STUDIES ON PHYSICO-CHEMICAL PARAMETERS OF HIREMAGALURU POND WATER IN CHIKMAGALURU, KARNATAKA.

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Abstract:
In the September and October months of the year 2022, an attempt has been made to determine the water quality of Hiremagaluru pond in the city of Chikmagaluru, Karnataka state. We studied various physico-chemical parameters like water temperature, pH, total alkalinity, total hardness, total dissolved solids, chloride, dissolved oxygen and free CO_2. The analysis indicates that the water of this pond is not polluted so much, but it needs to be protected from the perils of future contamination by giving certain degree of treatment like disinfection. The careful investigation revealed that studied pond is mesotrophic. Hence, preventive measures are necessary to avoid further degradation of the pond water quality. The estimated water quality parameters were compared with the WHO and BIS standards.

Key Words: Physico-Chemical Parameters, Hiremagaluru Pond & Chikmagaluru

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DOI: - 10.48047/ecb/2022.11.12.68

Introduction:

People on the globe are under various kinds of threats due to undesired changes in the physical, chemical and biological characteristics of soil, water and air. These are related to animal and plants and finally affecting on[1]. Quality of water resources depend on a several physico-chemical parameters and biological characteristics.

In recent days pollution of the water bodies is increasing due to rapid population growth, industrial proliferation, urbanization, increasing living standards and wide ranges of human activities. In India, studies on the water pollution and related problems started quite early but water quality studies were given attention only in the last few decades, as the situation became alarming[2]. Water contamination with pathogens and pollutants create many health risks after consuming these type water[3,4]. Even though ecological interrelationship, species diversity and physico-chemical properties of lakes have received significant attention, as of now water quality in relation to human health is an important part of limnology[5].

Testing of water before it is used for drinking, domestic, agricultural or industrial purpose is essential and important. Water must be analyzed using different physico-chemical parameters. The choice of parameters for testing of water depends upon the purpose of water usage and to what extent we need its quality and purity. Water does contain various types of floating, dissolved, suspended and microbiological as well as bacteriological impurities. Some physical characterization should be performed for testing of its physical properties such as temperature, pH, turbidity, TDS etc., and chemical tests should be performed for its BOD, COD, dissolved oxygen, alkalinity, hardness, and other characteristics.

The aim of the present study is to know the pollution status of ponds in terms of physico-chemical characteristics of water. We tested these different physico- chemical parameters regularly during the study period.

Materials and Methods:

Study Area: The present investigations are carried out to evaluate the status of the water in the Hiremagaluru pond of Chikmagaluru district. The study area is located at 13°18'N latitude and 75°48'E longitude and at an altitude of 1100 meters. The pond water which was selected for study is generally used for agriculture and partly

for domestic activities. The weather conditions of the study area during study period were rainy. The water samples from selected pond regions were collected every week in the months of September and October 2022.

Methods: In situ measurements of water temperature and pH were made recorded. Estimation of other physico-chemical parameters such as DO (Dissolved oxygen), free CO_2, alkalinity, hardness, chlorides as given by the standard procedures [6,7] pH was measured with a digital pH meter and. temperature was determined using the mercury thermometer. For the determination of dissolved oxygen demand sampled water stored with a 250mL dark colored reagent bottles. These water samples were fixed at site by Winkler's solution ($MnSO_4$, H_2O). These fixed samples were then taken to laboratory for further determination. DO was then determined on the fixed sample by titration. Titration technique was used to find alkalinity in which a known volume of water samples was titrated with 0.02M HCl. Chloride was determined by titration procedure where a known volume of water samples was titrated with 0.014 Normal silver nitrate solution. Total hardness of water was found by titrating 0.01N diamine tetra acetic acid (EDTA) using the Eriochrome Black-T indicator. Free CO_2 in water samples was determined using 0.1N Na_2CO_3[4].

Figure1: A view of Hiremagaluru Pond

Results and Discussion:

Average Physico-Chemical Parameters of Hiremagaluru Pond:

The average water temperature of the pond was 22.5°C and water is alkaline in nature. The total hardness and chloride content of the water were 93.85 mg/litre and 73.8 mg/liter respectively. Average values of Dissolved oxygen recorded with 5.84 mg/liter and Free CO_2 values of 7.14 mg/liter. Total alkalinity of Hiremagaluru pond found to be 148.31 mg/liter. Some analytical water quality parameters with respective analytical techniques and guideline values as per WHO, EPA and Indian standard are presented in Table 1.

Weekly Variations of Physico-Chemical Parameters:

Bar charts in Figure 2 and figure 3 represent water quality of Hiremagaluru pond at station I and II respectively. The water temperature of Hiremagaluru pond varied from 21°C to 25°C. In such an aquatic system the water temperature controls the rate of all chemical reactions, and affects organisms' growth, reproduction and immunity. Drastic temperature differences can be fatal to aquatic organisms[7]. pH is most important in determining the corrosive nature of water. Lower the pH value, more acidic in nature and higher is the corrosive nature of water. pH was positively correlated with total alkalinity. Various factors bring about changes the pH of water. Decrease in photosynthetic activity, the assimilation of carbon dioxide and bicarbonates are ultimately cause the increase in pH.. The higher pH values observed suggests that carbon dioxide, carbonate-bicarbonate equilibrium is affected more due to change in physico-chemical conditions[8,9]. During the present study, pH values fluctuated from 7.0 to 8.2. The average pH values of different water samples indicate alkaline nature throughout the study period.

It is established fact that carbon dioxide is the end product of organic carbon decay in almost all aquatic environments and its variation is often a good indicator of net ecosystem metabolism[10.11]. Therefore, in biogeochemical studies aquatic systems, it is desirable to measure parameters that define the carbon dioxide content of the system. CO_2 is also a major green-house gas on Earth. Its fluxes across the air-water or sediment-water interface are among the important concerns in global change studies. CO_2 level is often a measure of the net ecosystem production/metabolism of the aquatic system[12]. In this study, free CO_2 values varies from 1.93 to 12.32 mg/liter respectively.

Hardness, alkalinity and pH affect the toxicity of various substances in the water. It is determined by simple diluted HCl acid titration in presence of phenolphthalein and methyl orange indicators. Alkalinity in boiler water essentially is due to the presence of hydroxyl and carbonate ions. This hydroxyl alkalinity (causticity) in boiler water is necessary to protect the vessel of boiler against corrosion. Too high causticity results in operating problems, such as foaming. Very high causticity levels can cause a type of caustic attack of the boiler called "embrittlement"[4] The total alkalinity

of Hiremagaluru pond ranged from 124 to 188 mg/liter. Observed values of various physico - chemical clearly indicate that the water body in the present study was found to be less productive.

Dissolved Oxygen (DO) is one of the most important parameters. Its correlation with water body gives direct and indirect information like bacterial activity, availability of nutrients, photosynthesis, stratification etc [12.] As summer progresses, dissolved oxygen decreased due to increase in temperature and also due to increased microbial activity [13]. From our study we find higher DO values of Hiremagaluru Pond (3.5mg/liter to 7.4mg/liter). Higher values may be due to presence of biotic components (i.e., aquatic plant) releasing oxygen and it may be due to in higher interference of atmosphere air with the aquatic bodies.

Chloride is measured by titrating against standardized silver nitrate solution using potassium chromate solution in water or eosin solution and alcohol as indicator. The latter indicator is an adsorption indicator while the former makes a red colored compound with silver as soon as the chlorides are precipitated from solution[4]. In the current study, the chloride of Hiremagalur Pond is found to be from 38mg/l to 132mg/l. Levels less than10 mg/l are desirable. Levels more than 250 mg/l may cause a salty taste.

Total Hardness is the property of water which prevents the lather formation with soap and increases the boiling point of water. Hardness of water mainly depends upon the amount of calcium or magnesium salts or both[15]. The total hardness of Hiremagalur pond water ranged in between 78mg/l & 120 mg/l indicating the water is moderately hard.

Total Dissolved Solids (TDS) refer to suspended and dissolved matter in water. They are very useful parameter describing the chemical constituents of the water and can be considered as general of edaphically relation that contributes to productivity within the water body[13]. In the present study, TDS values ranged from 174 to 310 mg/l. From Table 3 as per TDS values it is observed that the pond water belongs to good class category (160 – 480).

Many studies have been done in our country to assess the quality of pond water but very few of them have studied the assessment of physico-chemical parameters of ponds receiving domestic waste[14,15]. In general, such characteristics are largely affected by human activities and influx of domestic waste in pond water, which cause a greater degree of eutrophication[16]. The information of physico-chemical parameters under study exhibits that the pond water is not eutrophicated. In the light of standards of water quality recommended by WHO and Indian standard, the pond water should be used by the human beings especially for drinking and cooking after water treatment. Pond water is also fit for aquaculture and irrigation.

Table 1: Standard Water quality parameters as given by WHO, EPA & Indian standards

S.No	Parameter	Technique used	WHO Standard	Indian Standard	EPA Guidelines
1	Temperature	Thermometer	-	-	-
2	pH	Digital pH meter	6.5 – 9.5	6.5 – 9.5	6.5 – 9.5
3	Dissolved oxygen	Redox titration	-	-	-
4	Total Hardness	Complexometric titration	200 ppm	300 ppm	< 200 ppm
5	Total Alkalinity	Acid – Base titration	-	200 ppm	-
6	Chloride	Argentometric titrations	250ppm	250ppm	250ppm

Source: (WHO, USEPA, Indian Standard, National Primary Drinking Water Regulations, Drinking Water Contaminants US EPA).

Table 2: Water quality of Hiremagaluru pond during study period

Area	Station I								Station II							
Month	September				October				September				October			
Week	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV
Temp.(^{O}C)	24	25	26	24	23	23	26	23	24	25	23	23	23	22	24	25
pH	7.3	7.8	7.6	7.7	7.8	8.0	8.1	8.2	8.2	7.6	7.3	7.3	7.5	7.4	7.4	7.7
TH	82	81	92	92	97	94	100	99	84	87	92	94	103	110	108	102
Chloride	62	90	48	59	82	80	81	78	118	91	71	59	70	75	79	78
DO	5.8	6.39	5.08	5.18	6.33	5.4	4.9	7.1	3.5	7.04	5.24	5.66	6.5	7.4	5.6	6.9
CO_2	2.33	2.32	6.8	6.2	7.4	9.1	8.9	10.3	1.93	2.3	4.5	6.5	2.9	8.3	6.8	3.5
Total Alk.	124	131	138	141	146	153	161	168	129	132	140	151	159	165	172	188
TDS	189	179	191	188	195	241	282	274	194	201	192	242	253	288	292	298

Table 3: Water class based on TDS values

S.No	Water Class	TDS (mg/liter)
1	Excellent	Less than 160
2	Good	160-480
3	Permissible	480-1280
4	Doubtful	1280-1600
5	Unsuitable	More than1600

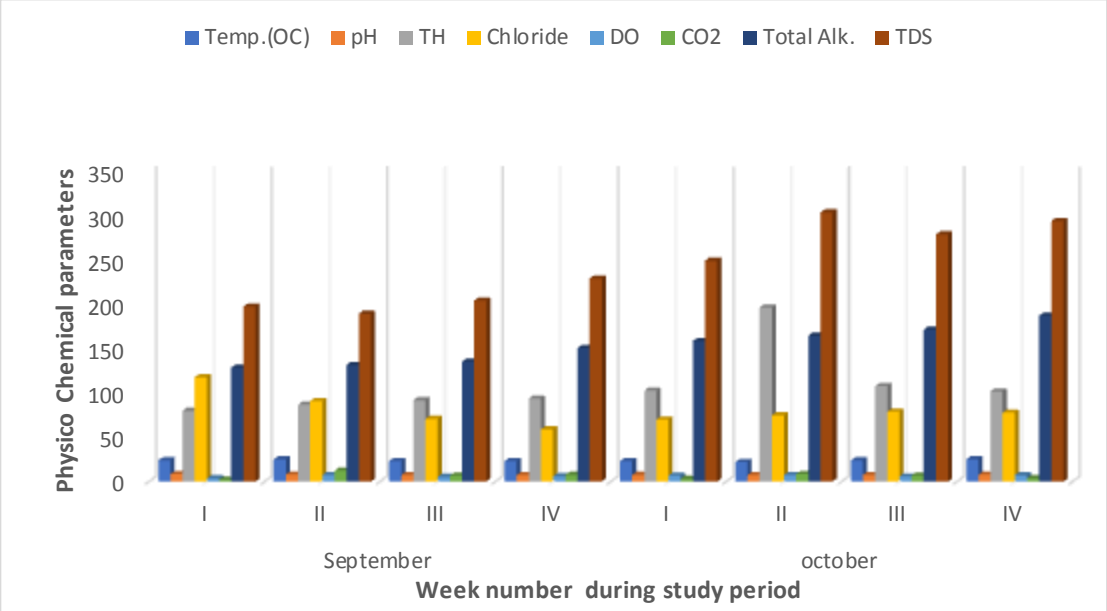

Figure 2: Water quality of Hiremagaluru pond at station I

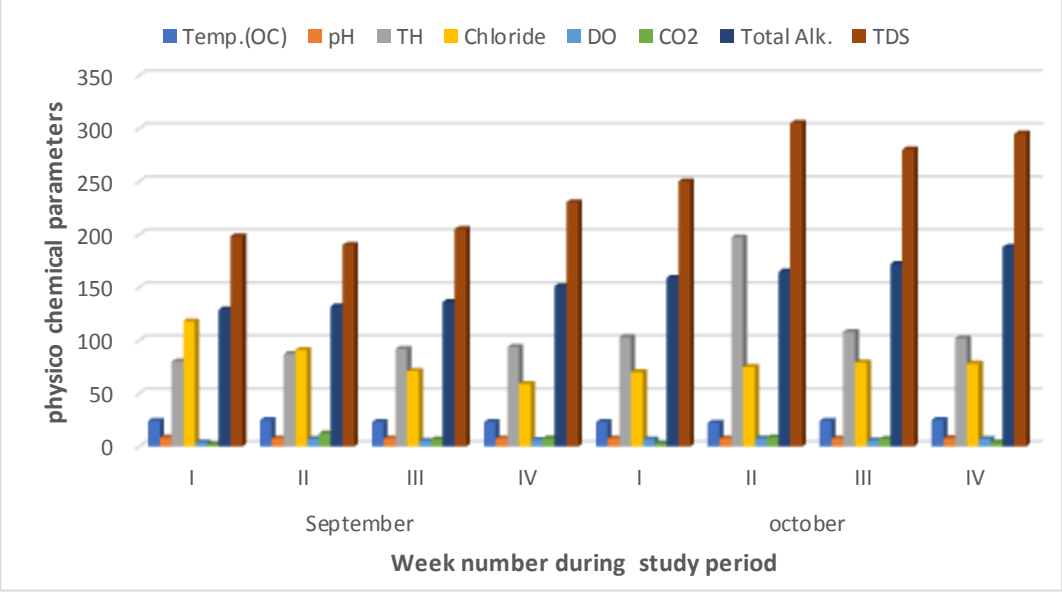

Figure 3: Water quality of Hiremagaluru pond at station II

Conclusion:

Almost all the physico-chemical parameters in the selected water body were within acceptable limits except alkalinity and chloride. The slight fluctuating water quality values obtained in this study showed that pond water is fit for aquaculture. Our present study gives knowledge about the management of pond for various requirements. To improve quality of Hiremagaluru pond water pond continuous monitoring of mentioned physico-chemical parameters is necessary.

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