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ASSESSMENT OF PHYSICO-CHEMICAL PARAMETERS OF HIREMAGALUR POND WATER IN CHIKMAGALUR, KARNATAKA

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Abstract:

During August & September 2016 an attempt has been made to determine the water quality of Hiremagalur pond in Chikmagalur, Karnataka state with regard to physico-chemical parameters like water temperature, pH, total alkalinity, total hardness, total dissolved solids, chloride, dissolved oxygen and free CO_2. The analysis reveals that the water of the Hiremagalur pond is not polluted so much, but it also needs to be protected from the perils of future contamination by giving certain degree of treatment like disinfection.

Key Words: Physico-Chemical Parameters, Hiremagalur Pond & Chikmagalur

Introduction:

People on globe are under tremendous threat due to undesired changes in the physical, chemical and biological characteristics of air, water and soil. These are related to animal and plants and finally affecting on it (Misra and Dinesh, 1991). Good quality of water resources depend on a large number of physico-chemical parameters and biological characteristics.

Today, Pollution of the water bodies is increasing due to rapid population growth, industrial proliferation, urbanization, increasing living standards wide ranges of human activities. In India too, studies on the problem of water pollution started quite early but water quality studies were given attention only during the last few decades when the situation become alarming (Oinam and Belagali, 2006). Water contamination with pathogens and pollutants create many health problems for the consuming the water. As such water quality in relation to human health is an important fact of limnology, even though ecological interrelationship, species diversity and physico-chemical properties of lakes have received considerable attention (Krishna et al.,2009; Biradar et al.,2014; Basavaraja and Kiran, 2016).

It is very essential and important to test the water before it is used for drinking, domestic, agricultural or industrial purpose. Water must be tested with different physico-chemical parameters. Selection of parameters for testing of water is solely depends upon for what purpose we going to use that water and what extent we need its quality and purity. Water does contains different types of floating, dissolved, suspended and microbiological as well as bacteriological impurities. Some physical test should be performed for testing of its physical appearance such as temperature, pH, turbidity, TDS etc, while chemical tests should be perform for its BOD, COD, dissolved oxygen, alkalinity, hardness and other characters. Hence the following different physico-chemical parameters are tested regularly during the study period.(Medudhula et. al, 2012)

The aim of the present study is to known the pollution status of ponds in terms of physico-chemical characteristics of water. However, no information is available in relation to physico-chemical characteristics of water in Hiremagalur pond of Chikmagalur.

Materials and Methods:

Study Area: The present investigations are carried out to evaluate the status of the water in Hiremagalur pond of Chikmagalur district. The study area is located at $13^{o}18'$N latitude and $75^{o}48'$E longitude. The pond waters which was selected for study are used for agriculture and partly for domestic activities. The climatic condition of the study area during study period was rainy. The water samples from selected pond of Chikmagalur region was collected every week in the month of August and September 2016.

Methods: Water temperature and pH were recorded at the sampling spot itself and the estimation of other physico-chemical parameters like, DO (Dissolved oxygen), free CO_2, hardness, alkalinity, chlorides as given by the standard procedures (Trivedy and Goel, 1986; APHA, 1998). Temperature was determined using the mercury thermometer while, pH was measured by a digital pH meter. Samples for dissolved oxygen demand were sampled with a 250mL dark colored reagent bottles. These water samples were fixed at site by Winkler's solution ($MnSO_4$, H_2O). All samples were then taken to laboratory for further determination. DO was then determined on the fixed sample by titration. Alkalinity was determined by titration procedure where a known volume of water samples was titrated with 0.02M HCl. Total hardness of water was measured by titrating 0.01N ethylene diamine tetra acetic acid (EDTA) using Eriochrome Black-T indicator. Chloride was determined by

titration procedure where a known volume of water samples was titrated with 0.014N of $AgNO_3$. Free CO_2 in water samples was determined using 0.1N Na_2CO_3. (Basavaraj Simpi et al, 2011).

Figure1: A view of Hiremagalur Pond

Results and Discussion:

Average Physico-Chemical Parameters of Hiremagalur Pond:

The average water temperature of the pond was 22^oC and water shows alkaline in nature. The total hardness and chloride of the water were 94.85 mg/l and 75.5 mg/l respectively. Average values of Dissolved oxygen recorded with 5.84 mg/l and Free CO_2 values 7.28 mg/l. Total alkalinity of Hiremagalur pond showed 150.31 mg/l. Different analytical water quality parameters with their analytical technique and guideline values as per WHO, EPA and Indian standard are presented in Table 1.

Weekly Variations of Physico-Chemical Parameters:

Figure 1 and 2 depicts the water quality of Hiremagalur pond at station I and II respectively. The water temperature of Hiremagalur pond varied from 22^oC to 25^oC. In an established system the water temperature controls the rate of all chemical reactions, and affects organisms' growth, reproduction and immunity. Drastic temperature changes can be fatal to aquatic organisms (Patil et al., 2012). 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 (Gupta et al.,2009). The reduced rate of photosynthetic activity, the assimilation of carbon dioxide and bicarbonates are ultimately responsible for increase in pH. Various factors bring about changes the pH of water. The higher pH values observed suggests that carbon dioxide, carbonate-bicarbonate equilibrium is affected more due to change in physico-chemical conditions (Karanth 1987). During the present study, pH values fluctuated from 7.0 to 8.2. The average pH values of different water bodies indicate alkaline nature throughout the study period.

Carbon dioxide is the end product of organic carbon degradation in almost all aquatic environments and its variation is often a measure of net ecosystem metabolism (Smith & Hollisbaugh, 1997, 1993, Hopkinson 1985). Therefore, in aquatic biogeochemical studies, it is desirable to measure parameters that define the carbon dioxide system. CO_2 is also the most important green house gas on Earth. Its fluxes across the air-water or sediment-water interface are among the most important concerns in global change studies and are often a measure of the net ecosystem production/metabolism of the aquatic system (Patil et al., 2012). In this study, free CO_2 values fluctuated from 1.93 to 12.32 mg/l respectively.

Total alkalinity is composed primarily of carbonate (CO_3^{2-}) and bicarbonate (HCO_3^-), alkalinity acts as a stabilizer for pH. Alkalinity, pH and hardness affect the toxicity of many substances in the water. It is determined by simple diluted hydrochloric acid titration in presence of phenolphthalein and methyl orange indicators. Alkalinity in boiler water essentially results from the presence of hydroxyl and carbonate ions. Hydroxyl alkalinity (causticity) in boiler water is necessary to protect the boiler against corrosion. Too high a causticity causes other operating problems, such as foaming. Excessively high causticity levels can result in a type of caustic attack of the boiler called "embrittlement" (Patil et al., 2012). The total alkalinity of Hiremagalur pond ranged from 124 to 188 mg/l. The above results 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 parameter. Its correlation with water body gives direct and indirect information e.g. bacterial activity, photosynthesis, availability of nutrients, stratification etc. (Premlata Vikal, 2009; Patil et al., 2012). In the progress of summer, dissolved oxygen decreased due to increase in temperature and also due to increased microbial activity (Moss 1972, Morrissette 1978, Sangu 1987, Kataria et al., 1996). From the above data the higher DO values of Hiremagalur Pond (3.5mg/l to 7.4mg/l) 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 (Patil et al., 2012). 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 (Trivedy and Goel, 1986).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 (Goher, 2002). 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 (Kanungo et al., 2006; Sayeswara et al., 2010). In general, such characteristics are largely affected by human activities and influx of domestic waste in pond water, which cause a grater degree of eutrophication (Kaur et al., 1996; Sayeswara et al., 2010). The information of physico-chemical parameters under study exhibits that the pond water is not eutrophicated. In the light of standard 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.

Conclusion:

Almost all the physico-chemical parameters in selected water body was within desirable limits except chloride and alkalinity. The slight fluctuating water quality values obtained in this study showed that pond water is fit for aquaculture. Our present study gives knowledge about management of pond for various requirements. To improve quality of water, there should be continuous monitoring of water in Hiremagalur pond of Chikmagalur, Karnataka.

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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 Hiremagalur pond during study period

Area	Station I								Station II							
Month	August				September				August				September			
Week	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV
Temp.(^{O}C)	22	25	23	24	23	23	22	23	24	25	23	23	23	22	24	25
pH	7.0	7.5	7.9	7.9	8.0	8.2	8.2	8.2	7.2	7.2	7.3	7.3	7.3	7.4	7.4	7.4
TH	78	81	89	92	91	94	100	115	80	87	92	94	96	120	108	102
Chloride	62	105	38	56	75	80	79	78	132	91	51	59	70	75	79	78
DO	3.7	7.39	5.08	5.64	6.22	5.5	4.9	7.1	3.5	7.04	5.24	5.88	6.5	7.4	5.6	6.9
CO_2	2.11	12.32	8.8	7.9	8.7	9.1	8.9	11.3	1.93	12.3	6.5	7.5	2.9	8.3	6.8	3.5
Total Alk.	124	131	138	141	146	153	161	179	129	132	136	151	159	165	172	188
TDS	174	180	186	194	190	240	300	310	180	190	205	230	280	305	280	295

Table 3: Water class based on TDS values

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

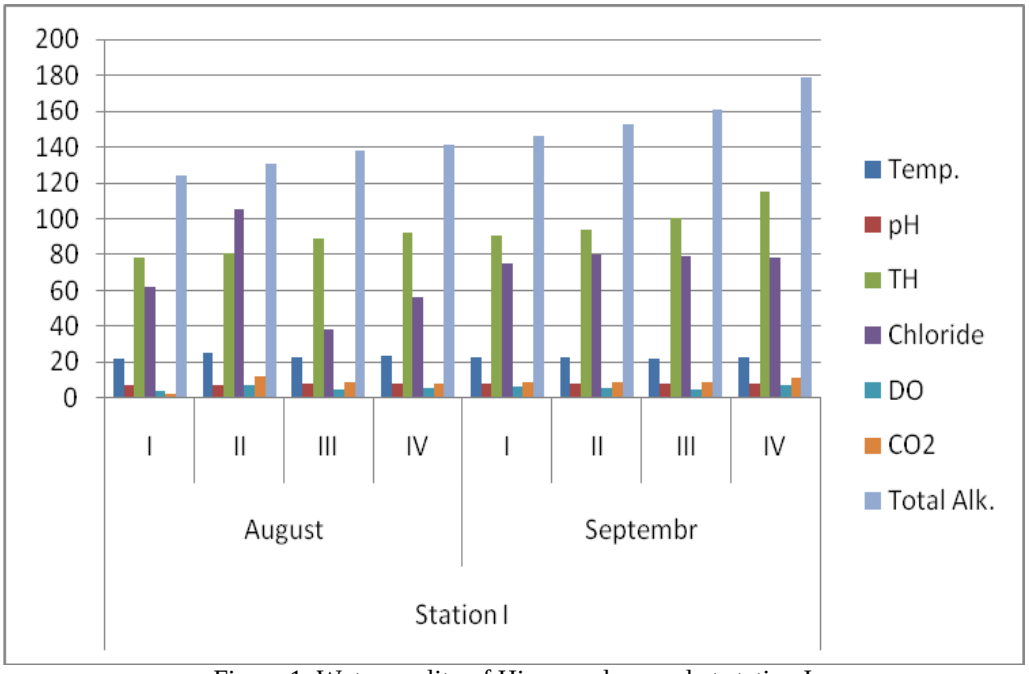

Figure 1: Water quality of Hiremagalur pond at station I

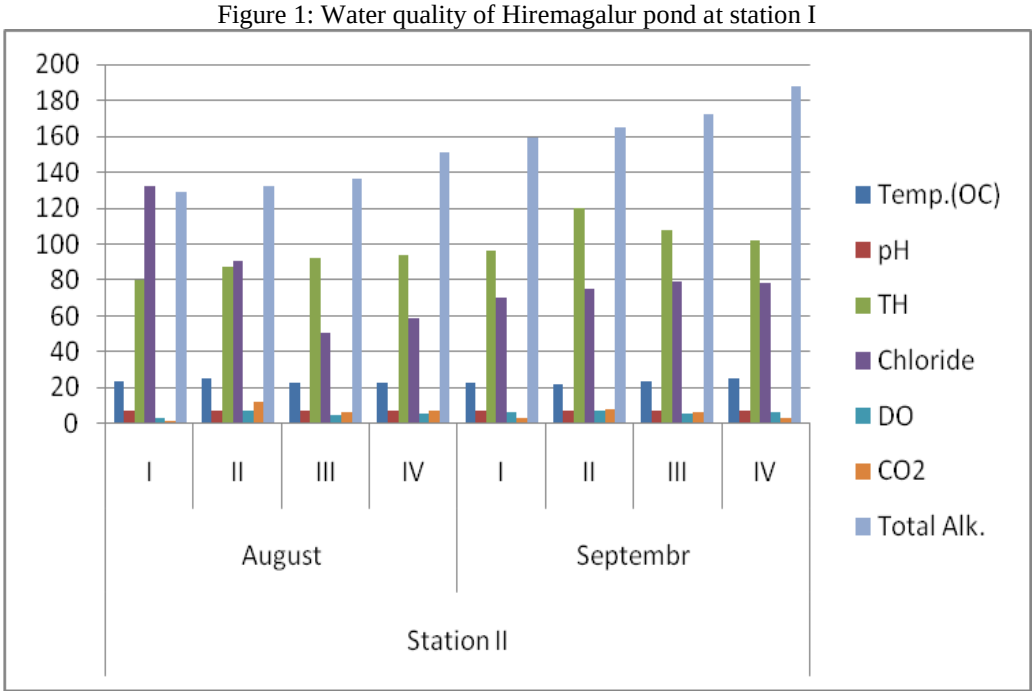

Figure 2: Water quality of Hiremagalur pond at station II