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# A Review on: Assessment of Groundwater Quality as Drinking Water Sources in Chikkaballapur District

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**ABSTRACT:** The comprehensive review of groundwater quality evaluations conducted in different parts of India shows how urbanization, industrialization, population increase, and increased agricultural activity are all contributing factors to the rising need for safe drinking water. Human activity is posing difficulties for groundwater, a replenishable resource, which is causing a decrease in quality. The study focuses on the Karnataka district of Chikkaballapur, where treated wastewater from Bengaluru is pumped to increase groundwater levels. A variety of issues are shown by the study of the literature, such as bacterial contamination, high chemical concentrations, and variable water quality indices. Suggestions include the need for sustainable water resource management, corrective actions, and public awareness. The abstract underscores the urgency of addressing contamination sources to ensure the availability of safe drinking water for current and future generations.

## I. INTRODUCTION

Everyone's basic necessity to survive is access to clean drinking water. The use of groundwater for drinking, irrigation, and industrial purposes has expanded significantly due to the unpredictability of the monsoon. Unlike surface water, groundwater is a naturally occurring, replenishable resource [13]. Increasing global population, urban development, industrial growth, and intensive agriculture are leading to a higher demand for groundwater. However, human activities, including industrial discharges and agricultural runoff, are adversely affecting the quality of groundwater [29]. As the main alternative source of drinking and residential water supply, the quality of the water is declining as a result of geogenic and anthropogenic processes. This has gained significant attention [15]. When evaluating groundwater quality for drinking, it is necessary to determine the chemical composition of the water. If the quality of the water is declining, corrective action must be taken, which requires identifying potential groundwater contamination sources [7].

The present study aims to evaluate the groundwater quality of Chikkaballapur district, Karnataka and to study the effect on drinking water of the area. In 2018, the government of Karnataka as taken decision on pumping the treated wastewater from Bengaluru to fill the various tanks in Chikkaballapura and Kolar District to increase the groundwater table. This action has increased the ground water table in both districts but there was very less knowledge regarding the quality of the ground water. This study identifies whether it is polluted or not and suggest the treatment for ground water to use as source of drinking water.

## II. ART OF LITERATURE

Unhygienic conditions around water sources contribute to bacterial growth. E. coli concentration ranged from 0 to 364/100ml, with 31.19% exceeding permissible limits. Its presence indicates fecal contamination, posing health risks like infections and gastroenteritis [1].

92% of water samples have physio-chemical properties well within the permissible limit except fluoride. 11 samples have high value of fluoride and not safe for drinking purpose. The presence of E. coli in only one sample of GW indicates potentially dangerous situation and require immediate attention [2].

Some samples exhibit elevated levels of electrical conductivity, alkalinity, chloride, calcium, sodium, potassium, and iron beyond permissible limits. The groundwater is categorized as a normal sulfate and chloride type, with the majority falling under  $\text{Na}^+\text{-SO}_4^{2-}$  classification. Iron levels surpass desirable limits in a significant portion, requiring remediation for domestic use. Shallow hand-pumped water quality suggests a recommendation for the replacement with deep bore hand-pumps [3].

The study emphasizes the importance of assigning weights to parameters based on human health and aquatic life, facilitating interpretation. Findings reveal insights into pollution sources and trends, guiding recommendations for water quality improvement. The comprehensive analysis contributes valuable information for effective water management and conservation efforts, aiding policymakers and environmental practitioners [4].

WQI ranged from 34 to 107. Highest values occurred during the monsoon season, and the lowest in the post-monsoon period. Most samples of study area fell within the Good to Moderate categories [5].

WHO standards, indicating subpar water, the assessment of the ground water of indoor city. Due to increasing urbanization surface water is getting over contaminated and more stringent treatment would be required to make surface water potable. The result of water quality assessment showed that parameter slightly higher in the wet season than in the dry season [6].

$\text{Mg}^{2+}$  dominated over other major cations, followed by  $\text{Na}^+$ ,  $\text{Ca}^{2+}$ , and  $\text{K}^+$ . Most samples exceeded the drinking water guidelines set by both national (BIS) and international (WHO, 2011) standards, indicated that groundwater in the study area is chemically unsuitable for drinking purposes. Geographical Information System (GIS) capabilities were used to classify zones with acceptable groundwater quality for drinking purposes [7].

The research evaluates groundwater quality using the Water Quality Index and Arc GIS mapping. The results reveal increased TDS levels in most locations, indicating critical groundwater quality. The study emphasizes the need for remedial measures and sustainable water resource management to address the identified challenges in the region [8].

Increasing population, urbanization, and modernization contribute to sewage disposal problems and surface water contamination, particularly in lakes. Nutrient enrichment threatens lakes, causing eutrophication. Various physio-chemical parameters were used to assess water quality in lakes. Pollution prevention, water re-use, and nutrient recycling in controlled urban agriculture are recommended to address water quality issues [9].

Total Dissolved Solids (TDS) within permissible limits. Total hardness ranges from 50 to 740 mg/l. 41% of samples are classified as hard, and 35% as very hard. Softening needed for hard and very hard water categories if used for drinking. Studied parameters meet BIS and WHO standards for drinking water. Groundwater in the study area is considered suitable for public health [10].

Dividing the city into three zones, groundwater samples were randomly collected and analyzed for physiochemical properties. Only pH in one location exceeded permissible values. Overall, the groundwater quality in Chennai, assessed through the water quality index and fluoride content, was found to range from excellent to good, suggesting its suitability for human consumption [11].

Findings revealed that most physicochemical parameters exceeded acceptable limits, and microbial levels did not meet recommended levels. Consequently, the samples were considered unsuitable for direct consumption without primary treatment like adding bleach, boiling, or filtering [12].

The water was found to be alkaline. Chemical parameters were compared with drinking water standards, indicating unsuitability for consumption. Evaluation for irrigation using various indices revealed poor quality. For industrial use, parameters were assessed for incrustation and corrosion impact on metal surfaces. Overall, the groundwater quality was considered unsuitable for drinking, irrigation, and industrial purposes due to exceeding chemical parameters [13].

The higher concentrations of major physicochemical parameters and heavy metals are degrading the groundwater quality. The current practice of waste discharge and disposal into near water bodies is creating environmental nuisances. The study reveals that the city's groundwater is under great threat, requiring regular monitoring of groundwater quality, stop unhealthy waste disposal practices, use new waste management techniques, and treat the water before using it. If the current system persists, groundwater may not be available in the future [14].

Aiming to inform and educate diverse users, from individuals to policymakers, about groundwater conditions for better decision-making and analysis of ground water quality the region was done from the test result 8 parameter and WQI was calculated. Almost all the parameter were in range making the water fit for drinking and other domestic and agriculture purpose [15].

The pH fluctuates between slightly acidic and slightly alkaline in the mandal. Quality of water availability is decreasing due to lack of sanitation facilities and domestic sewage and seepage run-off the analysis of the resultant exhibits that the WQI for the ground water of the selected locations require some pre-treatment prior to utilization and must be protected against the contamination hazards [16].

Elevated pH attributed to higher alkalinity and bicarbonate contents. Approximately 35% of samples exhibited electrical conductivity above 2000  $\mu\text{S}/\text{cm}$ , correlated with high total dissolved solids (TDS) values. WQI values indicated that 65.6% of samples were unsuitable for domestic and irrigation purposes due to high levels of salts/salinity, total hardness, sodium, and bicarbonates [17].

Based on salinity 39% of the ground water is not suitable for irrigation. Whereas in the pre-monsoon season 61% fall in excellent too good. There is a good correlation B/W rainfall and GW level the rate decreases or increase in rainfall and GW level in study area discussed. To suggest their permeability, index the ground water is suitable for irrigation [18].

the National Sanitation Foundation Water Quality Index (NSFWQI), provides a single value for overall water quality, aiding easy interpretation. Overall Index of Pollution (OIP) assesses pollution severity by integrating multiple parameters. The paper discusses results, implications, and strategies for environmental management. It aims to contribute to the conservation and sustainable management [19].

It analyzes pH, turbidity, TDS, EC, and ion concentrations in collected samples, deriving WQI values for comprehensive evaluation. Emphasizing monitoring and maintenance, it aims to offer insights into groundwater quality, aiding informed decision-making for water management and conservation in the region [20].

This paper examines the Cau River's water quality, crucial for drinking, irrigation, and ecosystem health. It analyses water samples for pH, DO, BOD, TSS, and heavy metals. Using indices like Water Quality Index (WQI), Pollution Load Index (PLI), and Heavy Metal Pollution Index (HPI), it assesses overall quality. Hotspots of pollution are found, guiding water management plans. The paper proposes ways to make the water cleaner and reduce pollution, helping people make better decisions about using and protecting this important river [21].

The study finds water quality below standards and recommends ongoing testing, treatment, and further research to ensure potability. Industrial contamination poses a threat to aquatic life, indicating the need for caution in utilizing Arkavathi River water and continuous monitoring [22].

Irrigation Suitability 5-30% of samples unsuitable due to various factors, mainly high electrical conductivity. The people in this region are frequently facing water storage and poor water quality problem. Irrigation water have a physical and chemical effect on plants and agricultural soil by decreasing soil productivity. To ensure that water is suitable for agriculture a continual monitoring program of water quality is essential [23].

The problem of sea water getting mixed with the underground water table has become acute in many of the gram panchayats. During the post-summer the water level decreases mechanically and water exploration is more and result

causes. Water loses its quality; they used these results for the mapping of saltwater intrusion and salinity mapping and generated as soil salinity model [24].

Chemical analysis revealed high levels of pollutants, rendering 100% of samples unfit for drinking due to exceeded thresholds. Geochemical data indicated both alkaline and saline water types, influenced by natural processes and human activities. WPI categorized 60% as moderately polluted and 40% as highly polluted. WQI classified 75% as poor and 25% as very poor quality, covering 85.84% and 14.06% of the study area respectively. Preventive measures like safe water supply and treatment are urged to safeguard public health [25].

The study focuses on seasonal hydro geochemistry and groundwater quality for drinking. Results showed alkaline, hard water with elevated levels of various ions, exceeding WHO limits. Most samples were classified as poor to very poor quality for drinking, according to Water Quality Index. Geochemistry is influenced by water-rock interaction and chemical weathering. Urgent measures are needed to address contamination and ensure safe drinking water in the region [26].

The study assessed groundwater quality for irrigation. Results varied across the area, with about a 27.03% having excellent water quality and over 59.46% being good for irrigation. Some wells had pollution from heavy metals, especially in certain parts. This is mostly because of things like saltiness in the water, erosion of rocks, and human activities like irrigation and industry. Overall, they found that groundwater pollution is a big problem in the area and needs serious attention to manage it properly [27].

This study assessed groundwater quality for drinking and irrigation purposes using physicochemical analysis and GIS techniques. Results showed mostly good quality water, with some samples unsuitable for drinking. Main water types were Ca, Mg-HCO<sub>3</sub><sup>-</sup>. Principal component analysis revealed dominant factors: ion exchange, weathering, and agriculture. Overall, ensuring safe drinking water and addressing irrigation challenges are crucial for sustainable development in the region [28].

The study evaluated groundwater quality, focusing on drinking and irrigation suitability. Analysis of pre-monsoon season samples revealed slightly alkaline water with various parameters measured. Results, compared to WHO guidelines, indicated 77% safe for drinking. WQI ranged from 78.49 to 115.92 mg/L. Overall, most samples were suitable for irrigation, but treatment is required for consumption in certain locations [29].

The study investigates groundwater chemistry suitability for drinking and agriculture using water quality indices, GIS mapping, and multivariate analyses. Results show NH<sub>4</sub><sup>+</sup>, K<sup>+</sup>, Ca<sup>2+</sup>, EC, Turbidity levels exceeding WHO standards in various proportions. Water Quality Indices indicate predominantly good drinking water quality. Most samples meet WHO and Bangladeshi drinking water standards, while irrigation water indices suggest high-quality groundwater [30]

## SUMMARY

The provided summaries cover a range of groundwater quality assessments in various regions of India from 2006 to 2024. These studies examine parameters such as pH, conductivity, turbidity, dissolved solids, chlorides, and bacterial presence, including E. coli, in groundwater samples. Findings reveal contamination issues, exceeding permissible limits in some cases, raising concerns for potable water use. While some areas exhibit deterioration trends and violations of drinking water standards, others show suitability for irrigation. Recommendations include public awareness, remedial measures, and sustainable water resource management. The studies underscore the importance of continued monitoring, addressing pollution sources, and implementing effective water management strategies to safeguard groundwater quality in different regions of India. Keeping the above references and BIS 10500:2012 as a base, the analysis of groundwater quality is conducted.

### III. CONCLUSION

Conclusively, the various research studies conducted on the quality of groundwater in different parts of India highlight the vital significance of addressing contamination issues in order to guarantee the availability of safe drinking water. Stress on this essential resource has increased due to the growing demand for groundwater brought on by causes including urbanization, industry, and population expansion. Some regions continue to be suitable for certain uses, like irrigation, but others indicate developments exceeding allowable limits for characteristics such as fluoride, electrical conductivity, and heavy metals. In order to reduce pollution sources and preserve groundwater quality, studies have constantly highlighted the necessity of ongoing monitoring, raised public awareness, and managed water resources effectively. Initiatives like the application of Water Quality Indices and thorough studies highlight the urgency and provide useful information for making educated decisions.

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