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Evaluation of water quality index and assessment of suitability of groundwater for drinking in Ellenabad city of Haryana, India

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Abstract
The present research work deals with the calculation of water quality index (WQI) and the statistical analysis to assess the ground water quality of the Ellenabad city of Haryana state. For this purpose, seven ground water samples were collected from the different locations of the city during pre-monsoon period of 2016 and analyzed for various physico chemical properties. The results were compared with the standard to check the suitability for drinking. The WQI was calculated to assess the overall ground water quality. Pearson's correlation matrix was used to find the relationship between various parameters. The correlation matrix clearly showed the permanent hardness of groundwater in the study area.

Keywords: Ellenabad, groundwater, physico chemical parameters, statistical analysis, water quality

Introduction
Groundwater is utilized for rural, modern, family unit, recreational and ecological exercises everywhere throughout the world. Over the most recent couple of decades, there has been a massive increment in the interest for fresh water because of quick development of population and the quickened pace of industrialization [1]. The nature of water is indispensable worry for humankind since it is straightforwardly connected with human welfare. In India, the greater part of the population is subject to groundwater as the main wellspring of drinking water supply. Consumable water is the water that is free from malady creating microorganisms and compound substances that are unsafe to health [2, 3], larger part of the rural ordinary citizens don't approach consumable water and along these lines, rely upon well, stream and waterway water for residential utilize. In India, there are more than 20 million private wells notwithstanding the administration tube wells. The narrative of every city might be extraordinary, yet the fundamental explanations behind the water emergency are normal, for example, expanding request, zonal divergence in dispersion of water supply, absence of moral structure, lacking information and assets, real land-utilize changes, long haul water level decreases, increment in saltiness and pollution [4]. Ground water is by and large considered as a sheltered wellspring of crisp drinking water [5]. In any case, the wells are for the most part considered as the most exceedingly bad kind of ground water sources in the term of physio-concoction sullying because of the absence of solid plinth and encompassing leakage framework W.H.O, 1998 [6]. The purpose behind illustration of vital parameters in water quality appraisal might be credited to the way that in the general portability of water, such parameters ought not be ignored [7, 3]. There are different courses as ground water is defiled, for example, utilization of manure in farming [8], leakage from profluent bearing water body [9]. Once the groundwater is despoiled, its quality can't be reestablished by preventing the poisons from the source. It accordingly winds up basic to routinely screen the nature of groundwater and to gadget ways and intends to ensure it [10]. The goal of this examination is to explore subjective investigation of some physicochemical parameters of ground water in the study area. For this the Water quality index was calculated.

Materials and Methods
A total of seven representative samples were collected from the municipal bore wells situated across the entire city. The temperature, pH and electrical conductivity (EC) were measured at the sampling sites. The TH, TA, Chloride, Ca and Mg concentration were measured by titration methods. The concentration of sulphate and Fe were determined by spectrophotometric method. SPSS 16.0 software was used for the statistical analysis.

Calculation of water quality index: In the present study, ten important parameters *viz*. pH, EC, TDS, TH, TA, Ca, Mg, Chloride, Sulphate and Nitrate were taken into consideration. To calculate the WQI, the weight has been assigned to each parameter depending upon it's relative importance in the groundwater quality. Various standards like WHO, Indian council of Medical Research (ICMR) [11] and BIS [12] has been used to calculate the WQI.

wi = k/Sn where Wi is the unit weight of the ith parameter, k is the constant of proportionality and Sn is the standard value for the ith parameter.

Quality rating $qi = \left(\frac{V_n - V_i}{S_n - V_i}\right) \times 100;$, q_i is the quality rating corresponding to i^{th} parameter, Vn is the observed concentration of the ith parameter and Vi is the actual concentration of that parameter in the pure water.

$$WQI = \frac{\Sigma wiqi}{\Sigma w_i}$$

Table 1: Status of water on the basis of WQI [13].

Water quality	WQI	Number of Samples
Excellent	0 to 25	Nil
Good	26 to 50	Nil
Poor	51to 75	Nil
Very Poor	75 to 100	Nil
Unfit for drinking	More than 100	All the Seven.

Results and Discussion

Table 2: Table showing the statistical analysis of quality parameters and their comparison with the standards.

	Minimum	Maximum	Mean	WHO Standards 2011	BIS Standards 1991	Number of samples above the prescribed limit of WHO	Number of samples above the prescribed limit of BIS
pH	7.50	8.50	8.0000	6.5-8.5	6.5-8.5	Nil	Nil
TDS	630.00	1950.00	9.5786E2	500	500	7	7
EC	984.00	3046.00	1.4963E3	1500	-	2	2
TH	110.00	450.00	2.5143E2	-	-	-	-
TA	110.00	160.00	1.3057E2	-	-	-	-
Ca	20.00	100.00	49.7143	75	75	2	2
Mg	14.40	50.40	30.5000	50	30	1	3
Chloride	150.00	540.00	2.4743E2	250	250	1	1
Fluoride	1.00	1.50	1.4286	1.5	1.5	-	-
Sulphate	42.00	220.00	1.1443E2	250	200	Nil	2
Nitrate	6.40	10.30	7.9143	45	45	Nil	Nil
Fe	.04	.07	.0572	0.3	0.3	Nil	Nil

pH, TDS, TH and EC: The pH in the study area varied between 7.5 to 8.5 which is within the limit. The variation in TDS was observed from 630-1950 mg/l. The prescribed limit for TDS in drinking water is 500 mg/l. All the seven samples were found to have a high value of TDS. The EC varied from 984 to 3046 mS. The total hardness was found to be within 110 to 450 mg/l.

Assessment of the suitability of groundwater for drinking

Table 3: Classification of water on the basis of TDS

TDS (mg/l)	quality of water	% of samples
< 300	Excellent	Nil
300 to 600	Good	Nil
600 to 900	Fair	57% (4)
900 to 1200	Poor	28.5% (2)
>1200	Unsuitable	14.25% (1)

Table 4: Classification of water on the basis of Total Hardness (mg/l) [14].

Total Hardness (mg/l) [14]		
<75	Soft	Nil
75 to 150	moderately hard	43% (3)
150 to 300	Hard	28.5% (2)
>300	Very hard	28.5% (2)

Total alkalinity (TA): The total alkalinity of groundwater is the alkalinity due to the presence of hydroxides, carbonates and bicarbonates in groundwater. In the present study area, the alkalinity is only due to the presence of bicarbonates. Bicarbonates are formed as a result of dissolution of soil bound and atmospheric carbon dioxide in groundwater. The TA varied from 110 to 160 mg/l.

Correlation analysis: The Pearson's correlation analysis of the different parameters is given in table 2. Three types of correlations *viz* strong (r>0.7), moderate (r = 0.5-0.7) and weak (r<0.5) can be explained using the table 2. A strong positive correlation significant at 0.05 level was observed between pH with TDS and EC, TDS and with Ca and Sulphate. The strong positive correlation significant at 0.01 level was observed between TDS with EC, Chloride and Nitrate ions, EC with Chloride and Nitrate ions, a very strong positive correlation between TH with Ca, Mg, Sulphate and Nitrate ions, Ca with Mg, Sulphate and Nitrate ions, Mg with Sulphate and Nitrate ions. The strongest correlation was observed between TDS and EC (r = 1.00). Using these observations, the main contributing factors of groundwater quality can be identified. A strong positive correlation between TH with Ca (r = 0.997), Mg(r = 0.994) and Sulphate (r = 0.925) showed that the hardness of water is permanent.

Table 5: Pearson's correlation matrix showing correlation between the variables

	pH	TDS	EC	TH	TA	Ca	Mg	Chloride	Fluoride	Sulphate	Nitrate	Fe
pH	1	.783*	.783*	.432	.237	.443	.411	.689	-.135	.599	.588	-.041
TDS		1	1.000**	.751	-.088	.776*	.707	.947**	.148	.804*	.890**	.550
EC			1	.751	-.088	.776*	.707	.947**	.148	.804*	.890**	.550
TH				1	-.535	.997**	.994**	.613	.185	.925**	.931**	.489

TA					1	-.489	-.596	-.101	.277	-.225	-.329	-.431
Ca						1	.981**	.646	.226	.932**	.935**	.503
Mg							1	.559	.124	.905**	.915**	.464
Chloride								1	.126	.599	.742	.599
Fluoride									1	.207	.242	.243
Sulphate										1	.945**	.381
Nitrate											1	.593
Fe												1

*. Correlation is significant at the 0.05 level

**. Correlation is significant at the 0.01 level

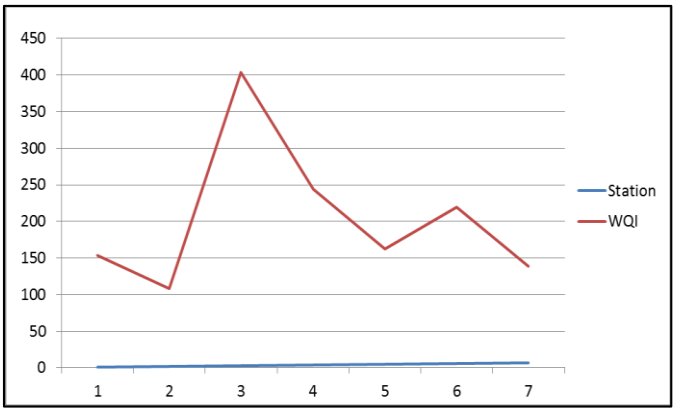

Fig 1: Variation of WQI

Conclusions

The proposed research work was carried out to assess the suitability of groundwater for drinking. The calculation of WQI clearly shows that the groundwater of the study area is unsuitable for drinking. The hardness of water in the study area is of permanent nature. So, the groundwater should not be used as such for drinking as it might be harmful for human health. Therefore, prior treatment of water is necessary before its consumption to avoid any health risk.

References

1. Ramakrishnaiah CR *et al*, Assessment of Water Quality Index for the Groundwater in Tumkur Taluk, Karnataka State, India, E-Journal of Chemistry 2009; 6(2):523-530.
2. Lamikaran A. Essential Microbiology for students and Practitioners of Pharmacy, Medicine and Microbiology, 2nd Edn., Amkra books, 1999, 406.
3. Shittu OB *et al*, Physico-Chemical and Bacteriological Analyses of Water Used for Drinking and Swimming Purposes in Abeokuta, Nigeria, African Journal of Biomedical Research. 2008; 11:285-290.
4. Datta PS. Groundwater ethics for its sustainability, current science, 2005, 89(5).
5. Nabanita Haloi HP, Sarma. Ground Water Quality Assessment of some parts of Brahmaputra Flood plain in Barpeta district, Assam with special focus on Fluoride, Nitrate, Sulphate and Iron analysis, International Journal of Chem Tech. 2011; 3(3):1302-1308.
6. Rizwan Reza, Gurdeep Singh. Physico- Chemical Analysis of Ground Water in Angul-Talcher Region of Orissa, India, Marsland Press, Journal of American Science. 2009; 5(5):53-58
7. Osuinde MI, Eneuzie NR. Bacteriological analysis of ground water, Nigeria, Journal of Microbiology. 1999; 13:47-54.
8. Altman SJ, Parizek RR. Dilution of nonpoint source nitrate in ground water, J Environ. Quality. 1995; 24:707-717.
9. Adekunle AS. Effects of Industrial Effluent on Quality of Well Water within Asa Dam Industrial Estate, Ilorin, Nigeria, Nature and Science, 2009, 7(1).
10. APHA, Standard methods for the examinations of water and wastewater, American Public Health Association, Washington, DC, 18th Ed, 1998.
11. ICMR, Manual of standards of quality for drinking water supplies. ICMR, Special report, 1975; 44:27,
12. BIS, Analysis of Water, Bureau of Indian Standards, New Delhi, 1993.
13. Chatterjee AA. Water quality of Nandakanan Lake, India. Journal of Environment and Health. 1992; 34(4):329-333
14. Sawyer GN, Mc Cartly DL. Chemistry of sanitary engineers, 2nd edition, McGraw-Hill, New York, 1967, 518.