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Geochemical Investigations of Water Samples from the Kapshi Lake Region in Akola, Maharashtra, India by Using RS & GIS

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Abstract:
The physicochemical characteristics of surface and groundwater of the Kapshi Lake near Akola, India, are investigated in this study. The pH, TDS, EC, TH, Ca, Mg, Cl, color, and temperature of six water samples from bore wells, dug wells, and Kapshi Lake were measured. Determining the relationship between surface and groundwater quality and their suitability for irrigation and drinking is the main goal. According to the research, human activities like agricultural runoff, industrial discharge, and inappropriate waste disposal are the main causes of the various levels of contamination found in Kapshi Lake's water sources. Sustainable resource management and public health depend on an understanding of the physicochemical characteristics of Kapshi Lake's surface and groundwater. Using the relevant information gathered Policymakers and local communities may develop efficient methods for regulating water quality using the useful data acquired from this study. In order to enhance the water quality in this area, future study should concentrate on pinpointing the precise causes of contamination and putting mitigating strategies into place.
Keywords: groundwater, runoff, evaporation, leaching, pollution, Kapshi

1. Introduction

Several studies have shown that the lack of clean, safe drinking water has a negative effect on public health and is associated with health problems in underdeveloped nations. In 2018, Adimalla N. The geochemistry of the soil that groundwater percolates thru before entering aquifers has a major impact on the kind and degree of chemical contamination in groundwater. Zuane (1990). Since it is impossible to prevent unwanted substances from dissolving in the waters once they reach the ground, information on groundwater quality can be very helpful in understanding the lithology of the region's rocks as well as the movement, recharge, and storage of groundwater (Walton, 1970) and the length of time that water is in contact with rocks (Johnson 1979; Sastri 1994). Groundwater is studied in the scientific field of hydrogeochemistry to determine its chemical makeup and interactions with the nearby geological environment. To comprehensively assess the water quality and its relationship to the environmental components in the Kapshi watershed, six water samples were meticulously collected from a range of sources, including bore wells, dug wells, and Kapshi Lake. These sampling locations were carefully chosen to represent a range of land use types and hydrological conditions (Phalke M.D. et al., 2026). Hydrogeochemistry offers important insights into the quality and suitability of groundwater for various uses, despite the fact that it may seem like a straightforward procedure for gathering and testing water. Laboratory analysis and field sampling techniques are crucial to hydrogeochemical investigations. Testing beliefs regarding how shape is determined quantitatively is one of the main goals of morphometric analysis (Phalke M.D. and Khadri SFR, 2025). Hutton (1983) provides a full evaluation of these strategies. Groundwater samples are often obtained using sterile containers from sources such lakes, hand pumps, drilled wells, and tube wells in order to prevent contamination. By evaluating groundwater samples, we can assess the water's chemical makeup and detect any potential contaminants.

2. Study Area:

The village of Kapshi is located in Maharashtra's Akola district. The study region is located between 20°33'47.989"N and 76°57'39.285"E, according to Survey of India Toposheet No. 55D/14. The total size is 11,2468 square kilometers. The Morna River Basin is one of the Kapshi Lake Basin's tributaries.

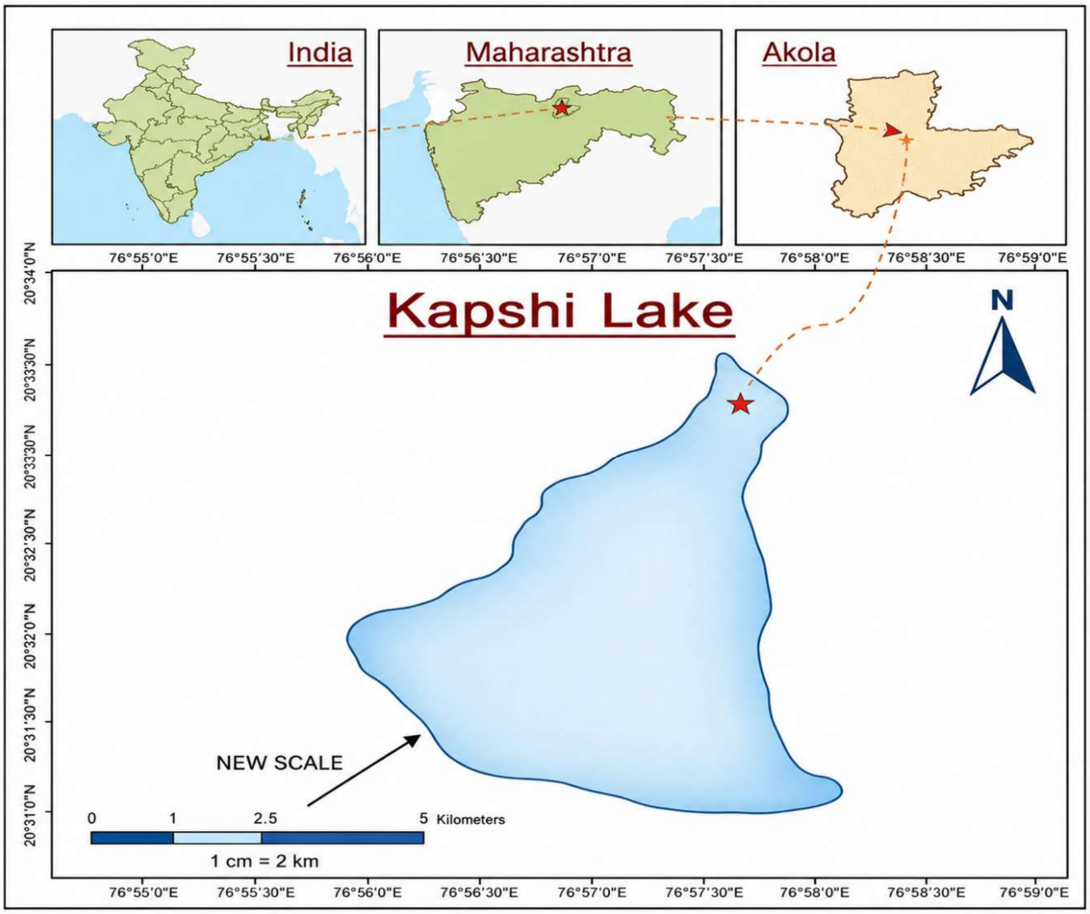


Fig.1: Study Area Map.

Methodology:

In order to better understand the spatial relationships between hydogeochemical parameters and environmental circumstances, we integrated Geographic Information Systems (GIS) with remote sensing techniques. This allowed us to examine how topography, hydrology, and land use affect the distribution of water quality indicators in the study area. This data also provided useful information about potential sources of contamination and the overall state of the watershed's water bodies.

Results & Discussions:

The current investigation used GIS tools for the morphometric analysis, which made it easier to compute and interpret morphometric and morpho-tectonic parameters (Phalke M.D. and Khadri SFR, 2025). Samples were obtained from the wells and surface of the research region. The spot-by-spot data found after the investigation is provided in Tables 1 and 2.

Table 1: Water Samples collected from the study area

Sample no.	Location	Well type	Lat	Long
1	Chikhalgaon	Dug well	20.52881056	76.9487
2	Near Kapshi Lake	Surface water (Nala in village)	20.56674273	76.9602
3	Kapshi Lake	Surface water in lake	20.56642091	76.9603
4	Chikhalgaon	Bore well	20.53728427	76.9407
5	Chikhalgaon	Dug well	20.55827442	76.9573

Color:
Throughout the inquiry, it was discovered that the water samples were clear, or colorless.

pH:
pH can affect the taste of water and show correlations with other characteristics of water quality, but it has no direct effect on human health (Islam ARMT, Ahmed N, Bodrud-Doza M, Chu R (2017)). The water sample's pH was discovered to vary from 6.5 to 9. Spot VI's pH was 9, while spot V's was 6.5. The pH values of spots III and IV were determined to be 7.9 and 8, respectively. However, it was discovered that the pH was 6.9 at places I and III.

Table 2: Geochemical characteristics of water samples taken from the research region

SR. NO.	PARAMETERS	SAMPLE 1	SAMPLE 2	`SAMPLE 3	SAMPLE 4
1)	**Colour**	Colourless	Colourless	Colourless	Colourless
2)	**Temperature**	24^0c	23^0c	26^0c	25^0c
3)	**Turbidity**	1 NTU	1 NTU	1 NTU	4 NTU
4)	**Ph**	6.8	7.8	6.9	7.9
5)	**Conductivity**	1080 µmho/cm	316 µmho/cm	685 µmho/cm	450 µmho/cm
6)	**Total dissolved solid**	990 mg/lit	500 mg/lit	700 mg/lit	700 mg/lit
7)	**Dissolve oxygen**	2.3 mg/l	7 mg/lit	8.5 mg/lit	3.4 mg/lit
8)	**Total alkalinity**	472 mg/lit	275 mg/lit	293 mg/lit	462 mg/lit

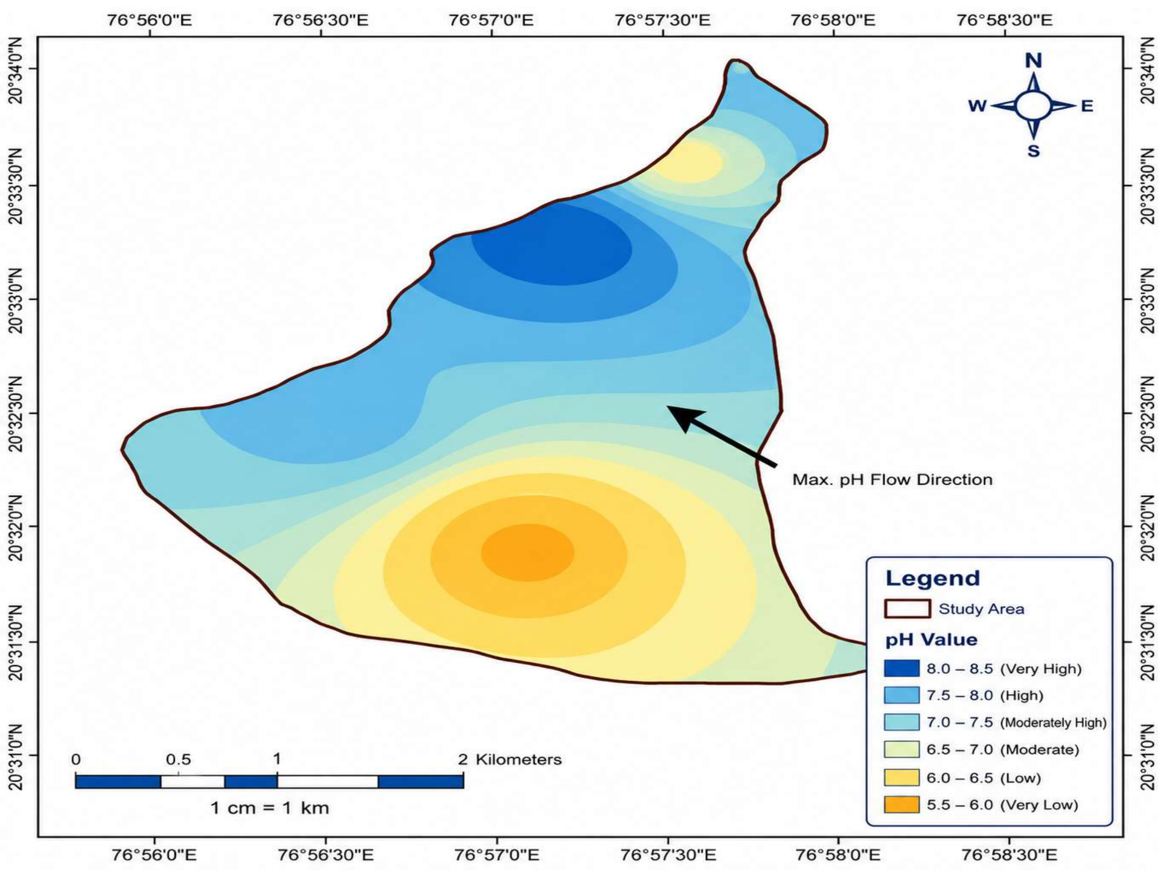
9)	**Total hardness**	462 mg/lit	213 mg/lit	702 mg/lit	825 mg/lit

Conductivity:
Conductivity in water is particularly important because it increases with temperature and the amount of dissolved salts, according to Panaskar DB, Wagh VM, and Pawar RS (2014). Spot VI had the maximum conductivity at 1174 µmho/cm, whereas Spot III had the lowest conductivity at 314 µmho/cm. The conductivity of the water sample was observed to vary from 314 to 1174 µmho/cm. At places I, II, IV, and V, the conductivity was measured at 1096 µmho/cm, 680 µmho/cm, 456 µmho/cm, and 1114 µmho/cm, respectively.

Total Dissolved Solids (TDS): The water sample was found to have 400–1000 mg/lit of TDS. At site I, the total dissolved solid was determined to be 1000 mg/l, whereas at site II, it was 400 mg/l. Locations III and V had total dissolved solids of 800 mg/l, while places IV and VI had total dissolved solids of 600 and 900 mg/l.

Oxygen dissolved:

The dissolved oxygen content in the well water sample ranged from 2.2 to 8.6 mg/l. Place III had the highest oxygen content (8.6 mg/l), whereas Location I had the lowest (2.2 mg/l).



Fir: 2: pH Map

Chloride:

The water sample's chloride content ranged from 76.68 to 159.04 mg/l. Spot VI had the greatest concentration of chloride at 159.04 mg/l, whereas spot III had the lowest at 76.68 mg/l. Sites I, II, IV, and V had chloride concentrations of 110.76 mg/l, 85.2 mg/l, and 122.12 mg/l, respectively.

Total hardness:

The entire water sample's hardness was determined to be between 216 and 820 mg/l. The overall hardness values for Spots I, III, V, and VI were 464 mg/l, 700 mg/l, 688 mg/l, and 748 mg/l, respectively. Spot IV had the highest total hardness (820 mg/l), while Spot II had the lowest total hardness (216 mg/l).

3. Conclusion

In the Kapshi Lake region, GIS is a helpful tool for examining the spatial distribution of water quality measures and how they relate to environmental conditions. We may identify possible hotspots and uncover vital information about the causes causing water contamination by merging multiple data layers into a GIS framework. Numerous significant implications might be drawn from the water quality data study. The increasing levels of TDS, EC, TH, and other contaminants show that the groundwater in the Kapshi Lake region is vulnerable to contamination. Water contamination in the area is mostly caused by anthropogenic activities including inappropriate trash disposal, agricultural runoff, and industrial discharge. Groundwater is more mineralized than surface water due to its interactions with geological formations, producing a chemical. Effective water quality management techniques are essential for preserving public health and guaranteeing sustainable resource management. This involves pinpointing the precise sources of contamination, putting pollution control strategies into action, keeping a careful eye on the situation, and creating thorough water management plans. By tackling these challenges, governments and local people may work to improve the water quality and ensure the long-term sustainability of water resources in the Kapshi Lake region.

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