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Assessment of underground water quality of Bhauribandh village of Huzur Tehsil at Rewa District, M.P., India

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ABSTRACT

In this work, underground water of Bhauribandh village has been evaluated on the basis of selected physical and chemical parameters viz. Colour, Odour, Turbidity, Temperature, pH, E. C., Total Dissolved Solids, Total Suspended Solids, Hardness, Calcium Hardness, Magnesium Hardness, Alkalinity, Dissolved Oxygen, Biochemical oxygen Demand, Chemical Oxygen Demand, Fluoride, Sulphate, Chloride and Arsenic. People of this village are using directly underground water taken from various sources not only for drinking purposes but also for domestic and irrigation. It was observed that during the monsoon season, there is a notable increase in turbidity, electrical conductivity (EC), and total dissolved solids (TDS) in groundwater samples from Bhauribandh village. These elevations can be ascribed to heightened runoff and enhanced mineral leaching processes during this period. Conversely, the winter season manifests higher levels of water hardness and indicators of organic pollution, likely stemming from diminished microbial activity under colder conditions. In contrast, summers display fluctuations in dissolved oxygen (DO) levels and concentrations of inorganic contaminants, influenced by temperature variations and human-induced activities. Understanding these dynamic seasonal variations is imperative for effective water resource management and the assurance of safe drinking water provision. Continuous monitoring is indispensable for fostering sustainable development in Bhauribandh village, ensuring the preservation of both public health and environmental integrity

Key words: *Underground water, Seasonal variations, TDS, DO, Alkalinity, Arsenic*

Introduction

Bahuribandh is a village in the Huzur Tehsil of the Rewa district of Madhya Pradesh, with a overall population of 780 families. As per the 2011 Population Census, the Bahuribandh village has a population of 4131 residents, comprising 2176 men and 1955 women (VillageInfo.in.2024). Water is known as "life" since it has no alternative. Water has been recognized as the very core of life. All living organisms, including plants, animals, and individuals, use it for existence. Water covers 60-95 percent of its bodies of all plants, insects, livestock, and humans. Sweat, excreta, urine, and vapour are all ways that water is produced (Landrigan, 2020). As a result, all living things need a large amount of water on a regular basis. Moreover, a large amount of water is needed for body growth and nutrition. As a result, thinking about life without water is ridiculous (Popkin, 2010). However, like any other natural resource, our water supply resources are limited and it will be drained within a century (Musie, 2023).

Unfortunately, human activities are contaminating waterways these days, and they are becoming inappropriate for use faster than usual. Water shortages are more severe than food or population scarcity, since food production and population issues are meaningless without adequate water supply (Kummu, 2016). Women in these villages must travel 1-14 kilometres a day to obtain water for drinking and cooking. According to the United Nations Food and Agriculture Department, if recent trends of wasting and polluting water do not improve, the world's biosphere, including man, will disappear in less than a century (Praveen, 2016). In India most of the population lives in villages and people in villages use underground water for drinking and other purposes without any treatment (Krishnan, 2003). If we compare life style of cites areas most of the houses have reverse osmosis systems installed or people use government supplied purified water for drinking purpose (Kalpana Balasooriya, 2023). Thus it is compulsory to evaluate water quality of all the villages where people are drinking underground water without any treatment. People of village are prefer natural products for various social activities (Chauhan, 2021; Yadav, 2021; Yadav, 2023) and only synthetic agrochemicals (Yadav, 2021, Yadav, 2022) are used in large amount for good production of crops than other household chemicals. In the present study Bahuribandh village has been selected for evaluation of underground water quality on the basis of selected parameters like as Colour (Yadav, 2017, Yadav, 2018), Odour, Turbidity, Temperature, pH, Elec. Conductivity, Total Dissolved Solids, Total Suspended Solids, Hardness, Calcium Hardness, Magnesium Hardness, Alkalinity, Dissolved Oxygen, BOD, COD, Fluoride, Sulphate, Chloride and Arsenic (Allauddin, 2012, Firdaus, 2012, Yadav, 2023, Singh, 2021, APHA, 1995). All the selected parameters were evaluated with seasonal variation and it was resulted that water quality is being affected day by day.

Materials and Methods

Selection of Sample sites: Six sample sites have been selected in Bahuribandh village from various places in Mansoon, Winter, Summer season (2023) as given in Fig. 1 and a specific code has been provided as given following. SS1= Mr. R.K. Tiwari (Bore well) SS2=Mr. Vinod Patel, (Bore well), **SS3**=Mr. G.D. Pandey, (Bore well) **SS4**= Mr. S.K Pal (Bore well), **SS5**= Mr. R.N. Kushwaha (Bore well), SS6= Mr. L.B. Mishra, (Bore well)

Analysis

Samples from above selected sites were collected in Mansoon, Winter and Summer seasons. Polypropylene bottles of 2.5 lire were used for collection and storage purposes. Color of the samples was analyzed by comparison visually with standard. Odour was determined by sniffing while turbidity was determined by terbidity meter, pH by pH meter and EC was determined by smart conductivity meter. Remaining parameters were evaluated by adopting standard methods prescribed in APHA (1995).

Results and Discussion

The analysis results given in Table 2 have been compared and discussed As per BIS-10500 accepted limits of various parameters have been taken into the

Fig. 1. Map of selected sample sites in Bahuribandh village

Table 2. Samples of Groundwater of Bhauribandh village during Summer, Winter, Mansoon (2023)

Parameters	SS1			SS2			SS3			SS4			SS5			SS6		
	S	W	M	S	W	M	S	W	M	S	W	M	S	W	M	S	W	M
Colour	Cols	Cols	Cols	Cols	Cols	Cols	Cols	Cols	Cols	Cols	Cols	Cols	Cols	Cols	Cols	Cols	Cols	Cols
Odour	Ina	Ins	In	Ina	Ins	In	Ina	Ins	In	Ina	Ins	In	Ina	Ins	Ino	Ina	Ins	In
Turbidity (NTU)	1.5	1	1.9	1	0.5	2.2	1	2	0.2	1.2	1.6	0.5	2.3	1.2	2.8	1.4	1.5	1.4
Temperature($_0$C)	29.2	23.2	31.2	35.7	24.1	29.5	33.2	22.9	30.4	32	23.8	28.1	33.2	24.8	29.7	32.4	22.3	30.4
pH	7.4	8	7.3	7	7	7.8	6.5	8	7.4	7	6.9	8.2	6.8	6.8	7.6	7.2	7.3	7.4
E. C. (mS/Cm)	658	586	639	845	478	1280	698	698	703	876	587	770	974	788	1286	1025	986	945
TDS(mg/l)	610	550	410	758	720	821	542	589	451	945	943	493	582	582	825	730	660	606
TSS(mg/l)	2	1	2.6	1.2	1.6	2.8	2.6	1.2	1.8	1.7	2	2	1.5	2.4	1.6	2.3	2.2	1.5
Hardness(mg/l)	320	232	166	560	490	373	820	228	218	635	236	382	684	600	417	480	352	268
Ca+2(mg/l)	74.5	58.32	38.5	48	145.23	107.2	53.1	96.2	45.3	94	83.5	108.20	107.55	114.45	65.5	110.85	99	56.2
Mg +2(mg/l)	64.3	42.36	16.9	70	54.26	25.60	54	35.2	25.6	40.2	41.50	27.25	36.5	36.8	61.8	40	60	31.0
Alkalinity(mg/l)	180	260	160	205	215	280	255	314	280	180	160	260	320	320	200	270	280	320
DO(mg/l)	2	4.9	5.5	1	2.1	4.8	2	5.1	8.7	3.1	4.6	5.1	1.8	6.3	3.2	4.5	3.2	5.3
BOD(mg/l)	1.8	2.6	5.8	21	3.6	4.9	4.4	5	4.1	2.2	4.8	5	2.3	4.6	4.7	3.7	6	5.2
COD(mg/l)	8.6	8.2	8	8.5	6.5	7	6.7	5.4	6.3	6.9	6.3	6.1	6.8	7.2	5.8	9.8	5.8	6.7
Fluoride(mg/l)	0.48	0.84	1.4	0.24	0.42	1.10	1.5	0.24	-	0.48	0.48	0.35	0.86	1.7	2.00	1.3	0.4	1.0
Sulphate(mg/l)	3.11	6.88	4.11	4	2.65	2.86	2.52	2.73	3.65	4.52	3.52	3.76	3.12	5.26	3.68	3.44	3.45	4.22
Chloride(mg/l)	38	29	39.65	43	38	65.20	20	30	29	21	18	34	19	33	19	28	28	25
Arsenic(mg/l)	0.005	0.002	0.002	0.004	0.004	0.002	0.002	0.006	0.003	0.006	0.001	0.005	0.001	0.003	0.008	0.004	0.002	0.003

Abbreviations: Cols= Clourless, Ina= Inoffensive, S= Summer, W= winter, Mansoon= M

consideration.

The data provided in Table 2 represent the analysis of groundwater samples from Bhauribandh village during different seasons: monsoon, winter, and summer, respectively. A comparison of the parameters across these seasons reveals notable variations, indicating seasonal influences on water quality.

Turbidity levels vary across seasons, with generally higher values during monsoon (ranging from 0.2 to 2.8 NTU) compared to winter and summer. This is likely due to increased runoff and sedimentation during the rainy season. Temperature changes are observed, with higher values recorded during monsoon and summer compared to winter. Increased temperatures during monsoon and summer may enhance microbial activity and chemical reactions in the water. pH levels show minor variations across seasons, with values generally within the acceptable range for drinking water. However, slight alkalinity is observed during monsoon and summer, possibly due to leaching of minerals from the soil. Both EC and TDS values tend to be higher during monsoon compared to winter and summers, indicating higher mineral content and ion concentration in the water during rainy seasons. Hardness levels fluctuate across seasons, with varying contributions from calcium and magnesium hardness. Higher values are observed during winter, suggesting increased mineral content during this season. DO levels vary across seasons, with generally higher values during monsoon and summer compared to winter? Increased DO during monsoon could be attributed to aeration due to rainfall, while higher temperatures in summer might decrease DO solubility. BOD and COD levels show seasonal variations, with generally higher values during winter. This could indicate increased organic pollution during this season, possibly due to reduced microbial activity and slower decomposition rates in colder temperatures. Concentrations of these contaminants

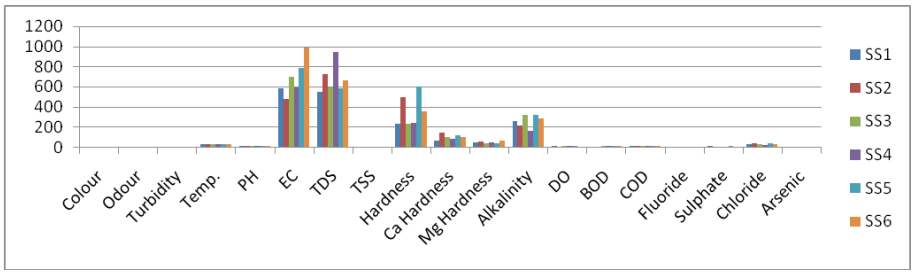

Fig. 2. Variation of parameters in Mansoon

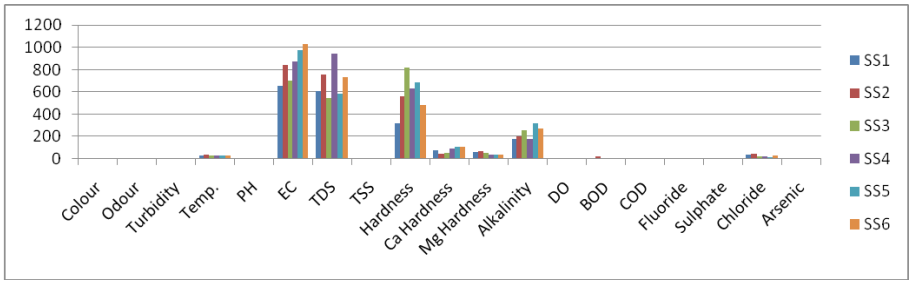

Fig. 3. Variation of parameters in Winter

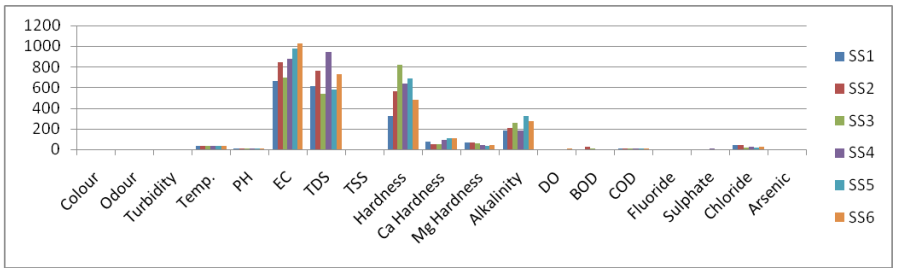

Fig. 4. Variation of parameters in Summer

show fluctuations across seasons, with varying sources and influences. For example, higher sulphate concentrations during monsoon could result from the dissolution of minerals in the soil, while fluctuations in chloride levels might be influenced by agricultural activities and rainfall patterns.

Conclusion

The analysis of groundwater samples from Bhauribandh village indicates significant seasonal variations in water quality parameters. Monsoon seasons generally exhibit higher turbidity, electrical conductivity, and total dissolved solids, possibly due to increased runoff and mineral leaching. Winter seasons show elevated hardness levels and organic pollution indicators, likely influenced by reduced microbial activity and slower decomposition rates. Summer seasons demonstrate fluctuating levels of dissolved oxygen and inorganic contaminants, reflecting complex interactions between temperature, rainfall, and anthropogenic activities. Understanding these seasonal variations is crucial for effective water resource management and implementing appropriate treatment measures to ensure safe drinking water supply for the community. Continued monitoring and analysis of water quality parameters are essential for identifying trends, assessing risks, and implementing timely interventions to safeguard public and environmental sustainability in Bhauribandh village.

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Conflict of Interest

None

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