WATER QUALITY PARAMETERS OF DHARMAVARAM TANK, ANANTAPURAMU (DIST), AP, INDIA.

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ABSTRACT

Different parameters in Dharmavaram tank, Dharmavaram were estimated from May 2011 to April 2013 to assess the water quality. The different Physico-chemical parameters like Temperature, pH, TDS, conductivity, salinity, dissolved oxygen, turbidity, alkalinity, free carbon dioxide, chloride, total hardness, calcium, magnesium, phosphates, sulphates, silicates, nitrites, nitrates, BOD and COD were carried out by standard methods. These parameters showed either positive or negative correlation between each other. The analysis reveals this parameters are interrelated with each other. From the data we can be said that water of this tank is not a good quality for culture of fish as well as drinking for animals.

Keywords: Dharmavaram tank, Water quality, Physico-chemical Parameters, BOD, COD.

No: of Tables: 2 No: of References: 40
INTRODUCTION

India abounds in water bodies, a preponderance of them are manmade, typical of the tropics. The manmade (artificial) water bodies are generally called Reservoirs, Ponds and Tanks though it is not unusual for some of them to be referred to as lakes. Ponds and tanks are small in size compared to lakes and reservoirs. In general, water bodies that are considered lakes in dry areas would only be considered ponds in regions with abundant water resources where there are more (and large) bodies of water [1]. The word "tank", is defined as a container for storing water. The need for a water tank is as old as civilization, providing storage of water for drinking, irrigation, agriculture, fire suppression, chemical manufacturing, food preparation as well as many other applications [2]. Tank is loosely defined and often used in common parlance to refer to some of the small irrigation reservoirs. Thus, a large number of small man-made lakes are also called tanks in Andhra Pradesh and are thereby excluded from reservoir list. Tanks in Andhra Pradesh are further classified as perennial and long seasonal [3]. Andhra Pradesh has (2937 water bodies) 98 small reservoirs, 2800 Tanks, 32 Medium reservoirs and 7 large reservoirs with total surface area of 4,58,507 hectors. Anantapuramu district has (27 water bodies) 22 tanks and 5 reservoirs with total surface area of 6048 hectors [4]. The tank is regularly used for fishing by the local people besides water is used for washing animals, tractors and cloths. Natural calamities are completed beside the tank and dumping of domestic solid waste. Due to this the water of Dharmavaram tank has become polluted. In India much research has been carried out with regards to assessment of water quality of different tanks some of them are fish pond conservation in Tanjavur [5], Kolong river [6], Bolinj Ram mandirtalao [7]. Selected fresh water ponds in Warangal area [8], Kadamba Tank [9], Urban Pond in thiruvantapuram district [10], Ponds in Athiyanoor panchayat [11], Fish pond of Shahdol [12], Eutrophicated costal lake [13], Lalpur pond [14], Two temple ponds of Karnataka [15], and different pond water of Bilaspur district [16].

The interactions of both the physical and chemical properties of water play a significant role in composition, distribution, abundance, movements and diversity of aquatic organisms [17]. Quality of water generally refers to the component of water which is to be present at the optimum level for suitable growth of plants and animals [18]. Qualitative and quantitative hydrological investigations and monitoring should be done at regular basis to study the current status of the habitat and socio-economic activities to identify possible solutions [19]. In order to assess water quality index, we have carried out the Physico-Chemical analysis of water and to find the relationship between different Physico-Chemical parameters in Dharmavaram tank. There is no information available on this till now.
METHODOLOGY

Study area: The study area is located 40 km from Ananthapuramu and it is 2nd largest tank in Ananthapuramu district. Geographically it is located at 14.43°N, 77.72°E the source of water to this tank is from Chitavathi River. It has an average elevation of 345 meters (1131 feet). It is famous for handloom silk sarees. Dharmavaram town as the second biggest tank in Ananthapuramu district located on Chitravathi river origin at Nandi hills, Karnataka. The storage capacity of this tank is 0.4 TMC. Dharmavaram tank serves as the main source of drinking water and for irrigation.

Sample collection and analysis: Water samples were collected during second week at monthly interval for a period of two consecutive years from May 2011 to April 2013 for the analysis of Physico-chemical parameters. Water samples were collected in acid washed 10 liters polythene containers below the depth of 5-10 centimetres and collection was usually completed during morning hours between 08 AM and 10 AM. Colour and odour of water was noticed and recorded. For each sample Temperature, pH was monitored at the sampling site using mercury thermometer and digital pH meter. Immediately after arrival into the laboratory the conductivity of the water were measured using the help of conductivity meter. All parameters were analyzed by following standard methods. The chemicals used in the present investigations were procured from Merck India. All glass ware used was of corning grade manufactured by Borosil India Ltd. Spectrophotometer used for our research work was ELICO double beam, SL210, UV VIS Spectrophotometer. Systronic Water Analyser 371 used with a micro controller was used for measuring pH, Dissolved oxygen (DO), Conductivity, Total Dissolved Solids (TDS), Salinity and Turbidity in water sample. Six replicates of each sample were analyzed for each parameter. Mean of the six replicates were taken for data analysis.

RESULTS AND DISCUSSION

Temperature: The temperature of water assessed between 23.25±0.273°C (December 2011) and 29.7±0.225°C (May 2013) (Fig. A). Temperature showed significant positive correlation with Conductivity, Turbidity, DO, BOD, COD, Alkalinity, Magnesium, Silicates, Phosphates, Nitrates, Sulphates and showed significant negatively correlation with pH, TDS, Total hardness, Carbon dioxide, Salinity, Chlorides, Calcium, Nitrates (Table 1,2). High temperatures were observed in the month of May due to clear atmosphere, greater solar radiation and low water level [20]. During winter season (December) water temperature was low due to frequent clouds, high humidity, high current velocity and high water level [21, 22].

pH: The pH of water observed in January 2011 was minimum (7.98±0.033) and maximum in and maximum in the month of May 2013 (9.98±0.024)(Fig. B). pH showed positive significant correlation with Conductivity, Carbon dioxide, Salinity, Silicates, Phosphates, Nitrates,
Naik et al.,

Sulphates and negatively correlated with Turbidity, TDS, DO, Alkalinity, Chlorides, Calcium, Magnesium, Nitrites (Table. 1, 2). Maximum pH in the month of May indicate high rate of photosynthesis [23], [24].

**Conductivity:** In this regard the monthly variability in conductivity of water was analysed between 3.686±0.217 mS (November 2011) and 12.5±0.1366 mS (May 2012) (Fig. C). Conductivity showed positive significant relation with Turbidity, TDS, DO, COD, Salinity, Alkalinity, Chlorides, Calcium, Silicates, Phosphates, Nitrites, Sulphates and showed negative significant correlation with Total Hardness, BOD, Carbon dioxide, Magnesium, Nitrites (Table. 1, 2). The electrical conductivity values are high in the month of May due to increased in the concentration of salts, because of evaporation [25], the dilution resulted from precipitation brings down its values in the month of November [26].

**Turbidity:** Turbidity of water noticed between 3.57±0.47 NTU (November 2011) and 13.16±0.8164 NTU (May 2012) (Fig. D). Turbidity showed positive significant correlation with TDS, Total hardness, DO, COD, Carbon dioxide, Alkalinity, Magnesium, Nitrites, Sulphates and showed negative significant correlation with BOD, Salinity, Chlorides, Calcium, Silicates, Phosphates, and Nitrites (Table. 1, 2). The high turbidity during summer season (May) might be responsible for the higher water temperature because suspended particles absorb heat from the sunlight making the water warm [27]. Settlement of slit, clay resulting low turbidity in (November) winter season [28].

**Total Dissolved Solids (TDS):** In 2011-12 year personal observation shows Total Dissolved Solids (TDS) of water analyzed between 1848±30.90 ppm (January 2012) and 4359.66±26.36 ppm (March 2012) (Fig. E). TDS showed positive significant correlation with BOD, COD, Carbon dioxide, Salinity, Alkalinity, Chlorides, Calcium, Magnesium and showed negative significant correlation with Total hardness, DO, Silicates, Phosphates, Nitrates, Nitrites, and Sulphates (Table. 1, 2). Seasonal variations showed maximum values in summer (March) due to evaporation of water and low level of water and minimum during the winter season (January) settlement of particles in the sediment [26], [29].

**Total Hardness (TH):** Our analysis showed the Total hardness of water was minimum in September 2011 (330.46±11.09 mg/L) and maximum in May 2012 (510.11±9.75 mg/L) (Fig. F). Total hardness showed positive significant correlation with DO, BOD, Carbon dioxide, Salinity, Alkalinity, Chlorides, Calcium, Magnesium, Phosphates, Nitrites, and showed negative significant correlation with COD, Silicates, Nitrates and Sulphates (Table. 1, 2). Total hardness of water bodies may be high during the summer season (May) which may be became higher temperature causes evaporation of water decrease in volume of water increase the concentration of salts and also due regular addition of large quantities of sewage and detergents into water bodies from the nearby residential localities and minimum in September is...
due dilution of concentration of salts with influx of rain water [29], [30].

**Dissolved Oxygen (DO):** Analysis of Dissolved Oxygen (DO) of water in this study was minimum (6.33±0.016 ppm) in May 2011 and maximum (9.041±3.4739 ppm) in January 2012 (Fig. G). Dissolved oxygen (DO) showed positive significant correlation with COD, Carbon dioxide, Salinity, Calcium, Magnesium, Nitrites, Sulphates and showed negative significant correlation with BOD, Alkalinity, Chlorides, Silicates, Phosphates, and Nitrites(Table. 1,2). The maximum DO in January might be due to low atmospheric temperature and intensive photosynthetic activity(31). The minimum DO was observed during summer months might be due to high metabolic rate of organisms [21], [32].

**Biochemical Oxygen Demand (BOD):** Monthly variation of Biological Oxygen Demand (BOD) of water was recorded low in May 2011 (6.33±1.032 mg/L) and high in March 2013 (10.64±0.02 mg/L)(Fig. H). BOD showed positive significant correlation with Salinity, Calcium, Silicates and BOD showed negative significant correlation with COD, Carbon dioxide, Alkalinity, Chlorides, Magnesium, Phosphates, Nitrites, Sulphates (Table. 1,2). The maximum BOD values are noticed in May where as maximum was observed in the month of March because of input organic wastes and enhanced bacterial activity [29], [33].

**Chemical Oxygen Demand (COD):** Assessment of COD value of water ranged between 275.1±11.40 mg/L (November 2011) and 508.68±5.045 mg/L (April 2013) (Fig. I). COD showed positive significant correlation with Carbon dioxide, Salinity, Alkalinity, Phosphates, and Nitrites COD showed negative significant correlation with Chlorides, Calcium, Silicates, Nitrites and Sulphates (Table. 1,2). The higher values are due to higher decomposition activities and low level of water in April. However, minimum COD are due to low temperature, low decomposition activities and dilution effect in November [30], [34].

**Free Carbon dioxide (Free CO₂):** Results of the concentration of Free Carbon dioxide of water in the present study between 2.88±0.040 mg/L (July 2011) and 7.7±1.204 mg/L (May 2012) (Fig. J). Free Carbon dioxide showed positive significant correlation with Salinity, Alkalinity, Calcium, Magnesium, Nitrites and it showed negative significant correlation with Chlorides, Silicates, Phosphates, Nitrites and Sulphates (Table. 1, 2). The fluctuations in free carbon dioxide values correspond directly with standing crop of phytoplankton increases in May, the free CO₂ lower because of greater utilization of free CO₂ for photosynthetic activity in July [35].

**Salinity:** The seasonal fluctuation in the Salinity values ranged from 2658.6±25.59 ppm (November 2011) and 6586.6±210.8 ppm (March 2013) (Fig. K). Salinity showed significant positive correlation with Calcium, Nitrites, Nitrites and it showed negative significant correlation with Alkalinity, Chlorides, Magnesium, Silicates, Phosphates and Sulphates (Table. 1, 2). The differences in the salinity are attributed to the increase in the
evaporation rate in the month of March [36].

**Alkalinity:** Measurement of the Alkalinity of water during 2011-12 fluctuated between 25.03±1.67 mg/L (October 2011) and 67.25±1.767 mg/L (February 2012) [Fig. L]. Alkalinity showed positive significant correlation with Chlorides, Calcium, Magnesium, Nitrites and showed negative significant correlation with Silicates, Phosphates, Nitrates and Sulphates (Table. 1,2). The increased alkalinity during winter (February) was due to concentration of nutrients in water, water level decreases result the death of decay of plants and living organisms [37].

**Chlorides:** The seasonal variation in the Chloride content of the water was a low level of 77.34±1.298 mg/L in October 2011 and high level of 100.67±0.98 mg/L in May 2012 (Fig. M). Chlorides showed positive significant correlation with Magnesium, Phosphates, Nitrates, Nitrites and Sulphates and showed negative significant correlation with Calcium, Silicates (Table. 1,2). Concentration of higher chlorides in May could be due to sewage mixing and increased temperature and evaporation of water [21].

**Calcium (Ca):** Determination of the seasonal variability in the Calcium content of water was lowest in November 2012 (70.32±0.08 mg/L) and highest in May 2012 (90.71±0.34 mg/L) (Fig. N). Calcium showed positive significant correlation with Phosphates, Nitrites and negative significant correlation with Magnesium, Silicates, Nitrates and Sulphates (Table. 1, 2). The high values of Ca and Mg in water bodies may be due to addition of lime and pesticides in an objective for better production [38].

**Magnesium (Mg):** Range of Magnesium of water between 36.39± 1.0488 mg/L (November 2011) and 74.89±2.42 mg/L (May 2012) (Fig. O). Magnesium showed positive significant correlation with Silicates, Nitrates, Nitrites, Sulphates and showed negative significant correlation with Phosphates (Table. 1,2). The permissible limit of Mg content for drinking water is 50 mg/L, maximum limit is 150 mg/l [39].

**Silicates:** The seasonal fluctuation in the Silicate concentration of water was between 0.376±0.005 ppm (January 2013) and 0.788±0.007 ppm (May 2012) (Fig. P). Silicates showed positive significant correlation with Phosphates, Sulphates and showed negative significant correlation with Nitrates, Nitrites (Table. 1, 2). In the support of this similar trend was noticed that the average value of silicate ranged from 0.2 to 0.75 ppm in pond water of Thiruchunapalli [40].

**Phosphates:** Phosphate value obtained in this study ranged between 0.135±0.011 ppm (April 2012) and 0.769±0.008 ppm (June 2012) (Fig. Q). Phosphates showed positive significant correlation with Nitrites, Sulphates and showed negative significant correlation with Nitrates (Table. 1, 2). The high values of phosphate are mainly due to rain, surface water runoff, agriculture runoff, washer man activity, leaching of phosphate fertilizer in the month of June [37], [40].
Nitrates: Fluctuation of the seasonal variability in the Nitrate concentration in this study was as low as 0.344±0.002 ppm in March 2012 and as high as 0.905±0.10 ppm July 2012(Fig. R). Nitrates do not show positive significant correlation, and negative significant correlation with Nitrites, Sulphates (Table. 1,2). Higher values are due to surface runoff and domestic sewage and specially washing activities [41].

Nitrites: Monthly variation of Nitrites content of water in the present study ranged between 0.127±0.003 ppm (July 2012) and 1.597±0.255 ppm (April 2013) (Fig. S). Nitrites showed negative significant correlation with Sulphates (Table. 1,2). Similar trend of nitrites in respective months was also noticed earlier by researchers who measured nitrites in fish pond water bodies [41].

Sulphates: Sulphate content of water was minimum in February 2013 (0.02±0.01 ppm) and maximum in August 2012 (0.74±0.00 ppm) (Fig. T). Agriculture increases after rains in July and more fertilizers are used for increasing productivity. Hence during August Sulphate concentration in water body could have increased as a result of runoff water having relatively large quantities of organic and mineral sulphur compounds [42].

CONCLUSION

Dharmavaram Tank water was polluted by effluents coming from runoff through the drainage and dyes released from silk industries, fishing, cleaning vehicles, washing clothes etc. So the physic-chemical parameters were beyond the permissible limits which may cause harmful effects on cultured fish. Consuming this water by animals and using this water for agriculture may drastically affect the Agricultural produce.

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Table 1: Average correlation values of Dharmavaram tank during 2011-2012
Table 2: Average correlation values of Dharmavaram tank during 2012-2013

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<td>0.232</td>
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<td>-0.13</td>
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Table 5.5. Average Correlation values of Samples collected from Dharmavaram Tank during 2011-12
Variation in Temperature (A), pH (B), Conductivity (C), Turbidity (D), TDS (E), TH (F), DO (G), BOD (H), COD (I), Co₂ (J), Salinity (K), Alkalinity (L), Chlorides (M), Calcium (N), Magnesium (O), Silicates (P), Phosphates (Q), Nitrates (R), Nitrites (S) and Sulphates (T) water samples collected from Dharmavaram tank during 2011-2013.