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Monitoring And Analysis Of Surface Water Quality In The Mudichur Region

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***ABSTRACT*:**
Water is one of the most vital and limited natural resources on Earth. Lakes serve as important freshwater sources, supporting irrigation, industrial operations, and domestic needs. However, modern civilization—through overexploitation, rapid industrialization, and population growth—has contributed significantly to environmental degradation.This study aims to assess the surface water quality of Mudichur Lake, located in [insert city/state]. A total of 10 water samples were collected from various locations within the lake and analyzed for key physico-chemical parameters including pH, alkalinity, hardness, chloride, total dissolved solids (TDS), fluoride, ammonia, nitrate, phosphate, and nitrite.The measured values were compared with Bureau of Indian Standards (BIS) drinking water quality guidelines. Spatial distribution of water quality across the lake was also evaluated. The analysis indicates that the lake water is of acceptable quality and can be used for domestic purposes following appropriate treatment.This assessment provides baseline data for future water quality monitoring and sustainable lake management in the Mudichur region.
Keywords: *Surface water, Mudichur Lake, Water quality, Physico-chemical analysis, Environmental monitoring, BIS standards*

INTRODUCTION

Lakes are inland water bodies typically occupying a natural basin, surrounded by land, and often fed and drained by rivers or streams. Unlike oceans or lagoons, lakes are isolated from tidal influences and are generally deeper and larger than ponds, although no universally accepted scientific distinction exists. While lakes are naturally occurring, many are increasingly influenced or altered by human activities.
Globally, freshwater bodies are facing severe threats from pollution, primarily due to rapid urbanization, industrialization, and unregulated anthropogenic activities. These factors have significantly diminished water quality, rendering many surface water sources unsuitable for consumption without prior treatment.
Since the dawn of civilization, lakes and other surface water bodies have been central to human settlement and socio-economic development. However, the very proximity of human activity has also made these ecosystems highly vulnerable to contamination.
In particular, urban lakes are disappearing or undergoing ecological degradation at an alarming rate. The decline in lake health has broad environmental consequences, including disruptions to biodiversity, alteration of local microclimates, and the loss of essential ecosystem services. The degradation of these water bodies not only affects environmental sustainability but also poses serious risks to public health and water security.

LITERATURE REVIEW

Murthy et alconducted an in-depth assessment of water quality across 34 lakes in Chikkaballapura Taluk, situated within the Eastern Dry Agro Climatic Zone of Karnataka. The research aimed to evaluate seasonal variations—specifically pre- and post-monsoon periods—by analyzing key physico-chemical parameters, including Total Dissolved Solids (TDS), Dissolved Oxygen (DO), Biological Oxygen Demand (BOD), Chemical Oxygen Demand (COD), nitrates, and phosphates[1].Pushoo et al. employed statistical analyses to evaluate changes in Dal Lake's water quality. Key methodologies includes Physicochemical

Parameter Analysis: Assessment of parameters such as pH, dissolved oxygen (DO), biological oxygen demand (BOD), chemical oxygen demand (COD), nitrates, and phosphates to determine pollution levels.Utilization of statistical methods to identify trends and correlations among various water quality indicators[2].M. S. Nambiar et al aims to design and implement an autonomous surface vehicle capable of monitoring water quality parameters in real-time. This innovation addresses the limitations of traditional water sampling methods, which are often labor-intensive, time-consuming, and may not provide comprehensive spatial data.

By facilitating real-time, efficient, and cost-effective water quality assessment, the ASV holds promise for widespread application in managing and protecting aquatic ecosystems[3].Haiqing chen et al aims to assess the current state of surface water in the Xi'an moat river, considering both its quantity and quality. The study seeks to identify the main factors influencing water quality and to provide recommendations for sustainable water resource management in the region[4].Y.Chan et al focuses to develop an autonomous surface vehicle capable of conducting real-time, in-situ monitoring of water quality parameters. This innovation aims to address the limitations of traditional water sampling methods, which are often labor-intensive, time-consuming, and provide limited spatial and temporal data[5].Gong et al aims to develop a comprehensive GIS-based framework for assessing and managing urban water quality. By leveraging GIS technologies, the authors seek to enhance the efficiency and accuracy of water quality monitoring, data analysis, and early warning systems in urban settings[6].M.Kassim et al decides to design and develop an autonomous Unmanned Surface Vehicle (USV) capable of real-time water quality monitoring. This initiative aims to address the limitations of traditional water sampling methods, which are often labor-intensive, time-consuming, and may not provide comprehensive spatial data[7].Zue and Chen aims to develop a predictive model utilizing BPNNs to evaluate surface water quality. This approach seeks to address the limitations of traditional water quality assessment methods, which often struggle with the complex, nonlinear relationships among various water quality parameters[8]. H. Zhang et alaims to evaluate the water quality of surface water bodies in Xinyang and identify the primary pollution characteristics influencing these water sources[9].

Guo et al aim was to provide a comprehensive understanding of the water availability and quality in the region, which is critical for sustainable water resource management. The study highlights the importance of considering both water quantity and quality in river basin management[10].Sudriani et al discusses the role of integrating multiple information sources in surface water monitoring systems to support sustainable watershed management. The authors emphasize the need for combining environmental data with hydrological, meteorological, and socio-economic information to provide a holistic view of watershed conditions. The paper advocates for the development of integrated systems that can aid in real-time monitoring, early warning, and decision-making for effective watershed management[11].

Dasu et al provides an analysis of surface water quality in Karnataka, India, using a distributed platform. The study highlights the use of a technology-driven approach for monitoring various water quality parameters, such as turbidity, pH, and dissolved oxygen. The research indicates the feasibility of deploying a distributed system for continuous water quality monitoring, which can help manage and protect water resources in the region[12].Chen et al presents the design of a system for tracing water pollution sources within surface water pipe networks. The authors propose a traceability system that combines sensor networks, data analysis, and GIS technology to identify and track the sources of pollution in water distribution systems. The system aims to improve the efficiency of pollution management and enhance the quality of water delivery[13].

Cherniak et al introduces a compact and cost-efficient Terahertz-Time Domain Spectroscopy (THz-TDS) system for conducting terahertz measurements through water. The system aims to improve the accuracy and efficiency of water quality monitoring by using terahertz waves, which can provide valuable information about the properties of water and other environmental factors. The study presents advancements in THz technology, making it a promising tool for environmental monitoring[14].Nogueira et al introduces a compact and cost-efficient Terahertz-Time Domain Spectroscopy (THz-TDS) system for conducting terahertz measurements through water. The system aims to improve the accuracy and efficiency of water quality monitoring by using terahertz waves, which can provide valuable information about the properties of water and other environmental factors. The study presents advancements in THz technology, making it a promising tool for environmental monitoring[15].

Verma et al investigates the physico-chemical parameters of water in Parmanand Nagar Pond in Raipur, India. The researchers measured parameters such as temperature, pH, dissolved oxygen (DO), total dissolved solids (TDS), and chemical oxygen demand (COD) to assess the water quality of the pond. The findings were used to understand the pollution level and health of the pond, aiming to inform local water quality management practices[16].Thirukonda et al compares the physico-chemical properties of groundwater and surface water in Mumbai, India. The study evaluated various water quality parameters such as pH, DO, TDS, turbidity, and heavy metals in both groundwater and surface water. The comparative analysis revealed significant differences in quality, with surface water showing higher levels of pollution due to urban runoff and wastewater discharge, while groundwater generally maintained better quality[17].

Dubey et al focuses on the analysis of physico-chemical parameters of the Kshipra River in Ujjain, India. Various parameters such as pH, DO, COD, TDS, and BOD were measured to assess the river's water quality. The results indicate that the river faces pollution from domestic and industrial effluents, and the study emphasizes the need for effective water quality management strategies to restore the river's health[18].Bharti et al discusses various water quality indices (WQI) used to assess the vulnerability of surface water bodies. The authors review the different methodologies for calculating WQIs and highlight their importance in understanding water quality degradation and in making decisions for water management. The paper also discusses how WQIs can help in assessing the health of aquatic ecosystems[19].

Janjala et al presents the physico-chemical monitoring of surface water in Korba District, Chhattisgarh, India. The study focuses on key water quality parameters such as temperature, pH, turbidity, DO, COD, and BOD. Statistical methods were applied to analyze the data and identify trends and pollution sources. The findings indicate significant water quality issues due to industrial and domestic waste discharges in the region[20].Xue and Chen presents a method for evaluating surface water quality using a Back Propagation Neural Network (BPNN). The authors applied BPNN to predict water quality parameters such as pH, DO, and turbidity, using historical data. The model demonstrated a high level of accuracy in predicting water quality, offering a promising approach for real-time water quality monitoring and management[21].

Qun et al introduces the Comprehensive Water Quality Identification Index (CWQII) as a tool for assessing river water quality. The authors apply CWQII to various river systems to evaluate pollution levels and the health of aquatic ecosystems. The index integrates multiple water quality parameters into a single comprehensive measure, facilitating easier interpretation and better management strategies[22].Aihong Gai et al focuses on the use of Geographic Information Systems (GIS) for evaluating water quality in Qingyang City, China. The authors employed GIS to analyze spatial variations in water quality parameters, helping identify pollution hotspots and the impact of urban development. The study emphasizes the importance of GIS in integrating environmental data for better water resource management[22].

Lan et al explores the application of computer artificial intelligence (AI) in monitoring surface water quality, particularly in the water conservancy industry. The authors propose an AI-based system for real-time measurement and monitoring of water quality parameters. The system aims to improve the efficiency and accuracy of water quality assessments, supporting better decision-making in water resource management[23].

METHODOLOGY

COAGULATION AND FLOCCULATION

Coagulation is the process of adding chemicals to water, causing them to bind together and form ‘flocs’. Flocculation is the process of adding flocculant to water, which further encourages floc formation and increases the floc sizes, making them easier to remove. Chemicals like alum (aluminum sulfate) are added

to the water to destabilize colloidal particles, forming larger aggregates called flocs.The term coagulation refers to the series of chemical and mechanical operations by which coagulants are applied and made effective. These operations include two distinct phases: (1) rapid mising to disperse coagulant chemicals by violet agitation into the water being treated, and (2) flocculation to agglomerate small particles into well-defined floc by gentle agitation for a much longer time. The coagulant must be added to the raw water and perfectly distributed into the liquid. Coagulation results from adding salts of iron or aluminum to the water and is a reaction between one of the following coagulants and water:
Alum - aluminum sulfate
Sodium aluminate
Ferric sulfate
Ferrous sulfate
Ferric chloride
Polymers
Flocculation follows coagulation in the conventional system and is the physical process of slowly mixing the coagulated water to increase the probability of particle collision. Through experience, we have determined that effective mixing reduces the required amount of chemicals and greatly improves the sedimentation process, which results in longer filter runs and higher quality finished water. The goal of flocculation is to form a uniform, feather-like material similar to snowflakes - a dense, strong floc that entraps the fine, suspended, and colloidal particles and carries them down rapidly in the settling basin. To increase the speed of floc formation and the strength and weight of the floc, polymers are often added.

Volume, ft^3 = Length, ft x Width, ft x Depth, ft
Volume, gal = Length, ft x Width, ft x Depth, ft x (7.48 gal/ft^3)
Detention Time:The detention time for flocculation basins takes more time and is generally between 5 and 30 minutes. We can determine detention time with the following equation:

$$\text{Detention time, min} = \frac{\text{Volume of tank, gal}}{\text{Flow rate, gpm}}$$

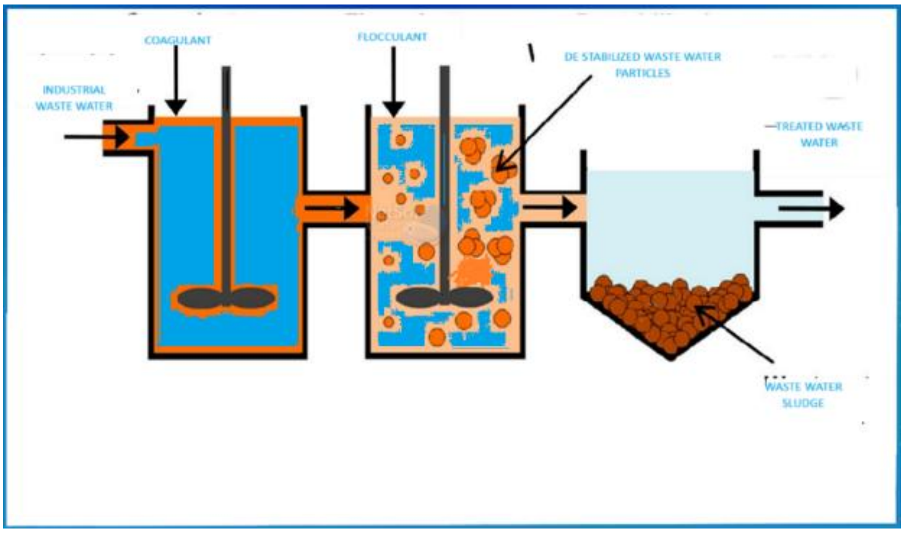

Fig no:1 Coagulation and Flocculation

SEDIMENTATION:
Sedimentation is a physical process that allows suspended solids to settle out of water under the influence of gravity. This step typically follows coagulation and flocculation, where chemicals like aluminum sulfate (alum) or ferric chloride are added to neutralize charges on particles, causing them to clump together into larger particles called flocs. These flocs, being heavier, settle at the bottom of sedimentation tanks,

resulting in clearer water above.The effluent of the sedimentation basin still contains particles that are too small to settle

Filtration:

Filtration is the final step of particle removal from water.After sedimentation, the water undergoes filtration to remove remaining suspended particles and microorganisms.

Common filtration methods include passing water through layers of sand, gravel, and charcoal. These filters trap particles that did not settle during sedimentation, further clarifying the water.

Disinfection:

The final step in water treatment is disinfection, aimed at eliminating pathogenic microorganisms to ensure the water is safe for consumption. Common disinfectants include chlorine, chloramine, ozone, and ultraviolet (UV) light. Chlorination is widely used due to its effectiveness and ability to maintain residual disinfectant levels in the distribution system.UV disinfection is a chemical-free method that effectively inactivates bacteria, viruses, and protozoa by damaging their DNA.

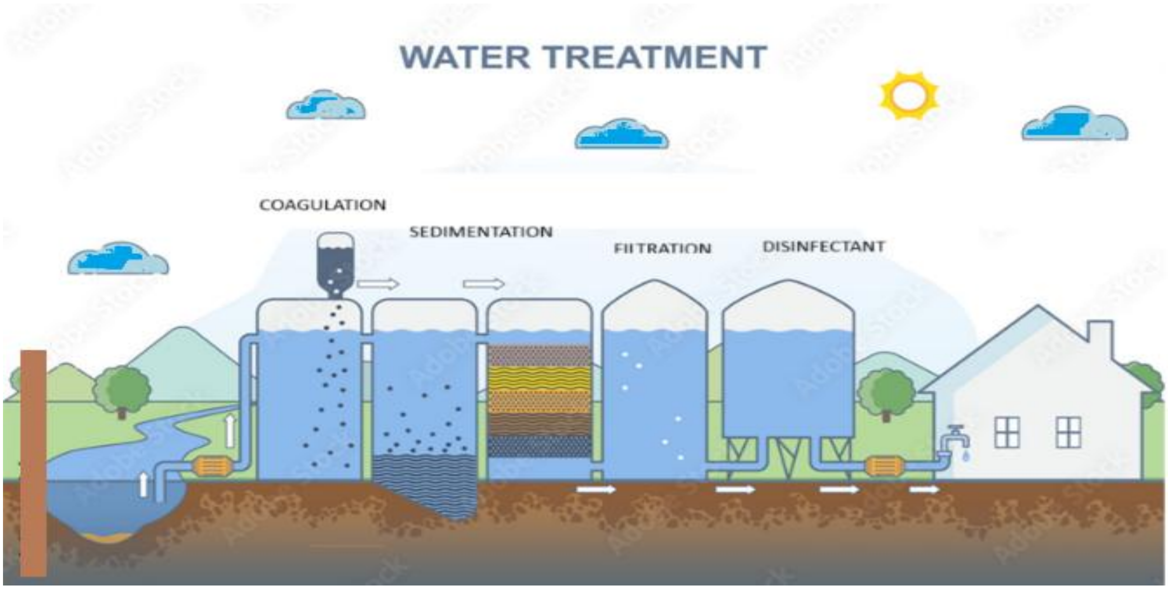

Fig no:2 Sedimentation,Filtration and Disinfection

RESULTS AND DISCUSSION

The surface water quality assessment in the Mudichur region was conducted by analyzing samples collected from multiple locations during different time periods.

The following key physico-chemical parameters were measured: pH, temperature, turbidity, dissolved oxygen (DO), biological oxygen demand (BOD), chemical oxygen demand (COD), total dissolved solids (TDS), and electrical conductivity (EC).

1. pH

The pH values ranged from 6.4 to 8.2, indicating slightly acidic to mildly alkaline conditions.

2. Dissolved Oxygen (DO)

DO levels varied between 2.1 mg/L and 6.8 mg/L.

3. Biochemical Oxygen Demand (BOD)

BOD levels ranged from 2.5 mg/L to 8.9 mg/L.

4. Chemical Oxygen Demand (COD)

COD levels were recorded between 18 mg/L and 74 mg/L.

5. Total Dissolved Solids (TDS)

TDS values ranged from 300 mg/L to 1100 mg/L.

6. Turbidity

Turbidity levels ranged from 5 NTU to 65 NTU.

7. Electrical Conductivity (EC)
EC values varied between 450 µS/cm and 1400 µS/cm, indicating different levels of ionic concentration.
TABLE 1-COMPARISON PARAMETERS

Sample No.	Parameters	Status
1	Ph	Safe
2	Alkalinity	Safe
3	Turbidity	Not safe
4	Hardness	Safe
5	Chloride	Not safe
6	Fluoride	Safe
7	Iron	Safe
8	Ammonia	Not Safe
9	Nitrite	Not safe
10	Phosphate	Not safe
11	Nitrate	Not safe
12	TDS	Safe
13	BOD	Not safe
14	COD	Safe

CONCLUSION

Through systematic evaluation of physico-chemical parameters such as pH, dissolved oxygen (DO), biochemical oxygen demand (BOD), chemical oxygen demand (COD), total dissolved solids (TDS), and turbidity, it is evident that several sampling sites exceed permissible limits prescribed by the BIS and WHO standards.Findings indicate significant anthropogenic pressure on water resources due to rapid urbanization, domestic sewage discharge, and inadequate waste management practices. The spatial analysis shows variations in water quality between upstream and downstream points, highlighting the cumulative impact of pollution sources.Overall, the surface water in the Mudichur region shows signs of moderate to high contamination, which may pose risks to human health, aquatic life, and agricultural activities if left unaddressed. Regular monitoring, improved wastewater treatment infrastructure, public awareness, and strict enforcement of environmental regulations are essential to restore and sustain water quality in the area.

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