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STUDIES ON SURFACE WATER QUALITY EVALUATION OF GOWRIKERE TANK, ANANDAPURA, SAGARA, SHIVAMOGGA, KARNATAKA, INDIA

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ABSTRACT
Studies were carried out to assess the water quality of Gowrikere tank at Anandapura village of Shivamogga district of Karnataka. The physico-chemical parameters of the Gowrikere tank were carried out during January to December 2013. The physico-chemical characteristics of tank have direct impact on prevailing organisms as well as human being using such water. The normal ranges of physico-chemical properties indicate the good water quality. The estimated water quality parameters were compared with the standard values prescribed by the Bureau of India Standards (BIS) and World Health Organization (WHO). The study revealed that water is polluted as it possesses high BOD and CO_2. Hence preventive measures are required to avoid further deterioration of the tank water quality.

KEYWORDS: Gowrikere tank, physico-chemical parameters, Shivamogga

INTRODUCTION

Water is one of the abundantly available substances in nature, which man has exploited more than any other resources for the sustenance of life (Shinde et al., 2011). Environmental pollution is a modern day evil affecting all ecosystems including aquatic ecosystems (Mahesh Anand Goudar and Sayeswara, 2011). Unplanned urbanization, rapid industrial and indiscriminate use of artificial chemicals in agriculture causing heavy and varied pollution in aquatic environment leading to deterioration of water quality and depletion of aquatic fauna (Yeole and Patil, 2005). Physico-chemical parameters play a vital role in determining the distributional pattern and qualitative abundance of organisms inhabiting a particular aquatic ecosystem. Fresh water has become a scarce commodity due to over exploitation and its necessities have led to the deterioration of surface and subsurface water. In the present investigation, an attempt has been made assess the quality and suitability of water for human consumption and domestic purposes.

MATERIALS & METHODS

Study area

Gowrikere tank (Anandapura village) is perennial water body situated at about 16 km away from the Sagara town, located between 14º 4' N latitude and 75º 38' E longitude. This is medium sized tank, with total water spread of 27.79 hectare, where rain is the main source of water. The river basin of the tank is Krishna. The water has undergone moderate changes in the physico-chemical properties due to overflowing of water from adjacent fields and other excessive human activities. The water is used for agricultural purpose and domestic activities.

Sampling techniques

Water samples were collected in precleaned polyethylene bottles between 8 to 10 am once a month. For dissolved oxygen the samples were fixed on the spot using Wrinkler's reagents.

Analysis techniques

The hydochemical parameters such as temperature and pH were measured on the site. The rest of the parameters like dissolved oxygen, biological oxygen demand, free CO_2, total alkalinity, total hardness, total dissolved solids, nitrates, phosphates, silicates and sulphates were analyzed in the laboratory, following APHA (2005).

RESULTS & DISCUSSION

The results of physico-chemical parameters are depicted in Figures 1-12. The salient features of the findings are summarized below.

Temperature

The water temperature is largely influenced by factors such as altitude, season, time and depth. It plays an important role in either decreasing or increasing the concentration of certain chemical characteristics, largely influenced by local climatic conditions. Values of temperature ranged from 20.9 to 28.1 ºC. The minimum value was recorded in March and maximum in September.

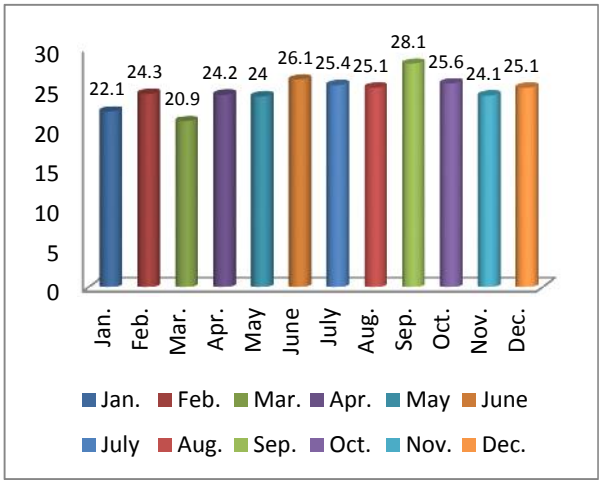


FIGURE 1: Monthly variation of temperature

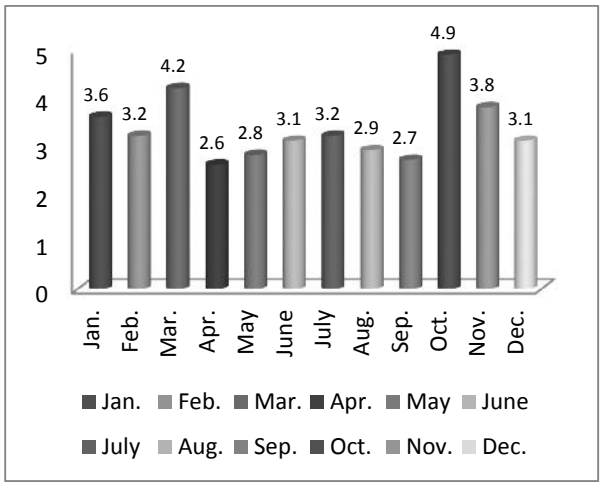


FIGURE 2: Monthly variation of pH

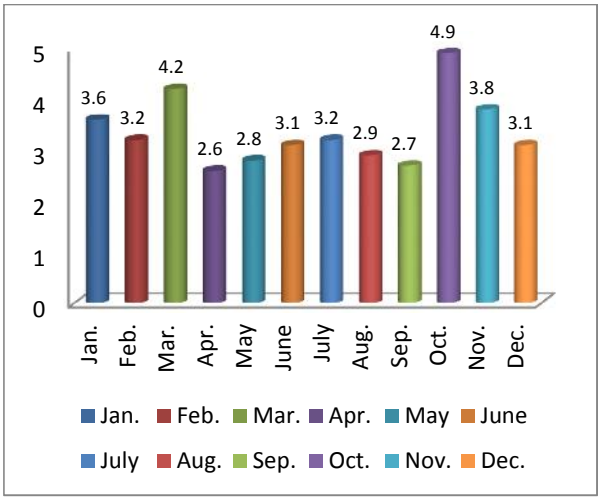


FIGURE 3: Monthly variation of Dissolved oxygen

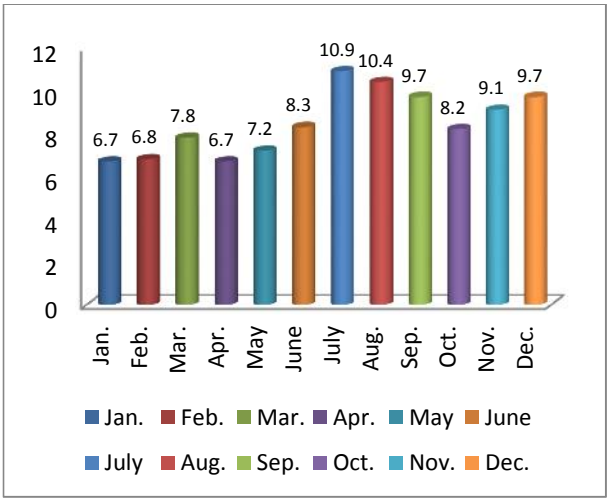


FIGURE 4: Monthly variation of Biological oxygen demand

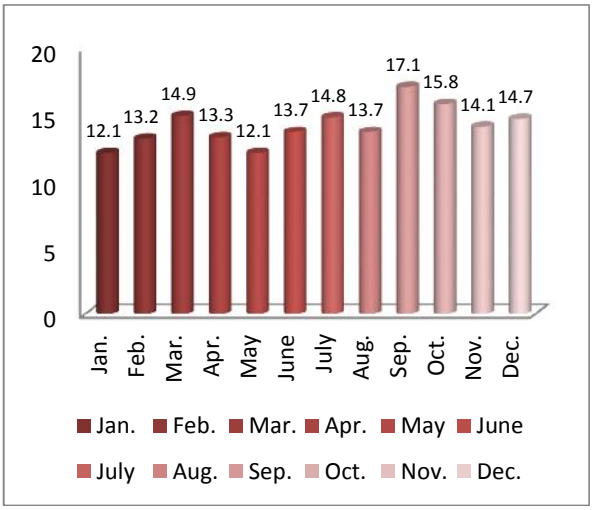


FIGURE 5: Monthly variation of Carbon dioxide

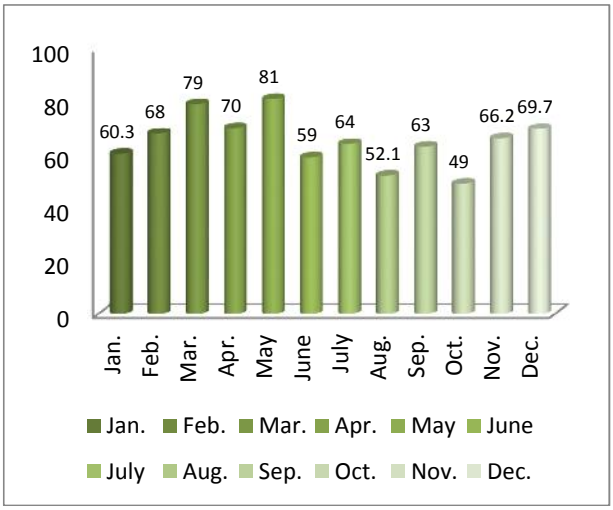


FIGURE 6: Monthly variation of Total alkalinity

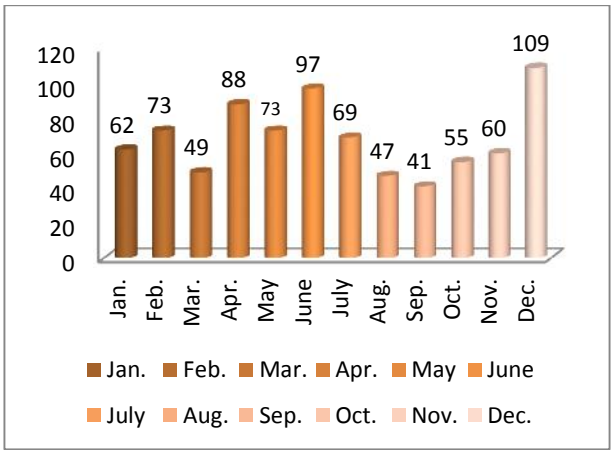
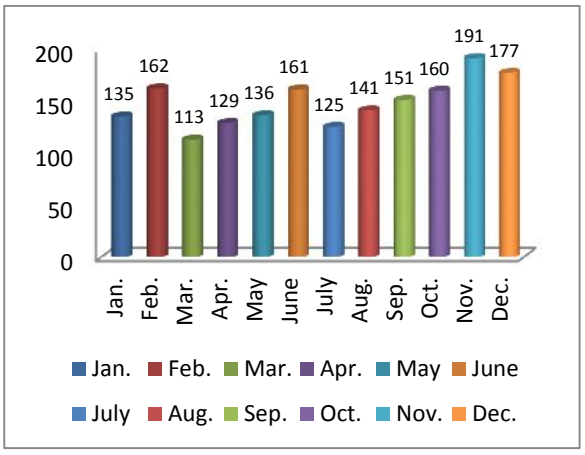


FIGURE 7: Monthly variation of Total hardness



FIHURE 8: Monthly variation of Total dissolved solids

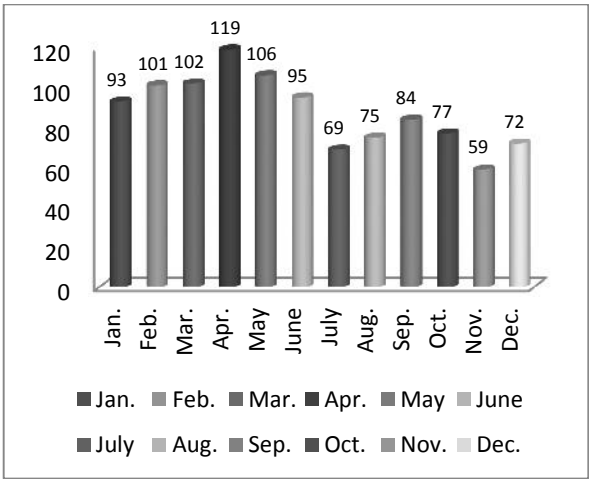


FIGURE 9: Monthly variation of Chloride

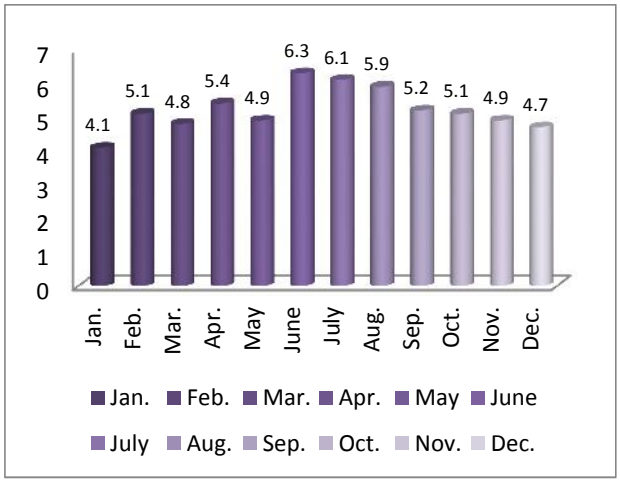


FIGURE 10: Monthly variation of Nitrates

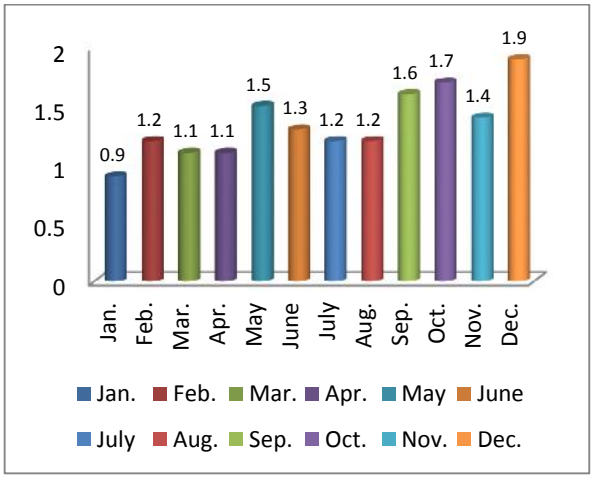


FIGURE 11: Monthly variation of Phosphates

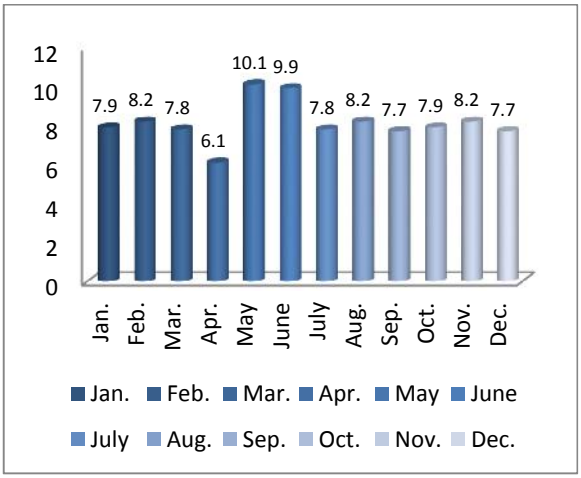


FIGURE 12: Monthly variation of Sulphates

Hydrogen ion concentration (pH)

The acidity or alkalinity of water is measured in terms of its pH or hydrogen ion concentration. pH is the negative logarithm of hydrogen ion concentration. Neutral water has the pH value of 7.0. If the pH value is less than 7.0, the water is acidic. Similarly, the water is alkaline, if the pH value is more than 7.0. The pH of water is slightly acidic to slightly alkaline and found with permissible limit of 6.5 to 8.5 as per the Bureau of Indian Standards (BIS). The values of pH ranged from 6.5 to 7.8. The minimum value was recorded in January and maximum in September. The pH is an important parameter in water

body since aquatic organisms are well adapted to specific pH range and do not withstand abrupt changes in it (George, 1997).

Dissolved oxygen

Dissolved oxygen is another vital parameter that determines the quality of water and inturn regulates the distribution of aquatic organisms. In the present investigation the DO level fluctuated between 2.6 to 4.9 mg/l. The highest and lowest values were recorded in October and April respectively. The variations of DO depend on the primary production and respiration of aquatic organisms.

Biological oxygen demand (BOD)

BOD is the amount oxygen required to carry out the biological decomposition of dissolved solids in sewage under aerobic conditions at standard temperature. BOD and other microbial activities generally increase by the introduction of sewage (Hynes, 1971). The values ranged from 6.8 to 10.9 mg/l. The highest and lowest values were recorded in July and February, respectively. They were found above the permissible limit of 6.5 mg/l as per WHO (1991).

Carbon dioxide

Free carbon dioxide is added to the aquatic system by directly being mixed from atmosphere. The decomposition of organic matter from aquatic ecosystem also adds carbon dioxide to the tank. The absence of free carbon dioxide indicates the total utilization for photosynthetic activities. CO_2 values ranged from 12.1 mg/l (May) to 17.1 mg/l (September). The variation of carbon dioxide was due to the absorption by plants for photosynthesis and activity f other living organisms (Sayeswara et al., 2012).

Total alkalinity (TA)

Alkalinity of surface water is primarily a function of carbonate, bicarbonate and hydroxide content. Alkalinity is measure. Total alkalinity is a measure of capacity of water to neutralize a strong acid. In the present study, total alkalinity values fluctuated between 49 mg/l (October) to 81 mg/l (May). Surface alkalinity may result from the discharge of domestic wastes.

Total hardness (TH)

Total hardness of water is not a pollution parameter but indicates water quality mainly in terms of Ca^{++} and Mg^{++} ions. Ca^{++} and Mg^{++} are the most abundant elements in natural surface and ground water and exist mainly as carbonates and bicarbonates. They also act as buffers regulating the pH of the medium. The values of hardness ranged from 47 mg/l (August) to 109 mg/l (December). Total hardness above 200 m g/l is not suitable for domestic use like drinking and cleaning.

Total dissolved solids (TDS)

Dissolved solids of the water are termed as Total dissolved solids. A large number of salts are found dissolved in natural water. High values of TDS and sulphates in drinking water are generally not harmful to human beings but high concentration of these may affect persons, who may suffer from kidney and heart diseases (Gupta et al., 2004). TDS ranged from 113 mg/l (March) to 191 mg/l (November). The minimum value may be due to the stagnant condition of the water body. The values are with permissible limits of 1500 mg/l (BIS, 1982).

Chloride

Chloride anion is generally present in natural water. Chlorides as chloride ions are major anions in waste water. The chloride concentration is higher in organic wastes and its higher level in natural water is indication of pollution from domestic sewage. The ecological significance of chloride lies in its potential to regulate salinity of water and exert consequent osmotic stress on biotic communities. The values of Chloride ranged in between 59 to 119 mg/l, being maximum in April and minimum in November. Chlorides increase the degree of eutrophication.

Nitrates

Nitrate is the most highly oxidized form of nitrogen compounds commonly present in natural water, because it is product of aerobic decomposition of nitrogenous matter. Significant sources of nitrates are fertilizers, decayed vegetables and animal matter. Unpolluted natural water contains very small quantity of nitrates. The nitrates values ranged between 4.1 to 6.3 mg/l. The highest and lowest values were recorded in June and January, respectively.

Phosphates

Phosphorus is a nutrient for plant growth and a fundamental element in the metabolic reaction of plants and animals. Phosphorus occurs in natural water as various types of phosphates. The most important sources of phosphates are the discharge of domestic sewage, detergents and agricultural runoff (Trivedy and Goel, 1984). Values of phosphates ranged from 0.9 to 1.9 mg/l with the minimum value in January and maximum in December.

Sulphates

Sulphate is present in fertilizers; they also come from agricultural runoff water, which contains relatively large quantity of organic and mineral sulphur compounds. The supply of sulphate ions in surface water under natural conditions are due to the reaction of water with sulphate congaing rocks and with the biochemical and partly chemical oxidation of sulphides and other compounds of sulphur (Shinde et al., 2011). Sulphate values fluctuated between 6.1 mg/l (April) to 10.1 mg/l (May).

CONCLUSION

Many studies have been done in our country to assess the quality of tank water but very few of them have studied the assessment of physico-chemical parameters of tanks receiving domestic waste. In general, such characteristics are largely affected by human activities and influx of domestic waste in tank water, which cause a greater degree of eutrophication. The results of physico-chemical analysis have revealed that the Gowrikere tank is highly contaminated due to human disturbances, influx of domestic waste and agricultural run-off from the adjacent area of tank. In the light of standard of water quality recommended by WHO, the tank water should not be used by human beings especially for drinking and cooking. It is recommended that the domestic wastes as to be properly treated before discharged in the tank. Anthropogenic activities should be prevented by organizing awareness programs. Proper scientific planning is needed to use this tank water effectively.

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