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Assessment of Physico-Chemical Parameters of Kattamaisamma Lake of Sooraram Village, Hyderabad, Telangana State, India.

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ABSTRACT

Surface water forms the major source of drinking water and maintaining the ground water levels in the rural and urban areas of most of the developing nation of the world. Lake water is a source of drinking and domestic use purposes for rural and urban population of India. In the last few decades, parallel to rapidly developing technology, increase in population and urbanization, we have been witnessing alarming surface water pollution all over the world. The main goal of the present study was to assess lake water quality of Kattamaisamma lake. A systematic study has been carried out to assess the physicochemical characteristics of water qulity of katamysamma lake, Soorarm, Medak district, Telangana. In the study area 11 surface water samples have been collected and analyzed for the parameters such as pH, Electrical Conductivity(EC), Total Dissolved Solids(TDS), Total Hardness (TH), Total Alkalinity (TA), Sodium (Na^+), Potassium (K^+), Calcium(Ca^+), Magnesium (Mg^{+2}), Nitrates (NO_3^-), Sulphates (SO_4^{-2}), Fluoride (F^-), Clorides (Cl^-). The study revealed that lake waters are slightly acidic to alkaline in nature and found that the physic-chemical parameters of lake waters are higher than the prescribed standard limits for drinking purposes (IS 10500: 2012). This research work shows that the water quality of the Kattamysamma lake from Sooraram area pollution possibly due to increase of anthropogenic activities and improper release of sewage water and agricultural effluents.

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Introduction:

Water is the most abundant and most useful compound in the world and hence it is called Jeevan in Sankrit or life. Life is not possible without water, the 2/3rd mass of our body is water and 70% surface of the earth is covered by water. Lakes are known to be the ecological barometers of the health of a city. They regulate the micro climate of any urban center and that play a very important role in urban ground water recharging network. (Abound S. Jumbe., et al., 2008.). Basically the quality of water is described according to its physical, chemical and biological parameters. For evaluating suitability of lake water bodies for drinking purposes understanding its physico chemical characteristics is necessary. Periodic monitoring and assessment of water quality helps to develop management strategies to control surface water pollution (Shuchun et al., 2010). Water pollution occurs when water body is adversely affected due to the addition of undesirable materials to the water. Sewage is the major source of nutrients worldwide. Fertilizer lechates are largely Nitrogen and Phosphorous which are designed to boost plant productivity end up destroying the water quality and biodiversity of a lake system. The general urban run-offs carrying detergents accelerate eutrophication and hence the death of a lake biodiversity.

Present study deals with a Kttamaisamma lake which is situated between 17^0 33', 17^0 42' North latitudes and 78^0 26,78^0 26' East longitudes. It is located in Sooraram, 20 km from Hyderabad, Telangana, India. The climate of the study area is generally hot. In the present study lake water quality analysis was done for post monsoon season.

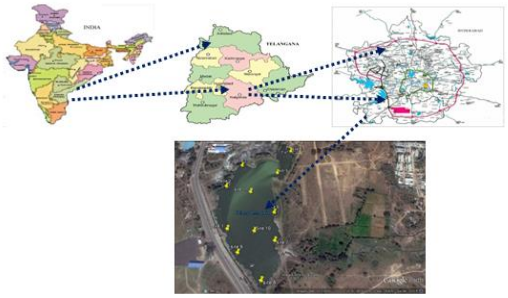

Fig.1: Location Map of the Study Area

Materials and Method:

The present study was carried out from Saroornagar of Hyderabad District to evaluate the quality of the Kattamaisamma Lake. Cleaned polyethylene bottles were used to collect 11 water samples locations from the lake shown in the table 1. The selected sites are of approximately 10 to 12 m far from each other. The bottles were rinsed with the same water which is to be taken as sample to avoid possible cross contamination. The physico-chemical parameters were analyzed as per the standard procedures recommended by APHA, (American Public Health Association) 1998, and Central Pollution Control Board (CPCB), Guide manual: Water and Waste water analysis. The results are expressed as milligram per liter, except pH and EC in µS/cm.

Table: 1. Various Physico- Chemical Parameters of Kattamaisamma Lake

S. No	pH	EC	TDS	TH	TA	Na^+	K^+	Ca^{2+}	Mg^{2+}	NO_3^-	SO_4^{-2}	F-	Cl-
1	7.3	2000	1280	415	360	135	12	122	26.8	64	127	1.02	273
2	7.3	1900	1216	405	380	136	12	126	21.9	69	131	1.01	288
3	7.5	3000	1920	345	385	131	12	126	7.3	16	129	1	284
4	7.4	2000	1280	360	410	135	13	152	6.1	21	116	0.98	302
5	7.8	2400	1536	380	340	127	14	128	14.6	20	131	1	288
6	7.5	2100	1344	400	280	132	14	126	20.7	23	125	1	288
7	7.5	2000	1280	395	315	117	14	120	23.1	14	117	1.01	277
8	7.6	1570	1005	407	301	120	15	130	20	25	125	1.3	245
9	7.8	1690	1082	498	348	135	20	150	30	20	135	0.9	240
10	7.9	1650	1056	453	333	140	21	132	30	25	119	1.1	250
11	7.8	1460	934	369	369	135	21	115	20	20	100	1	220

(**Note:** EC = Electrical Conductivity, TDS = Total Dissolved Solids, TH = Total Hardness, TA = Total Alkalinity.)
(EC in µS/cm, except pH and EC all are in mg/lit)

Table: 2. Comparison of Physico-Chemical Analysis Data with IS 10500:2012

Water Parameters	Minimum	Maximum	Average	IS 10500:2012	% of samples exceeding acceptable limit
pH	7.3	7.9	7.58	6.5-8.5	0
EC (µS/cm)	1460	3000	1979	Not Mentioned	
TDS (mg/l)	934	1920	1266	500	100
Total Hardness (mg/l)	345	498	402	200	100
Total Alkalinity (mg/l)	280	410	342	200	100
Sodium (mg/l)	117	140	131.2	Not Mentioned	
Potassium (mg/l)	12	21	15.3	Not Mentioned	
Calcium (mg/l)	115	152	129.9	75	100
Magnesium (mg/l)	6.1	26.8	20.03	Not Mentioned	
Nitrates (mg/l)	14	69	28.73	45	19
Sulphates (mg/l)	100	135	123	200	0
Fluoride (mg/l)	0.9	1.3	1.03	1.0	81.8
Chloride (mg/l)	220	302	268.5	250	72.72

Results and Discussion:

The results of a water quality assessment from Kattamaisamma lake water are shown in Table. 1 and compared those values with IS 10500: 2012 in Table.2.

pH:

The pH of the water sample indicates the neutral to alkaline nature which may be due to the pressure of bicarbonate which undergo hydrolysis in solution (Kulkarni and Pawar, 2006). pH is very important in regulating the respiration and enzyme system (Sivagurunathan and DhinaKaran, 2005). High pH levels are undesirable since they may impart a bitter taste to the water. In this study the pH values ranged from 7.3 to 7.9 with an average of 7.58. All the samples are within the acceptable limits as per IS 10500:2012.

Electrical Conductivity:

Electrical Conductivity is the capacity of a solution to conduct the electric current since most of the salts present in ionic forms are therefore capable of conducting current. A sudden increase in conductivity of the water is the indicator of the addition of the pollutant to the water (Trivedy and Goel, 1986). The electrical conductivity (EC) varies from 1460 µS/cm to 3000 µS/cm with an average of 1979 µS/cm.

Total Dissolved Solids:

In natural water, dissolved solids are composed mainly of carbonates, bicarbonates, chlorides, sulphates, phosphates, nitrates, calcium, magnesium, sodium, potassium, iron and manganese. They originate from dissolution or weathering of the rocks and soil, including dissolution of lime, gypsum and other slowly dissolved soil minerals.(Suleekh Chandra et al). In the study area TDS values varies from 934 to 1920 mg/lit, with an average value of 1266 mg/lit. 100% of the samples are exceeded the standards of IS 10500-2012.

Total Hardness:

The total hardness (TH) of water sample was determined by complexometric titration with EDTA using Eriochrome black-T as indicator. Basically calcium, magnesium, barium, strontium etc are responsible for the total of hardness water. The calcium is one of the alkaline earth metals, not known to produce may any hazardous effect on human health. The magnesium has ten times the solubility of calcium and being bivalent, too produces hardness. The calcium and magnesium hardness are the two elements, which from the most abundant ions in fresh water. (K.C. Khare et al., 2008). The total hardness of the water samples ranges from 345-498 mg/lit, with an average of 405 mg/lit. All samples (100%) are exceeded as per standards of IS 10500:2012

Total Alkalinity:

The IS 10500-2012 acceptable limit for total alkalinity is 200 mg/lit, beyond this limit taste may become unpleasant. Organically polluted water may also have alkalinity derived from the salts of organic weak acids like acetic acids, propionic acids and hydrosulphuric acid. Ammonia and hydroxides are also important sources of alkalinity in certain conditions (Swayer and MCkarty, 1985). The total alkalinity in the study area varied from 280 to 410 mg/l, with an average of 342 mg/lit.

Sodium:

Sodium (Na) is an essential element required for normal body function including nerve impulse transmission, fluid regulation, and muscle contraction and relaxation. However, in excess amounts, sodium increases individual risk of hypertension, heart disease, and stroke. In the study area water sodium ranges between 117-140mg/lit. The average value is 131.2 mg/lit.

Potassium:

Potassium (as K^+) is found in low concentrations in natural waters since rocks which contain potassium are relatively resistant to weathering. It is readily incorporated into mineral structures and accumulated by aquatic biota as it is an essential nutritional element. Present study area water has the Potassium ranges between 12-21 mg/lit, with an average value 15.3 mg/lit.

Calcium and Magnesium:

Calcium and magnesium are exists in surface and ground water mainly as carbonates and bicarbonates. Lake water contributed calcium as due to higher proportion of calcium in the surrounding rocks and soils which is essential for plant precipitation of lime, bone building etc. The main source of magnesium is sewage inflows and minerals generate from soil erosion and are important for enzyme activation, growth of chlorophyll and phytoplankton (Ramesh and Seeta, 2013; Verma et.al, 2012). In the studied area lake water calcium and magnesium vary from 115-152 mg/lit and 6.1 - 26.8 mg/lit respectively. Calcium ranges 100% exceeded the permissible levels of IS 50100-2012.

Nitrates:

Nitrate is a naturally occurring oxide of nitrogen and is an essential component of all living things. It is the primary source of nitrogen for plants, and it occurs naturally in soil and water. Nitrate is used mainly in inorganic fertilizers. When nitrate levels in drinking water exceed 45 mg/l, these higher levels in drinking water leads to methaemoglobinaemia (blue baby syndrome). Drinking water will be the major source of total nitrate intake, especially for bottle-fed infants. In the study area nitrate content varied from 14 to 69 mg/l. The average nitrare concentration in the studied lake water 28.73 mg/l. Only 19% of the samples exceeded the standards of IS 10500-2012.

Sulphates:

In the study area concentration of sulphates in the water samples ranges from 100-135 mg/lit with an average of 123 mg/lit. All samples within the acceptable limits (IS 10500:2012).

Fluoride:

The recommended limit of fluoride as per WHO are 1.5 mg/lit and 1 mg/lit as per IS 10500:2012. Values over 1.5 mg/L may cause dental fluorosis or mottling of permanent teeth in children between the ages of birth to 13 years. Steps may be taken to reduce the risk of dental fluorosis. The Fluoride concentration in lake water ranged between 0.9 -1.3 mg/L. The average value is 1.03. 81% of the samples exceeded the standards of IS 10500-2012.

Chloride:

Chloride is present in all natural surface and ground water from as low concentration to high

concentration. Chlorides are mainly come from inorganic salts like NaCl, KCl and CaCl2 etc. which are generally provided by soil, natural layers of chloride salts, municipal and industrial sewage and animal wastes (Gopalkrushna, 2011). Chloride is not harmful to humans but high concentration of chloride increase the corrosive property of water. Chloride ranges in the study area vary from 220 to 302mg/lit, with an average of 268.5 mg/lit. Except 3 samples all are (72%) exceeded the permissible limits of IS 10500:2012, and permissible limit is 250 mg/lit.

Conclusion:

It is concluded from the present study that majority of the samples has higher concentrations with regard to TDS, TA, TH, Ca^{2+}, F^- and Cl^- as per IS 10500:2012 specification for drinking water in lake water. The suggested measures to improve the lake water quality includes total ban on the activities that causes pollution. Finally, it is recommended that a policy has to be developed for water allocation linking ecological, hydrological and socio-economic aspects of life, with the involvement of all of the stake holders.

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