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Water Quality Assessment in the Bhiwandi-Thane Region, Maharashtra, India

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Abstract:

Water quality plays an essential role in maintaining human health, agricultural productivity, and ecological balance, especially in regions experiencing rapid industrial and urban development. The Bhiwandi-Thane region of Maharashtra has undergone major changes over the last few decades, with a steady rise in industrial units, power-loom activities, residential clusters, commercial hubs, and transportation networks. While this growth has brought economic advantages, it has also increased pressure on local water bodies. With more industries, a larger population, and expanding settlements, the region now faces growing concerns regarding pollution, wastewater discharge, and untreated sewage entering natural water systems. To understand the depth of this challenge, the present study evaluates the physical, chemical, and microbiological characteristics of both groundwater and surface water sources in the area.

Keywords: Water Quality Assessment, Groundwater, Surface Water, Physico-chemical Parameters, Microbiological Analysis, Industrial Pollution, Urbanization, Bhiwandi-Thane Region, Maharashtra

Introduction

Water in its natural state is rarely pure, as it dissolves minerals, organic matter, and gases as it flows through rocks, soil, and human settlements. However, when contamination from industrial discharge, sewage, and agricultural runoff increases beyond natural limits, water quality begins to deteriorate. This situation is particularly evident in regions where urbanization occurs faster than environmental infrastructure can keep up. The Bhiwandi-Thane area represents such a setting, where industrial growth has created a strong economic backbone but has simultaneously increased the amount of wastewater reaching local creeks, rivers, lakes, and groundwater recharge zones. Understanding water quality in this region is important not just for academic research but also for public health planning, urban development, agricultural management, and environmental policymaking. In many developing regions, groundwater is relied upon heavily for drinking water and household needs because it is usually safer and less exposed to contamination compared to surface water. However, groundwater can also become polluted when untreated waste infiltrates through the soil or when sewage systems leak. Surface water bodies, on the other hand, serve as the main outlets for stormwater, drainage, industrial effluents, and domestic wastewater. Lakes and creeks in the Bhiwandi-Thane region often receive large amounts of untreated waste, which leads to reduced dissolved oxygen levels, increased turbidity, and microbial contamination. These issues highlight the need for reliable data to guide environmental and public health decisions.

The purpose of this study is to evaluate water samples collected from both groundwater (wells and bore wells) and surface water (creeks and lakes) in the Bhiwandi-Thane region. The study uses standard water testing parameters, including pH, dissolved oxygen, biochemical oxygen demand, chemical oxygen demand, turbidity, total dissolved solids, chlorides, sulphates, nitrates, and faecal coliform. These parameters help determine the suitability of water for drinking, irrigation, domestic activities, and ecological functions. By comparing the results with guidelines provided by the World Health Organization and the Central Pollution Control Board, the study reveals the extent of pollution and provides a clear picture of the water quality challenges faced by the region.

Objectives of the Study

The main objective of this research is to evaluate the present condition of water quality in the Bhiwandi-Thane region of Maharashtra by analyzing key physico-chemical and microbiological parameters in groundwater and surface water sources. The study aims to understand how industrial expansion, urban development, and waste discharge affect local water bodies.

Another important objective is to compare the observed water quality values with established standards to determine the suitability of the water for drinking, household use, and agriculture. The study also seeks to identify the main sources of contamination and to highlight the environmental and public health implications of polluted water in the region. Based on the findings, the research aims to suggest the need for improved wastewater treatment systems, better regulatory enforcement, and long-term monitoring programs to protect water resources and prevent future deterioration.

Materials and Methods

The water samples were collected from selected wells, bore wells, lakes, and creeks across different parts of the Bhiwandi-Thane region. The sampling locations were chosen to reflect areas with varying degrees of urbanization, industrial activity, and population density. Groundwater samples were collected using clean, sterilized containers to prevent external contamination, while surface water samples were taken from points where human influence was expected to be most noticeable, such as near drainage outlets, industrial zones, residential clusters, and natural water inflow points.

Each sample was tested in accordance with WHO and CPCB guidelines using standardized laboratory techniques. The pH of the water was measured to determine its acidity or alkalinity. Dissolved oxygen was measured immediately after collection because it decreases quickly when water is left standing. Biochemical oxygen demand and chemical oxygen demand were measured to understand the degree of organic and chemical pollution in the water. Total dissolved solids were measured by evaporating water and weighing the minerals left behind. Turbidity was assessed using standard nephelometric methods to understand the clarity of the water. Chlorides, sulphates, and nitrates were analyzed chemically to determine the presence of dissolved ions, while faecal coliform tests were performed using microbiological plating methods to detect contamination from human or animal waste. These tests allowed for a detailed comparison between groundwater quality and surface water quality. Groundwater is often protected from direct exposure to pollutants because it passes through different layers of soil and rock. However, in areas where the soil is porous or where pollutants are present in large quantities, even groundwater can become contaminated. Surface water is more directly influenced by human activities and is therefore expected to show signs of pollution when waste is released into the environment without treatment.

Analysis parameters and observation Table:-

Parameter	Observed Range	WHO Limit	Source	Water Quality Status
pH	6.5 – 8.5	6.5 – 8.5	Wells, Lakes	Acceptable
Dissolved Oxygen (DO)	2 - 8 mg/L	> 5 mg/L	Surface Water	Low in polluted areas
Dissolved Oxygen (DO)	2 - 8 mg/L	> 5 mg/L	Surface Water	Low in polluted areas
Biochemical Oxygen Demand (BOD)	3 – 15 mg/L	< 3 mg/L	Creeks, Industrial Zones	High, indicating pollution
Chemical Oxygen Demand (COD)	10 – 40 mg/L	< 10 mg/L	Surface Water	Elevated in industrial areas
Total Dissolved Solids (TDS)	138 – 813 mg/L	< 500 mg/L	Groundwater	Mostly borderline acceptable
Turbidity	10 – 150 NTU	< 5 NTU	Creeks, Urban Runoff	High, indicating contamination
Chlorides	50 – 250 mg/L	< 250 mg/L	Various	Within limits
Sulphates	20 – 200 mg/L	< 250 mg/L	Various	Within limits
Nitrates	1 – 45 mg/L	< 50 mg/L	Groundwater	Mostly safe
Faecal Coliform	0 – 400 CFU/100 mL	0 CFU/100 mL	Surface Water	Contaminated, health risk

Results

The results of the study show a clear distinction between groundwater sources and surface water bodies. Groundwater samples generally showed stable pH levels between 6.5 and 8.5, which is within the acceptable range for drinking water. This suggests that groundwater in the region is not affected by extreme acidic or alkaline pollutants. Total dissolved solids were in acceptable or borderline acceptable ranges, indicating that groundwater still retains its natural mineral content but is not excessively contaminated. Chloride, sulphate, and nitrate concentrations remained within safe limits, suggesting that industrial chemicals and fertilizers have not heavily infiltrated groundwater systems.

In contrast, surface water sources displayed significant variations and several signs of pollution. Dissolved oxygen levels were found to be low at many sampling points, especially near creeks receiving untreated sewage or industrial effluents. Low dissolved oxygen is harmful because aquatic life requires oxygen to survive, and when oxygen levels drop, fish and other organisms cannot thrive. Biochemical oxygen demand values were higher than acceptable limits in several surface water samples, showing that organic matter is present in large quantities, most likely from sewage and household waste. Chemical oxygen demand also exceeded safe limits in creeks affected by industrial activity, reflecting the presence of chemical pollutants that do not degrade easily. Turbidity levels were extremely high in surface water, especially during periods of urban runoff or after wastewater discharge events. High turbidity means the water is cloudy, filled with suspended particles, and often unsafe for direct use. Faecal coliform levels were above permissible limits in almost all surface water samples, indicating the presence of bacteria

from sewage contamination. Such contamination poses serious risks to human health because it can lead to diseases like cholera, dysentery, typhoid, and gastrointestinal infections.

Discussion

The findings clearly indicate that surface water bodies in the Bhiwandi-Thane region are under severe stress due to untreated waste entering water channels. The high biochemical oxygen demand and faecal coliform values show a strong presence of organic pollution, most likely from residential sewage, commercial establishments, and waste from informal settlements that often lack proper drainage systems. Lower dissolved oxygen levels can be directly linked to excessive organic matter, which consumes oxygen during decomposition. This leads to an unhealthy environment for aquatic organisms and contributes to foul odour, algal blooms, and the spread of disease-causing bacteria. Industrial activities in the region further worsen the water quality. Bhiwandi is known for its textile and power-loom industries, many of which discharge chemicals and dyes into nearby creeks without adequate treatment. Such pollutants increase chemical oxygen demand and introduce harmful substances into the aquatic environment. When industrial chemicals mix with sewage, the resulting contamination becomes more difficult to remove and can persist for long periods. This mixture threatens not only surface water ecosystems but also groundwater, especially in areas where soils are permeable and where drainage channels are poorly maintained. Groundwater remains relatively safe in the present study, but its condition should not be assumed to remain stable indefinitely. With increasing industrialization, urbanization, and waste generation, the pressure on groundwater aquifers is expected to rise. If polluted surface water continues to percolate into the soil, groundwater quality may decline in the future. This is especially concerning because groundwater is the primary source of drinking water in many households, and once contaminated, aquifers are difficult to restore. To address these concerns, the region needs stronger wastewater treatment facilities, strict enforcement of industrial discharge standards, better coordination between municipal authorities, and awareness programs that encourage proper waste disposal. Installing sewage treatment plants, maintaining drainage lines, regulating industrial waste, and conducting regular monitoring could significantly improve water quality. Public participation is also essential, as households play a major role in waste generation. Cleaner rivers and lakes require collective responsibility from individuals, industries, and government authorities.

Conclusion

The study shows that water quality in the Bhiwandi-Thane region varies significantly between groundwater and surface water sources. While groundwater remains within acceptable limits for drinking and domestic use, surface water bodies are heavily polluted due to untreated sewage, industrial effluents, and urban runoff. The contamination observed poses direct risks to public health and contributes to long-term ecological damage. Strengthening environmental regulations, improving waste management infrastructure, and promoting community awareness are essential steps toward protecting water resources. Immediate action is required to prevent further deterioration, especially in surface water bodies, and to safeguard the future of groundwater reserves. Protecting water quality is not only an environmental responsibility but also a vital component of sustainable development for a rapidly growing region like Bhiwandi-Thane.

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Conflicts of interest

The authors declare that there are no conflicts of interest regarding the publication of this paper.

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