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Water Quality Assessment of Lakes by Investigating Different Physical and Chemical Parameters

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Abstract:

Water is the most precious and important natural resource for humans and living organisms. Though most of the earth's surface consists of water only a small amount of it is usable, because about 97% is salty water (marine) and only 3% is fresh water. Water is used for different purposes like drinking, agriculture, or industry, etc. each of these users has different requirement of standards of water quality to fulfil their purpose. Therefore, water quality analysis is done to check water quality and is suitable or not for use. It consists of sampling, preservation, and analysis of water.

Keywords —**Water Quality Analysis, parameters, Glacier-fed Lake Neel Tal, Wular Lake, Shantisagara Lake**

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I. INTRODUCTION

Water Quality: -The chemical, biological and physical characteristics of water, with respect to its suitability for a required purpose or use. Water is used for different purposes like drinking, agriculture, or industry, etc. Each of these users has different requirements of standards and parameters of water quality to satisfy their purpose.

Water Quality Analysis: -Water quality analysis is to check the standards and parameters of water and to ensure the suitability of the water to use for a required purpose.

Water Quality Analysis Requirement: -
1. To check the standards and parameters of water quality.

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2. To check the suitability of water for use.

3. To monitor the working system for water quality maintenance.

4. To check whether any change is required in the system and to decide what changes should be done.

5. Water quality analysis is necessary for public health and industrial use.

II. LITERATURE SURVEY

A. *Chandola Lake - Ahmedabad*

In this paper, the author studied the standard methods, Physico-chemical parameters of lake water. He observed that small industries and slum areas existed in the lake complex, which is responsible for polluting the lake water. He also observed that sewage waste and organic pollutants released by industries and slums.

The present study was carried out by the author on Chandola Lake located in the city of Ahmedabad. In his studies, he did sample in the morning. Water samples were collected in polyethylene bottles, and then the closed bottle was immersed in the lake at a depth of 0.5 to 0.7 m, and then a bottle was opened and closed again to bring it out of the surface. There were samples collected from them from five different sites and mixed to produce a unified sample. From the time of sample collection to the time of actual analysis, many physical and chemical reactions will alter the quality of the water sample; So, to minimize this change the specimen was preserved after the collection the specimen. Water samples were preserved by adding chemical preservatives and lowering the temperature. They analysed water temperature, pH, dissolved oxygen, electrical conductivity, and total dissolved solids immediately after the collection of water samples.

They were studied for a period of one year from March 2009 to February 2010. They collected monthly data, but their results were shown by season. A season like March to June summer season, July to October monsoon season, November to February winter season takes four months. After the analysis, the collected water sample was brought to the laboratory and the relevant analysis was done.

After investigation, we conclude that the water in that lake is not useful, because a large number of small industries and the sloping area near that lake were responsible for releasing large amounts of sewage waste and organic pollutants, resulting in the lake water is polluted. And that water is not suitable for human consumption and use. The water of that lake challenges diseases. Constant addition of sewage waste and organic pollutants are responsible for the increase in the value of sodium, nitrate, phosphate, chloride, magnesium, and calcium, etc. and, at the same time, the addition of those pollutants influences the photosynthesis rate, resulting in death. There are also plants and living organisms. Lake water is highly contaminated and if a similar situation persists for a long time, Chandola Lake may soon become ecologically inactive.

B. *Glacier-fed Neel Tal – Garhwal, Himalaya*

In this paper, the author studied that the Water Quality Index of the lake is unfit for human consumption. In 2014 & 2015, they take sampling in the months of June and August, once the lake was accessible. They collected water samples from 3 totally different sites of the lake concerning 30cm below the surface water through autoclaved thermo-flask throughout between 9:00 and 11:00 am hrs. Water quality parameters like pH scale, air temperature, water temperature, and DO were measured at the site. However, for the remaining parameters, they transferred the water samples to the Laboratory, Department of Environmental Sciences, and H.N.B University at Srinagar-Garhwal, Uttarakhand Bharat. All Physico-chemical parameters and coliform tests were analysed by the quality ways, like Wetzel and Likens (1991), APHA (2005), etc. was used to analyse the parameters.

Coliform Detection -

For water quality analysis, the coliform group of microorganisms could also be differentiated by the presumptive test, the confirmed test, and therefore the complete test. The presumptive test was done to confirm the availability of lactose fermenting gas-producing microorganisms. It was to verify the Most Probable Number (MPN) of coliforms in a

water sample besides their properties of fermenting lactose and producing gas. They confirmed and therefore the complete test was used for differentiating the coliform with non-coliforms. These tests were performed by following the quality strategies by APHA (2005).

By analysis of Glacier-fed Lake that was in Uttarkashi district of Garhwal Himalaya within the Uttarakhand state, India. Hence, concluded that the; Temperature of that Lake is minimum at 4.1 C and most at five.7 C at that they're taking samples for testing. Accumulating and analysing the physical, chemical, and biological parameters of water and their dimension to access the water quality. We notice that the amount of Water Quality Index of that Lake is 17.585, that was disclosed that the lake water quality is 'excellent and is suitable human consumption and usage.

C. Surha Lake - Uttar Pradesh

In this paper, the author studied that the rise in pollution of the lake throughout these sampling years is ascertained that there had been an even increase within the pollution throughout the year 2006 to 2008, because of vital modification in the physicochemical characteristic of water above study vital negative relationship is ascertained between hydrogen ion concentration and alternative water quality parameters except BOD, chloride, and temperature that incorporates a positive relationship. Moreover, the negative relationship has additionally been found between pH scale with Ca and Cl whereas, positive with DO, Mg, and turbidity. The results indicate that the water quality is contaminated and the systematically rising from slight to moderate throughout 2006-08, because of more input of domestic waste and agricultural runoff from the lake catchments. Additionally, mathematical analysis, among physiochemical parameters reveals that the BOD is the important parameter that governs alternative parameters of water quality in lakes. The current study might be helpful for environmentalists or policy manufacturers to strategize the conservative life to take care of its ecological health.

D. Wular Lake -Ramsar Site in Kashmir Himalayan

In this study, physicochemical parameters of surface water quality littered with completely different pollution sources were monitored over 2 years of duration. The widespread deterioration in water quality of Wular Lake had been according to because of anthropogenic influences. (Agricultural practices, waste runoff, agriculture & urban sprawl) Surface water samples (0.5 to 10 m) were collected from 5 sites on monthly basis from Feb 2011 to Jan 2013. The important sources of this lake pollution came from domestic waste products and agricultural activities and run-off. This analysis showed that the variations within the water quality measure seasonal factors and anthropogenic factors. During this case, it absolutely was found that top WQI was mainly because of the presence of a high concentration of Iron and different parameters. WQI analysis showed that the water of the lake was fit for drinking purposes however increase values will warn us regarding future consequences. During this analysis, mathematical exploratory techniques were evaluating variations in the Surface Water Quality of Wular Lake. By finding out this Wular Lake analysis and informative things regarding pollution management, it results give info developing higher pollution management methods for the Wular Lake.

E. Ramgarh Lake- Gorakhpur, (UP)

1. The temperature of the water of Ramgarh Lake at Gorakhpur is between 29 oC to 34 oC. Moreover, the temperature between upper and lower layers at individual stations was observed to be between 0.2 °C to 2.5 °C with the formation of a thermocline at several places within the lake body. The lower layers were comparatively cooler because of the penetration of sunlight to a limited depth in the higher region of the lake. This might be attributed to the extremely cloudy nature of the water because of the high amount of algal growth and different suspended solids.

2. Testing of DO was done by using Digital DO Probe wherein DO readings of lake water at the top layer were taken. The data regarding DO showed

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the changes over a very wide range with a minimum value of 6.89 mg/L to a maximum of 10.2 mg/L correspond to locations RL9 and RL10 respectively. Overall observations with DO showed that at many stations it was at the saturation to super-saturation levels. The super saturation values in the range of 9 to 12 mg/L could be mostly attributed to the abundant algal presence in the lake body.

3. From the Biological Oxygen Demand (BOD) the values of 24 mg/L (minimum) and 61 mg/L (maximum) for top layers were observed for stations RL4 and RL7 respectively.

4. The COD values of water of the lake varied from 104.11 mg/L (minimum) to 170.08 mg/L (maximum) for stations RL4 and RL9 respectively.

5. Phosphate level in Ramgarh Lake was recorded as 0.30 mg/L (minimum) to 0.44 mg/L (maximum). The minimum Phosphorus level was observed at RL5 station and maximum Phosphorus level is observed at station RL3. The presence of phosphate is an indication of entering sewage as well as agricultural runoffs in the lake.

6. The nitrate- nitrogen shows significant variation. The values range between 0 mg/L to 1.46 mg/L. Hence, indicates the eutrophic status of the lake.

Hence conclude that the lake is getting polluted over time. Initially, the Lake was oligotrophic which has gradually changed to mesotrophic because of increased anthropogenic activities in the catchment. The lake has become eutrophic because ofthe increased addition of pollutants/contaminants. The data of sampling at 10 locations from November (2013) to September (2014) showed that the lake has become eutrophic state and conservation measures must be implemented to improve the lake.

F. Karanji Lake, Kukkarahalli Lake, Dalvoy Lake – Mysore

In these three lakes Kukkarahalli Lake, Karanji Lake, Dalvoy Lake fluctuation of the values was analysed. The aim of the research was to determine physicochemical and biological parameters of water pollution in the three lakes of Mysuru city with a view to revealing information about city water quality. The sampling sites were selected on the basis of locations of inflow and outflow. The water samples were collected from the surface and few meters below water level to analyse the varying characteristics. The mean depth of Kukkarahalli Lake - 0.5m, Dalvoy Lake - 0.5m, and Karanji Lake - 0.4m was recorded during the test. From the results, the pH of the lakes found to be 8.6 to 9.3 in Kukkarahalli Lake, 7.2 to 8.6 in Dalvoy and Karanji Lake. The test of main parameters like pH, DO, BOD, COD, Faecal and total coliforms in different months were represented in the tables. The temperature of the water body varied from 22° C to 32°C during the study period. The coliform Bacteria include the genera Escherichia, Citrobacter, Enterobacter, and Klebsiella, etc. It showed that the lake is Eutrophic. The aquatic plants like water hyacinth and Lavancha were seen abundant in Lake which helps in the self-purification of the lake. It also showed that the lakes were not suitable for aquaculture due to the minimum DO level and suitable for agricultural purposes. Therefore, to remove this type of pollution the periodic removal and disposal of weeds from the lakes are necessary. We have to do catchment area treatment and Lake Front Ecodevelopment (bunching, fencing, shoreline development, etc). This result reveals to us that the lake's water is bacteriologically affected and is not suitable for bathing and other recreational activities.

G. Shantisagara Lake - Chennagiri Taluk, Devanagari dist.

1. It is acceptable for drinking purposes and excellent for industrial uses.
2. Physico-chemical characteristics like Hardness, BOD, DO, TDS, Chlorides are within the limits in the Lake water.

3. Physico-chemical characteristics like Alkalinity, Acidity, Total solids, TSS, exceed the limit in the lake water.

4. The WQI values show the given lake water is soft and it is very fit for domestic uses.

5. The more turbidity of water at the station (S-3) is 5cm, and the least turbidity of water at the station (S-2) is 4.67cm. Hence the clarity of the water is very good.

H. *Ambazari Lake- Nagpur, Maharashtra*

The pollution level enhanced in Ambazari Lake because of spiritual activities and cause adverse effect to the aquatic life and whole aquatic system. The high impact of pollution was seen throughout the festivals, idols immersion in these aquatic ecosystems destroyed the total ecological balance. It was determined that the water quality parameters like TSS, TDS, TS, turbidity, conductivity, hardness, DO, BOD and COD considerably enhanced throughout the immersion duration and so declined slowly within the post-immersion duration by self-purification mechanism of the water body. It was additionally detected that the water quality of Ambazari Lake endures a modification from poor to better. Generating awareness among the society regarding reducing pollution because of festival waste can facilitate in preserving system of those water bodies.

I. *Powai Lake- Mumbai*

Mumbai is one of the financial and commercial cities of India so demand for potable water is increasing day by day with the increase in population Powai water supply was brought to Mumbai for the first time in 1891 complaints were received from the public regarding the quality of Powai. Water samples were collected from Powai Lake at three different places Near the Powai Garden. The present assessment of physicochemical parameters like colour, transparency, salinity, nitrate, phosphate, sulphate, hardness, and conductivity of Powai Lake water, indicates that it is highly polluted, various parameters of the water samples showed variations due to seasonal and anthropogenic activity.

J. *Velachery Lake-Chennai*

There are about 2,000 families living on the southern side of the lake. Almost, all of them have bathrooms within the ground; they handily direct the pipelines to the lake, inflicting comprehensive injury to the water body. The government's effort to prevent the lake water has not yielded satisfactory results. This paper shows the results of the quality of water with altogether completely different values. At the tip, all the parameters are not up to the extent of World Health Organization standards. Thus, over that water is impure and not appropriate to be used.

K. *Futala lake-Nagpur*

In this current study, water samples were collected from totally different sampling points and analysed at the laboratory in analytical ways. The physicochemical parameters that were analysed for Hebbal Lake were pH scale, Turbidity, DO, BOD, Total solids, Total dissolved solids, Total suspended solids, Total hardness, Magnesium, calcium, Chlorides, all parameters were within limits. This lake is mostly getting contaminated once the festivals happen like Holi, Navratri, Ganesh Utsav, etc.

L. *Sampling Procedure for Lake or Stream Surface Water Chemistry- Research note*

The physicochemical analysis includes data of seven parameters such as pH, total solids, turbidity, D.O, B.O.D, Temperature Change, Faecal Coliform, nitrate, and total phosphate. The sampling of the water of the lake water should be taken by taking the various precautions and the methods to be used in sampling the water like a collection of the water in the bottle that bottle should be clean, and the samples should be collected from the 5-6 inches below the surface of the water in the lake. Labelling should be done for every sample properly. Samples should be transported to the nearby testing location by maintaining a temperature of around 4º-5ºC.

M. *Ten Urban Lakes in Mumbai*

Pollution in the lakes is hindering the ability of the ecosystem to serve the city, which could be a vital asset for the city. This study has provided a scientific data for planktonic, aquatic macrophyte diversity and water quality of selected lakes of

Mumbai. Physical and chemical parameters when analysed to study pollution level in the lakes. Higher level of nutrients and BOD and low values of Turbidity, dissolved oxygen in lake water is indicating heavy organic pollution. Out of 12 lakes studied Powai, Sheetal and Shyam Nagar lakes were most polluted, whereas Arey and MNP lakes were the least polluted lakes. Lakes having vegetated catchment area recorded low levels of nutrients and BOD in comparison with lakes surrounded by highly urbanized watershed. This indicates the importance of good vegetation cover for the health of Lake Ecosystem. The study recommends that all the lakes should be conserved and protected from further degradation.

N. Lakes of Haryana (Tikkar Taal, Karan Lake and Brahma Sarovar)

The water quality index of each lake in this study is 100, found more than which clearly indicates that their water is unsuitable for drinking, bathing and completely different human use. The major causes of water quality contamination were found to be: Human neglect, contamination by humans and animals' interference, etc.

III. PROPERTIES STUDIED

As per the requirements, strategies of water quality analysis are chosen. Several the factors are as follows:
• Volume and the variety of samples are to be analysed.
• Analysis value/price.
• Promptness needs for analysis.
Some tests are to do on taking samples to analyse the water quality. Properties to be analysed are as follows:
1. Total Solids Dissolves
2. Total Solids Suspended
3. pH scale Determination
4. Chloride Content Determination
5. Conductivity
6. Determination of sulphate content
7. Turbidity
8. Iron content
9. Mn content.

1. Total Solids Dissolved: This term refers to the number of inorganic salts and quantity of organic matter available in a water sample.
2. Total Solid Suspended: The particles that do not appear to be dissolved in solution and have some specific weight and size of around two microns are total suspended solids.
3. pH scale Determination: pH describes the character of the sample whether it is basic or not or alkaline within its pH scale.
4. Chloride Content Determination: The concentration of chloride ions is found by subtracting the titration findings of the moles of silver ions that reacted with the thiocyanate from all the moles of silver nitrate mixed in solution.
5. Conductivity: Pure water is not a good conductor of electricity while an impure sample can conduct electricity because of it contains some metal particles and salts.
6. Determination of sulphate content: An easy and precise turbidimetric technique of finding sulphate S in water samples is described.
7. Turbidity: Turbidity is that the haziness of the sample because of suspended or dissolved particles within the sample.
8. Iron and Mn content: it is the presence of particles of these elements.

IV. FUTURE SCOPE

The plan and show of a model distant, programmed, versatile, constant, and minimal expense water quality checking framework is depicted. In this framework, minimal expense parts i.e., microcontroller, LCD screen, and different segments are utilized to accomplish the destinations of the proposed plan with satisfactory exactness.

Contrasted with the past related works, the expense of the framework model is impressively low. To guarantee the versatility of the gadget, an independent, little-size Arduino microcontroller is utilized. The created framework was tried under various conditions, with the arrangement of water with various pollutions, and in various timeframes.

The consequences of the test for all occasions have been fruitful. We presume that every one of the targets of the proposed framework has been accomplished. To test more boundaries of the water quality for certain applications, different sensors can be remembered for the framework. The framework has wide application, and it is usable and reasonable by all classes of clients.

V. CONCLUSION

1. The occasional upsides of WQI show that during the summer season, lake water is more influenced than during winter. This could be because of the way that the microbial movement gets decreased because of low temperature, accordingly, keeping DO even out at an acceptable reach during the whole winter season.

2. The proposed measures to improve the lake water quality remember absolute boycott for the exercises that causes contamination.

3. Consequence of water quality evaluation unmistakably showed that the greater part of the water quality boundaries marginally higher in the wet season than in the dry season.

4. Water quality is reliant upon the kind of contamination added and the idea of self-cleaning of water.

Factual and numerical exploratory methods were used to assess varieties in the surface water nature of Lake Wular. This investigation has shown that the most noteworthy wellsprings of variety in water quality are both occasional factors just as anthropogenic components. The outcomes display that the DA procedure is valuable in the present authorized arrangement of surface waters in the entire lake bowl; henceforth, the quantity of inspecting locales and individual expense later observing plans can be diminished. The water quality record gave a numeric articulation, used to change an enormous number of factors information into a solitary number, which addressed the water quality degree of the entire Wular Lake bowl. Hence, the investigation delineates the helpful use of chemo metric procedures for the examination and translation of lake water quality information and distinguishing proof dependent on contamination status and ID of contamination sources as a feature of the endeavours towards the executives of supportability of this lake. Likewise, The Glacier Fed Lake and Shantisagara Lake water were reasonable for human use, because their physical-substance attributes were inside the breaking point and water quality is magnificent for human utilization.

A significant explanation of the Lakes pollution is that the blending of the sewage and wastewater discharges from the droop region and enterprises settled near the lake. A bigger effect of contamination was seen all through the celebration season when the drenching of icons in these regular amphibian environments annihilated the full biological equilibrium.

It is proposed that there should be garbage removal frameworks and wastewater should be treated prior to getting into the lake. Scholarly and mindfulness programs must be coordinated to oversee contamination.

REFERENCES

[1] Sampling Procedure for Lake or Stream Surface Water Chemistry Robert Musselman

[2] Surface water (Futala Lake) quality and its pollution load in terms of water quality index (WQI) P. J. Puri1*, M. K. N. Yenkie1 , D. B. Rana1 , S. U. Meshram1 and L. S. Awale2 1Department of Applied Chemistry, LIT, Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur 5Department of Chemistry, C. P. & Berar College, Ravinagar, Nagpur

[3] Application of water quality index (WQI) for the assessment of surface water quality (Ambazari Lake) P. J. Puri*, M.K.N. Yenkie, D.B. Rana and S.U. Meshram Department of Applied Chemistry, L.I.T., RTM Nagpur University, Nagpur-440033

[4] Water Quality Analysis of Shantisagara Lake Rashmi C Lz, Sahana S M2, Sandesh N K3, Shivakumar V B4, Poornima K B5 Students, civil engineering department, STJIT, Ranebennur, Karnataka, India1, 2, 3, 4 Assistant Professor, Civil Engineering Department, S.T.J.I.T, India

[5] Water Quality Analysis of Lake – A Case Study Parul Baranwal1 , Mansi Tripathi2 , S.K. Singal3 1 Post Graduation Student, Alternate Hydro Energy Centre I.I.T Roorkee, Uttarakhand-247667, India 2,3Alternate Hydro Energy Centre, I.I.T Roorkee, Uttarakhand- 247667, India

[6] Water Quality Analysis of Lake – A Case Study Parul Baranwal1, Mansi Tripathi2, S.K. Singal3 1 Post Graduation Student, Alternate Hydro Energy Centre I.I.T Roorkee, Uttarakhand-247667, India 2,3Alternate Hydro Energy Centre, I.I.T Roorkee, Uttarakhand- 247667, India

[7] Assessment of Water Quality of Powai Lake, Mumbai, India Chhaya Mitter Head and Associate Professor, Department of Zoology, Sathaye College, Mumbai, Maharashtra, India

[8] https://www.researchgate.net/publication/340398299_ASSESSMENT_OF_WATER_QUALITY_OF_TEN_URBAN_LAKES_IN_MUMBAI

[9] https://www.hindawi.com/journals/jeco/2014/724728/

[10] Water Quality Assessment of Lakes in Mysuru, India - A Case Study

[11] ASSESSMENT OF WATER QUALITY STATUS OF LAKES IN HARYANA, INDIA Ravinder Kumar1., Alka S. Grover2 and Meenu Wats*1 1Department of Zoology, D.A.V. College Sector-10, Chandigarh, India 2Department of Chemistry, D.A.V. College Sector-10, Chandigarh, India

[12] Assessment of Water Quality in Surha Lake Based on Physiochemical Parameters, India Saurabh Mishra1* M.P. Sharma2 and Amit kumar3 1, 2,3 Biomass and ecosystem lab, Alternate Hydro Energy Centre, Indian Institute of Technology Roorkee, Uttarakhand, 247667, India.

[13] Assessment of the water quality of Glacier-fed Lake Neel Tal of Garhwal Himalaya, India Rahul Kumar & Ramesh C. Sharma