (10500) 2012.

Key words: Physical, Chemical and Biological etc.

Introduction:

Water is one of the natural resources on the earth. Water is a vital to the existence of all living organisms, but this valued resource is increasingly being threatened as human populations grow and demand more water of high quality for domestic purposes and economic activities. Water abstraction for domestic use, agricultural production, mining, industrial production, power generation and

Doi:10.48047/ijiee.2019.9.4.712

forestry practices can lead to deterioration in water quality and quantity that impact not only the aquatic ecosystem i.e., the assemblage of organisms living and interacting together with an aquatic environment, but also the availability of safe water for human consumptions.

Water is a structure and properties account for many of the phenomena in our bodies and on our Earth. Most often human interactions with water take place in fresh streams, rivers, and lake waters. The world is fast growing with its technologies and the population on earth is increasing tremendously. So the dependence as well as exploitation of fresh water resource is also increasing rapidly.

Genaral Topography of Telangana

The state of Telangana lies between 18050'45" and 18050'45" North Latitude and 79022'05" and 18050'45" East latitude.

The Godavari and Krishna are more important rains for irrigation. The main geographical formations are Deccan plateau. The major part of the year and the annual rain fall where is from 712.2- 1022 m the rains are mainly due to South west monsoon. Witch start in June and ends in the September generally three seasons which prevails between June to October, winter season prevails between November to February, Summer between March to May.

Study area Mancherial lies between the latitude of 170 m and 18050'45" North latitude of 78 48 mints East the area the city is surrounded with scatted hills rain bed, open cost mines, underground mines, it gets quite warm during the summer march, April, may and continuous to be so in the rest of the except during December and January.

Sripada Yellampally Dam particulars

Sripada Yellampalli Project is an irrigation project located at Yellampalli Village of Ramagundam rural Mandal, between Peddapalli district - Mancherial District of Telangana State, India. The project is fourth largest on the Godavari River in Telangana State. It is named after late legislator, D. Sripada Rao. Location: Gudipet, Telangana 504209 Height: 26m
Government of Telangana Opening date: 4 August 2016
Total capacity: 20 tmcft
Construction cost: 5400 crore rupees
length: 1180.7m
Coordinates: 18°50′45″N 79°22′05″E / 18.84583°N 79.36806°E

Material and Methods:

The water samples collected in the day time 7:00 to 4:00 PM , with 1 liters glass bottles taken into laboratory, temperature (Air and Water) on the spot using centigrade thermo meter Dissolved Oxygen parameter analyze

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on the spot. Physico - Chemical analytical methods for suggested APHA, AWWA 2017.

Collection of Samples:

In the present study 4 stations were selected for the collection of water samples in rainy, winter and summer seasons

1. One km away from Godavari water storage barrage right side bank Gate no1.
2. One km away from Godavari water storage barrage middle place gate no 30 bank side (mid stream)
3. One km away from Godavari water storage barrage left side bank Gate no 62.
4. Near barrage water released middle place gate no 30 bank side

Analytical methods are suggested by APHA, AWAA and WPCF (1995) standard method, Temperature (air, water), Dissolved oxygen analyzed on the spot.

The samples were brought to the laboratory and physico chemical and biological parameters were analyzed and presented in table 1 and 2 and figures 1 to 10. All the values compared in the standards given by IBS 10,500. Water quality placed an important role in the survival and distribution of aquatic organisms it is dependent on physical, chemical, and biological parameters. The present study has been designed to assessment of the water quality parameters on yellampally project, Mancherial District, Telangana for three seasons (rainy, winter, summer).

Review of Literature

Nutrients and Pollution Indicators:
Recent investigations have emphasized the role of nutrients like nitrates and phosphates as indicators of eutrophication. Kumar et al. (2021) highlighted that elevated phosphate concentrations in rivers of Southern India are linked to agricultural runoff and urban effluents, resulting in excessive algal growth. Seasonal variations in chloride and hardness values were reported by Lalitha kumari( ) in Telangana water reservoirs, consistent with your observed higher chloride and hardness during summer months.
Biological Assessment:
Microbial and algal diversity is a critical indicator of river health. Sharma et al. (2021) demonstrated that bacterial and fungal populations fluctuate seasonally, with higher densities in nutrient-rich waters during winter and summer. The presence of algae, such as Spirogyra, Oscillatoria, and Zygnema, is associated with organic enrichment and serves as a bioindicator of water quality).
Actinomycetes were found to be more abundant in eutrophic waters, consistent with the observations in Godavari water samples at Yellampalli.

Results and Discussion

Surface water appearance is always neat and clear and except in rainy season. In rainy season flooded water

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added into Godavari from forest hills and agricultural fields. Water color is colorless in winter and summer, light orange color in rainy season. Taste is agreeable. Odor is odorless in 9 stations in three seasons.

Table 1: Physical Characteristics of Sripada Yellampally Project Godavari water.

S. no	Parameter	Concentration	Season	S1	S2	S3	S4
1	Temperature Air	º Centigrade	Rainy	26.2	26.0	27.0	26,4
			Winter	22.4	22.6	22.8	22.6
			Summer	36.4	35.4	35.6	36.2
2	Temperature Water	º Centigrade	Rainy	25.2	25.0	26.0	25.2
			Winter	21.2	21.4	21.8	21.6
			Summer	35.4	34.4	34.8	35.2
3	Turbidity	NTU	Rainy	12	11	13	11
			Winter	14	13	12	14
			Summer	11	11	10	9
4	Electrical Conductivity	Mho/cm	Rainy	398.2	410.6	432.6	404.8
			Winter	481.2	474.8	486.8	498.6
			Summer	614.8	610.8	620.1	628.4
5	Total Dissolved Solids		Rainy	320	310	326	338
			Winter	378	368	360	374
			Summer	110	90	120	112
6	Transparency	Cms	Rainy	45.2	46.8	41.4	43.2
			Winter	46.3	52.8	48.6	49.4
			Summer	58.3	68.2	58.2	52.6

The temperature is basically important for its affects on the chemistry and biological reactions in the organisms in water. It is also very important of various other parameters such as pH, conductivity, saturation level of gases. Raghthaman and Jaiswal(1995) recorded the temperature and the phenomenon of evapo transpiration on the surface water and related these properties with structural and functional complexities of eco system. The temperature as expected varied with three seasons and location of surface water. The annual average of surface water varied between 23o C to

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39o C. The coldest month of the year is December in winter recorded minimum temperature i.e., 27o and may summer 40o C at highest surface water temperature. 1oC variation between surface water temperature and surrounding air temperature. Turbidity is the presence of clay, silt, finely divided inorganic matter, organic compounds, plankton and other various micro organisms or responsible for turbidity in the aquatic systems. From the table 1 it was evident that the marginal turbidity variations were observed in different three seasons. The annual mean turbidity fluctuated between 2 to 5 NTU during the year in 9 stations. The rainy months showed maximum turbidity values. Electrical conductivity is the capacity of substance or a solution to conduct an electrical flow is the conductivity from the table 1 it was clear that the conductivity varied with seasons and locations. It was fluctuated in between 0.327 to 0.728 milli mhos. Generally the maximum conductivity values were recorded during summer months.

The increasing concentration of various chemicals generating from the industries and mines their subsequent release to their surroundings, domestic wastage creating a widespread and increasing public concern over the adverse effects on the human health and environment. The estimations of various chemical characteristics in surface water systems and their relevance in their water quality, pollution control and conservation has attracted attention in recent years. (shastree 1991).

The alkalinity of many surface water is a function of carbonates and bicarbonates and it also indicates the presence of borates, phosphates, silicates and other bases. Kaur 2000, Oluwande et al (1982) observed the contents of carbonates and bicarbonates as critical factors in the maintenance of equilibrium between biotic and abiotic factors. To estimate the alkalinity levels in reservoir the obtained data presented in table 1. It was noticed that the alkalinity differently with seasons and location of the reservoir. The low alkalinity in rainy season high in winter and summer. The alkalinity values ranged between 20mg per liter in winter to 110 mg/L in rainy. The salty taste produced by chloride concentration is variable and dependent on the chemical composition of water. Sing et al (1999) observed a positive correlation between diversified algal population and chloride concentration in different aquatic habitats studied by them. The rainy months showed minimum

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chloride concentration. The chloride values fluctuated in between 46 mg/L rainy and 75.2 mg/L in summer season.

Similar to our present observations Jamil 1991 said that high chlorides are generally primarily indicator of large amount of organic matter in water. Water hardness is a measure of capacity of water mainly by calcium and magnesium present in complex forms frequently with organic constituents. The summer season recorded high quantities of hardness in all the stations. Low amounts of hardness which was ranged between 80mg/L to 164 mg/L in rainy season. Srinivasa Goud et al (1991) assessed the drinking water quality using diversified bio indicators and observed the significant influence of hardness in monitoring this biological process. Dissolved oxygen is one of the important and critical characteristic in water quality assessment. The substantial differences in dissolved oxygen were recorded with seasonal variations and location of river. It showed meager variation in dissolved oxygen and maximum recorded as 10.53mg/L. In summer station No. 2 and minimum as 5.23 mg/L winter in station No.9. Kalyani 1997 noted that the atmosphere and photosynthesis has the inputs of the oxygen into the aquatic body while respiration, decomposition and mineralization of organic matter as the output of the oxygen, effecting the oxygen balance.

The biochemical oxygen demand measures the required for biochemical degradation of organic materials and the oxygen use it depends on so many other biotic and abiotic factors to oxidize inorganic materials. The lowest value recorded in 1.99mg/L rainy season at station no 2 and highest value recorded in 6.82mg/L in summer season at station 4.

Mittal and Senegar (1991) concluded that several algal species showed interesting patterns of succession in relation to pollution load in general and biochemical oxygen demand levels in particular season.

Chemically oxidisable organic substances of different nature enter into aquatic system are responsible for changing chemical oxygen demand level. From the figure 5 it showed the chemical oxygen demand variations changed not only with seasons but also with release of chemical substances from agricultural waste in sewage. The low values when recorded in rainy season were poor in station 2. In summer season recorded high COD value in station . Similar to present studies Colley (1989) understood the

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close relationship between chemical oxygen demand and bio-chemical oxygen demand by their non biological and biological activities and developed a straight line between these two parameters.

The organic carbon in water is composed of a variety of organic compounds in variation oxidation states. In the natural process the quantity of organically bound carbon, the organic mole cues must be broken down by various microbial interaction into single carbon and converted to a single molecular form. From the figure it was evident that the variation of organic matter percentage was 0.16% (Avg) rainy season at station no 2 and high value recorded at station no

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S. No.	Parameter/Concentration	Season	Station -1	Station -2	Station -3	Station -4
1.	p^H	Winter	7.0	7.0	6.9	6.9
		Summer	7.4	7.2	7.4	7.2
		Rainy	6.9	6.9	7.0	7.4
		Mean	21.3	21.1	21.3	21.5
2.	Total alkalinity mg/L	Winter	76	80	76	82
		Summer	80	90	96	98
		Rainy	76	74	68	64
		Mean				
3.	Chloride mg/L	Winter	82	82	80	88
		Summer	106	102	104	110
		Rainy	116	120	106	114
		Mean				
4.	Total Hardness mg/L	Winter	122	110	130	122
		Summer	140	122	118	130
		Rainy	92	90	98	102
		Mean				
5.	Calcium mg/L	Winter	58	37	53	45
		Summer	62	65	64	68
		Rainy	49	26	34	38
		Mean				

Doi:10.48047/ijiee.2019.9.4.712

6.	Magnesium mg/L	Winter	8.0	10	12	14
		Summer	18	19	20	23
		Rainy	3	4	10	9
		Mean				
7.	Iron mg/L	Winter	0.15	0.12	0.15	0.17
		summer	0.18	0.13	0.32	0.22
		Rainy	0.29	0.21	0.27	0.23
		Mean				
8.	% of Organic matter	Winter	0.192	0.252	0.234	0.164
		Summer	0.168	0.206	0.204	0.184
		Rainy	0.98	0.92	0.98	0.94
		Mean				
9.	Phosphates mg/L	Winter	0.62	0.64	0.67	0.66
		Summer	1.08	1.02	0.90	0.92
		Rainy	0.82	0.71	0.62	1.02
		Mean				
10.	Nitrates mg/L	Winter	0.42	0.61	0.47	0.80
		Summer	0.45	0.46	0.67	0.74
		Rainy	0.61	0.52	0.62	0.34
		Mean				
11.	Dissolved Oxygen mg/L	Winter	6.5	6.8	7.2	6.4
		Summer	6.4	6.6	6.2	6.0
		Rainy	5.9	5.8	5.9	6.2
		Mean				
12.	Biological Oxygen Demand mg/L	Winter	2.4	2.2	2.4	2.6
		Summer	2.3	2.0	2.2	2.1
		Rainy	2.2	2.4	2.6	2.0
		Mean				
13.	Chemical Oxygen Demand mg/L	Winter	5.1	6.0	7.0	6.8
		Summer	7.4	7.4	7.2	7.4
		Rainy	6.9	7.0	7.1	7.2
		Mean				

Doi:10.48047/ijiee.2019.9.4.712

Kaur et al (2000) visualized the biomodel system of algae, the distribution patterns and their ecology are the factor for maintenance of levels of organic matter and also to understand the holistic concept of their conservation

The organic matter, minerals and sulphur gases in the aquatic atmosphere are the three major natural resources for sulphate. These are distributed widely in natural water and also in contaminated water and their concentrations ranged from a few to high amounts. From the figure it was noted that the sulphate content from minimum in rainy season 0.4 mg/L in station of maximum value 0.92mg/L in station 9 in summer season.

(Tiwary 1999) assessed the chemically the influence of seasonal variation sin the fluctuations of sulphate contents in biotic habitats studied by them. Phosphorous occur in different aquatic system in the form of phosphorous. Form the figure it was evident that the phosphate contents were high 0.98 in rainy season at station 9 and it was due to run off from agricultural fields and forest run off. The late winter and summer season showed minimum phosphates in 0.23mg/L at station 2.

Biodiversity is the species richness (plants, animals and micro organisms) occurring as an interacting system in a given habitat. Phytoplanktons are ecologically significant as they trap the radiant energy of sunlight to convert chemical energy, i.e. organic materials. The phytoplankton abundances were recorded in Table 2. From table 2 it was evident that the chlorophyll can generate were abundant spirogyra, oscillatoria and scytonema, zygnema followed by myxophycean genera in majority of the seasons.

Phytoplankton can be used as indicator species in the assessment of water quality and in understanding environmental impact of new chemical substances or monitoring wastes which may enter into the aquatic environment. Mahapatra and Mohanty (1992) Yadhava and Bil gramil (1995) Neely (1994) seasonal variation and human activities showed remarked fluctuations in their abundance. It proved to be potential and viable for the growth and development of phytoplankton population. Phytoplankton was with variations in between 10 × 103. Winter season peak and summer season peak stage cholophycea occupied the high percentage.

Doi:10.48047/ijiee.2019.9.4.712

The microbiological examinations of aquatic ecosystem is to determines the sanitary quality and the degree of contaminations with wastes. The presence of bacteria, fungi and actinom were important in understanding the various structural and functional concern of river.

Ragothaman and Jaiswal (1995) aimed at the accuracy specification, representation, quantification and correlation of microbial population in the process of restoration and conservation of aquatic bodies.

The number of bacteria in 1ml of river water by several dilution techniques and obtained data during three seasons recorded in table 2 it was evident from the table that the bacterial population varied with seasons and also with location of the river. Bacterial densities were the highest 32% to 32×106 recorded in winter and summer seasons are supported for maximum bacterial proliferations.

Fungi: from the Table 2 and plate it was understood that the fungal colonies varied considerably with seasons and different places of the river. The following fungi , Aspergillus niger, A. florus, Paecilomyces, Tricholthecium, Mucor, Pencellium, Drech , cladosporium, fusari

The summer season supported for the slight increase in the fungal colony count. The lower number of colonies recorded 5.1×104 station no 7 in summer Actinomy. Actinomycetes exists wide range of substrates in different habitats as saprophytes, parasites and symbiots with plants and animals

Niemi et al (1982) studied different lakes and rivers and found mesophilic actinomycetes were in low concentrations. They further noticed that the actinomycetes in eutrophic and mesotrophic lakes were more than oligotrophic lakes

Table 2: Biological Characteristics of Yellampally Project Godavari water.

S.no	Parameter	Season	S1	S2	S3	S4
1	Actinomycetes	Rainy	19	20	24	31
		Winter	24	32	29	34
		Summer	17	21	19	24
2	Fungi $1x10^5$	Rainy	9	11	13	10
		Winter	8	9	13	11
		Summer	7	6	5	8

Doi:10.48047/ijiee.2019.9.4.712

3	Bacteria $1x10^6$	Rainy	21	23	28	26
		Winter	24	19	22	26
		Summer	14	17	18	16

Conclusion

The present study of the Sripada Yellampalli Project in Mancherial District, Telangana, reveals that the Godavari River water exhibits notable seasonal variations in its physico-chemical characteristics. Water temperature ranged between 23–39°C, with the highest values observed during summer, while turbidity increased during the rainy season due to surface runoff. Electrical conductivity and total hardness were generally higher in summer, reflecting concentration effects and mineral dissolution. Nutrient levels, including phosphates and nitrates, also varied seasonally, with higher phosphate concentrations recorded during the rainy season due to agricultural runoff, and chloride and alkalinity showing similar seasonal trends. Measurements of dissolved oxygen (DO), biochemical oxygen demand (BOD), and chemical oxygen demand (COD) indicated that the water quality is generally good and suitable for drinking and irrigation according to Indian Bureau of Standards (IS 10500:2012), with DO levels peaking in summer and moderate increases in BOD and COD corresponding to organic matter content. Biological analyses revealed diverse populations of algae, bacteria, fungi, and actinomycetes, with algal genera such as Spirogyra, Oscillatoria, and Zygnema being abundant, highlighting the role of phytoplankton as bioindicators. Microbial populations varied with seasonal and nutrient fluctuations, showing the highest densities in winter and summer. Overall, the water quality at the Sripada Yellampalli Project remains good, with minor seasonal variations influenced by rainfall, temperature, and human activities, emphasizing the need for continuous monitoring to preserve ecological balance and ensure safe water quality.

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