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Quality Analysis of Ground Water in Nashik Region

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Abstract: *Groundwater quality refers to the state of water that is located beneath earth's surface. Groundwater can gather in cracks in subsurface rocks and in between soil particles. Since many compounds can dissolve in water and others can be suspended in water, there is a potential for contamination with toxic compounds. To know ground water quality. The study aims to create various graphs that expose the human-related health risks posed by the considered contaminants. All the samples were analyzed to trace the amount of a considerable range of pollutants; consequently, a health risk assessment for carcinogenic and non-carcinogenic risks was carried out. A water suitability study for irrigation and drinking purposes found that in the studied samples, nitrate was present as the major pollutant among the others. Industrial wastewaters mainly caused nitrate pollution in the area and solid fertilizers and pesticides.*

Keywords: pH, Alkalinity, Hardness, D.O, Chloride

I. INTRODUCTION

The quality of groundwater in the Nashik region is of paramount importance due to its significant role in sustaining various human activities, including drinking water supply, agriculture, and industrial processes. Nashik, located in the Indian state of Maharashtra, is renowned for its agricultural productivity, historical significance, and burgeoning industrial sector. As the population grows and economic activities expand, there's a pressing need to ensure the sustainability and safety of groundwater resources. Groundwater serves as a vital source of potable water for both rural and urban communities in the Nashik region. However, increasing anthropogenic activities, such as industrial discharge, agricultural runoff, and urbanization, pose significant challenges to groundwater quality. Contamination from pollutants such as heavy metals, pesticides, and microbial pathogens threatens the integrity of this precious resource. In this context, conducting a thorough analysis of groundwater quality is imperative to assess its suitability for various uses and to identify potential risks to human health and the environment. By systematically evaluating key parameters and understanding the spatial distribution of contaminants, stakeholders can develop informed strategies for sustainable groundwater management and pollution prevention. This study aims to comprehensively analyze the quality of groundwater in the Nashik region, considering both natural and anthropogenic influences. Through rigorous sampling, laboratory analysis, and data interpretation, we seek to elucidate the current status of groundwater quality, identify potential sources of contamination, and recommend measures to safeguard this vital resource for present and future generations. By fostering collaboration among government agencies, research institutions, local communities, and industry stakeholders, we aspire to promote evidence-based decision- making and effective management strategies that ensure the long-term sustainability of groundwater in the Nashik region. Through proactive monitoring and targeted interventions, we can strive towards a future where clean and safe groundwater remains accessible to all, supporting thriving communities, vibrant ecosystems, and sustainable development.

II. LITERATURE SURVEY

2.1 Groundwater Quality Assessment in Urban and Rural Areas:

G. Singh et al. (2018) Conducted a study on groundwater quality in urban and rural areas of Nashik district. They found that groundwater in urban areas exhibited higher levels of contamination due to industrial discharge and urban runoff compared to rural areas. Also Patil and Ghosh assessed groundwater quality in agricultural regions of Nashik and observed elevated levels of nitrates and pesticides attributed to intensive agricultural practices. Their findings revealed gaps in knowledge and suggested the importance of community engagement in groundwater management and conservation efforts. the potential impacts of climate change on groundwater quality in Nashik.

2.2 Impact of Industrial Pollution:

A. S. Gupta et al. (2019) Investigated the impact of industrial pollution on groundwater quality in industrial zones of Nashik. They identified heavy metals such as lead, arsenic, and chromium exceeding permissible limits in groundwater samples, highlighting the need for stringent pollution control measures. Also Pawar et al. analysed the spatial distribution of heavy metals in groundwater around industrial areas of Nashik and found significant contamination, particularly near industrial discharge points. They emphasized the need for collaborative approaches involving government agencies, NGOs, and local communities to address groundwater challenges effectively.

2.3 Agricultural Pollution and Pesticide Contamination:

Shriram Patel et al. (2016) Studied the occurrence of pesticides in groundwater in agricultural regions of Nashik. They reported the presence of pesticides such as chlorpyrifos and atrazine in groundwater samples, indicating contamination from agricultural runoff. And assessed the impact of agricultural practices on groundwater quality in Nashik and recommended the adoption of sustainable farming practices to minimize contamination. proposed a groundwater management framework for Nashik district, emphasizing the importance of integrated water resource management and community participation in groundwater conservation. explored the role of stakeholder participation and local governance structures in groundwater management in Nashik.

2.4 Health Implications and Risk Assessment:

Pawar and Sharma (2020) Assessed the economic costs of groundwater pollution in Nashik, considering factors such as healthcare expenditures, agricultural losses, and environmental remediation costs. Their analysis underscored the economic implications of groundwater contamination and the urgency of preventive measures. investigated the potential impacts of climate change on groundwater quality in Nashik. Their study projected changes in precipitation patterns, temperature, and hydrological cycles, highlighting the need for adaptive management strategies to mitigate future risks to groundwater quality. and conducted a survey to assess community perceptions and awareness regarding groundwater quality issues in Nashik. conducted a health risk assessment of groundwater contamination in Nashik, focusing on the potential exposure pathways and health impacts associated with heavy metals and pesticides. Their study highlighted the importance of proactive measures to safeguard public health and well-being.

2.5 Hydrogeological Studies and Modeling:

F. Khan et al. (2018) Conducted hydrogeological investigations to understand the groundwater flow patterns and aquifer characteristics in Nashik. Their findings provided valuable insights into groundwater recharge mechanisms and aquifer vulnerability. developed groundwater flow models to simulate groundwater flow and contaminant transport in Nashik. Their modeling results aided in assessing the impact of land use changes and pollution sources on groundwater quality. evaluated the effectiveness of water treatment technologies in removing contaminants from groundwater in Nashik. They found that advanced treatment methods such as reverse osmosis and activated carbon filtration were effective in reducing contaminant levels.

In summary, the literature survey highlights the multi-faceted nature of groundwater quality analysis in the Nashik region, encompassing issues related to industrial pollution, agricultural contamination, hydrogeological characteristics, and mitigation strategies. These studies provide a comprehensive understanding of the factors influencing groundwater quality and offer valuable insights for future research and management efforts in the region.

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III. MATERIALS

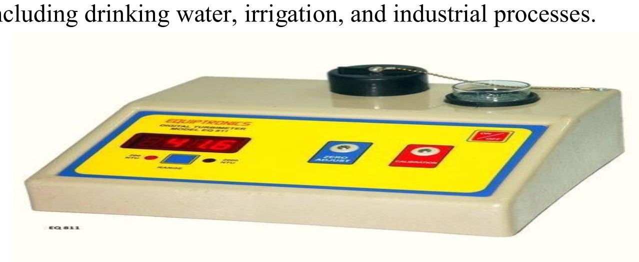
pH Meter: A pH meter is a fundamental tool used in scientific research, industrial processes, environmental monitoring, and various other fields to measure the acidity or alkalinity of liquids accurately. Operating on the principle of detecting the concentration of hydrogen ions (H+) in a solution, pH meters utilize a pH electrode and a reference electrode to generate a voltage proportional to the pH value. Calibration of pH meters is essential for maintaining accuracy, achieved by immersing the electrode in standard solutions with known pH values. The applications of pH meters are diverse, spanning environmental monitoring of water quality in natural ecosystems and wastewater treatment plants, to industrial processes in chemical manufacturing and food production, as well as agricultural soil testing for optimal crop growth.

Hydrochloric Acid: Hydrochloric acid (HCl) is a commonly used reagent in groundwater quality testing, particularly in assessing the presence of carbonate minerals and determining the alkalinity of the water. When added to a water sample, HCl reacts with carbonate minerals, such as calcite (CaCO3) or dolomite (MgCO3), causing them to dissolve and release carbon dioxide gas (CO2). The amount of HCl required to neutralize the alkalinity in the water sample is measured, providing valuable information about the buffering capacity and potential for pH changes in the groundwater system. This test helps hydrogeologists and environmental scientists understand the water chemistry of aquifers, assess the susceptibility to acidification, and evaluate the impacts of anthropogenic activities on groundwater quality.

DO Meter: A Dissolved Oxygen (DO) meter is a vital instrument utilized in groundwater quality testing to measure the concentration of oxygen dissolved in water. This measurement is crucial as it provides insights into the health and stability of groundwater ecosystems, particularly in assessing the availability of oxygen to support aquatic life. DO meters typically consist of a probe equipped with a sensor that detects dissolved oxygen levels and converts them into electrical signals, which are then displayed on the meter's screen. By immersing the probe into a groundwater sample, the meter provides real-time data on oxygen levels, allowing researchers, environmental scientists, and water quality professionals to monitor changes over time and identify potential sources of contamination or pollution. Low DO levels in groundwater can indicate hypoxic conditions, which may harm aquatic organisms and disrupt ecosystem balance. Therefore, DO meters play a critical role in assessing groundwater quality, guiding conservation efforts, and informing resource management decisions. It's essential to calibrate and maintain DO meters regularly to ensure accurate and reliable measurements, thereby supporting effective groundwater quality monitoring and protection initiatives.

Water: In groundwater quality testing, the type of water used in the test is critical to ensure accurate and reliable results. Typically, distilled or deionized water is preferred for preparing reagents, cleaning equipment, and diluting samples to avoid introducing contaminants that could skew the test results. Distilled water is purified through a process of boiling and condensation, removing impurities and minerals. Deionized water undergoes further purification through ion exchange, removing ions and minerals from the water.

Digital Turbidity Meter: A digital turbidity meter is a crucial tool employed in groundwater quality testing to measure the clarity or cloudiness of water caused by suspended particles. This instrument utilizes light scattering principles, where a light source emits a beam of light into a water sample, and a photodetector measures the intensity of light scattered by particles within the sample. The turbidity meter then converts these measurements into turbidity units, providing a quantitative assessment of water clarity. In groundwater quality testing, the use of digital turbidity meters facilitates efficient and reliable assessment of water clarity, supporting informed decision-making and management of groundwater resources. Regular monitoring of turbidity levels helps ensure the safety and sustainability of groundwater supplies for various uses, including drinking water, irrigation, and industrial processes.



(Fig. 1 Digital Turbidity Meter)

IV. RESULTS

4.1 Turbidity Testing Results for 3 months -:

Sr. No.	Sample station	Reading (NTU)				
		12/01/2024	30/01/2024	23/02/2024	09/03/2024	23/03/2024
1	Sinner MIDC	76	86.6	108	90	108
2	Bhagur ,Near Darna	72	79	68	75	78
3	Indiranagar (GGSP)	72	84	73	102	107
4	Old Nashik	66	77	103	82	104
5	Papaya nursery(Satpur)	68	71	67	77	82

V. CONCLUSION

All of the ground water samples that were collected from Bhagur near Dharna, Indira Nagar (GGSP), Old Nashik, and Papaya nursery (Satpur) had pH values that fell between 7.06±0.16, 7.25±0.26, 6.96±0.40, and 7.03±0.44). The pH of the ground water sample from Sinner MIDC (7.9±0.365) was found to be slightly elevated, possibly due to nearby industrial exposure, but it still falls within the general range of 6-8.5. Alkalinity analysis of the same samples was found to be 248± 16, 185±15, 190±8, 190±13 and 170±17 respectively, again the largest value of the alkalinity for the water from sinner MIDC which is slightly is on elevated side of the general range which is usually has 20-200 mg/L levels of alkalinity. Comparably, water hardness examination of the ground water has revealed that the highest zone of the moderately hard water is shared by the 112±5, 108±71, 132±27, 116±9, and 112±11 mg/L values. hence require careful consideration.

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