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STUDIES ON UNDERGROUND WATER QUALITY OF SOME VILLAGES OF KATIHAR REGION BIHAR

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Abstract : Some Physico-chemical Parameters of underground water collected from 5 wells at a distance of 30 km along from railway station of katihar from different location of five villages (five sampling points) were studied in June 2024 to May 2025. In case of underground water, it was found that there was a marked variation in the Physico-chemical parameters of various sample points in different seasons.

***IndexTerms*:**--Physico-chemical characters, under-ground bore water, water quality.

I. INTRODUCTION

Katihar district bihar in bihar is primarily served by Ganga and Kosi river, with the Kosi joining the Ganga near Kursela in the district. From the literature survey, it is known that no investigation has been carried out on the quality of underground water in the blocks of katihar such as Dhalan, Manihari, Kadwa, Korha, and Barai,. Five villages are selected for this study situated in side away from the river Ganga and Koshi which is famous river also known as " Sorrow of Bihar". Each village's house are about 5 to 6 thousand People.

EXPERIMENTAL

Materials and methods

Water samples collected from five sampling points of different localities 30 Km from railway station of katihar . These points are namely (1)Dhalan (2) Manihari (3) Kadwa (4)Korha (5) Barai

Table 1: Sampling points and places

Sampling Point	Places
1	Dhalan (Tube well)
2	Manihari (Tube well)
3	Kadwa (Tube well)
4	Korha (Tube well)
5	Barai (Tube well)

Table 2: Methods used f or estimation of various physic-chemical parameters

S.No.	Parameters	Methods
1	Temp	Thermometer (0 to 300^{0}C)
2	pH	pHmetry
3	Conductivity `	Conductometry
4	TDS	Filtration method
5	DO	Zoelometric method

6	Free CO_2	Titration method
7	Total hardness	EDTA titration
8	Total alkalinity	Titration method
9	Magnesium	EDTA titration
10	Calcium	EDTA titration
11	Chloride	Silver nitrate method
12	Sulphate	Turbidometric method
13	Nitrate	Brucine method

The selection of well and bore well from these villages were made with a distance of about 5 Km. from each sampling point along side of katihar. The underground water samples were collected from deep well from these villages. Water samples were collected in 3 liters polyethylene cans , which were previously cleaned and washed with deionised water and rinsed with this sample several times. These samples were collected in the spell of June 2024 to May 2025.

The physicochemical parameters such as pH, temperature, conductivity, TDS, DO, free CO_2, total hardness , alkalinity, magnesium, calcium, chloride, sulphate, and nitrate were determined using standard methods. Reagent used for the present investigations were A. R. grade and double distilled water was used for preparing various solutions.

RESULTS AND DISCUSSION

Thirteen physic-chemical parameters of water samples were determined and recorded . The temperature of the sample was noted at the sample spot during collection. At the same time,dissolved oxygen was measuered by the chemical method. Other parameters like electrical conductivity, pH, total dissolved solids, total alkalinity, total hardness, calcium, magnesium, chloride , free CO_2 , sulphate and nitrate were measured within few hours from sampling. The parameter were analysed by prescribed standard method.

The analysis of ground water samples includes the determination of the concentration of the inorganic constituents present in addition to the measurement of pH, electrical conductance, total dissolved solid and other minor constituents. Each of these properties is useful in evaluating the chemical character of underground water. In the present study, under ground water from 5 wells tapping various aquifer formation in area been sampled and analysed for a period of an year in rainy. winter and summer seasons. The variation in the concentration of the parameter is shown in Table 3.

From these data, it is evident that the concentration of all ions in winter season were low and exhibiting increasing trends in rainy and summer seasons. This is due to fact that minerals , which are present in soil decrease due to the rise in water table. Kripanidhi et al.[3] have reported similar trend in ground water of typical hard rock terrain and pollution in villages.

It was found that the temperature of all fives wells varied from 23 to 25. Various chemical and biological reactions in water depends to a great extent on temperature. The observed values of temperature indicates that the water quality would be certainly affected by the parameter.

The pH of water varied between 8.19 to 8.54 . It is found that in summer, pH of all sampleis high. On an average, pH of all samples was in desirable limit as prescribed for drinking water standard (8.5 ICMR).

The specific conductivity of water samples under study varies between 150 to 900 µ mho/cm. The maximum permissible limit of this parameter for drinking water is 300 µ mho/cm. but average specific conductivity exceeds this limit because of it's high values during rainy season. In rainy season due to floods and rains, water level in the well increases. which contains more electrolytes.

The permissible limit of T.D.S. of drinking water is 500 mg/L. (WHO).The observation shows that the TDS is in the range of permissible range as compared to WHO.

The good quality water has solubility of oxygen 7.1 to 7.5 mg/L at 31^0 to 36^0 but except in rainy season, all the samples showed higher values of D O. Low values of D. O. in rainy season may be due to high values of conductivity of water.

CO_2 contents in well water is due to rain, from plant roots and decaying vegetation. The factors responsible for solubilisationof CO_2 are temperature , pressure. pH and total alkalinity. The free CO_2 Contents of water

of the bore wells varied from 1.66 to 7.82 . However, the permissible limit of free CO_2 has not been prescribed.

Hardness has no known adverse effects on health. However, maximum permissible level has been prescribed for drinking water in 500 mg/L (WHO). According to some classification, water having hardness upto 75 mg/L .is classified as soft, 76-150 mg/L, is moderately soft, 151-300 mg/L as hard and more than 300mg/L as very hard. On the basis, the results show that (1) all the water samples in rainy season were moderately soft and (2) most of the observations in winter season show that hardness increases moderately.

Total alkalinity of bore well water in terms of $CaCO_2$ varied between 340.1 to 630.7 . The values of total alkalinity were comparately large. The water for domestic use having alkalinity less than 100 mg/L. is safe.The high content of alkalinity is shown in the Talble 3. Which is relatively high.

Present investigation shows the concentration of calcium in the water samples is in the range of 25.8 to 38.6 mg/L. during june to may 2024-2025. According to Ohle, the water having calcium values more than 25 mg/L. is classified as 'Calcium rich'. Thus, as per the recommendation of $Ohle^9$, most of the water samples are 'Calcium rich'. The observed values of magnesium were between 29.5 to 41.6 mg/L. during 2024-2025. The observation show that maximum contents of magnesium occurred during winter. Present investigation also shows that the majority of samples do not exceed the limits as prescribed by ISI as well as WHO.

Table 3: Seasonal variation in the underground water quality of north side of Ward region (JUNE 2024 to MAY 2025)

Parameter	Rainy Season /Sample station					Winter Season /Sample station					Summer Season/ Sample station				
	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
Temp (^{0}C)	23.3	24.2	23.4	23.2	23.1	24.1	24.4	24.8	24.6	24.5	25.4	25.2	25.4	25.3	25.4
pH	0.02	8.23	8.14	8.1	8.3	7.80	8.14	7.39	7.80	8.09	8.24	8.29	8.19	8.34	8.54
Conductivity (µ S)	900	810	850	900	1000	400	450	475	400	450	500	550	560	500	550
TDS (mg/L)	500	400	700	600	550	600	550	625	600	650	475	500	600	550	600
D.O. (mg/L)	2.12.7	2.8	2.3	2.4		7.0	8.7	6.9	6.4	5.5	4.4	8.5	5.5	6.7	5.1

Free CO_2 (mg/L)	2.42	3.57	2.70	1.81	1.66	5.20	6.15	5.71	7.82	5.67	4.20	3.65	4.41	3.97	4.51									
Total hardness *(mg/L)*	133	184	199	168	189	265	245	190	214	210	272	365	305	263	245									
TotalAlkalinity(mg/L)	340.1	360.3	420.1	521.7	479	414.9	560.1	582.2	561.1	523.8	630.7	587.2	525.5	420.8	590.7									
Magnesium (mg/L)	34.8	36.1	35.7	31.6	40.0	41.6	38.5	29.7	36.4	30.6	32.4	31.4	33.7	37.8	34.7									
Calcium (mg/L)	31.6	33.7	31.5	28.6	35.5	37.7	31.7	25.8	31.7	28.0	30.7	38.6	30.4	33.0	31.2									
Chloride (mg/L)	102.4	87.2	77.5	84.0	111.5	121.5	130.0	137.7	109.7	102.7	189.4	179.8	135.1	115.7	134.6									
Sulphate (mg/L)	50.0	59.2	53.0	54.1	57.0	43.28	40.20	41.8	44.9	50.6	52.3	62.3	60.42	66.2	58.3									
Nitrate (mg/L)	0.043	0.021	0.11	0.099	0.134	0.039	0.021	0.02	0.071	0.08	0.051	0.02	0.15	0.11	0.17									

Chloride contents of the water sample were very low in rainy season and low in winter season. According to WHO, maximum permissible limit for chloride is 500 mg/L. The values observed in present study are well below this permissible limit.

The Sulphate content varies between 40.2 to 66.2 mg/L. and the nitrate content varies between 0.023 to 0.17 mg/L. The sulphate and nitrate values were also found within the prescribed limits.

CONCLUSION

There was a marked variation in the physico-chemical parameters (Table 3)

I. Water purification process is a natural system. The physical process involved in self purification of water sources are dilution, sedimentation, suspension, filtration, gas transfer and heat transfer. Many of the chemical reactions involved in the self purification process must be biologically mediated.

II. In rainy season, conductivity is high as compared to winter and summer seasons.

III. Similarly, TDS, DO, free CO_2, , magnesium and calcium were high in winter season as compared to rainy and summer seasons.

IV. Also, pH, temperature , total hardness, total alkalinity, chloride, sulphate and nitrate were high in summer season as compared to rainy and winter seasons. The data in table 3 for various physic-chemical parameters were found within the prescribed limits, and hence, water from all the sampling points are suitable for drinking purpose.

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