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Assessment of Ground Water Quality of Gadchandur Village of Chandrapur District, Maharashtra, India

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Abstract:

One of the most significant sources of drinking water is groundwater, particularly in rural and semi-urban areas. However, the quality of groundwater has declined as a result of growing human activity. The physicochemical characterization of groundwater samples taken from particular sites is the main focus of this work. Standard techniques were used to assess a number of parameters, including pH, electrical conductivity (EC), total dissolved solids (TDS), total hardness, total alkalinity, chloride, fluoride, magnesium, calcium, nitrate, sulphate, and iron. The water's appropriateness for consumption was assessed by comparing the results with BIS and WHO drinking water standards. Certain parameters surpassed allowable limits, according to the study, indicating the necessity for ongoing therapy and monitoring.

Keywords: Groundwater, Physicochemical parameters, Water quality, TDS, Hardness, BIS standards.

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Introduction:

Groundwater is essential for supplying the drinking, agricultural, and industrial demands of the population. In India, a large segment of the population relies on groundwater for everyday needs. Water constitutes 70.9% of the Earth's surface ("CIA-The world fact book" Central Intelligence Agency) and is essential for all recognized forms of life*(1–3)*. On the planet, it is primarily located in oceans and expansive water bodies, with 1.6% of water underground in aquifers and 0.001% in the atmosphere as vapor, clouds

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(composed of solid and liquid water particles suspended in the air), and precipitation (water vapors within the climate system, Special Report, [AGU], December 1995)*(4)*. Water can also be found in the atmosphere in solid, liquid, and vapor forms. It is also found as groundwater within aquifers. Water is crucial in the global economy, serving as a solvent for many chemical compounds and aiding in industrial cooling and transpiration. Around 70% of freshwater is used for agricultural purposes. Freshwater is a limited resource, crucial for farming, industries, and human survival; without sufficient and quality freshwater, sustainable development cannot be achieved. As a result of swift industrial development, agricultural runoff, and inadequate waste management, groundwater quality is worsening. Physicochemical evaluation aids in determining the appropriateness of water for consumption and various uses*(5–7)*.

Groundwater quality is affected by geological structures, climate, and human interventions. Thus, regular evaluation is crucial for guaranteeing a safe water supply and avoiding health risks*(8)*.

Materials and Methods:

1. Study Area:

Groundwater samples were collected from various locations in Gadchandur village, including hand pumps. The sampling locations were chosen according to population density and usage trends.

2. Sample Collection:

Samples were gathered in clean plastic bottles. Prior to collection, bottles were washed out with sample water. The specimens were safeguarded and transferred to the lab for examination.

3. Analytical Methods:

The physicochemical parameters were analyzed using standard procedures. The following parameters were studied:

- pH (using pH meter)
- Electrical Conductivity (EC meter)
- Chloride
- Calcium
- Magnesium
- Sulphate
- Fluoride
- Nitrate
- Total Dissolved Solids (TDS meter)
- Total Alkalinity (acid titration method)
- Total Hardness (EDTA titration method)
- Turbidity
- Iron

Results and Discussion:

The quality of water is defined by different physical and chemical analyses. Different observations gathered throughout the experimental work are organized in table 1.

The pH levels varied from 7.0 to 7.8, suggesting a mildly alkaline characteristic of the water.

Electrical Conductivity (EC) measurements ranged from 1856 to 2930 µS/cm, indicating a moderate level of mineral content. The chloride levels varied between 144-288 mg/L, staying within acceptable limits. The calcium concentration was determined to be within the acceptable range, specifically 96-152 mg/l. The magnesium concentration was determined to be between 64.15 and 99.92 mg/l, exceeding the allowable limits. Sulphate concentrations ranged from 2–54 mg/L, which is below acceptable thresholds.

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Table 1. Physico-chemical parameters of water samples

SN	Parameter	Near Mata Mandir	Near Sai Mandir	Near Kanyaka Mandir	Teacher Colony	Near Bus Stop
1	pH	7.0	7.8	7.1	7.3	7.0
2	Electrical Conductivity (µS/cm)	2290	1856	2930	2290	2890
3	Chloride (mg/l)	178	144	288	178	224
4	Calcium (mg/l)	118.4	96	152	118.4	148.8
5	Magnesium (mg/l)	79.12	64.15	98	79.12	99.92
6	Sulphate (mg/l)	48	6	54	2	38
7	Fluoride (mg/l)	0.55	0.95	0.66	0.68	0.76
8	Nitrate (mg/l)	27.58	28.86	29.52	29.18	27.40
9	Total Dissolved Solids (mg/l)	1488	1206	1904	1488	1878
10	Total Alkalinity (mg/l)	324	264	416	324	412
11	Total Hardness (mg/l)	444	360	568	444	560
12	Turbidity (NTU)	4.7	0.91	1.0	1.15	0.97
13	Iron (mg/l)	0.16	0.01	0.12	0.01	0.01

The fluoride levels varied between 0.55 - 0.95 mg/L, which are acceptable limits. Nitrate concentrations varied between 27.40–29.52 mg/l, falling within the acceptable limits. The TDS values varied from 1206 to 1904 mg/L, surpassing the recommended limit of 500 mg/L. The water samples might have harmful dissolved ions in excessive amounts, so they require treatment such as Reverse Osmosis (RO) before use. The alkalinity levels varied between 264-416 mg/l, making them appropriate and safe for household use. The overall hardness varied between 360 and 568 mg/L, signifying hard water. The water's turbidity was measured between 0.91 and 4.7 NTU. The iron concentration was detected at 0.01-0.16 mg/l, which is within acceptable limits.

The findings suggest that the quality of groundwater in certain regions is declining because of human activities. Elevated levels of TDS, hardness, and turbidity are especially troubling.

Conclusion:

The research indicates that although the majority of groundwater samples are within acceptable limits, some parameters like TDS, hardness, and turbidity surpass advised values in many locations. This suggests possible health hazards if ingested untreated. Consistent monitoring, effective waste management, and groundwater protection measures are crucial for sustaining water quality.

Recommendations:

- Periodic monitoring of groundwater quality
- Implementation of proper sanitation and waste disposal systems

- Treatment of water before consumption (filtration, RO, etc.)
- Public awareness regarding groundwater conservation

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