Assessment of Ground Water Quality- A Case Study for Nandesari Region

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Abstract- Assessment of ground water quality is crucial as it determines the usability of water for drinking purpose. The aim of this study is to assess the groundwater quality of various villages of Nandesari region. As the main source of water is ground water for all the villages of the region during off monsoon season, water samples for off monsoon season were collected. These samples were analyzed for various parameters such as pH, alkalinity, hardness, etc. The WQI was determined for Nandesri GIDC, Nandesari, Damapura, Kotna, Radhiyapura, Angadh and Ramgadh for potability of ground water. The results of this study conclude that the ground water quality of Nandesari region is not suitable for drinking purpose. The quality of water has to be improved before use by further treatment.

Key Words - Ground Water Quality, Physio Chemical Parameters, Water Quality Index

1.0 Introduction

Rapid growth of population as well as industrialization leads to increase in water demand. To reach the required amount of water, surface water is not enough, an alternative for this is ground water. But before the use of ground water its quality must be assessed. The aim of this study is to evaluate the ground water quality of Nandesari region by collecting bore well samples from different villages, which are surrounded by Nandesari Estate. Followed by which, the water quality index was calculated to obtain the results and conclusion.

1.1 Location of Study

This study was conducted at Nandesari GIDC Estate, as well as nearby villages which were located in the district of Vadodara, Gujarat. It has a large notified area consisting large number of chemical factories. Source of water for the surrounding villagers is ground water. Details of Ground water sampling are as follows:

Sr No	Sample Location	Type of Source	Depth in ft.
01	Nandesari GIDC	Bore Well	160
02	Nandesari	Bore Well	150
03	Damapura	Bore Well	140
04	Kotna	Bore Well	160
05	Radhiyapura	Bore Well	180
06	Angadh	Bore Well	160
07	Ramgadh	Bore Well	140

Table No 1.0 Sampling Locations

2.0 Methodology

Ground water samples were collected from different locations of Nandesari region from November 2021 to May 2022. Physio-chemical properties of collected samples were analyzed and reported. Sample analysis methodology is given in the table below:

Sr No	Parameter	Unit	Method Employed
01	pH	-	Digital pH meter
02	Total Alkalinity	mg/l	Titrimetric Method (with HCL)
03	Total Hardness (as CaCo3)	mg/l	Titrimetric Method (with EDTA)
04	Chloride (as Cl-)	mg/l	Titrimetric Method (with AgNo3)
05	Nitrate (as No3-)	mg/l	Spectrophotometric method
06	Fluoride (as F-)	mg/l	Iron Selective method
07	Total Dissolved solids	mg/l	Digital Conductivity meter

Table No 2.0 Sample Analysis Methodology

Based on the results of ground water samples water quality index was calculated by using the methodology as shown below:

Weighted Arithmetic Index Method (Brown et.al 1972).

Step: 01

Calculate the unit weight (Wn) for each parameter using the formula:

$Wn = K/Sn$,

Where $K = 1/ \Sigma 1/Sn$

Sn = Standard desirable value of the nth parameters.

Step: 02

Calculate the Sub Index (Qn) Value using the formula:

$Qn =100\{(Vn-Vi)/(Sn-Vi)\}$,

Where,

Vn = Estimated value of nth Parameter of given sampling station.

Vi = Ideal Value of nth parameter for water

Sn = Standard Permissible value of the nth parameter.

Step: 03

Calculate the Water Quality Index using the formula:

$WQI = (\Sigma Wn*Qn)/ \Sigma Wn)$

Water Quality Index	Water Quality status
0-25	Excellent
26-50	Good
51-75	Poor
76-100	Very Poor
>100	Unfit for Consumption

Table No 2.1 Water Quality Index

3.0 Result

The results are shown in table No 3.0. These results obtained were compared with BIS. It was seen that values of total alkalinity, Total Hardness, chloride and total dissolved solids were greater than its desirable limits. pH and nitrites were within the limit and fluoride content was near the acceptable limit. WQI was calculated and compared with standards. Table No 3.1 shows the water quality index value with status and table no 3 shows that the quality of ground water with respect to sampling locations.

Parameters	Acceptable limit as per BIS	Unit	Average Analysis results (Nonember-2021 to May-2022)						
			Nandesari GIDC	Nandesari	Damapura	Kotna	Radhiyapura	Angadh	Ramgadh
			GW 01	GW 02	GW 03	GW 04	GW 05	GW 06	GW 07
pH	6.5-8.5	-	7	7.17	7.37	7.36	7.39	7.44	7.4
Total Alkalinity	200	mg/l	412.86	339.71	430.14	257.43	333.71	247.86	344.57
Total Hardness (as caCo3)	200	mg/l	322.14	307.29	308.57	299.71	296.43	300.71	305.71
Chloride as (Cl-)	250	mg/l	247.33	218.06	248.7	188.17	212.51	185.34	219.23
Nitrate (as NO3-)	45	mg/l	6.4	6.17	6.49	3.13	6.46	5.73	5.46
Fluoride (as F-)	1	mg/l	0.9	1.03	1	1.17	1.24	1.16	1.04
Total Dissolved solids	500	mg/l	1800.71	1870	1935.43	1319.29	1909.29	1851.71	1840.14

Table No: 3.0 Test Results for analyzed samples

Sampling Location	Sampling No	Index Value	Water Quality Status
Nandesari GIDC	GW 01	80.7	Very Poor
Nandesari	GW 02	92.88	Very Poor
Damapura	GW 03	91.95	Very Poor
Kotna	GW 04	105.72	Very Poor
Radhiyapura	GW 05	112.52	Unfit for Consumption
Angadh	GW 06	105.64	Unfit for Consumption
Ramgadh	GW 07	95.3	Very Poor

Table No: 3.1 Water Quality Status

4. Conclusion

Total 7 samples were collected and tested during the months from Nov-2021 to May 2022. It was found that most of the test parameters were beyond the permissible limit and hence the ground water in this region was not fit for drinking purpose. Based on the water quality index calculations, the ground water quality is very poor and unfit for Consumption. Nandesari region consists of chemical industries and the disposal of effluents has a poor impact on the ground water quality. Pretreatment is must before using it for drinking purpose.

5. Acknowledgment

6. Reference

[1] B Vijaya Lalitha, K Sai Tejaswini, "A study on assessment of groundwater quality and its suitability for drinking in Vuyyuru, Krishna(dist.), Andhra Pradesh", IJEDR, Volume 5, Issue 2, ISSN: 2321-9939 (2017).

[2] Devendra Dohare, Shriram Deshpande, Atul Kotiya, "Analysis of Ground Water Quality Parameters: A Review", Research Journal of Engineering Sciences, Vol. 3(5), 26-31, ISSN 2278 – 9472 (2014).

[3] Aswini P. V, Chinnu Mary, Er. Lakshmipriya A. R, "Groundwater Quality Analysis", International Journal of Engineering Research & Technology (IJERT), Volume 4, Issue 13, ISSN: 2278-0181 (2016).

[4] Valentina Andreea Calmuc, Mădălina Călmuc, " Various methods for calculating water quality Index", Annals Of "Dunarea De Jos" University of Galati, Fascicle II, Year X (XLI), No. 2 (2018).

[5] Arun Verma, Prof R. K. Bhatia, Prof Atul Sharma, " Quality Assessment of groundwater resource in centre India region", IJIRT, Volume 4 Issue 10, ISSN: 2349-6002 (2018).

[6] Kiplangat Cherono Nelly, Felix Mutua, " Ground Water Quality Assessment Using GIS and Remote Sensing: A Case Study of Juja Location, Kenya", American Journal of Geographic Information System, DOI: 10.5923/j.ajgis.20160501.02 (2016).

[7] Bureau of Indian Standards, PM/ 10500/ 1 October-20 (2020).

[8] Ravi Kumar Gangwar, Jaspal Singh, A. P. Singh, D. P. Singh, "Assessment of Water Quality Index: A Case Study of River Ramganga at Bareilly U.P. India" , International Journal of Scientific & Engineering Research, Volume 4, Issue 9, September, ISSN 2229-5518, (2013).

[9] Shweta Tyagi, Bhavtosh Sharma, Prashant Singh, Rajendra Dobhal, " Water Quality Assessment in Terms of Water Quality Index", American Journal of Water Resources, DOI:10.12691/ajwr-1-3-3, (2013).