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ASSESSMENT OF TANK WATER QUALITY IN RELATION TO SOME PHYSICO-CHEMICAL PARAMETERS - A CASE STUDY IN CHORADI TANK OF SHIVAMOGGA, KARNATAKA, INDIA

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ABSTRACT

Study was carried out in Choradi tank near Choradi village of the Shivamogga district on physico-chemical characteristics for a period of twelve months from January to December 2007. Comparison of physico-chemical parameters values observed was made with the standards prescribed by the Bureau of India Standards (BIS) and World Health Organization (WHO). The study revealed that, tank water is not polluted. In the light of standard of water quality recommended by WHO, the tank water can be easily used for drinking and cooking purpose after proper treatment.

KEY WORDS: **Choradi tank, Physico-chemical parameters, Shivamogga**

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INTRODUCTION

India is the single most vital component of the earth that make possible for life to originate, evolve, flourish and reach the present form that we have today [1]. The earth is called as a wet planet as two third of it is occupied by water. About 99.7% of water found on earth is in the oceans, while it is not available for human consumption. Rest of the 0.3% is fresh water. Fresh water has become a scarce commodity due to over exploitation and its necessities have led to the deterioration of surface and subsurface water. The causative factors for the pollution of water are industries, agriculture and domestic activities[2]. Due to over expanding population and industrial settlements, the demand for fresh water is increasing day by day . Further, rapid industrialization, unplanned urbanization and extensive use of artificial chemicals have led to varied extent of pollution in aquatic environments leading to deterioration of water quality and depletion of aquatic fauna. Physico-chemical parameters play a vital role in determining the distributional pattern and quantitative abundance of organisms inhabiting a particular aquatic ecosystem[3]. Several investigators have studied the physico-chemical dynamics of varied lentic water bodies with the intent to assess the water quality [4,5,6,7,8,9,10,11,12,13,14]. The basis of selection of Choradi tank was that its water is used by a large population which receives periodic flooding from the plains. In the present investigation, an attempt has been made to assess the suitability of water for human consumption and domestic purposes.

MATERIALS AND METHODS

Study area

Choradi tank is an annual water body receiving water from the adjacent paddy fields and rain is the main source of water. The river basin of the tank is Krishna. The total area of Choradi tank is about 26 acres of which water spreads over an area of 15 acres with an average depth of 8-10 feet. It is located at Choradi village, 44 km away from Shivamogga town. The water is used for domestic purposes like washing of clothes, vehicles and for domestic animals, etc. The water has undergone moderate changes in its physico-chemical properties due to ecological degradation, overflowing of water from adjacent paddy fields and other excessive human activities.

Sampling techniques

Water was sampled on a monthly basis, between 7 to 9 am from January to December 2007. This water samples were collected in good quality polythene bottles.

Analysis techniques

Water temperature was recorded at the sampling site itself. Dissolved oxygen was fixed on the spot itself in BOD bottles. Various parameters like turbidity, total hardness, sulphate, free CO_2, alkalinity, BOD, TDS, phosphate, nitrate and chloride were estimated as per the standard methods[15].

RESULTS AND DISCUSSION

The results of seasonal variation of physico-chemical parameters of Choradi tank are given in Table 1 and Figures 1-3. Salient features of the findings are summarized below with permissible and excessive limits prescribed by [16,17] in Table 2 for comparison.

Water Temperature

Water temperature is very important parameter, because it influences the biota in a water body by affecting activities such as behavior, respiration and metabolism. The seasonal water temperature ranged from 21.9 to 25.8^{o}C. The minimum value was recorded in February and maximum in April. Turbidity is a measure of cloudiness of water.

Table 1
Physico-chemical characteristics of Choradi tank water.

Parameters	Months:2007											
	Jan.	Feb.	Mar.	Apr.	May	Jun.	July	Aug.	Sep.	Oct.	Nov.	Dec.
Temperature	22.9	21.9	24.8	25.8	25.1	24.3	22.1	22.6	23.6	22.1	23.8	20.9
Turbidity	11.3	11.9	13.3	12.8	21.8	49.4	67.5	42.9	33.9	29.6	17.1	15.5
pH	6.4	6.3	6.7	7.2	7.3	6.9	6.9	7.1	7.4	7.1	7.1	7.3
DO	6.1	6.5	7.1	8.1	7.9	7.2	6.3	7.5	6.6	6.9	7.1	6.8
BOD	0.7	1.1	1.2	0.6	0.8	1.0	1.1	0.9	0.7	0.9	1.1	0.9
CO_2	4.9	5.3	2.7	2.8	5.3	5.1	3.1	6.1	6.4	5.3	6.2	3.3
Alkalinity	24	32	38	29	35	41	37	39	29	31	32	33
TDS	31.2	30.5	30.1	41.3	21.7	30.2	31.1	32.7	31.8	35.3	32.4	36.7
TH	54	32	45	44	43	33	41	42	38	29	42	47
Chloride	22.3	20.2	19.2	11.4	12.7	21.7	15.3	21.1	22.2	18.2	19.1	22.7
Phosphate	0.053	0.071	0.072	0.058	0.082	0.087	0.093	0.087	0.067	0.061	0.059	0.073
Nitrate	0.9	1.1	0.84	0.7	1.2	0.82	0.91	0.097	0.81	0.95	0.81	0.76
Sulphate	3.1	2.5	3.9	4.4	3.2	4.3	4.9	4.1	4.2	4.4	3.3	4.3

All values are expressed in mg/l except pH, temperature (^{o}C) and turbidity (NTU)

Table 2
Permissible and excessive limits prescribed by BIS and WHO

Sl. No.	Parameters	BIS (1993)		WHO (1991)	
		P	E	P	E
01	Temperature	-	-	-	-
02	Turbidity	5	25	-	-
03	pH	6.5	9.2	6.5	8.5
04	Dissolve oxygen	-	-	-	-
05	Biological oxygen demand	6.5	-	6.5	-
06	Carbon dioxide	-	-	-	-
07	Total alkalinity	200	600	-	-
08	Total dissolved solids	500	1000	300	600
09	Total hardness	300	600	-	-
10	Chloride	250	1000	200	600
11	Phosphate	-	-	-	-
12	Nitrate	45	45	-	45
13	Sulphate	200	400	200	400

All values are expressed in mg/L except pH and turbidity (NTU).
P- Permissible limit, E- Excessive limit.

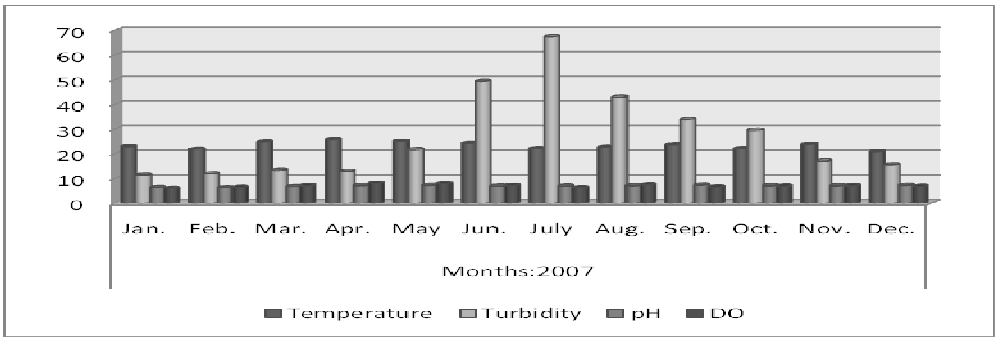

Figure 1
Monthly variation of temperature, turbidity, pH and DO

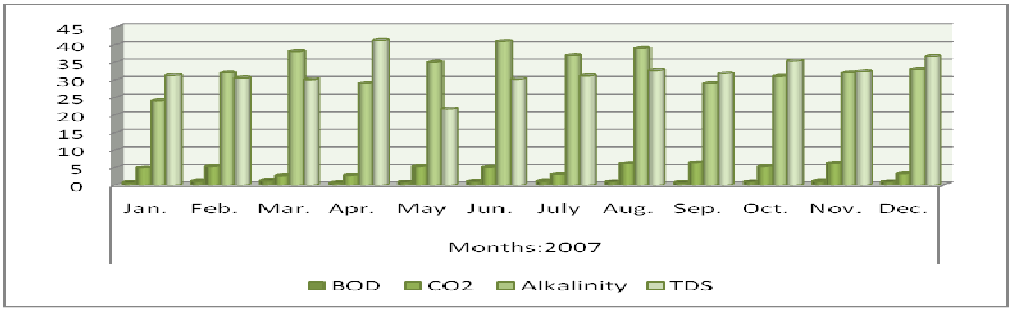

Figure 2
Monthly variation of BOD, CO_2, Alkalinity and TDS

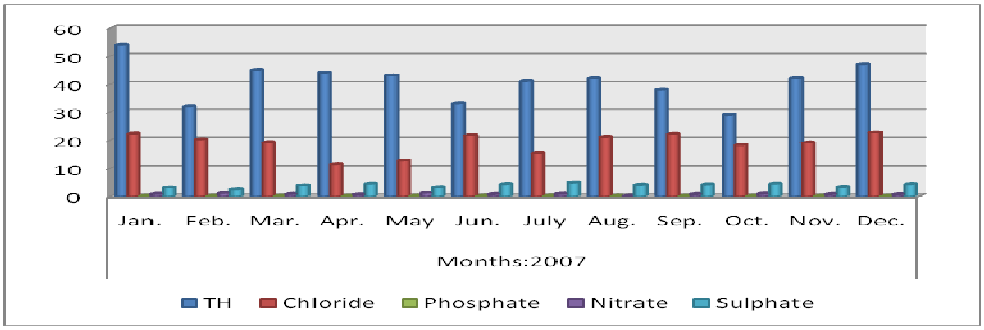

Figure 3
Monthly variation of TH, Chloride, Phosphate, Nitrate and Sulphate

Turbidity
Suspension of particles in water interfering with the passage of light is called turbidity. Turbidity is due to nature of suspended matter viz., size, from colloidal to coarse dispersion and from pure inorganic substances to those that are highly organic in nature. The values of turbidity ranged from 11.3 to 49.4 NTU. The highest and the lowest values were recorded in June and January, respectively.

pH
pH is the negative logarithm of hydrogen ion concentration. pH values are slightly acidic to slightly alkaline and found within permissible limit of 6.3 to 7.4 as per the Bureau of Indian Standards [16]. The minimum value was observed during February (6.3) and maximum during September (7.4). The pH is important since aquatic organisms are well adapted to specific pH range and do not withstand abrupt changes in it.

Dissolved oxygen
Dissolved oxygen is an important aquatic parameter, whose presence is vital to aquatic fauna. In the present study the DO level fluctuated between 6.1 to 8.1 mg/L. The highest and the lowest values were recorded in April and January, respectively. The variations of DO depend on the primary production and respiration of aquatic organisms. The permissible standard of DO is above 5mg/L [18].

Biological Oxygen Demand
BOD is an important parameter to oxygen required for degradation of organic matter[19]. In the present study BOD values ranged between 0.6 to 1.2mg/L. The minimum value was noticed in the month of April while maximum in March. They were found above the permissible limit of 6.5mg/L [17].

Carbon dioxide
Free carbon dioxide values fluctuated between 2.7 to 6.4 mg/L. The highest and the lowest values were recorded in September and March, respectively. The variation of CO_2 was due to the absorption by plants for photosynthesis and activity of other living organisms.

Alkalinity

Alkalinity of surface water is determined by carbonate, bicarbonate and hydroxide content. In the present study total alkalinity ranged from 24 mg/L (January) to 41mg/L (June). It is within permissible limit of 600mg/L[16]. Surface alkalinity may result from the discharge of domestic wastes.

Total Dissolved Solids

TDS values ranged from 30.1 to 41.3 mg/L, the minimum was recorded in March and maximum in April. The minimum value may be due to the stagnant condition of the water body. The values are within permissible limits of 1500 mg/L [16.]

Total Hardness

Hardness is due to concentration of alkaline earth metals. Total hardness of water is not a pollution parameter but indicates water quality mainly in terms of Ca^{2+} and Mg^{2+} contents. Total hardness values observed are 31 to 44 mg/L. The minimum value was recorded in February and maximum in April.

Chloride

Chloride anion is generally present in natural waters. The chloride concentration is higher in organic wastes and its higher level in natural water is definite indication of pollution from domestic sewage[20]. In the present study, chloride values fluctuated between 11.4mg/L (April) to 22.7 mg/L (December). High chloride content indicates the deterioration of water quality usually linked with sewage load[21]. The most important sources of chlorides in the fresh water are the discharge of domestic sewage and farm drainage. The concentration of chlorides is thus the indicator of pollution.

Phosphate

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. Values of phosphates ranged from 0.053 to 0.093 mg/L with the minimum value in January and maximum in July.

Nitrates

Nitrate is the most highly oxidized form of nitrogen compounds commonly present in natural waters, because it is a product of aerobic decomposition of organic nitrogenous matter. In the present study, nitrate values ranged from 3.7 to 7.8mg/L. The minimum value of nitrate was noticed in the month of April while maximum in February.

Sulphate

Use of fertilizers having sulphate content contribute to water pollution by increasing sulphate concentration in water body. The values fluctuated between 2.5 to 4.9 mg/L. The minimum value was recorded in July and maximum is January.

CONCLUSION

The study revealed that there were variations in certain physico-chemical properties of Choradi tank in Choradi village of Shivamogga district due to the surface run-off and other human activities. The results were compared with standard values prescribed by the Bureau of Indian Standards (BIS) and World Health Organization (WHO). Except turbidity, all other physico-chemical characteristics were found within permissible limits. Therefore, the present investigation based on scientific methodology clearly shows that the said study tank water can be easily used for drinking and cooking purpose after proper treatment.

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