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# Study of Some Physico-Chemical Parameters of Godavari River Water at Ramkund, Nashik With Reference to Correlation Study

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**ABSTRACT**

In the present study physico-chemical parameters such as, Temperature pH, Electrical conductivity, Total dissolved solid, Suspended solids, Total hardness and Total alkalinity, Dissolved oxygen, Biological oxygen demand and Chemical oxygen demand of Godavari river water samples were analyzed. Samples were collected monthly from May 2009-April 2010 from study station Ramkund of Nashik City. An attempt has also been made to establish coefficient of correlation (r) between above parameters to identify water quality. Monthly variations appeared to have influenced on water parameters. Statistical analysis shows that many of the parameters bear a good positive correlation and some bears a negative correlation.

**KEYWORDS** Ramkund, physico-chemical parameters, coefficient of correlation, water quality

## INTRODUCTION

Water is the most vital factor for the existence of all living organisms. Discharge of Industrial effluents, domestic waste and sewage without any treatment into the water bodies has resulted in deterioration of the quality of aquatic habitat. Indiscriminate discharge of industrial effluents is toxic to aquatic environment, creates water pollution, making water unfit for drinking, agriculture and for aquatic life (Sukumaran, 2002; Patil and Lohar, 2009). World Water Assessment Programme indicates that, in next 20 years the quality of water available to everyone is predicted to decrease by 30% (WWDR, 2003).

Monitoring and assessment with the help of water quality analysis techniques provide basic information on the condition of our water bodies. The availability of good quality water is an indispensable feature for preventing diseases and improving quality of life. It is necessary to know information about different physico-chemical parameters before it is used for different purposes. In developing countries such as India the most of the rivers e.g. Godavari, Ganga etc. are the ends of effluents and sewage discharged from urban as well as industrial areas.

The objective of the present study have been considered, to evaluate the physico-chemical parameters of Godavari river water from Ramkund of Nashik City and to study the statistical correlations among various parameters with significant values.

## MATERIALS AND METHODS

The Godavari River selected for the present investigation originates in the Nashik district at Trimbakeshwar in Maharashtra State. It rises in the Sahyadri range near Trimbakeshwar and drains in Nashik and Niphad Tahasils.

**Study area:**

Ramkund is a holy place, 35 kms from the origin of Godavari river which is situated in Nashik city of Maharashtra State, India. Ramkund fall within latitude 20°00'28.27" N and longitude 73°47'33.00" E. Ramkund is also known as Ganga ghat is a holy place. Various rites and rituals are performed here. Water is used for bathing and washing also. The domestic waste water is largely released before and after this point.



**Figure 1: Ramkund, Nashik (M.S.) India.**
**Source: Google earth**

**Physico-chemical analysis of water:**

Monthly sampling was done during the study period (2009-10). The methods used for chemical analysis were standardized according to the procedure given in 'Standard Methods for the Examination of Water and Waste Water' by APHA (1995). Following different physico-chemical parameters were tested for monitoring quality of Godavari river water at Ramkund,

**Physical indicators –** Temperature, Electric Conductivity, Total Dissolved Solids, Suspended Solids.

**Chemical indicators –** pH, Total Alkalinity, Total Hardness, Dissolved Oxygen, Biochemical Oxygen Demand, Chemical Oxygen Demand.

**Statistical Analysis -** The statistical parameters like average and standard deviation (±) were calculated.

**Correlation Studies -** Correlation coefficient (r) among the studied physico-chemical parameters was calculated.

## RESULTS AND DISCUSSION

The results of the seasonal variation in physico-chemical parameters of Godavari river water samples from Study station Ramkund along with statistical analysis is presented in Table 1

while the correlation matrix for the water quality parameters are given in Table 2.

**Temperature:**
Water temperature is very important parameter, because it influences the biota in a water body by affecting activities such as behaviour, respiration and metabolism. In an established system the water temperature controls the rate of all chemical reactions. The result obtained shows an average temperature value which is 27.530C. Highest temperature recorded in May 330C and lowest in March 24.30C. The higher temperature values of the water samples observed during the study period can be attributed to the climatic condition of the area which is characterized generally by the higher temperatures during the dry season.

**pH:**
pH is most important in determining the corrosive nature of water. Lower the pH value higher is the corrosive nature of water. Various factors bring about changes the pH of water. In present study pH varied between 8.9-7.6. Maximum pH was recorded in April which exceeds the permissible limit prescribed by WHO. Higher value of pH might be due to increased photosynthetic activity by phytoplankton and macrophytes. The variation of pH in surface water samples from Ramkund shows that the samples are alkaline in nature.

**Electrical conductivity (EC):**
Electrical conductance of water is a measure of its ability to carry electric current as a result of dissolved salts in the water. The conductivity measurements provide an indication of ionic concentrations. The electrical conductivity values ranged from 393 to 158 µmho/cm. Highest electrical conductivity recorded in August and lowest in July. Higher conductivity values are expected because of the sewage and industrial waste disposal activities taking place before Ramkud.

**Total Dissolved Solids (TDS):**
TDS values are also considered as an important parameter in determining the usage of water. TDS are composed mainly of carbonates, bicarbonates, chlorides, phosphates and nitrates of Calcium, Magnesium, Sodium, Potassium, Manganese, organic matter salt and other particles (Siebert et al, 2010). High TDS values are not suitable for both irrigation and drinking purposes. TDS values in present study ranged between 395.9 to 443.4 mg/l. The acceptable limit of TDS in drinking water is 600 mg/l. Maximum values were observed in August and minimum values were observed in July and March.

**Suspended Solids (SS):**
Suspended solids are very useful parameters describing the chemical constituents of the water. The SS values at Ramkund ranged from 70 to 18 mg/l. Highest SS recorded in May while lowest in December and April.

**Total Hardness (TH):**
Water hardness is a measure of capacity of water to react with soap. Total hardness of water is characterized by content of calcium and magnesium salts. It is an important criterion for determining the usability of water for domestic, drinking and many industrial supplies (Mitharwal et al, 2009). Total hardness values were varied between 240.0 to 76 mg/l. Highest values were recorded in March while lowest in August.

**Total Alkalinity (TA):**
Alkalinity is a measure of ability to neutralize acids. The value of total alkalinity in water provides an idea of natural salts present in water. Excess alkalinity gives bitter taste to water and reacts with cations forming precipitates, which can damage the pipes, valves, etc. The alkalinity at Ramkund ranged between 127 to 24.2 mg/l. Maximum values were observed in September and minimum values were observed in November.

**Dissolved Oxygen (DO):**
Dissolved oxygen present in drinking water adds taste and it is highly fluctuating factor in water. The DO Values indicate the degree of pollution in water bodies. The DO at Ramkund ranged between 5 to 7 mg/l. Maximum values were observed in August exceeding the permissible limit set by WHO.

**Biological Oxygen Demand (BOD):**
BOD determination is still the best available single test for assessing organic pollution. The BOD is the amount of oxygen required to biologically break down a contaminant. The BOD values ranged from a minimum of 5 mg/l to a maximum of 16 mg/l in April and September respectively.

**Chemical Oxygen Demand (COD):**
COD determines the oxygen required for chemical oxidation of organic matter. COD values convey the amount of dissolved oxidisable organic matter including the non-biodegradable matters present in it. COD values ranged from a minimum of 17 mg/l to a maximum of 45 mg/l in April and September respectively.

**Correlation coefficient (r) analysis:**
In the present study, the correlation coefficients (r) among various water quality parameters have been calculated. Out of the 55 correlation coefficients, 2 correlation coefficients (r) between the pH and TDS (0.9997) and COD (0.9060) are found to be with very strong positive levels ($0.7 < r < 1.0$), and 2 correlation coefficients give the strong positive ($0.4 < r < 0.69$) level of r values. 3 correlation coefficients give the value of r which belongs to the moderate significant coefficient levels ($0.3 < r < 0.39$). 33 cases were calculated out positive correlation while 22 cases were calculated out negative.

**CONCLUSIONS**
The physico-chemical parameters showed significant monthly variations. These temporal fluctuations were either by various physico-chemical parameters which were positively or negatively correlated to each other. In present investigation, water samples collected from Ramkund were below permissible limit as per WHO standards except pH in April and DO in August.

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**TABLE-1 MONTHLY VARIATIONS OF PHYSICO-CHEMICAL PARAMETERS OF GODAVARI RIVER WATER SAMPLES COLLECTED FROM RAMKUND (2009-10).**

| Months | Physico-chemical parameters | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | TEMP | pH | EC | TDS | SS | TH | TA | DO | BOD | COD |
| May | 33 | 8.2 | 170 | 100 | 70 | 98 | 87.4 | 6.7 | 7 | 20 |
| June | 30.1 | 8.1 | 170 | 100 | 24 | 100 | 98.6 | 6.2 | 6 | 18 |
| July | 30 | 8.3 | 158 | 92 | 32 | 97 | 113 | 5.9 | 10 | 30 |
| August | 27.5 | 7.9 | 393 | 232 | 64 | 76 | 126 | 7 | 9 | 30 |
| September | 27.2 | 7.9 | 286 | 168 | 58 | 172 | 127 | 5.6 | 16 | 45 |
| October | 28.6 | 8.1 | 209 | 120 | 21 | 216 | 28.6 | 5 | 12 | 37 |
| November | 27 | 7.7 | 305 | 180 | 38 | 222 | 24.2 | 6.8 | 7 | 24 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| December | 24.4 | 8.0 | 232 | 136 | 18 | 218 | 26.3 | 7 | 7 | 19 |
| January | 25 | 7.9 | 238 | 140 | 62 | 211 | 69.6 | 6.3 | 7 | 19 |
| February | 25.2 | 7.7 | 182 | 108 | 36 | 221 | 48.8 | 5.9 | 10 | 30 |
| March | 24.3 | 7.6 | 160 | 92 | 42 | 240 | 74.8 | 6.4 | 6 | 19 |
| April | 24.8 | 8.9 | 216 | 128 | 18 | 234 | 89.6 | 6.5 | 5 | 17 |
| Aevearge | 27.53 | 7.87 | 392.08 | 229.42 | 51.33 | 180.08 | 97.22 | 5.95 | 8.58 | 26.17 |
| S. D. (±) | 2.75 | 0.47 | 151.77 | 90.03 | 20.17 | 51.15 | 51.29 | 0.95 | 2.47 | 6.18 |

**TEMP=Temperature, EC=Electric conductivity, TDS=Total dissolved solids, SS=Suspended solids, TH= Total hardness, TA= Total alkalinity, DO=Dissolved oxygen, BOD=Biological oxygen demand COD=Chemical oxygen demand**

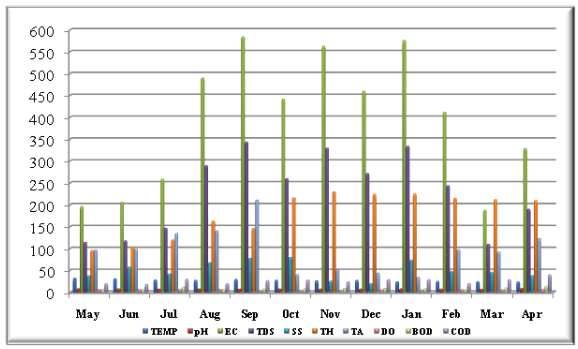



**Figure 2- Monthly variations of physico-chemical parameters of Godavari river water samples collected from Ramkund (2009-10).**

**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 | SS | TH | TA | DO | BOD | COD |
|---|---|---|---|---|---|---|---|---|---|---|
| TEMP | 1.0000 | | | | | | | | | |
| pH | 0.2836 | 1.0000 | | | | | | | | |
| EC | -0.2837 | -0.1911 | 1.0000 | | | | | | | |
| TDS | -0.2795 | -0.1979 | 0.9997 | 1.0000 | | | | | | |
| SS | 0.0823 | 0.0838 | 0.3080 | 0.3059 | 1.0000 | | | | | |
| TH | -0.8415 | -0.3347 | 0.5186 | 0.5211 | -0.1143 | 1.0000 | | | | |
| TA | 0.2973 | 0.0330 | -0.0617 | -0.0589 | 0.2531 | -0.5456 | 1.0000 | | | |
| DO | 0.1211 | 0.3765 | -0.6543 | -0.6524 | -0.4246 | -0.4043 | 0.0680 | 1.0000 | | |
| BOD | -0.4312 | 0.0732 | -0.1816 | -0.194 | -0.3862 | 0.2143 | 0.0777 | 0.0446 | 1.0000 | |
| COD | -0.5675 | 0.1024 | 0.0617 | 0.0505 | -0.1348 | 0.4272 | -0.0088 | -0.1625 | 0.9060 | 1.0000 |

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