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ASSESSMENT OF GROUNDWATER PORTABILITY USING PHYSICOCHEMICAL PARAMETERS: A CASE STUDY

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ABSTRACT

Groundwater is an important source of water for both domestic uses and industrial purposes. It is very crucial especially in rural and semi-urban areas where there are not many sources of water. However, increasing urbanization, improper disposal of waste, overuse of fertilizers, and sanitation have caused deterioration in the quality of groundwater. This particular research aims to find the quality of groundwater in selected locations in Bidar Taluk through the analysis of physicochemical parameters such as PH value, turbidity, acidity, alkalinity, hardness, dissolved oxygen, and chloride level. Samples of water taken from various regions were analyzed based on the criteria laid down by the standards of drinking water for comparison. From the findings of the analysis carried out on the samples, it can be noted that the values of all the parameters analyzed fall within the acceptable levels, making the water safe for consumption.

KEYWORDS: Groundwater Quality, Physicochemical Parameters, Water Quality Assessment, Bidar Region, Drinking Water, Hydro chemical Analysis, Water Pollution, Groundwater Monitoring

1. INTRODUCTION

1.1 General

Groundwater contamination is nearly always the result of human activity [4]. In areas where population density is high and human use of the land is intensive; groundwater is especially vulnerable. Virtually any activity where by chemical or waste may be released to the environment either intentionally or accidently has the potential to pollute groundwater. When groundwater becomes contaminated, it is difficult and expensive to cleanup. When we speak of groundwater contamination, we mean solutes dissolved in the water that can render it unfit for our use or unfit for an ecosystem that the water enters.

1.2 Background of Groundwater Quality Issues

The leading cause of groundwater pollution is the effect of human activities. Groundwater is at high risk in places where there is intensive human activity and high human population density. Anything that leads to the disposal of hazardous substances, either directly or indirectly, into the environment poses a risk of contamination of underground water sources. Once polluted, it becomes very expensive to restore the quality of such groundwater.

Groundwater pollution can be defined as the process whereby the water becomes unfit for human consumption due to the existence of dissolved contaminants. The movement of contaminants through groundwater is influenced by certain physical, biological, and chemical features. Generally, most of the contaminants follow the direction of flow of water in the underground water source.

This implies that they can spread far and wide depending on how fast the groundwater flows, and in what state the contaminant is. Since the speed of flow of

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underground water is quite slow, the contaminants remain concentrated. In addition, the contaminants are carried faster when passing through rocks with fractures.

The contaminants can infiltrate the groundwater through pathways such as root channels, abandoned wells, and animal burrows among others. The contaminants become even more risky in areas close to pumping wells since the water is pumped from all around the well.

Natural processes of removal include dilution, adsorption, oxidation, and biodegradation, but these processes are quite slow and may fail to remove contaminants totally.

1.3 Objectives of the Study

The purpose of the current research is to conduct a quality assessment of the groundwater in selected areas of Bidar Taluk through physicochemical properties. The detailed objectives of the study are listed below:

- To obtain groundwater samples from various points in the study area.
- To conduct analysis for crucial physicochemical factors like pH, turbidity, acidity, alkalinity, hardness, dissolved oxygen, and chlorides.
- To make comparisons of the data collected with the permissible standards for drinking water.
- To determine the suitability of groundwater for drinking and household use.

2. LITERATURE REVIEW

Contamination of groundwater is one of the most common environmental issues owing to the adverse impacts it poses on humans' health and ecosystem sustainability. Numerous studies have been conducted in relation to the origins, transportation mechanism, and evaluation procedures of groundwater contamination by means of physicochemical and hydro chemical parameters.

V. Sunitha et al. (2012) [1] claimed that high utilization of nitrogenous fertilizers led to the formation of nitrate pollution (NO_3-N) of the deeper soil layers that ultimately contaminated underground water. It was stressed that appropriate irrigation and fertilizer administration should be practiced in order to minimize the risk of subsurface contamination.

According to ***Jianhua Wu et al.*** (2013) [3], wastewater irrigation led to groundwater contamination caused by NO_3-N, COD, and TDS parameters. The authors pointed out that both human and natural factors affected groundwater quality.

Awajiogak Anthony Ujile (2013) [6] explored the phenomenon of groundwater contamination around landfill areas and noted the importance of hydrogeology as a mechanism of pollutant transportation. He concluded that waste management measures had to be taken in order to prevent groundwater pollution.

The problem of groundwater contamination in India was discussed by ***Sunderrajan Krishnan and Rajnarayan Indu (2013)*** [4]. The necessity of adopting specific region-based anti-pollution legislation and educating people in order to ensure appropriate management was highlighted.

The effectiveness of WQI in measuring the level of groundwater contamination was proved by ***Olayiwola Oni and Olubunmi Fasakin (2016)*** [7]. According to their findings, groundwater's Vesali Naseh et al. (2013) [2] located near dumpsites were extremely polluted and unfit for human consumption.

M. M. Akhtar and Zhonghua Tang (2013) [5]. identified contamination sources and analyzed total dissolved solids (TDS) in groundwater, highlighting the impact of urbanization on groundwater quality.

R. Venkata Ramana and P. V. Nageswara Rao (2017) [8] found that the degradation of groundwater quality occurred under the influence of agricultural activities, backwater intrusion, and groundwater extraction. In order to avoid water contamination, groundwater had to be used in a controlled manner.

Sayed Hossein Hozi et al. (2018) [9]. investigated groundwater pollution causes and highlighted the influence of environmental and anthropogenic factors on groundwater contamination

3. RESULTS AND ANALYSIS

The following section gives the results of

physicochemical analysis of groundwater samples taken from various parts of Bidar Taluk. Analysis is done for parameters like pH, turbidity, acidity, alkalinity, hardness, dissolved oxygen, and chloride and then compared with permissible levels to judge whether the groundwater is fit for consumption or not.

3.1 Zone-wise Analysis of Groundwater Quality

In this part, we discuss the zone-wise evaluation of the groundwater collected from various areas of Bidar Taluk. These areas include Kamthana, Janwada, and Chitta. Various physio-chemical parameters like pH, turbidity, acidity, alkalinity, hardness, dissolved oxygen, and chloride have been evaluated in order to study the quality of groundwater at different zones and their suitability for consumption.

ZONE I - KAMTHANA REGION

A. Physical Parameters

Sl. No	Parameters	Results
1	Color	Colorless
2	Odor	Odorless
3	pH	6.5
4	Turbidity	Clear

B. Chemical Parameters

Sl. No	Parameters	Results
1	Acidity	28.8 mg/l
2	Alkalinity	60 mg/l
3	Hardness	156 mg/l
4	Dissolved Oxygen	5.8 mg/l
5	Chloride	82 mg/l

ZONE II - JANWADAS REGION

A. Physical Parameters

Sl. No	Parameters	Results
1	Color	Colorless
2	Odor	Odorless
3	pH	6.8
4	Turbidity	Clear

B. Chemical Parameters

Sl. No	Parameters	Results
1	Acidity	29.7mg/l
2	Alkalinity	59.3 mg/l
3	Hardness	152 mg/l
4	Dissolved Oxygen	5.34 mg/l
5	Chloride	83.19 mg/l

ZONE III - CHITTA REGION

A. Physical Parameters

Sl. No	Parameters	Results
1	Color	Colorless
2	Odor	Odorless
3	pH	7.2
4	Turbidity	Clear

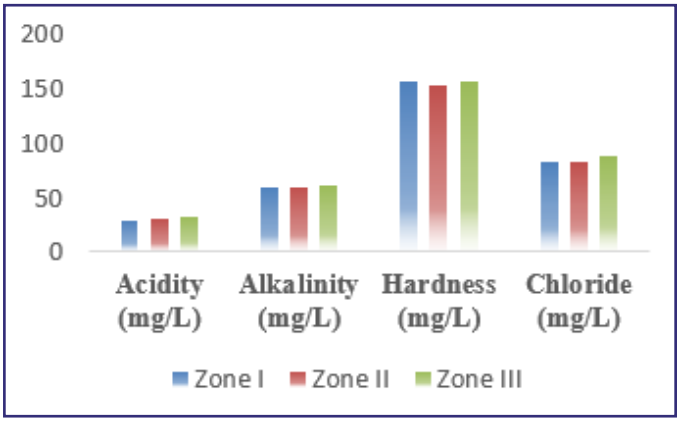
B. Chemical Parameters

Sl. No	Parameters	Results
1	Acidity	32.8 mg/l
2	Alkalinity	60.53 mg/l
3	Hardness	156 mg/l
4	Dissolved Oxygen	5.37 mg/l
5	Chloride	87.67 mg/l

Considering the physicochemical analysis carried out, it can be seen that groundwater at all three locations in Bidar Taluk meets drinking water standards. The parameters of pH, alkalinity, hardness, and chloride show that the water is fit for domestic consumption. However, small differences in acidity and dissolved oxygen content reveal that local effects are contributing to these parameters, possibly because of agricultural activities, discharge of wastes, and geological composition.

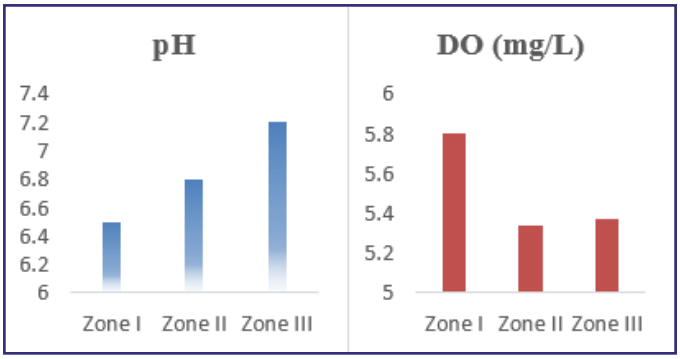
There is a potential threat to groundwater quality if the existing trends persist in the coming years because of urbanization, heavy use of fertilizers, and poor waste disposal. Without proper regulation and control measures, the parameters like nitrate, hardness, and total dissolved solids can increase in coming years, rendering the water unfit for consumption.

Fig. 1: Zone-wise comparison of physicochemical parameters of groundwater samples in Bidar Taluk.



The graph in Figure 1 represents the results of acidity, alkalinity, hardness, and chloride among the three zones. The values for acidity rise from 28.8 mg/L (zone I) to 32.8 mg/L (zone III). This depicts the minimal effect of environmental factors on the values. Alkalinity levels remain almost stable at around 59-60 mg/L. The high stability indicates that the buffering property of groundwater is quite stable. The values of hardness lie between 152-156 mg/L. This reveals the consistency of minerals like calcium and magnesium in the three zones. The chloride values range from 82 mg/L (zone I) to 87.67 mg/L (zone III).

Figure 2: (a) Variation of pH across different zones, (b) Variation of dissolved oxygen (DO) across different zones.



A **B**

In Figure 2(a), pH is observed to increase from 6.5 at Zone I to 7.2 at Zone III, which means there are some slightly alkaline groundwater conditions. According to Figure 2(b), dissolved oxygen slightly declines from 5.8 mg/l at Zone I to 5.37 mg/l at Zone III, and this could be attributed to differences in biological activity.

Table 1Comparison of Groundwater Quality Parameters with BIS Standards (IS 10500-2012) [10]

Parameter	Average Value	BIS Permissible Limit
pH	6.83	6.5 – 8.5
Hardness (mg/L)	154.6 mg/L	300 mg/L
Chloride (mg/L)	84.2 mg/L	250 mg/L

The comparison of groundwater quality parameters with BIS drinking water standards (IS 10500-2012) [10] shows that all the parameters fall under the permissible limits. The value of pH at 6.83 lies between the permissible limits of 6.5 and 8.5, which means that the water quality is neutral. The value of hardness at 154.6 mg/L is below the permissible limit of 300 mg/L, which means that the hardness level is moderate. The value of chloride at 84.2 mg/L is below the permissible limit of 250 mg/L, which implies that the salinity level is low.

4 INTERPRETATION OF RESULTS:

The following section describes the interpretation of physicochemical properties of the groundwater samples taken from various zones in Bidar Taluk. These values have been compared with permissible standards for their quality assessment for drinking and domestic uses.

Color: It represents the physical nature of the water. All the samples were determined to be colorless. It shows that there is no visual contamination and the samples are fit for consumption.

Odor: It refers to the dissolved substances. The samples do not contain any odor, showing no organic/chemical pollution in the water. Hence, they are suitable for consumption.

pH: The pH value is between 6.5 to 7.2, which falls under permissible limit (6.5-8.5). It indicates that the groundwater is either neutral or slightly alkaline.

Acidity: Acidity value was found less than 60 mg/L, which falls within the permissible limit. It indicates that water has no acidic features.

Alkalinity: Alkalinity value was between 59-60 mg/L, which are well within the permissible limit of 200 mg/L. It indicates the good buffering action in water. Total Hardness: Hardness value is between 152-156 mg/L, which falls within permissible limit (300 mg/L). It indicates moderately hard water.

Chloride content: Chloride value ranges from 82 to 87.67 mg/L, which is less than the permissible limit (250 mg/L). It shows that water has less salinity.

Dissolved Oxygen (DO): Dissolved Oxygen is 5.34 to 5.8 mg/L, which indicates good oxygen availability.

5 CONCLUSIONS

This study attempted to assess the quality of groundwater in the selected regions of Bidar Taluk based on physicochemical parameters. It was found that the values obtained for all parameters viz. pH, acidity, alkalinity, hardness, dissolved oxygen, and chloride, were well within the permissible range mentioned by BIS (IS 10500-2012) [10].

From the findings of this experiment, it can be concluded that the quality of groundwater is good enough in all three zones for various domestic and human consumption uses. The minor differences in the values recorded in the different zones could be due to environmental factors. There were no instances of contamination observed in any of the zones.

It is recommended that there be regular monitoring of groundwater in order to maintain its quality in the future.

6 FUTURE SCOPE

In future research, studies could be enhanced through the use of water quality assessment tools like WQI and GIS mapping. The inclusion of other parameters such as total dissolved solids (TDS), nitrates, heavy metals, and microorganism testing will enhance the accuracy of groundwater assessment. Studies involving long-term groundwater monitoring and the effects of seasons on groundwater quality could also be useful in understanding how urbanization and agriculture affect groundwater resources.

REFERENCES

1. V. Sunitha, B. Muralidhara Reddy, M. Ramakrishna Reddy," Groundwater Contamination from Agro Chemicals in irrigated Environment: Field Trials" ISSN: 0976-8610(2012).
2. Groundwater Pollution Sources Apportionment in the Ghaen Plain, Iran "Mohammad Reza VesaliNaseh, Roohollah Noori, Ronny Berndtsson, Jan Adamowski and Elaheh Sadatipour" article published in International Journal of Environmental Research and public health (2013).
3. Jianhua Wu, Peiyue Li, Hui Qian, Jie Chan "Groundwater Pollution in and Around a Paper Wastewater-Irrigated Area, Northwest China" research conference paper publication 261156119 june2013.
4. Sunderrajan Krishnan and RajnarayanIndu Consultants "Groundwater Contamination In India: Discussing Physical Processes, Health And Socio-Behavioural Dimensions" By, IWMI-Tata Water Policy Research Programmes, Anand,India.
5. M. M. Akhtar and Zhonghua Tang - Identification of Contamination Sources and TDS Concentration in Groundwater of Second Biggest City of Pakistan, "International Journal of Environmental Science and Development, Vol. 4, No. 3, June2013"
6. Awajiogak, Anthony Ujile "Evaluating Groundwater Contamination Processes And Developing Framework For Qualitative Management In Parts Of Nigeria" IJIRSET vol.2 issue 8 August 2013 ISSN:2319-8753
7. Oni and Olubunmi Fasakin, "The Use of Water Quality Index Method to Determine the Potability of Surface Water and Groundwater in the Vicinity of a Municipal Solid Waste Dumpsite in Nigeria." ISSN 2320:0936(2016).
8. R. Venkata Ramana, Dr. P. V. Nageswara Rao "Contamination of groundwater in Jadavalli village in Guntur district of A.P." VFSTR Journal of STEM Vol. 03, No.01 (2017)2455-2062.
9. Sayed Hossein Hozi, Sayed Ahmad Khatounabadi, EsmaeilDodangeh, SaeidEslamian, Kaveh Ostad-Ali-Askari, Hossein Gholami, Vijay P. Singh, Nicolas R Dalezios "Investigation of reasons causing ground water pollution in Yazd Iran" ISSN 2349-4395 and ISSN 2349-4409(2018).
10. Bureau of Indian Standards (BIS), IS 10500:2012 Drinking Water — Specification, New Delhi, India.