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Analysis of Ambattur Lake Water Quality with Reference to Physico – Chemical aspects at Chennai, Tamil Nadu

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Abstract: ***Drinking water is contaminated through the pipe distribution system of directly through ground water due to addition of waste discharged from domestic, industrial and agriculture sources. The present study was designed to assess the nature and Physico-chemical characteristic of water samples collected from in and around Ambattur Lake, Chennai,Tamilnadu.The Physico-chemical parameters such colour, pH, odour, Biological oxygen demand (BOD), Chemical oxygen demand (COD), Calcium, Hardness, Alkalinity, chloride, Nitrate and magnesium were studied. The results obtained showed a fluctuation in this parameter's which gave an idea about the intensity of pollution caused by industrial which is largest area in Asia and also manmade activities. In the present study revealed that the lake water was alkaline. The chloride and hardness concentrations were high. The water quality was found to be hard which was due to excess of calcium and magnesium ions present in lake water in excess quantity. Every parameter showed a significant correlation with increased lake water pollution. The determined Physico-chemical parameters were compared with the BIS and ICMR standards for the drinking water to know about the quality of the groundwater.***

Keywords: Ambattur Lake, surface water, water pollution, physicochemical parameter.

1. Introduction

Water pollution is a major problem related to the economic/industrial growth of any country. The number industries in India, during the last decade, has grown more than ten times and accordingly the development of economic growth and industries. Some of the industries release their effluent water and ultimately groundwater. Government of India is aware of these problems and has started looking into the remedial measure to clean some of the highly contaminated surface water bodies. Involvement of very high costs of remediation will make this process slow and therefore, it is essential that the contamination of bodies is controlled rather than remediation. Water is an essential element for life. Freshwater comprises 3%of the total water on earth. Only a small percentage (0.01%) of this freshwater is available for human use. [1] Pollution is an undesirable change in the physical, chemical and biological characteristics of our air, land and water. That may or will affect human life or that of desirable species [2].

The effluent contains various inorganic and organic substances in different concentration may affect the nature and quality of Lake Water. [3]. There are various ways as ground water is contaminated such as use of fertilizer in farming , seepage from effluent bearing water body [4]. Most of the industries discharge their effluent without proper treatment into nearby open pits or pass them through unlined channels, resulting in the contamination of ground water [5]. The incidence of ground water pollution is highest in urban areas where large volumes of waste are concentrated and discharge into relatively small areas [6]. The hydro-geochemical conditions are also responsible for causing significant variations in ground water quality [7]. In this study, the quality of the lake water located at the Ambattur was studied by determining the Physico-chemical parameters of the water during the south-west monsoon season (March-2015). These studies generate a baseline regarding the quality of the water which is used for agriculture and other household purposes [8]. In the present study to carry out qualitative analysis of Physico-chemical parameters of ground water in the study area.

2. Materials and Methods

2.1 Study Area

Ambattur aeri, or Ambattur Lake, is a rain-fed reservoir which reaches top levels during the monsoon seasons. In November 2008, incessant monsoon rain filled the lake and encroachments on the north and south banks of the lake were demolished. It also caters to the drinking water needs of the Chennai city after Poondi and Chembarambakkam Lake. Ambattur aeri is one of a chain of three water bodies, including the Korattur aeri and the Madhavaram aeri, where surplus water from one is Tran sported to another. The study was carried out in Ambattur Lake Region is a town and located in the suburbs of Chennai city which is well known for largest Industrial Estate. Ambattur is a biggest industrial town in Chennai. The present investigation was to estimate the mineral content of the contaminant water area in Ambattur Lake.

2.2 Sample collection

The samples which were used extensively for agricultural and other purposes were identified. The lake water samples collected from one locations using spot sampling

procedure. The bottles were cleaned thoroughly with 1% Nitric acid before samples collections. Before the samples were collected the bottles were thoroughly rinsed with the samples.

Figure 1: (Ambattur Lake East)

Figure 2: (Ambattur Lake West)

2.3 Analysis

At the sampling point itself, the Ph, conductivity and total dissolved solids were noted and collected samples were subjected to the physical and chemical tests.

3. Results and Discussion

The collected samples were analyzed for different Physico-chemical parameters such as pH, BOD, COD, Total hardness, colour, odour, alkalinity, chloride, calcium, and magnesium as per the standard methods and the results were compared with the Indian Standards for potable water. The results are presented in the Table: 1. The Physico-chemical characteristics of effluent treated water were compared with the Indian Standard Specification for Drinking Water [9]. The colour of the effluent treated water was greenish and brownish. The Sample collected from the effluent discharged water storage lake was found to have unobjectionable odour on prolong stay it gave foul smell; this may be due to organic wastes from chemical industries. Our water analysis's primary concern with the contaminated lake water analyzed with the drinking water specification and any adverse effects may affect the health [10].

4. Physico-Chemical Parameter

4.1 Colour

The contaminated lake water was slightly green-brownish yellow in colour.

4.2 Odour

The odour of contaminated lake water was objectionable.

4.3 pH

The pH of the Ambattur lake water sample is 7.92. The pH value of the lake water sample is under the normal range when compared with the drinking water standard. Higher pH values of studied lake water during summer could be ascribed to increased photo synthetic assimilation of dissolved inorganic carbon by planktons. pH values above 7.5 may indicate hard water. pH is defined as the negative logarithm of the effective hydrogen-ion concentration $(pH = \log[H^+])$. The normal pH range for drinking water is 6.5- 8.5; lake water sample has a pH of 7.92(Table: 1) which falls under the normal range. A high pH will affect the mucous membrane [11]. Water below 6.8 is beyond slightly acidic and approaching extremely corrosive (4.0-5.9). Evidence of this condition is green stains on sinks and porcelain fixtures. Water with a pH above 7.2 will leave deposits such as calcium and magnesium that will, over time, clog the pipes.

4.4 Biological Oxygen Demand (BOD)

BOD is a value of presence of organic materials in water which can support increasing of microbe organisms. Surface water (river, lake, and pond) containing BOD values 10 mg/l are consider being moderately and more than 20 mg/l as to be highly polluted water. The biological oxygen demand of the lake water is 46 mg/l. The lake water has high BOD level when compared to the drinking water standard, would therefore be easy to deplete the oxygen content if any material were present which would react with oxygen. Thus a high content of BOD in sample (46 mg/l) shows high organic and inorganic waste materials that require oxygen for oxidation. This shows the seepage of organic and inorganic waste materials from the effluent into nearby lake water.

4.5 Chemical Oxygen Demand (COD)

The maximum permissible value of COD is 10 mg/l for drinking water the chemical oxygen demand of the normal drinking water standard is 250mg/l in comparison the lake water contain a high level of COD (350mg/l). According to the general standards for discharge of environmental pollutions the cod level is 250 mg/l. The lake water level has higher in samples shows contamination amount is high.

4.6 Alkalinity

The total alkalinity of the contaminated water was noted that 550mg/l thus the total alkalinity is very high in the lake water sample. Alkalinity for a standard drinking water is 200mg/l. It Indicates the presence of bicarbonates, carbonates and hydroxides above the normal value the water taste becomes unpleasant high alkalinity should be corrected for both economic and health concerns.

4.7 Hardness

The total hardness of Calcium Carbonate in the water sample is 660mg/l, the normal value is 300mg/l. hard water is arbitrary, the Indian Geological survey uses the following classification: 1 to 60 mg/l is considered moderately hard, 121 to 180 mg/l is considered hard, and above 180g/l is considered very hard. Total Hardness ($CaCO_3$ - calcium carbonate) "Hardness" refers to the amount of calcium and magnesium in the water and is measured in grains per gallon. Hard water consumes soap before lather will form and Creates scale and sludge, Caustic embrittlement and corrosion in boilers, water heaters, cook wares, and water pipes.

4.8 Chloride

Higher concentration of chloride in water is often found in combination with higher sodium concentration. ICMR and BIS have prescribed 250 mg/l as the maximum permissible value. If the chlorine value exceeds 300 mg/l and the presence of a major Cation is sodium, so it is confirmed water is salty. Sources of chlorides are from soluble salts such as sodium chloride. The chloride content of the lake water showed a high level of 350 mg/l (Table: 1). The high level of chlorine beyond 250mg/l affects the taste, palatability and corrosive effect of water.

Nitrate

The total concentration of nitrate is 47 mg/l (Table: 1). The desirable amount of nitrate in drinking water standard is 45mg/l. High level of Nitrate encourages growth of algae and other organism's types here. Infants below the age of six months who drink water containing nitrate in excess could become seriously ill and if untreated may die. Symptoms include shortness of breath and blue-baby syndrome. Nitrates are one of the major inorganic salts regulating the productivity of phytoplankton. The tolerance limit for the nitrate is 45mg/l beyond this causes methanemoglobinemia.

4.9 Calcium

Calcium is essential element for various enzymatic transformations within the cell especially in the trans-phosphorylation in algal, fungal and bacterial cell the normal concentration of calcium according to the drinking water standards is 75mg/l. The concentration of contaminated lake water is 180 mg/l. thus the level of calcium is found to be very high which contributes to the hardness of water. Calcium is an important content in natural water which determines the rigidity of water. The Indian Standard for Drinking Water Specification stated the tolerance limit of calcium as 75mg/l. The high level of calcium in the lake water results in Encrustation in water supply structure and adverse effects on domestic use.

4.10 Magnesium

Magnesium also one of important mineral for various enzymatic transformations within the cell especially in the trans- phosphorylation in algal, fungal and bacterial cell [12]. The level of magnesium in the contaminated lake water is 130 mg/l. the contaminated lake water has high level of magnesium when compared with the drinking water standards (30 mg/l). Thus the presence of high level of calcium and magnesium indicate the hardness of water. Most of the hardness and scale-forming properties of water which for example, consume soap; water low in Calcium and Magnesium is desirable in the electroplating, tanning, dyeing and textile manufacturing industries as well as for boiler use.

4.11 Dissolved Oxygen

The level of Dissolved Oxygen in the contaminated lake water is 5.2 mg/l(Table:1) which is not good for aquatic species . The contaminated lake water has moderate level of DO when compared with the drinking water standards (6 to 10 mg/l). Thus the presences of low level of DO indicate the less problems of lake water species and this level of DO is permissible level for domestic and some other purposes and not fit for drinking purposes.

5. Comparison of Physico-chemical Parameters in Ambattur Lake

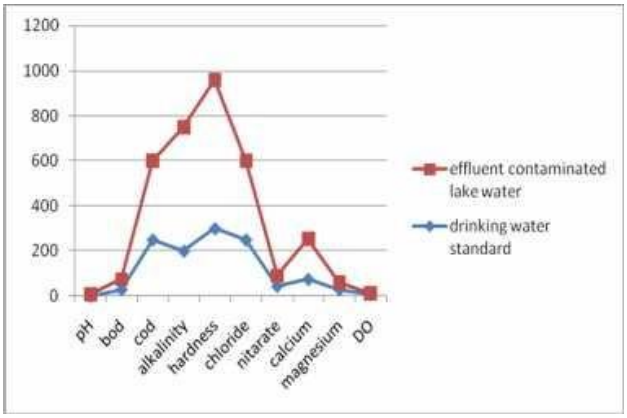

Table 1: Analysis of chemical parameters in lake water of Ambattur Chennai

S.No	*Parameters*	*Drinking Water Standard*	*Effluent Contaminated Lake Water*
1	Ph	6.5-8.5	7.92
2	BOD	30	46
3	COD	250	350
4	Alkalinity	200 mg/l	550 mg/l
5	Hardness	300 mg/l	660 mg/l
6	Chloride	250 mg/l	350 mg/l
7	Nitrate	45 mg/l	47 mg/l
8	Calcium	75 mg/l	180 mg/l
9	Magnesium	30 mg/l	130 mg/l
10	Dissolved Oxygen	6 -10 mg/l	5.2 mg/l

Chemical examination expressed in mg/l except pH, BOD, COD.

Table 2: Analysis of Physico parameters in lake water of Ambattur Chennai

S.No	Parameters	Drinking Water Standard	Effluent Contaminated Lake Water
1	Colour	Clear	Slightly Green- brownish yellow
2	odour	Unobjectionable	unobjectionable

6. Conclusion

Ambattur Lake shows high mineral contents in terms of total dissolved solids, total hardness, Calcium, Magnesium, Nitrate and Chloride. The reason for high values of Physico-chemical parameters at certain sampling location may be due the unscientific disposal of the water. It may cause laxative effects on health. From this research study, it can be concluded that lake water of the study area is not suitable for drinking purpose and must to do the recycling procedure before using irrigation purpose also. So we must to take special care for lake water further more pollution should be avoided in and around lake water.

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