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Assessment of Physico-Chemical and Biological Parameters of Sanjay Lake and Old Fort Lake Water In Delhi

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ABSTRACT
Water is the most essential requirement for the human survival. With daily human consumption of about 80 L/day/person and increasing population ,the consumption and scarcity in the fresh water sources increases by many folds, so there is need of water sources which could fulfil the never ending need of water for human usage. In this regard, efforts are being made to generate or identify fresh water sources so that it can be used for drinking, irrigation and fish culture. So, for this very purpose we have analysed Samples of water were taken from the two lakes- sanjay lake and old fort lake (both in delhi) and analyzed microbiologically and physicochemical using standard methods. This paper deals with assessment of various water quality parameters of the water samples. The assessment was done during June 2016 – July 2016. This paper consists of the causes of water pollution of the two lakes, impacts of the pollution and the reasons because of which the water from these two water bodies cannot be used for irrigation, drinking and fish culture.
Keywords - fresh water sources, microbiologically and physicochemical analysis, assessment of various water quality parameters, water pollution

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I. INTRODUCTION

Urbanization and human activities are gradually destroying the natural environment across the globe. Lakes are such one of the example of important environmental features which are a very useful part of the ecosystem.

Sanjay lake in East Delhi is one of the many water bodies that is paying the price for increasing urbanization. In 1981-82, the Delhi Development Authority (DDA) converted a lowland area into Sanjay Jheel park. Sanjay Jheel was a huge rainwater fed natural lake. At times, the water supply was augmented by by the back flowing Yamuna. During floods, it also received water through Hindon River channel. Gradually, residential colonies of Mayur Vihar, Patparganj ate up the rainwater catchment area, which used to be the main source of water supply for the lake. Also construction of embankment along the Yamuna river to prevent its water from flooding the area obstructed the water supply from the river, which lies barely one kilometre away. As a result, the lake considerably dries up in peak summer. The Old Fort Lake or Purana Quila Lake lies quietly at the foot of a hill situated a few km southeast of India Gate and a few km north of the Tomb of Emperor Humayun with the Old Fort set as the backdrop standing majestically amidst greenery. It is probably one of the only lakes that existed since the first city of Delhi named 'Indraprastha' was built. On the east, the Yamuna river flows which used to be the water source of the Old Fort. Old fort lake was constructed for the recreational activity for the Delhi people. From the last few years it has been seen that the lake has been severely polluted by the human activities of recreation which has an adverse effect on the lake water. The fish population has drastically decreased in the water and algal content has increased.

To study the effect of the various factors which influence the adjacent environment of that particular water body we need to study all physical, chemical and biological parameters. By determining these parameters we can actually conclude the condition of that lake and take measures to clean and make it a good feature for others.

Identification of baseline water conditions in the water bodies and sources of water pollution, detection of any sign of deterioration of water quality, identification of any contaminated area, determination of extent and effect of the specific waste discharges, estimation of the pollution load carried by a water course system, development of

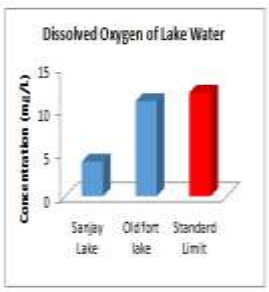
water quality guidelines and standards of specific water uses are some of our objectives.

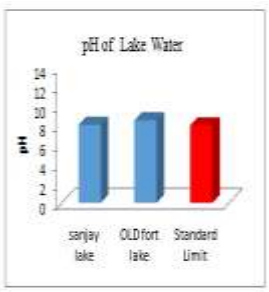
II. METHODOLOGY

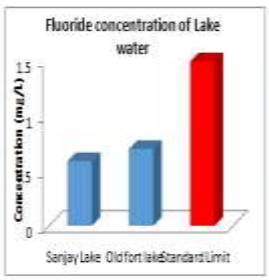
To determine the parameters of the quality measurement, various instruments were used. Ultraviolet–visible spectroscopy or ultraviolet-visible spectrophotometry (UV-Vis or UV/Vis) refers to absorption spectroscopy. The instrument used in ultraviolet-visible spectroscopy is called a UV/Vis spectrophotometer. It measures the intensity of light passing through a sample and compares it to the intensity of light before it passes through the sample. The instrument was used to determine the concentration of nitrites and phosphates in the sample. To measure the concentration of salts in the solution conductivity measurement is carried out using conductometer. To measure the pH of the solution pH meter is used. Titrimetric experiments were carried out to measure the concentration of calcium, magnesium, total hardness, alkalinity (CO_3^{2-} and HCO_3^-) and chloride concentration. Flame Photmetry was conducted to measure concentration of sodium and potassium.

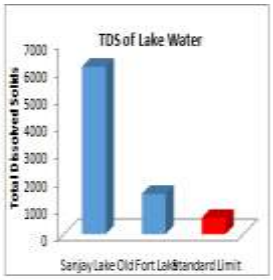
III. RESULT

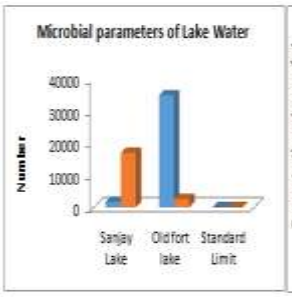
The characteristic of water, which have been accepted as sufficient to determine its suitability for different purposes are different and also they vary to a large extent. Here we are going to limit ourselves only to drinking, irrigation, fish culture. The water of these two lakes is not fit for any of the above use. The result are stated below in respect to different standards set up by the different organizations

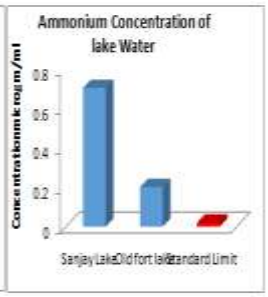


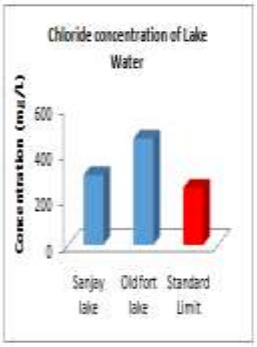


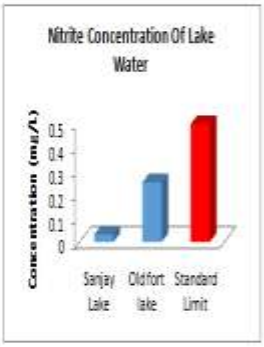


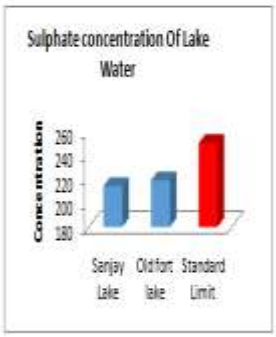


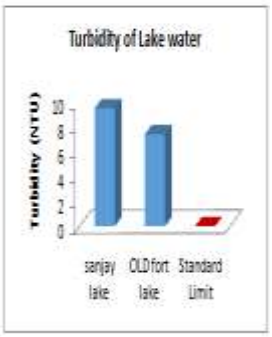


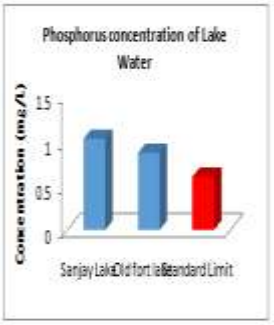


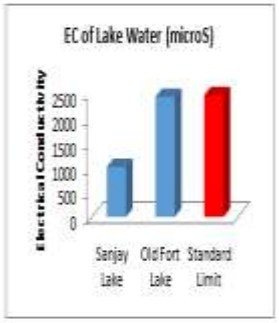


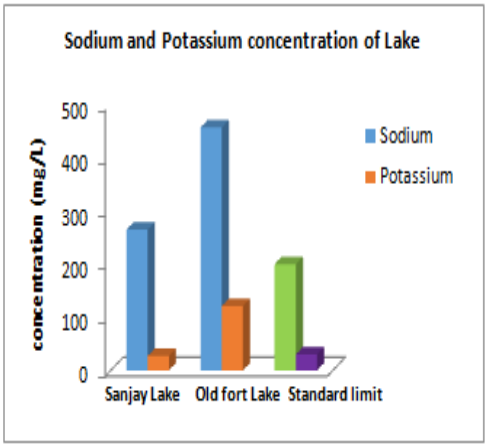


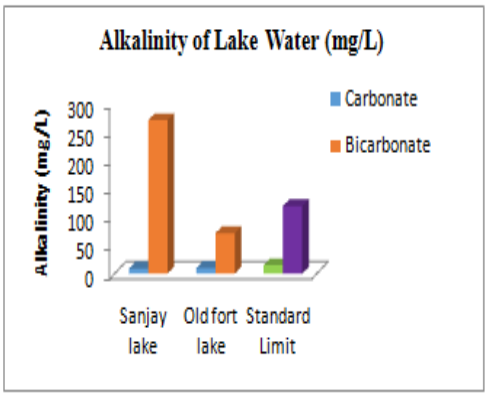


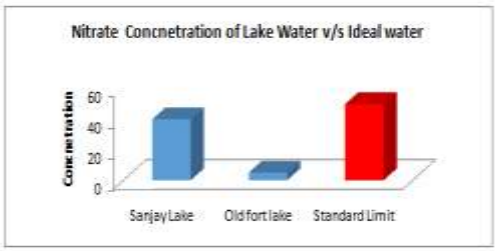


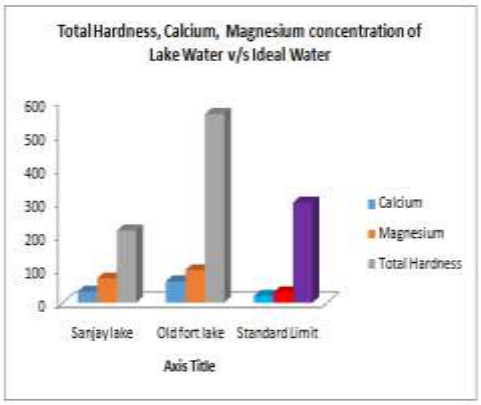












S.No.	PARAMETER	WHO STANDARD	INDIAN STANDARD	EPA GUIDELINES	SANJAY LAKE	OLD FORT LAKE
1.	Color	NA	5 Hazen units	NA	NA	NA
2.	Odor	Acceptable	Acceptable	NA	Foul smell	No smell
3.	Electrical Conductivity	NA	NA	2500 µs/cm	1025 µs/cm	2065 µs/cm
4.	pH	6.5-9.5	6.5-9.5	6.5-9.5	8.06	8.52
5.	Total Hardness	200 ppm	300 ppm	<200 ppm	215.96 ppm	565.2 ppm
6.	Calcium	NA	75 mg/l	75	32.93 mg/l	63.88 mg/l
7.	Magnesium	50mg/l	30mg/l	NA	72.49 mg/l	97.31mg/l
8.	Ammonia	0.3 ppm	0.5 ppm	0.5 ppm	0.0702	0.209
9.	BOD	6	30	5	NA	NA
10.	Chloride	250 ppm	250 ppm	250 ppm	304.7	465.92
11.	Magnesium	150 ppm	30 ppm	NA	72.49	97.31
12.	Nitrate	45 ppm	45 ppm	50 mg/l	5.66	40.96
13.	Nitrite	3 ppm	45 ppm	0.5 mg/l	0.0308	0.2532
14.	Sodium	200 ppm	180 ppm	200 ppm	265.23	457.76
15.	Sulphate	250 ppm	200 ppm	250 ppm	214	219.33
16.	Coliform	2.2/100 ml	10/100 ml	<1/100 ml	17000 ml	35000 ml
17.	Fecal	Nil ml	Nil ml	Nil ml	1700/ ml	2600 ml

*NA- Not Available

Desirable and permissible limits allowed for the Drinking Water

S.No	Parameters	Desirable limits mg/l	Permissible limits mg/l
Essential Characteristics			
1	Colour Hazen unit	5	25
2	Odour	Unobjectionable	-
3	taste	agreeable	-
4	Turbidity (NTU)	5	10
5	pH	6.5-8.5	No relaxation
6	Total Hardness, $CaCO_3$	300	600
7	Iron (Fe)	0.3	1.0
8	Chloride (Cl)	250	1000
9	Residual Free Chlorine	0.2	-
10	Fluoride (F)	1.0	1.5
Desirable Characteristics			
11	Dissolved Solids	500	2000
12	Calcium (Ca)	75	200
13	Magnesium (Mg)	30	100
14	Copper (Cu)	0.05	1.5
15	Manganese (Mn)	0.1	0.3
16	Sulphate (SO_4)	200	400
17	Nitrate (NO_3)	45	100
18	Phenolic compounds	0.001	0.002
19	Mercury (Hg)	0.001	No relaxation
20	Cadmium (Cd)	0.01	No relaxation
21	Selenium (Se)	0.01	No relaxation
22	Arsenic (As)	0.05	No relaxation
23	Cyanide (CN)	0.05	No relaxation
24	Lead (Pb)	0.05	No relaxation
25	Zinc (Zn)	5.0	15
26	Hexavelant Chromium	0.05	No relaxation
27	Alkalinity	200	600
28	Aluminum (Al)	0.03	0.2
29	Boron (B)	1.0	5.0
30	Pesticides	Absent	0.001

Desirable and acceptable Range of the various parameters suitable for fish culture.

Sr.No	Parameter	Acceptable range	Desirable range	Stress
1.	Temperature (°C)	15-35	20-30	<12, >35
2.	Turbidity (cm)		30-80	<12>80
3.	Water colour	Pale to light green	Light green to light brown	Clear water, Dark green &Brown
4.	Dissolved oxygen (mg L^{-1})	3-5	5	<5, >8
5.	BOD (mg L^{-1})	3-6	1-2	>10
6.	CO_2 (mg L^{-1})	0-10	<5, 5-8	>12
7.	pH	7-9.5	6.5-9	<4, >11
8.	Alkalinity (mg L^{-1})	50-200	25-100	<20, >300
9.	Hardness (mg L^{-1})	>20	75-150	<20>300
10.	Calcium (mg L^{-1})	4-160	25-100	<10, >250
11.	Ammonia (mg L^{-1})	0-0.05	0- <0.025	>0.3
12.	Nitrite (mg L^{-1})	0.02-2	<0.02	>0.2
13.	Nitrate (mg L^{-1})	0-100	0.1-4.5	>100, <0.01
14.	Phosphorus (mg L^{-1})	0.03-2	0.01-3	>3
15.	H_2S (mg L^{-1})	0-0.02	0.002	Any detectable level
16.	Primary productivity (C $L^{-1}D^{-1}$)	1-15	1.6-9.14	<1.6, >20.3
17.	Plankton (No. L^{-1})	2000-6000	3000-4500	<3000, >7000

IV. DISCUSSION

This investigation led to the following inferences – pH of the lake water lies within the tolerance limit given by ISI and also comparable with the irrigation water. On the basis of the EC, the lake waters investigated is classified as highly saline water. It can be used only on the soil of good permeability and for growing of tolerant crops. It is unsuitable for drinking or fish culture. TDS value of the old fort lake lies in the tolerance range but not of the Sanjay Lake. The water of old fort lake is suitable for irrigation and fish culture. The lake waters of both the lakes have suitable content of total hardness. Hence it is suitable both for household use and fish culture. Alkalinity values are found out to be very high and thus the water is not fit for consumption in either of the three fields. Concentration of chloride was quite high for both lakes and hence unsuitable for any of the purposes. A high concentration of sodium usually renders soil alkaline and unfit for agriculture. The concentration of potassium is extremely high which makes it unfit for irrigation, fish culture. The high concentration of sodium, calcium and magnesium ions in water sample indicate the fertility values of the soil will be affected if this water is used. Incorporation of the high amounts of cations (Na^+, K^+, Mg^{2+}) and anions (HCO_3^-, CO_3^{2-}, Cl^-) in soil can cause increased electrical conductance in soil. The microbial content of the samples of both lakes is too high such that it is unsuitable for drinking and fish culture. The consumption of such water may be very hazardous for human health. It appears from the findings that the lake water of both the lakes is potentially polluted and aesthetically unacceptable for irrigation purpose. It will affect the crops as well as the quality of soil. The water is also neither suitable for the drinking purpose nor fish culture. As a precaution this water should be treated well before any use.

V. CONCLUSION

Water is not only the most vital requirement of all living organisms but provides the habitat to a significant proportion of the earth's biodiversity. Humans depend upon water not only for their biological needs but also for food production and all social and cultural activities such as industrial production, energy generation, microclimate regulation, waste disposal, navigation, recreation, aesthetics etc. Conservation of lakes and wetlands requires several actions to be taken together. It is necessary to first assess the current state of the water body in terms of its physical, chemical, hydrological and biological characteristics and then determine the objectives and goals for which the water body is to be conserved. These may relate to the conservation of water quality and for the conservation of biodiversity depending upon the services required from the water body. Suitable water treatment processes can be adopted which helps in purification of the water bodies. The purification of the water body is very important thing because all our biosphere is dependent on the water only for its survival.

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