

Water Quality Assessment of Kangrali Water Body of Belagavi

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ABSTRACT: Water is a main natural resource, a basic need for life. Pollution of water bodies is one of the areas of major concern to the environmentalists. Water quality is an index of health of the organisms. Due to overpopulation almost all the water bodies are completely changing into residential areas.. In the present study attempt has been made to know the water quality. Water samples were collected and brought to the laboratory for analysis. Concentrations of investigated parameters were within the permissible limits, but chloride values were more in the summer is due to the anthropogenic activities such as washing animals, washing vehicles, bathing, etc. It is also observed that most of the houses are having pit latrines that may be the cause for slight increase in the chloride values.

KEYWORDS: Kangrali, Physico-chemical parameters, water quality, correlation, water assessment.

I. INTRODUCTION

Water is one of the three major components of the environment, there exists a close linkage between the quality of water and the environment which bears an almost importance for ecosystem. Natural bodies of water are not absolutely pure as various organic compounds and inorganic elements remain in dissolve form. The physical and chemical quality of water vary according to the basin depth, shape size, penetration of light, temperature, pH and nature of soil etc. The quality of drinking water is of vital concern for human health and life. Fresh water supply provides water for domestic use for population. Water resources are critical importance to both natural ecosystem and human development. It is essential for domestic purposes for cleaning, cooking bathing and in agriculture for irrigation, power generation fisheries etc. Acquiring potable water is day to day struggle for most of the people, Indian water bodies are being progressively degraded. Water quality of a system is influenced by both natural and anthropogenic effects which include local climate, irrigation practices, planned water management etc. A healthy lake or pond or water body could conserve natural and social balance by contributing healthy environment of its location.

In the present scenario urban lakes/ponds are under direct threat of qualitative and quantitative degradation by means of pollution. Anthropogenic activities such as domestic sewage, run off from agricultural land, laundering increases pollution load and alters physico-chemical properties. Variation in these properties influence the distribution and richness of the aquatic organisms.

In the last few decades, there has been a growing necessity for conservation our sources. Assessment of water quality is based on the physico-chemical parameters. The healthy aquatic system supports a varied and rich community of organisms [1]. City planners were very much aware about the fact that lakes can improve the life quality of human civilization [2]. Thus they have usually constructed big lakes in almost all developed cities for great many purposes such as drinking water source, bathing and cleaning, agricultural irrigation, fishery, sustainable use for industry, boosting of natural ground water level, aesthetic value and many other livelihood. A healthy lake eco-system could conserve natural and social balance by contributing healthy environment of its location. Nowadays naturally existing dynamic equilibrium of water bodies like rivers, lakes and estuaries are affected by the human activities[3,4&5].

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Several researchers made investigations on water resources and usefulness for various purposes. The hydrobiological studies on the fresh water bodies located in Tamil Nadu [6], Kerala [7], Madhya Pradesh [8], Karnataka [9 & 10] North West [11].

II. MATERIALS AND METHODS

The observation of water quality parameters of Kangrali was made between August 2007 and July 2008. Kangrali water body is situated 5 Kms away from the west of the Belagavi city and lies in between $15^{\circ}52'$ North latitude and $74^{\circ}29'$ East longitude at about 747 meters above the sea level. The main source of water is rain and surface drainage. The water body having a small surface area of 3 hectare and the maximum depth is about 4 to 5 meters. Four sites were selected for collection of water samples, they are 4 around water body.

Samples were collected in 2 litre PVC containers and were analyzed for the 3304 physico-chemical parameters. For the analysis of physico-chemical factors the surface water was collected from fixed spots of the tank every month between 6 am to 8 am for a period of one year. Physical parameter such as temperature and pH were analyzed at site by thermometer and broad range pH paper. Chemical parameters such as total hardness, chloride, TDS, sulphate, DO, BOD Na, K and iron were analyzed in the laboratory by following procedures of standard methods. DO by using Winkler's azide modified method, total hardness by EDTA titrimetric method, sodium and potassium by flame photometric method, chloride by using argentometric method. The results were evaluated in accordance with the standards prescribed under Indian standard drinking water specifications and WHO standard. Chemical and biological methods for water pollution by [12]. The present study was undertaken to investigate the water quality of the Kangrali water body. The results are discussed in the light of available literature with comments on recorded ecological correlations.

III. RESULTS AND DISCUSSION

The data on physico-chemical analysis has been presented in Table 1, seasonal variations of physico-chemical parameters and simple correlation coefficient test is presented in table 2 and 3 respectively. The physico-chemical factors may vary substantially at different seasons of the study period, and vary place to place and time to time.

Temperature is an important physical parameter of the water body which regulates natural process within the environment and governs physiological function in organism. Temperature is basically important parameters and affects on the chemical and biological in the organisms of water [12]. According to [13] fast microbial decomposition followed by release of energy could one of the reasons for increased temperatures.

Water temperature fluctuate between 21°C to 29°C during limnological studies of Kangrali water body. Highest temperature recorded in May and lowest temperature in June. John Mohammad [14] recorded 21°C to 30.9°C in Wyrá reservoir of Telangana and [15] observed that water temperature fluctuate between 21°C to 29°C during limnological studies of Udaipur lakes. Seasonally more temperature recorded in summer. It is noticed that water temperature is always lower than that of air temperature due to various reasons like gases in the air, humidity, dust and other colloidal particles. Statistically it significantly correlated with TDS ($r=0.847$), Total hardness ($r=0.746$), Calcium ($r=0.778$), Na ($r=0.833$) and negatively correlated with SO_4 ($r=-0.610$) and Turbidity ($r=-0.380$).

pH is most important in determining the corrosive nature of water. Lower the pH value higher is the corrosive nature of water. pH was positively correlated with electrical conductance and total alkalinity [16]. As most of the chemical and biochemical reaction are influenced by the pH it is of great practical importance. pH values were found between 6.9 to 7.9. It is indicating that it possesses alkalinity nature throughout the study period. The high values may be due to the sewage discharged from agricultural fields and higher temperatures. pH values were important for plankton growth. The pH of water affects many chemical and biological process in water. The largest variety of aquatic animals prefer a range of 6.5- 8.0.

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Electrical conductivity is a measure of water capacity to conduct electric current. As most of the salts in the water are present in the ionic form, are responsible for conduct of electric current [17]. The more conductivity of water is lesser is its resistance to electric flow, there by indicating higher concentration of dissolved salts and higher tropic status of the system. [18] has classified the irrigation water according to the electrical conductivity as EC < 250 Excellent, 250-750 Good, 750 -2000 permissible and 2000-3000 doubtful, > 3000 unsuitable. In the present study electrical conductivity values are ranged between 476 (Sept) to 600 μ mhos (April).

Table.1: Monthly variation in physico-chemical parameters of Kangrali water body of Belgaum

	WT	pH	EC	TUR	TDS	TH	Ca	mg	Cl	DO	BOD	SO4	Fe
Feb	27	6.9	528	16	382	140	40	12	120	6.4	3.8	7.4	0.12
Mar	27.4	7.4	560	16	391	125	35	9	140	6.2	3.4	9.6	0.12
Apr	28.3	7.6	600	15	380	125	32	10.5	138	6	3.1	7	0.17
May	29	7.9	570	15	400	140	38	11	160	5.8	3.9	8.1	0.12
Jun	21	7.7	490	17	260	99	28	7	114	6.3	2.2	10.4	0.14
Jul	21.6	7.5	460	19	290	108	30	8	120	6.9	2	14	0.14
Aug	21.8	7.6	499	19	293	83	20	8	115	7.3	2.1	12	0.14
Sept	22.1	7.8	476	17	238	105	25.5	10	116.5	7.4	2.4	9.3	0.12
Oct	23	7.4	522	15	206	109	28	10	109.5	7.7	1.9	9.4	0.13
Nov	23.2	7.8	480	13	221	96	27	8	130	8	2.2	7	0.1
Dec	25	7.5	540	11	300	90	26	7	113	8.2	1.8	7.1	0.1
Jan	25.4	7.4	530	17	310	90	28	8	126	8.1	1.5	6.7	0.12

[WT=water temperature, pH= hydrogen ion concentration, EC=Electrical conductance, Turb=turbidity, TDS=Total dissolved solids, TH=Total hardness, DO=dissolved oxygen, BOD=Biochemical oxygen demand] [Except WT ($^{\circ}$ C), pH, EC(μ mhos) and turbidity (NTU) all values are expressed in mg/l].

Turbidity in water is because of suspended solids and colloidal matter. It may be due to eroded soil caused by dredging or due to the growth of micro-organisms. High turbidity makes filtration expensive. If sewage solids are present, pathogens may be encased in the particles and escape the action of chlorine during disinfection. In the present study turbidity ranged between 11 and 19 NTU. Maximum value recorded in July and August and minimum value in December month. Seasonally more values recorded in monsoon. High turbidity signify presence of large amount of suspended solids [19], this is again indicate the high rate of siltation so as to decrease the depth of the water body. Total dissolved solids denote mainly the various kinds of minerals present in the water. Dissolved solids do not contain any gas and colloidal etc. The concentration of dissolved solids is an important parameter in drinking water and other water quality standards [20].

Table 2: Average seasonal variations in the physico-chemical parameters in Kangrali water body .

	Summer	Monsoon	Winter
Water temperature	27.9 $^{\circ}$ C	21.62	24.15
pH	7.45	7.65	7.5
Turbidity	15.5	18	14
EC	564.5	481.2	518
TDS	388.25	270.25	259.25
Total hardness	132.5	98.75	96.25
Ca	36.25	25.85	27.75
Mg	10.62	8.25	8.25
Chloride	139.5	116.37	119.6
DO	6.1	6.97	8

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BOD	3.55	2.1	1.85
Sulphate	8.02	11.4	7.55
Fe	0.13	0.13	0.11

Waters with higher solids content have laxative and sometimes the reverse effect upon people whose bodies are not adjusted to them. TDS consist of oxygen demanding wastes, disease causing agents, which can cause immense harm to public health. Total dissolved solids ranged between 221 mg/l (November) and 400 mg/l (May). Seasonally they appeared more in summer followed by monsoon and least value recorded in winter. Statistically it is significantly correlated with water temperature ($r=0.847$), TH ($r=0.874$) calcium ($r=0.710$) and with sodium ($r=0.582$). Similar observation made by [20] in Ammanagi pond of Belagavi of Karnataka. According to [5] high values of TDS in drinking water are generally not harmful to human beings but high concentration of these may affect persons suffering from kidney and heart diseases [21].

Total Hardness of water is due to the presence of certain salts of calcium, magnesium and other heavy metals dissolved in it. In the present study total hardness values ranged between 83 mg/l (August) and 140 mg/l (Feb & May). Seasonally total hardness value were maximum in summer followed by monsoon and minimum values were recorded in winter season. Statistically total hardness was significantly positively correlated with water temperature ($r=0.718$), TDS ($r=0.688$), calcium ($r=0.934$), mg ($r=0.841$), BOD and Na. negatively correlated with DO. [22] reported the positive correlation of total hardness with calcium, electric conductivity, total dissolved solids, magnesium. These studies support our findings. Hardness classified water on the basis of hardness in the following manner. 0-60 soft, 61-120 moderately hard, 120 -160 hard and > 180 very hard [23].

Calcium contributes hardness to water. Maximum values recorded 45mg/l in February and minimum values were 20 mg/l in December. This may be due to increase in the biomass especially gastropods which consume available calcium.

Magnesium is essential for chlorophyll bearing organisms and plants. In the present study high value was found in summer (10.62 mg/l) followed by monsoon and winter (8.25 mg/l). However variation during monsoon and winter period is same or negligible. Similar observation was recorded by [18] in Almatti reservoir of Bijapur in 2011.

Chloride is a basic parameter of detecting pollution of water by sewage before the development of bacteriological procedure. The most important source chloride in natural waters is the discharge of sewage, human and animal excreta as well as industrial effluents. In the present study chloride values were ranged between 160 mg/l (May) and 113 mg/l (December). Seasonally maximum values were recorded in summer followed by monsoon. Higher values due to contamination through large quantities of sewage input. Similar observation was recorded by [24] in Halali Reservoir of Madhya Pradesh. High chloride concentration indicate the presence of sufficient amount of oxidisable organic matter of animal origin, which on oxidation increases the nitrate content. Chloride relation with any other factor was not convincingly significant. It is also suggested that higher concentration of chloride in water is an index of pollution of animal origin and there is a direct correlation between chloride and pollution level.

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Table 3: Simple correlation test between water parameters of Kangrali water body

	WT	pH	EC	Turb	TDS	TH	Ca	mg	Chl	DO	BOD	SO4	Fe
WT	1	-.202	.895**	-.380	.847**	.718**	.748**	.597*	.584*	-.474	.723**	-.610*	.006
pH		1	-.130	-.078	-.280	-.250	-.381	-.289	-.622*	-.009	-.136	.091	.012
EC			1	-.393	.735**	.529	.508	.440	.347	-.441	.538	-.562	.236
Turb				1	.011	-.055	-.126	.014	-.027	-.276	-.051	.723**	.523
TDS					1	.688*	.725**	.466	.620*	-.694*	.768**	-.219	.209
TH						1	.934**	.841**	.619*	-.776**	.915**	-.191	.168
Ca							1	.688*	.697*	-.674*	.832**	-.290	-.003
mg								1	.558	-.507	.761**	-.285	.179
Chlor									1	-.405	.652*	-.371	.028
DO										1	-.816**	-.158	-.538
BOD											1	-.205	.105
SO4												1	.354
Fe													1

, **. Correlation is significant at the 0.01 level (2-tailed). *. Correlation is significant at the 0.05 level (2-tailed).

Dissolve oxygen which indicates the health of the ecosystem refers to the volume of oxygen present in water body. It is an important water quality parameter to be measure because it prevail biological and physicochemical attributes of surrounding water. Oxygen enters into the water by aerial diffusion and as a photosynthetic byproduct of aquatic plants and algae. The DO value indicates the degree of pollution in the water bodies. The aquatic life distressed when DO levels drops to 4-2 mg/lit. DO level falls undesirable changes in odor, taste and color reduce the usefulness of water[25].In the present study DO values were recorded between 5.8 mg/l to 8.2 mg/l. Seasonally maximum values recorded in winter. Statistically it was negatively correlated with WT ($r=-0.474$),EC ($r=-0.441$),TH ($r=-0.776$) and BOD (-0.816).

Biochemical oxygen demand (BOD) is an important parameter of water quality which measures the quantity of oxygen consumption by microorganisms during decomposition of organic matter. BOD is usually used for determining the oxygen demand of municipal or industrial discharge. High BOD indicates high scale contamination of organic matter in the water. Though high BOD is always accompanied by low DO level.

BOD values ranged from 1.5 mg/l (Jan) to 3.9 mg/l (May). Seasonally maximum values recorded in summer followed by monsoon. Statistically significantly correlated positively with WT ($r=0.723$), TDS ($r=0.768$),TH ($r=0.915$),Ca($r=0.832$) and negatively correlated with DO ($r=-0.816$).Higher levels of BOD indicate the presence of higher concentration of organic matter and when BOD exceeds the available DO, the DO in the water is depleted. BOD shows a strong negative correlation, similar observation was recorded by [26].

Sulphate itself has never been a limiting factor in aquatic ecosystems. Sulphate ion is one of the important anion present in natural water and produce cathartic effect on human beings when present in excess amount [5]. In the present study sulphate value was recorded from 6.7 mg/l to 14 mg/l. Lower values observed in winter season. Same observation was made by [27] in Aliyan reservoir of Coimbatore in 2004. This may be due to the dilution of river

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water and higher values because of runoff water from agricultural lands. If the sulphate concentration in water source is less than 10 mg/l, it is an indication that the water source is fresh and unpolluted.

Presence of iron in considerable amounts in water imparts colour and develops turbidity when exposed to air, consequently water becomes unacceptable for drinking. Iron values in the present study were 0.1 to 17 mg/l. Values were found below the permissible limits for drinking water. The maximum permissible limit of iron in drinking water is 0.3 ppm.

IV. CONCLUSION

Increased anthropogenic activities, siltation, sewage contamination and high nutrients due to the indiscriminate use of fertilizers in the agricultural catchment area are the major cause for the eutropication. Most of the parameters are well below the permissible limits except BOD. It shows that there is lot of anthropogenic activities such as clothing, cleaning vehicles, washing domestic animals, if such activities are not controlled by the local authority, the water will become polluted. There is a possibility of inflow pit latrine. Village must be kept clean, waste materials should not be thrown into the water body. It is also observed that the pollution load is relatively higher during summer season when compared to the winter and rainy season. People depend on this water are often prone to health hazards due to polluted drinking water. Therefore some effective measures are required to enhance the drinking water quality by delineating and effective water quality management plan for the region.

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