DISSOLVED OXYGEN OF POWAI LAKE

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Abstract :

Dissolved oxygen refers to the amount of oxygen gas that is present in water, typically measured in milligrams per liter (mg/L) or percentage saturation. This oxygen is crucial for the survival of aquatic organisms like fish, invertebrates, and microbes, as they rely on it for respiration.The concentration of dissolved oxygen in water is influenced by various factors, including:Temperature, Salinity, pressure, water movement, biological activity, pollution Dissolved oxygen is a key indicator of water quality. Low levels of Dissolved oxygen (hypoxia) can lead to stress or death for aquatic organisms, causing environmental problems like fish kills. High levels of Dissolved oxygen, while rare, can also cause issues, such as promoting the growth of unwanted microorganisms.Monitoring Dissolved oxygen levels is essential for maintaining healthy aquatic ecosystems and ensuring safe water quality for various uses, such as drinking, fishing, and recreation.

Dissolved oxygen refers to the molecular oxygen dissolved in water, which is a critical parameter for assessing the aquatic ecosystem. The concentration of dissolved oxygen in water is influenced by the presence of aquatic organisms, as these organisms consume oxygen for metabolic processes, thereby reducing the dissolved oxygen levels. The measurement of dissolved oxygen is a fundamental indicator of water quality, the ecological health of freshwater bodies such as lakes, and the intensity of aquatic life. Monitoring Dissolved oxygen levels provides valuable insights into the biological productivity and environmental status of a lake. The primary method for determining the dissolved oxygen concentration in freshwater systems is through water sampling, followed by laboratory analysis using the Winkler method, a well-established titrimetric technique.

Key Words : Quality Of Water, Laboratory Analysis, Winklers Method.

Introduction:

Powai Lake was constructed in **1799** by the British as part of a project to supply water to the growing city of Mumbai (then Bombay). The lake was built by **Colonel John Powell**, a British engineer and military officer. It was created by damming the **Pawai** stream, which was a natural water source in the area.

Over the years, Powai Lake's role as a water supply resource continued. However, as Mumbai urbanized throughout the 20th century, Powai Lake's surroundings began to undergo significant changes. The area around the lake, once quite rural, began to be developed for residential and commercial purposes.

By the late 20th century, Powai became one of Mumbai's most prominent and upscale areas, with notable developments like the **Indian Institute of Technology (IIT)**, one of the country's premier technical institutions, which was established near the lake in 1958.Powai

Lake, located in the Powai neighborhood of Mumbai, India, is an artificial waterbody constructed in 1890 with the primary objective of supplying water to the city. The lake was created by damming the Mithi River and is now recognized as an important bird area, supporting a diverse range of avian species. However, Powai Lake has encountered significant environmental challenges, including pollution and encroachment, which have prompted concerted restoration and conservation efforts to preserve its ecosystem.

Significance of Dissolved Oxygen:

Dissolved oxygen (DO) is crucial for aquatic ecosystems, water quality, and various biological and chemical processes.

1. Aquatic Life Support,Fish, invertebrates, and microorganisms rely on DO for respiration.Low DO levels (hypoxia) can cause fish kills and disrupt ecosystems
2. DO levels reflect the health of water bodies:Low DO suggests pollution, excessive organic matter, or eutrophication.
3. Decomposition & Nutrient Cycling :Bacteria use oxygen to break down organic matter.Proper decomposition prevents harmful buildup of waste and toxins.
4. Drinking Water Treatment:Adequate DO helps reduce harmful gases (e.g., hydrogen sulfide)Prevents growth of anaerobic bacteria that produce foul odors
5. Industrial & Aquaculture Used in wastewater treatment to break down pollutants.Essential for fish farming to maintain healthy stock.
6. Oxygen Balance in Atmosphere DO contributes to the overall oxygen cycle, affecting both aquatic and atmospheric interactions.Maintaining optimal DO levels (typically 5-14 mg/L) is essential for sustaining life and ensuring clean water systems.

Dissolved oxygen (DO) plays a critical role in maintaining aquatic life, as it is essential for the survival of aquatic organisms, including fish and other wildlife. DO is a key indicator of overall water quality, with low levels often signifying pollution or other detrimental environmental conditions. Aerobic decomposition, which occurs in the presence of sufficient oxygen, helps maintain water clarity by preventing the accumulation of organic sludge.

The level of dissolved oxygen in water is inversely related to water temperature, as DO concentration tends to decrease with rising water temperature. Monitoring dissolved oxygen is essential for identifying eutrophication, a condition in which excess nutrients lead to algal blooms, which deplete oxygen levels and can disrupt aquatic ecosystems. Healthy DO levels are particularly crucial for fisheries, as low levels can limit fish populations.

Statement of the Problem:

Lowering dissolved oxygen in powai lake leads to several ecological and biochemical prolems:

- Reduced dissolved oxygen levels can result in hypoxic or anoxic conditions,leading to widespread aquatic organism mortality.
- Aquatic organism rely on oxygen for cellular respiration.Decreased dissolved oxygen impairs their metabolic functions,leading to physiological stress,reduced growth rates,and reproductive failure.

- Fish,invertebrates and aerobic microorganisms experience high mortality rates under dissolved oxygen conditions,leading to reduced biodiversity and ecosystem collapse.
- Low dissolved oxygen promote harmful algal booms which further deplete dissolved oxygen through microbial decomposition and respiration.
- Low dissolved oxygen enhances the solubility of heavy metals and increase the bioavailability of pollutants,leading to higher toxicity level in aquatic food chains.
- In the context of Powai Lake, monitoring dissolved oxygen is critical due to the increasing pollution and industrialization surrounding the area. High dissolved oxygen levels are typically associated with minimal pollution, while lower levels are indicative of contamination and poor water quality. Thus, the analysis of DO levels is necessary to assess the extent of pollution and its impact on aquatic life.

Research Methodology: Winkler's Method :

Material and Methods:

Reagents:

1. Winklers A reagent gram of mncl2 or 45 gram of mnso4 dissolved in 100 ml distilled water store in a brown bottle .
2. Winklers B reagent ; 70 gram of KOH or 50 gram of NAOH and 15 gram of KI dissolved in 100 ml of distilled water store in brown bottle .
3. Standard sodium thiosulphate solution (Na2S2O3) ; 0.014 nl , 3.5 gram of Na2S2O3 dissolved in little amount of distilled water and volume raised to 1000ml with distilled water concentrated HCl.
4. Starch solution (1%) ; 1 gram of starch made into paste with 5 ml of distilled water paste is added slowly to 95 ml of hot boling water with constant stirring ..

To analyze the water quality of Powai Lake, a standard laboratory technique known as Winkler's Method is employed to measure dissolved oxygen levels. This method involves the following steps:

1. A water sample is collected and sealed in a sample bottle to prevent the exchange of gases with the atmosphere.

2. A series of reagents are added to the sample, including Winkler's reagent A (manganese sulfate) and Winkler's reagent B (alkaline iodide-azide).

3. Upon the addition of concentrated hydrochloric acid (HCl), the manganese hydroxide precipitate formed reacts with the dissolved oxygen in the sample, resulting in a color change.

4. The presence of iodine is then detected by the addition of starch as an indicator. A blue color forms if oxygen is present, and the intensity of the color is used to determine the dissolved oxygen concentration.

5. The endpoint is reached when the blue color fades to colorless, indicating that the dissolved oxygen has reacted fully with the reagents.

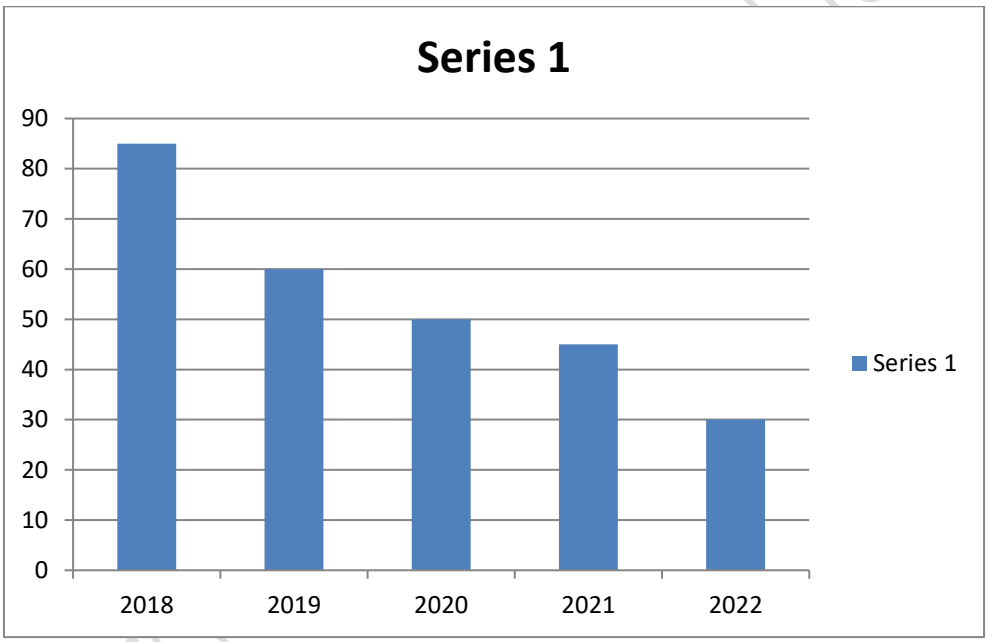
The Winkler method allows for accurate quantification of dissolved oxygen, and the results obtained indicate that Powai Lake currently has low DO levels, primarily due to

industrialization and the influx of pollutants, such as gases and chemicals.

Result:

The standard range for dissolved oxygen in water bodies is between 6.5 to 8 mg/L, which indicates healthy, potable water and supports aquatic life, including fish populations. Values between 80-120% saturation indicate optimal water quality. Conversely, water with low DO levels (<3 mg/L) is indicative of severe pollution and poses a threat to the survival of aquatic organisms.Powai lake in Mumbai has been facing water quality issues for many years,and reports in 2022 indicated a continued decline in water quality.The primary reason for the deterioration include: pollution and sewage discharge,industrial Run off,eutrophication,encroachment and urbanization,reduced biodiversity.

In 2022,researchers and environmentalists highlighted these concerns,calling for stricter pollution controls,better sewage treatment infrastructure,and lake restoration efforts to improve the water quality and preserve the ecosystem.



Discussion:

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Conclusion:

The analysis of Powai Lake water in 2022 reveals a significant decline in water quality, as indicated by the reduced dissolved oxygen levels. This suggests an unhealthy aquatic environment, with the survivability of organisms being compromised. Consequently, the water in Powai Lake is unsuitable for drinking purposes and poses potential risks to the ecosystem. The findings underscore the need for immediate intervention to reduce pollution and restore

the ecological balance of the lake.The conclusion regarding powai lake being unsuitable for drinking purposes in 2022 is based on several factors related to water quality.Studies and assessment have consistently indicated high level of pollution due to industrial discharge, domestic sewage and surface runoff from the surrounding urban areas.The lake contains elevated concentration of heavy metals,high biochemical oxygen demand , chemical oxygen demand,and microbial contamination, making it unfit for human consumption without extensive treatment.

Despite its ecological significance and aesthetic values, Powai Lake's water quality falls below the standard required for potable use as outlined by national water quality guidelines.Therefore, the lake primarily serves recreational,research,and nonpotable purposes while ongoing conservation efforts aim to improve its condition.

Summary of Key Findings:

- Low dissolved oxygen levels correlate with higher pollution levels in Powai Lake.
- The 2022 DO levels are suboptimal, leading to poor water quality and limited support for aquatic life.
- The application of Winkler's Method provides a reliable means for assessing water quality through DO measurements.

In conclusion, increased pollution levels in Powai Lake have led to a degradation of its water quality, necessitating prompt restoration measures to improve its ecological health and support its aquatic inhabitants.

Acknowledgement:

1. I would like to express my sincere gratitude to everyone who contributed to the successful completion of this research paper on the dissolved oxygen levels of Powai Lake.
2. Firstly, I extend my heartfelt thanks to Dr.Alpa patel for their invaluable support, insightful feedback, and encouragement throughout the research process. Their expertise helped shape the study's direction and improve the quality of the analysis.
3. I am also grateful to the principal Dr.suryakant azgaonkar and management representative Dr.Sukhada Chirate Of SANDESH COLLEGE OF ARTS,COMMERCE AND SCIENCE. for motivating and writing the research papers on dissolved oxygen on Powai lake.
4. Special appreciation goes to my peers, family, and friends for their continuous motivation and support during the research period.
5. Lastly, I acknowledge the importance of environmental awareness and hope this research contributes meaningfully to ongoing efforts toward the conservation and restoration of Powai Lake.

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