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Physico-Chemical Characterization of Lake Water from Mariamman Kovil, Thanjavur District in India

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Abstract— Pond water samples were collected from Mariamman kovil, Thanjavur district (India). These water samples were analyzed for their physicochemical characteristics. Laboratory tests were performed for the analysis of sample for alkalinity, total dissolved solid, sulphate, phosphate and nitrate, temperature, pH, BOD, COD, magnesium, turbidity chloride and calcium. Physico-chemical analysis pond water sample was observed within the ranged as prescribed by WHO and Indian standards but alkalinity and total dissolved solid are higher than that of permitted limit in pond water. The sulphate, phosphate and nitrate are lower than that of permitted limit in pond water. The temperature, pH, BOD, COD, magnesium, turbidity chloride and calcium are within the permitted limit in pond water.

Keywords— Pond water, Physicochemical, Alkalinity, Phosphate, Mariamman kovil

I. INTRODUCTION

Water is a vital element for the survival of life on our planet. It covers about three fourth of the earth‘s surface (Mishra 2008). Surface water is a general term describing any water body which is found flowing or standing on the surface such as streams, rivers, ponds, lakes and reservoirs (Ghosh 2002). India is a country of rivers. Like network a number of river systems spreaded all over the country (Gray 2005). Life, prosperity and civilization revolve around water in the Indian sub-continent (Gerstein and Levitt 1998). Unfortunately, pollution of the environment is one of the most horrible ecological crises to which we are subjected today. The three basic amenities for living organisms are air, water, and soil or land. Some times in the past, these amenities were pure, virgin, undisturbed, uncontaminated and basically most hospitable for living organisms, but the situation is just the reverse today because progress in science and technology is also leading to pollution of environment and serious ecological imbalance which in the long run, may prove disastrous for mankind. The root cause of the environmental pollution has been the man‘s misbehavior with the nature under the false ego that he is the master of nature. These undesirable situations are created by man himself and other living biota on the earth (Black 2005).

Water pollution is the phenomenon that is characterized by the deterioration of the quality of land water (rivers, lakes, marshes and ground water) or seawater as a result of various human activities (Mathur and Chodhary 2004). Use of polluted water itself takes about 25000 peoples all over the world every day (Agarwal 2002). Water is the basic need of life. Fresh water immediately available to man for drinking and other purposes is only 0.002% of the total water. Since the demand for water is mostly for fresh water, and everyone have to depend mainly on this tiny fraction of the total water present on this planet. Further the uneven distribution of water on the surface of the earth makes it a scarce resource at several places. A number of diseases are caused by the consumption of poor water quality. It has been reported in the “community health study” that 50% of all reported cases of illness, and 40% of deaths in Pakistan are due to drinking of poor water quality (Anil Kumar and Arnab Kumar 2001). The present study involves the analysis of water quality in terms of physico-chemical parameters of pond water from Mariamman kovil, Thanjavur district.

II. MATERIALS AND METHODS

A. Description of the Study Area

The lake water sample was collected from Mariamman kovil, Thanjavur district, Tamil Nadu, India.

B. Collection of Sampling

Sample was collected in 250ml glass bottles. The samples were collected for other physiochemical parameters, pre-cleaned by washing with non-ionic detergents, rinsed in tap water. Before sampling, the bottles were rinsed three times with sample water before being filled with the sample. The actual samplings were done midstream by dipping each sample bottle at approximately 20-

30 cm below the water surface, projecting the mouth of the container against the flow direction. The samples were then transported in cooler boxes.

C. Physio-Chemical Parameters

The methods used for the analysis of various physic-chemical parameters were the same as given in Standard Methods for the Examination of water (Chhatwal **1990**; APHA **1976**) and National Environmental Engineering Research Institute [13].

D. Determination of Temperature

The water temperature was recorded at the sampling area by using digital thermometer. Surface water temperature was recorded by dipping thermometer directly into water in a container, taking care not to expose it to hear or direct solar radiation.

E. Determination of pH

pH was recorded at the sampling site using digital pH meter maintained at the room temperature.

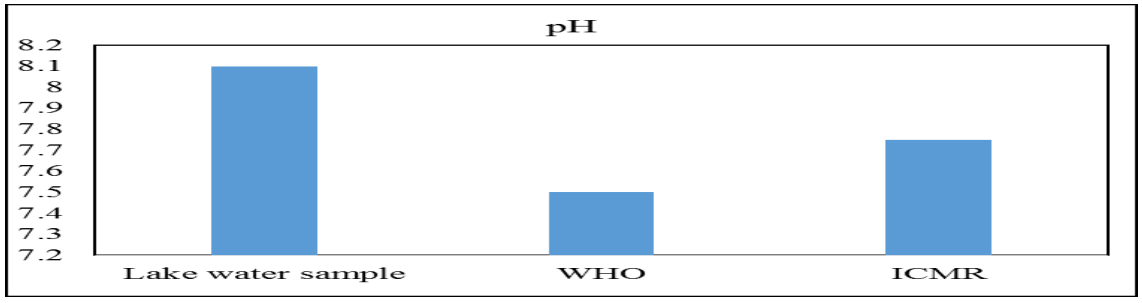
III. RESULTS AND DISCUSSION

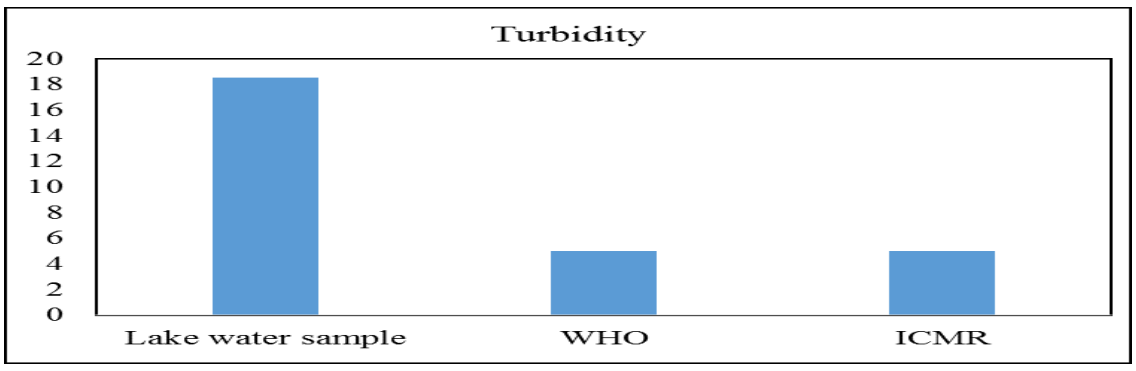
The present study was carried out to investigate the physicochemical characters of pond water. The observations made on pond water sample were compared with WHO and ICMR drinking water standard [14 &15]. Table 1 represent the pH, turbidity, TDS and temperature of pond water sample. Water sample of turbidity and TDS temperature are above the standard limit.

Parameters	Lake water sample	WHO	ICMR
Odour	No characteristic odour	No characteristic odour	No characteristic odour
pH	8.10	6.5-8.5	7-8.5
Turbidity	18.52	5	5
Total dissolved solids (mg/l)	1020	500	500
Temperature (°C)	29.6	28-35	28-37

Table.1: pH, Turbidity, TDS and Temperature of Pond Water sample

Values were expressed as mean ± SD for triplicate.





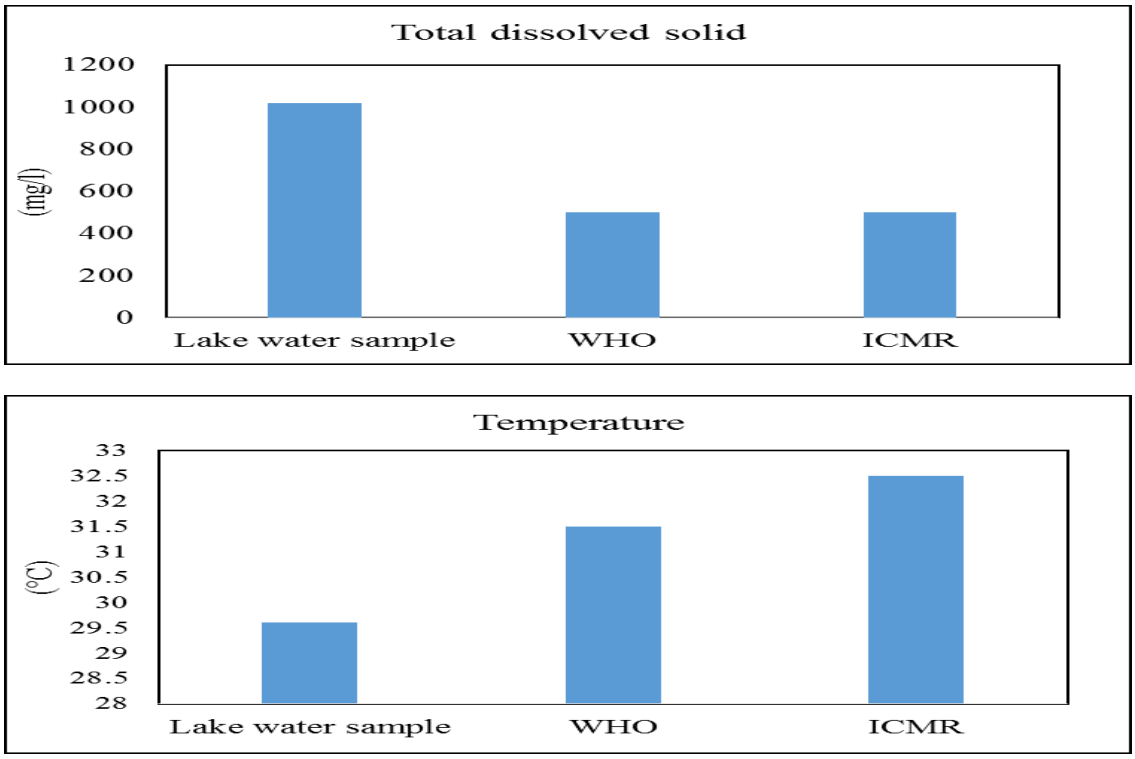


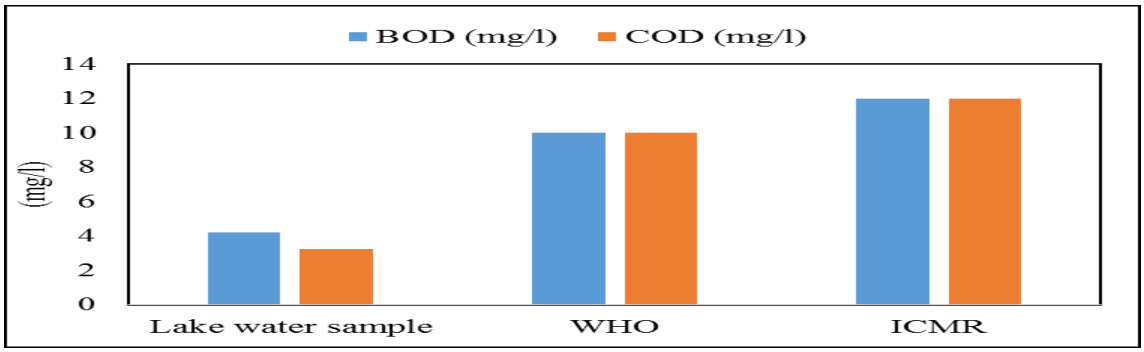
Fig.1: pH, turbidity, TDS and Temperature of Pond Water sample

Table 2 represents the concentration of BOD, COD and total alkalinity of pond water. BOD and COD level was decreased when compared to standard. The total alkalinity level was higher than that of standard.

Table.2: BOD, COD and Total Alkalinity of Pond Water

Parameters	Lake water sample	WHO	ICMR
BOD (mg/l)	4.20	10	12
COD (mg/l)	3.25	10	12
Total Alkalinity (mg/l)	328	75	100

Values were expressed as mean ± SD for triplicate.



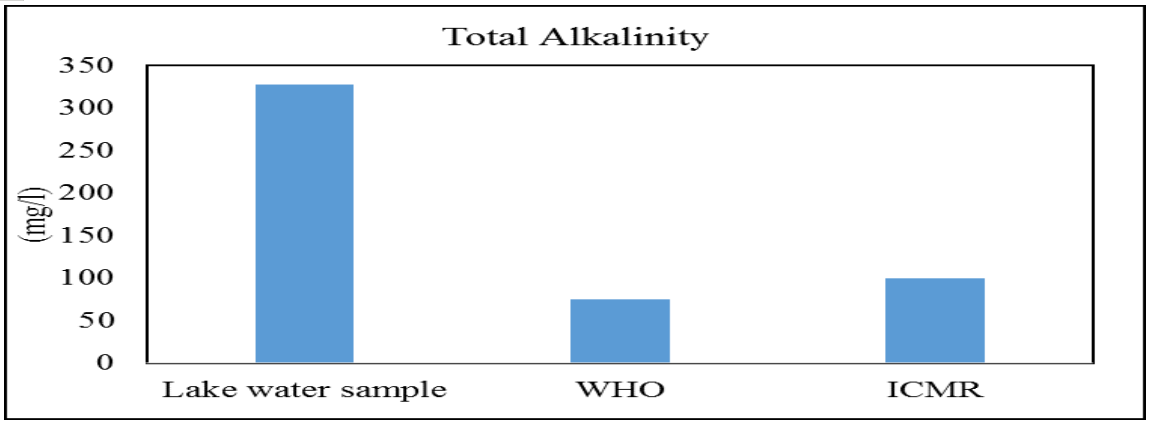


Fig.2: BOD, COD and Total Alkalinity of Pond Water

Table 3 represents the concentration of Magnesium and calcium of pond water. Magnesium and calcium were lowest range when compared to standard.

Table.3: Magnesium and Calcium of Pond Water

Parameters	**Lake water sample**	**WHO**	**ICMR**
Calcium (mg/dl)	221	75-200	75-200
Magnesium (mg/dl)	40	150	148

Values were expressed as mean ± SD for triplicate.

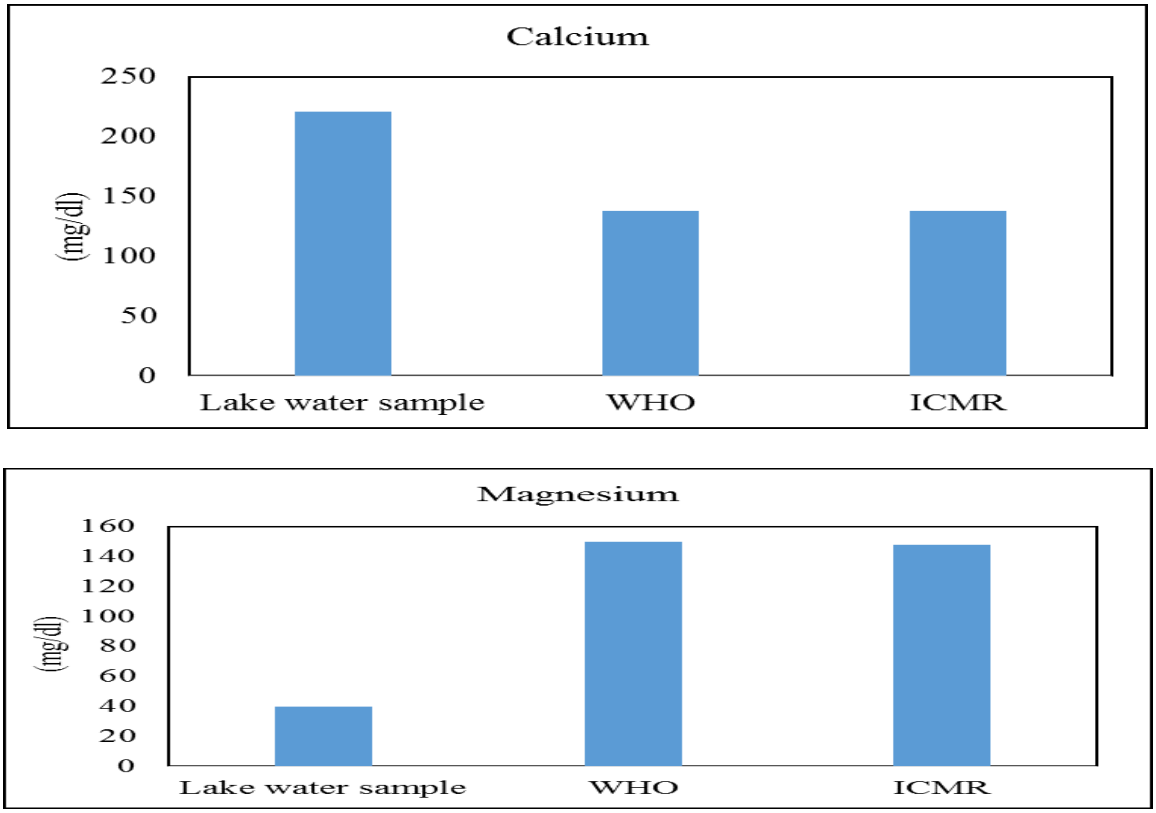


Fig.3: Magnesium and Calcium of Pond Water

Table 4 represents the concentration of sulphates, nitrate and chloride pond water. Nitrate and sulphate were lowest range when compared to standard while chloride within the standard limit.

Table.4:Sulphates, Nitrate and Chloride of Pond Water

Parameters	Lake water sample	WHO	ICMR
Chlorides (mg/l)	1252	200-1000	250-1000
Sulphates (mg/l)	310	200	200
Nitrates (mg/l)	125	45	20-100

Values were expressed as mean ± SD for triplicate.

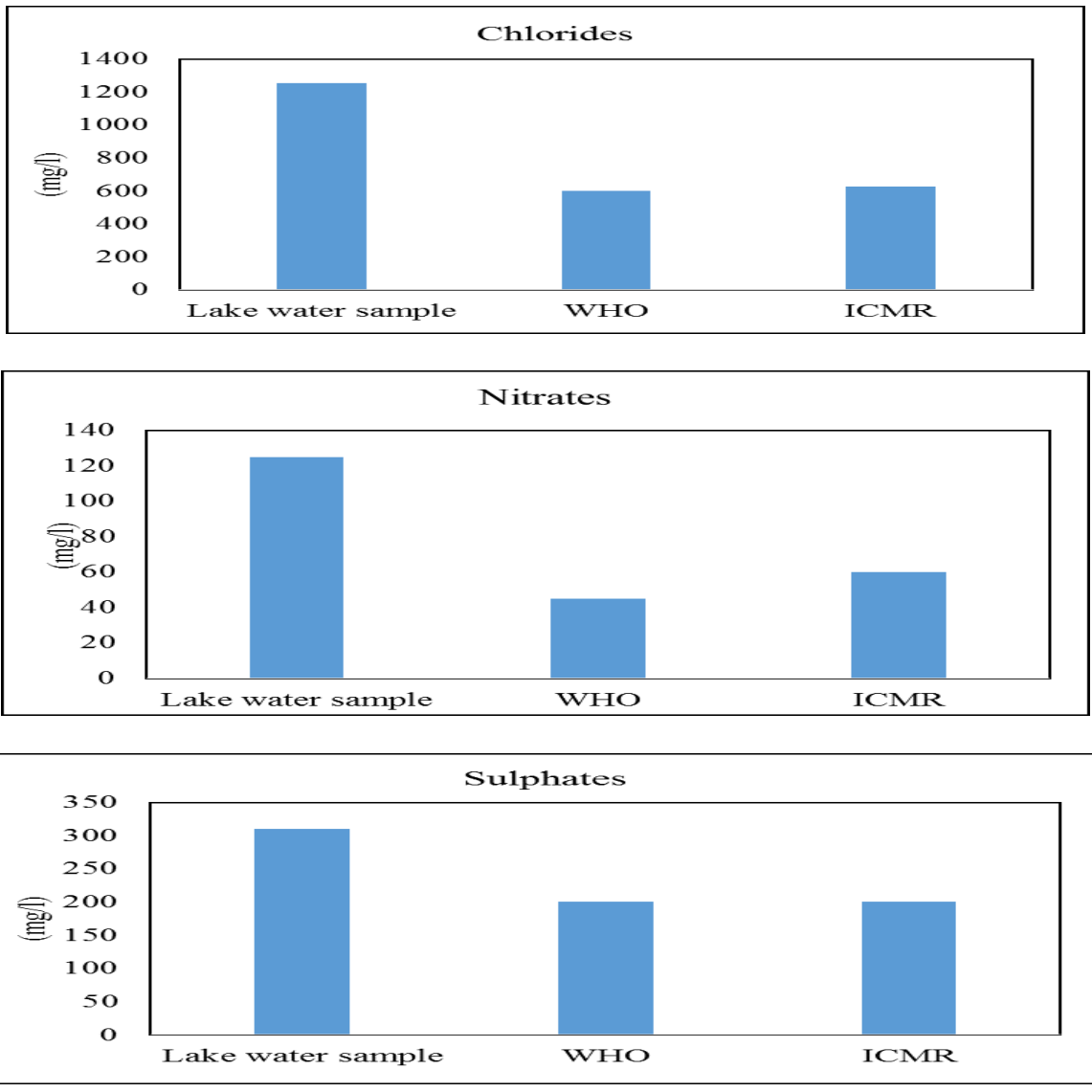


Fig.4: Sulphates, Nitrate and Chloride of Pond Water

Table 5 represents the concentration of Phosphate in pond water. Phosphate was lowest range when compared to standard

Table.5: Phosphate of sample I and sample II

Parameters	Lake water sample	WHO	ICMR
Phosphate (mg/l)	6.52	5	4

Values were expressed as mean ± SD for triplicate.

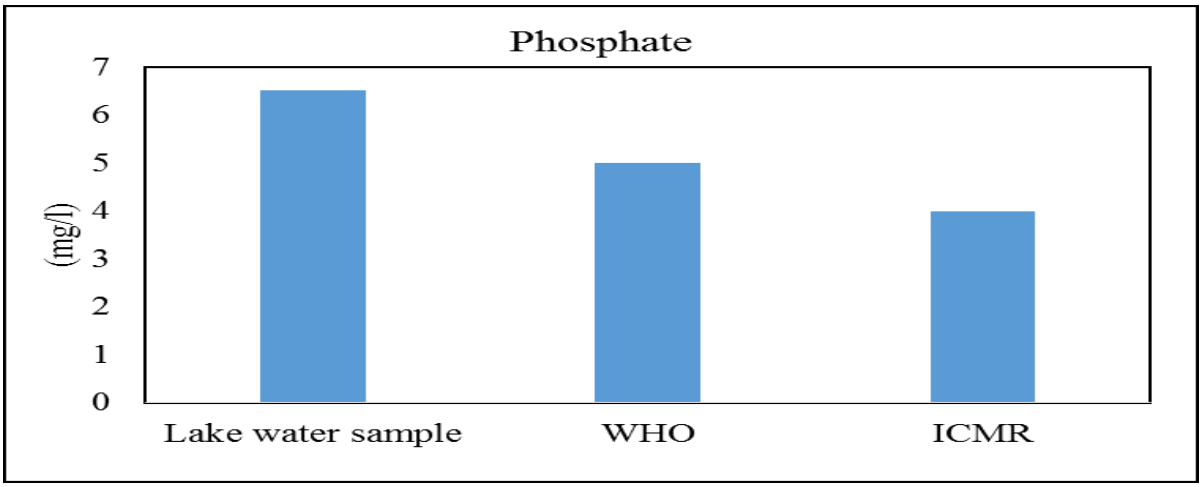


Fig.5:Phosphate of sample I and sample II

Water resources are of critical importance to both natural ecosystem and human development. It is essential for agriculture, industry and human existence. The healthy aquatic ecosystem is depended on the physico-chemical and biological characteristics [16]. The quality of water in any ecosystem provides significant information about the available resources for supporting life in that ecosystem. Good quality of water resources depends on a large number of physico-chemical parameters and biological characteristics. To asses that monitoring of these parameters is essential to identify magnitude and source of any pollution load. These characteristics can identify certain condition for the ecology of living organisms and suggest appropriate conservation and management strategies. Many researches are being carried out till present [17-19]. In order to assess the physicochemical property of drinking water of sample I compared with WHO and ICMR drinking water standard [14 & 15]

F. Temperature

In the present study temperature range was kept from 29.6ºC for sample. This temperature was ranged within the permissible limit of WHO.

G. pH

pH is a scale of intensity of acidity or alkalinity and pH measures the concentration of hydrogen ions in water, the variations in temperature affects on pH. All samples were ranged within the permissible limit of WHO. However higher values of pH hasten the scale formation in water heater and reduce the germicidal potential of Chlorine.

H. Alkalinity

The total alkalinity of water samples were ranges from 75 to 100mg/l. The total alkalinity 328 mg/dl for pond water. The water sample has within the permissible limit as compared to standard. Alkalinity in itself is not harmful to human being; still the water samples with less than 100 mg/l are desirable for domestic use [20].The high alkalinity imparts an unpleasant taste.

I. Turbidity

The turbidity profile of the pond water is 5 NTU. The turbidity values obtained from the sampling points was higher than WHO standard of 5 NTU. None of the receiving water body met the FEPA guideline of 0 to 1 NTU for turbidities in water for domestic use. These values are grossly exceeded in the water samples and it disqualifies the receiving water body for direct domestic use. Also, the excessive turbidity in water can cause problem with water purification processes such as flocculation and filtration, which may increase treatment cost. High turbid waters are often associated with the possibility of microbiological contamination, as high turbidity makes it difficult to disinfect water properly [21].

J. Total Dissolved Substances (TDS)

The dissolved oxygen of the pond water is 6.22. The DO content in treated final effluent which was observed to deplete faster than DO from the receiving water body could be attributed to the presence of degradable organic matter which resulted in a tendency to be more oxygen demanding. Dissolved oxygen is an important factor used for water quality control. The effect of waste discharge on a surface water source is largely determined by the oxygen balance of the system and its presence is essential in maintaining biological life within a system. Dissolved oxygen concentrations in unpolluted water normally range between 8 and 10 mg/L and concentrations below 5 mg/L adversely affect aquatic life [22-23]. DO standard for drinking purpose is 6 mg/L whereas for sustaining fish and aquatic life is 4-5 mg/l. The DO value from this study fell short of the recommended standard. For water quality variable such as dissolved oxygen, water quality criteria are set at the minimum acceptable concentration to ensure the maintenance of biological function [24-25].

K. Calcium:

The calcium is 96mg/dl for pond water. The tolerance range for calcium hardness is 75 to 200 mg/l. Calcium contents in all samples nil. Calcium is needed for the body in small quantities, though water provides only a part of total requirements.

L. Chemical Oxygen Demand (COD) and Biochemical Oxygen Demand (BOD)

COD is a measure of pollution in aquatic ecosystems. It estimates carbonaceous factor of organic matter. In present study obtained in the range of 4.20mg/l and above the permissible limit set by WHO (10mg/l).BOD is the amount of oxygen required by the living organisms engaged in the utilization and ultimate destruction or stabilization of organic water. It is a very important indicator of the pollution status of a water body.

The BOD value shown range from 9 mg/L. The BOD values for all water sample were found higher than the prescribed limit WHO(10mg/l).Both BOD and COD may be due to discharge of domestic sewage and industrial waste water to soil and water bodies and may be due to the logging of the industry wastes [26]. Large quantities of domestic sewage, agricultural wastes and other wastes may contribute to the high values of chemical oxygen demand. High COD and BOD may causes to affect the aquatic life.

M. Sulphate

Sulphate range 18mg/dl for sample. The tolerance range for sulphate is 200 to 400 mg/l. The high concentration of sulphate may induce diarrhea.

N. Chloride

Chloride found low during the study ranged from 318mg/dl for sample. Similar results were reported by Swarnalatha and Nasing Rao and Umavathi *et al.,* [27-28] showed that low concentration of chloride is association with decreased level of pollution. Chloride values ranged from 200 to 1000 mg/l. High chloride content can cause high blood pressure in people. Chloride in excess (1000 mg/l) imparts a salty taste to water and people who are not accustomed to high chloride may be subjected to laxative effect. High chloride concentration is also an indicator of large amount of organic matter [29].

O. Nitrate

During the study Nitrate 20 mg/dl for sample. All the samples are within the permeable limit. High concentration of nitrate is drinking water is toxic [28].

IV. CONCLUSION

The following conclusion obtained from the study. Physico-chemical analysis pond water sample was observed within the ranged as prescribed by WHO and Indian standards but alkalinity and total dissolved solid are higher than that of permitted limit in pond water.

The sulphate, phosphate and nitrate are lower than that of permitted limit in pond water. The temperature, pH, BOD, COD, magnesium, turbidity chloride and calcium are within the permitted limit in pond water.

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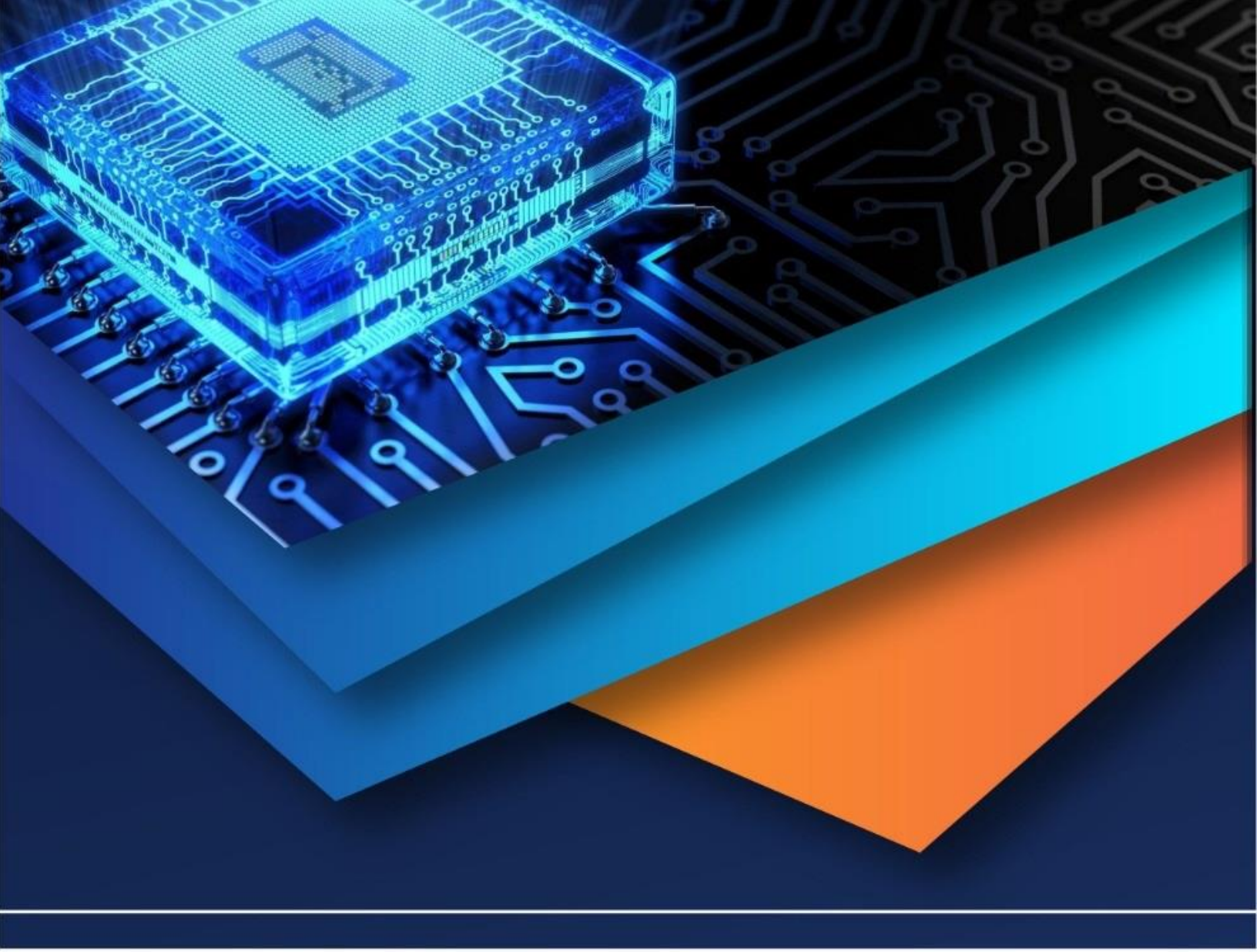

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