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Assurance of water quality index and appropriateness of ground water in a College in Bahraich, U.P

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ABSTRACT

This paper displays an investigation because of natural parameters on ground water quality in Kisan (PG) College, Bahraich (U.P.). Ground water tests were accumulated from various places in the college grounds and their quality was compared on the idea of water quality index, that determines the water quality for drinking purpose. WQI was resolved based on different physical and synthetic parameters like pH, EC, turbidity, TDS, corrosiveness, alkalinity, all out hardness calcium, magnesium, chloride, nitrate, sulfate, iron and broke up oxygen. These parameters were resolved for the figuring of water quality index (WQI). A correlation of the nature of ground water of five extraordinary areas of the College has been made.

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1. Introduction

The contamination of water bodies is expanding relentlessly because of fast populace development, urbanization, expanding expectations for everyday comforts and differing human exercises. Time is maybe not very far when unadulterated and clean water might be inaccessible for keeping up the typical human life. There are a few different ways to survey the nature of water as considered fit for drinking, water system and mechanical use. Various parameters influence the ease of use of water for a specific

reason. Ground water is one of the fundamental wellsprings of water prerequisite of individuals in India just as different pieces of the world. Contamination of water has been accounted for to cause 80% of human infections and 30% of newborn child mortality. It is, consequently, critical to screen the nature of ground water contamination of different parts of our nation (Singh and Parwana 1992). Keeping this in account, the present investigation expects to ascertain the water quality index (WQI) so as to evaluate

the reasonableness water for human use in K.D.C. (P.G.) College, Bahraich.

2. Materials and Methods

Region Bahraich is situated in the Tarai area of Uttar Pradesh flanking Nepal with a scope of 27°20' and longitude 82°49'. The ground water nature of the entire district has all the earmarks of being not excellent since the greater part of the populace is experiencing different water borne infections. Ground water is accessible for household use even at a profundity of 9 to 12 meters. This low profundity ground water has numerous toxins maybe because of nearly inadequate filtration medium as earth. The present investigation has been made on the hand siphon ground waters of the Kisan (PG) College, Bahraich (U.P.) at five locales arranged at Divisions of Botany Deptt., Chemistry Deptt., Zoology Deptt., Principle Office, and Physics Deptt. Standard tools and analytical reagents or general reagents were utilized in examination with the help of following standard techniques (APHA 1992).

Water Quality Index Framework:

A water quality record, regular with numerous different lists frameworks, relates a gathering of water quality parameters to a typical scale and joins them into a solitary number as per a picked strategy for calculation. The ideal utilization of WQI is to evaluate water quality patterns for the board reason despite the fact that it isn't intended for a flat out proportion of the level of contamination or the genuine water quality.

The water quality index was determined considering nine significant physico-synthetic parameters utilizing ICMR and ISI principles by following equation:

$$WQI = \sum_{i=1}^n q_i W_i / \sum_{i=1}^n W_i$$

Where, W_i is a unit weight factor, given by the formula,

$$W_i = K/S_i$$

S_i is the standard value of i^{th} parameter and K is proportionality constant.

The unit weights W_i for all the 9 chosen parameters with standard values are given in Table 1.

The quality rating q_i is determined as follows:

$$q_i = 100 (V_i - V_{10}) / (S_i - V_{10})$$

Where,

q_i = Quality rating for the n^{th} water quality parameter.

V_i = Estimated value of the n^{th} parameters at a given sampling station.

S_i = Standard permissible value of n^{th} parameter.

V_{10} = Ideal value of the n^{th} parameter in pure water.

All the ideal values (V_{10}) are taken as zero for the drinking water except for pH = 7.0 and DO = 14.6 mg/L.

3. Results and Discussion

During the development phase, the use of ethanol as the diluent resulted in preferable outcome in UV analysis. The pre-determined wavelength of maximum absorption (λ_{max}) was 288 nm.

The estimations of different physico-chemical parameters for count of WQI are introduced in Table 2, quality rating in Table 3, sub index values in Table 4, WQI values in Table 5, and status of water quality dependent on WQI in Table 6.

pH values: The pH estimations of the ground water of the College are in acidic range changing from 6.93 to 6.50. The present perception discovers support by crafted by Chatterjee and Raziuddin (2002).

It is realized that pH of water doesn't cause any extreme wellbeing peril; in any case, low pH actuates the development of tri halo methane which are dangerous. In the present examination pH esteems are inside the ICMR norms (6.5-8.5) and ISI measures (6.5-9.2).

Total dissolved solids: TDS values ran from 250 to 331 mg/L. In the present investigation TDS values are inside the ICMR benchmarks (1500 to 3000 mg/L) and ISI guidelines (500 mg/L). Higher fixation of broke down solids may create trouble in steers and domesticated animals and a salty to water.

Total hardness: Hardness esteems were recorded somewhere in the range of 155 and 265 mg/L. High estimations of hardness in the physics Deptt. Credited to low water level. The scale of hardness from the drinker perspective might be taken as underneath:

0-50 mg/L - Soft

50-100 mg/L - Moderately soft

100-150 mg/L - Slightly hard

150-250 mg/L - Moderately hard

Over 250 mg/L - Hard

In this regard the ground water of College is tolerably hard. Hardness beneath 250 mg/L is viewed as consumable yet this breaking point produces gastrointestinal aggravation.

Total acidity: Absolute acidity values are inside 75 to 210 mg/L. High estimations of total acidity in the test of Principle office may be because of the nearness of septic tank. Acidity in itself isn't destructive to people.

Turbidity: The estimations of turbidity are inside 5.0 to 8.8. (N.T.U.). The high estimation of turbidity in the test of Principal office is because of essence of septic tank. The allowable turbidity endorsed as a standard for drinking water is between 5 to 10 mg/L (turbidity units).

Dissolve Oxygen (DO): The estimations of DO differ from 1.5 to 4.3 mg/L. The low estimation of DO in Physics Deptt. And, Principal office can be credited to expansion of effluents containing oxidisable organic matter. The grouping of DO in the ground waters of College is underneath passable cutoff of 5 mg/L during every one of the seasonable natural issue.

Calcium: Happens in water chiefly because of the nearness of limestone, gypsum, dolomite and gypsiferous minerals. The determination of calcium is generally required for consumable water. The qualities differed in the range of 60 to 80 mg/L. High calcium substances in water are bothersome for washing, washing and laundering. It will in general make scales on utensils. The passable furthest reach of calcium is 75 mg/L (ISI).

Magnesium: The qualities differed inside scope of 16 to 32 mg/L in the waters of the College. The admissible furthest reach of magnesium is 30 mg/L (ISI). Magnesium is a

fundamental component for man. In any case, at more significant levels, magnesium salts have a diuretic impact.

Chloride: Concentration of chloride were found to shift inside 122 to 200 mg/L. Despite the fact that chloride fixation is high in ground water, yet it is underneath allowable point of confinement.

Sulfate: The estimations of sulfate extended inside 85 to 165 mg/L. The most extreme qualities watched can be ascribed to expansion of septic tank water. Sulfate may have diuretic impact if magnesium is available at a proportional concentration (Chatterjee and Raziuddin 2002). In the present examination sulfate in ground waters is beneath reasonable utmost.

Nitrate: Nitrates are the final results of deterioration of natural issue present in completely oxidized waters and destructive over 45 mg/L. In the present investigation

nitrate in ground waters is underneath passable farthest point.

Iron: WHO Global gauges of iron suggested a passable cutoff of 0.3 mg/L and inordinate utmost of 0.1 mg/L in drinking water. The qualities ran inside 0.2 to 0.8 mg/L Utilization of WQI is a helpful strategy in surveying the water nature of ground waters. In the present investigation, use of WQI gives a near assessment of water quality at various examining places. Scrutiny of WQI information from Table 5 shows that the index value is most extreme for physics Deptt. also, least for chemistry Deptt. It tends to be closed from the investigation that the water quality at different areas in the College is in the accompanying diminishing request: Botany Deptt. >ChemistryDeptt. > Zoology Deptt. >Principle Office >Physics Deptt.

Table 1: Drinking water standards recommending agencies and unit weights (all values except pH are in mg/L)

Sl. No.	Parameters	Standards (Si)	Recommending agency	Unit Weight (Wi)
1.	pH 6.5-8.5 ICMR and ISI 0.218176	6.5-8.5	ICMR and ISI	0.21817
2	Total Dissolved Solid (mg/L) 500 ICMR and ISI 0.003708	500	ICMR and ISI	0.003708
3	Total Hardness (as CaCO ₃) (mg/L) 300 ICMR and ISI 0.00618	300	ICMR and ISI	0.00618
4	Calcium (mg/L) 75 ICMR and ISI 0.02472	75	ICMR and ISI	0.02472
5	. Magnesium (mg/L) 30 ICMR and ISI 0.0618	30	ICMR and ISI	0.0618
6	Sulphate (mg/L) 150 ICMR and ISI 0.01236	150	ICMR and ISI	0.01236
7	Chloride (mg/L) 250 ICMR and ISI 0.007416	250	ICMR and ISI	0.007416
8	Nitrate (mg/L) 45 ICMR and ISI 0.0412	45	ICMR and ISI	0.0412
9	Dissolved oxygen (mg/L) 5 ICMR 0.37089	5	ICMR	0.37089
10	Electrical conductivity, µmhos/cm 300 ICMR 0.00618	300	ICMR	0.00618

Table 2: Water quality parameters of K.D.C. (P.G.) College, Bahraich

Sl. No.	Parameters	Chemistry Dept.	Botany Dept.	Physics Dept.	Zoology Dept.	Principals's . Office
1	pH	6.50	6.75	6.93	6.67	26.60
2	TDS (mg/L)	275.00	250.00	280.00	330.00	331.00
3	Total hardness (as	165.00	155.00	265.00	233.00	190.00

	CaCO ₃ (mg/L)					
4	Total acidity (mg/L)	140.00	175.00	130.00	170.00	210.00
5	Turbidity (N.T.U.)	6.50	5.00	8.80	6.00	66.80
6	Dissolved O ₂ (mg/L)	3.20	4.30	1.50	2.50	2.10
7	Calcium (mg/L)	60.00	70.00	70.00	63.00	80.00
8	Magnesium (mg/L)	18.00	16.00	25.00	23.00	32.00
9	Chloride (mg/L)	135.00	148.00	200.00	190.00	122.00
10	Sulphate (mg/L)	85.00	90.00	135.00	165.00	100.00
11	Nitrate (mg/L)	32.00	25.00	40.00	40.00	35.00
12	Iron (mg/L)	0.50	0.20	0.70	0.4	00.80

Table 3: Water quality index (Qi) of K.D.C.(P.G.) College, Bahraich

Sl. No.	Parameters	Chemistry Dept.	Botany Dept.	Physics Dept.	Zoology Dept.	Principals's Office
1	pH	-33.3333	-16.6666	-4.6666	-22.00000	26.60
2	TDS (mg/L)	55.0000	50.0000	56.0000	66.00000	331.00
3	Total hardness (as CaCO ₃) (mg/L)	55.0000	51.6666	88.6300	77.6666	190.00
4	Dissolved O ₂ (mg/L)	118.9473	18.9473	136.8421	126.8492	2.10
5	Calcium (mg/L)	80.0000	93.3200	93.3200	84.0000	80.00
6	Magnesium (mg/L)	60.0000	83.3000	83.3000	76.6000	32.00
7	Chloride (mg/L)	56.0000	90.0000	90.0000	110.0000	122.00
8	Sulphate (mg/L)	54.0000	0.0000	80.0000	76.6000	100.00
9	Nitrate (mg/L)	71.1111	88.8888	88.8888	88.8888	35.00

Table 4: Determined subindex (QiWi) estimations of various parameters of K.D.C (P.G.) College, Bahraich.

Sl. No.	Parameters	Chemistry Dept.	Botany Dept.	Physics Dept.	Zoology Dept.	Principals's Office
1	pH	-7.2727	-3.6362	-1.0181	-4.7998	-4.7992
2	TDS (mg/L)	0.2039	0.1854	0.2076	0.2447	0.2454
3	Total hardness (as CaCO ₃) (mg/L)	0.3390	0.3193	0.5480	0.4806	0.6820
4	Dissolved O ₂ (mg/L)	44.1163	39.8218	50.7533	46.8492	48.4109
5	Calcium (mg/L)	1.9776	2.3086	2.3086	2.0764	2.6361
6	Magnesium (mg/L)	3.7080	3.2959	5.1499	4.7376	6.5919
7	Chloride (mg/L)	0.7003	0.7416	1.1124	1.3596	0.8239
8	Sulphate (mg/L)	0.4004	0.4390	0.5932	0.5636	0.3619
9	Nitrate (mg/L)	2.9297	2.2888	3.6620	3.6622	3.2044

Table 5: Water quality index (WQI) of K.D.C. College, Bahraich.

Sl. No	Place of sample	WQI
1	Chemistry Department	47.1027
2	Botany Department	45.7642
3	Physics Department	63.3171
4	Zoology Department	55.1744
5	Principal's Office	58.1573

Table 6: Status of water quality based on WQI.(Chatterjee & Raziuddin 2002)

Sl.No	WQI	Status
1	0-25	Excellent
2	26-50	Good
3	51-75	Poor
4	76-100	Very Poo
5	100 and above	Unsuitable for drinking

4. Conclusion

WQI was resolved based on different physical and synthetic parameters like pH, EC, turbidity, TDS, corrosiveness, alkalinity, all out hardness calcium, magnesium, chloride, nitrate, sulfate, iron and broke up oxygen. These parameters were resolved for the figuring of water quality index (WQI). A correlation of the nature of ground water of five extraordinary areas of the College has been made.

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