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Research Article

QUALITATIVE ANALYSIS OF GROUND WATER OF KALINAGAR VILLAGE IN GADCHIROLI DISTRICT, MAHARASHTRA, INDIA

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ABSTRACT

Groundwater is the main source of water for domestic, industrial and agricultural consumption and most of the people from tribal area used ground water for drinking purpose. In recent year unwanted activities of man and industrial development, the quality of all type of water became polluted. Now it is one of most severe issue for all living organism to enhance quality of water. Also, fluoride concentration is responsible for various diseases in mankind. High or excess consumption of fluoride lead to dental and skeletal fluorosis and some cases of these diseases have been seen in Kalinagar village and its nearby area. In the present paper, ground water of Kalinagar village were collected from different site and analyzed for various qualitative parameters for quality assessment and also focused on fluoride concentration. The main goal of this study is to prepare quality profile of groundwater in order to discuss its suitability for society.

Keywords: Groundwater, Kalinagar, Qualitative parameters, fluorosis.

1. INTRODUCTION

Groundwater is the basis need of all type of living organism in the world. As per as human being concern, groundwater is only the source of drinking water. It is our prime duty to make sources of groundwater to be clean and pure. Due to domestic, agriculture and industrial discharge make groundwater impure and polluted which affect normal metabolism of living organism [1]. Groundwater is preferable over surface water for a number of reasons. First of all, groundwater is easier and normally used in households for drinking, cooking and other activities. Surface water is used general as well as in agricultural and generate electricity. The surface water also recharge the groundwater. The rain water drips deep into the ground. Melting snow and glaciers recharge the groundwater. In urban area, groundwater is mainly used for the purpose of drinking purpose and agriculture. Unethical activity of society like excessive use of fertilizer and pesticide, make sources of groundwater out of use and create the water deficiency. Contamination or pollution of groundwater can severally affect the availability of this natural resources. The contamination includes metals like lead, Chromium, Sodium and non-metals like nitrate, sulphate, Fluoride and chlorides [2].

The present paper deals with qualitative and quantitative analysis of ground water of Kalinagar village by accessing pollution indicating parameter such as pH, TDS, Electrical conductivity, Alkalinity, Chlorides, TH, Calcium, Magnesium, Sulphate, Nitrate and Fluoride etc.

2. MATERIAL AND METHODS

2.1. Study of Area

In the present study, four different site for ground water sample collection have been identified in Kalinagar village, district Gadchiroli, Maharashtra and their location mentioned in the following table 1. The groundwater samples were collected monthly from the months of March to May-2018.

Table 1: Site description of collected water samples

Sr. No.	Sample Code	Latitude (N)	Longitude (E)
1	KN1	19° 69' 97"	79° 91' 11"
2	KN2	19° 69' 83"	79° 90' 67"
3	KN3	19° 69' 68"	79° 90' 91"
4	KN4	19° 69' 63"	79° 90' 98"

Fig. 1: Satellite image of study area [3]

2.2. Sample Collection

The groundwater samples were collected in pre-cleaned plastic container as per standard procedure given in literature and temperatures were recorded on site.

2.3. Chemical Analysis

The collected sample were analyzed for various parameter like pH, TDS, EC, Alkalinity, Chloride, TH, Calcium hardness, Magnesium hardness, SO_4, NO_3, Iron and Fluoride. All the parameters were determined by standard procedure given in APHA [4]. The results of these experiments were reported in Table 2.

3. RESULTS AND DISCUSSION

The results obtained experimental study of ground water of Kalinagar village have been given in following table-2 and reported in standard unit.

Table 2: Physicochemical parameter of Ground-water Sample of Kalinagar Village

Parameters	KN1	KN2	KN3	KN4
pH	7.1	6.9	6.9	7.1
EC mS/cm	0.728	1.896	1.280	1.499
Alkalinity, g/L	360	530	370	410
TDS, mg/L	468	1368	898	860
Chloride mg/L	17.23	263.6	141.94	92.26
TH, mg/L	368.3	999	666	733
Ca mg/L	79.92	173.16	119.88	150.96
Mg mg/L	40.54	137.84	89.19	86.49
Nitrate mg/L	6.32	79.62	56.29	65.36
Iron mg/L	2.18	2.96	3.02	2.93
Sulphate mg/L	8.55	18.36	19.43	11.66
Fluoride mg/L	2.18	2.96	3.02	2.93

3.1. pH

The values of pH of varied between 6.9 to 7.1, the highest value were recorded in KN1and KN4 while minimum in KH2 and KH3. The result clearly indicate that the water samples are almost neutral and under permissible limit.

3.2. Electrical Conductivity (EC)

Electrical conductivity is a measure of current carrying capacity of water sample due to presence of free ions in water. EC of groundwater of Kalinagar village lies between 0.728 to 1.896 and recorded maximum at KN2 and minimum at KN1.

3.3. Alkalinity

Alkalinity values of all groundwater samples varies in the range of 360 mg/L to 530 mg/L. The highest alkalinity value is obtained for the sample KN2 and lowest value is obtained for the sample KN1. All the four samples exceed the desirable level but well below the maximum permissible level prescribed by BIS [5].

3.4. Total Dissolved Solid (TDS)

Total Dissolved Solid (TDS) is the term used to determine inorganic and organic matter present in solution in water. High value of TDS in groundwater is due to the presence of minerals [6]. Therefore, it affects the other parameters of groundwater like taste, hardness and corrosion properties [7]. In this study, KN2 has highest TDS i.e. 1368 mg/Land KN1 has lowest TDS i.e. 468 mg/L. KN2, KN3 & KN4 were above the desirable level and well below the maximum permissible level prescribed by BIS.

3.5. Chlorides (Cl)

According to WHO [8], ICMR [9] and BIS, the permissible level of Cl in water is 250 mg/L. In this study, the Cl content in all the four groundwater samples is between 17 mg/L to 264 mg/L. Out of these, three water samples KN1, KN3 & KN4 are below permissible level and KN2 has above permissible level.

3.6. Total Hardness (TH)

TH (Total Hardness) in groundwater is mostly due to the presence of Ca and Mg salts. The TH was obtained in the range of 368 mg/L to 999 mg/L. The highest TH value was obtained for the sample KN2 and lowest TH value was obtained for the sample KN1. Except KN1, all the three samples were above the permissible level prescribed by WHO, ICMR and BIS.

The classification of groundwater (table-3) based on TH shows that three water samples (KN2, KN3, KN4) fall under the very hard category [10]. Very hard water leads to pre-natal mortality, cardio-vascular diseases etc. and is not good for domestic purposes [11].

Table 3: Classification of water based on Total Hardness

TH(Total Hardness) mg/L	Description
<500	Soft
500-1000	Moderately Hard
1000-2000	Hard
>2000	Very Hard

3.7. Calcium (Ca)

In this study, Ca (Calcium) content varies from 80 mg/L to 173 mg/L. The highest value of Ca was obtained for the sample KN1. Except KN1, all the three samples have above the maximum permissible level prescribed by BIS.

3.8. Magnesium (Mg)

In this study, Mg (Magnesium) varies from 40 mg/L to 138 mg/L. The highest value of Mg was obtained for the sample KN2 and lowest value of Mg was obtained by KN1. Water samples KN1, KN3 and KN4 were above desirable level but below the maximum permissible level. KN2 has well above the maximum permissible level.

3.9. Nitrate (NO_3)

The maximum permissible level of nitrate is 45 mg/L and beyond this causes methemoglobinemia [12]. The nitrate value of all the four water samples ranges between 6 mg/L to 80 mg/L. The highest value 79.62 mg/L of nitrate was determined for sample KN2. The lowest value 6.32 mg/L of nitrate was determined for sample KN1. Only KN1 sample has below permissible level of nitrate and remaining three samples have well above the maximum permissible level of nitrate.

3.10. Iron (Fe)

The permissible limit of iron value in the groundwater is 0.3 mg/L, according to WHO standards. In this study, the values of iron varies between 0.19 mg/L to 0.58 mg/L. Out of these four samples, KN1 & KN3 were above permissible level and KN2 & KN4 were below permissible level.

3.11. Sulphate (SO_4)

Groundwater containing sulphate minerals through rocks and soil. Sulphate minerals gives oxides in contact with water. Bad test occurs due to high level of sulphate in groundwater [13]. The maximum permissible level of sulphate is 200-400 mg/L prescribed by BIS. The value of Sulphate in groundwater samples varies between 8 mg/L to 20mg/L. All the four groundwater samples shows below desirable level of sulphate in water.

3.12. Fluoride (F)

Fluoride is very essential parameter of water at very low concentration for human beings, High concentration (above 1.5 mg/L) will leads to dental and skeletal fluorosis [14]. The permissible limit of fluoride in water is 1.5 mg/L, according to WHO, ICMR and BIS. In this study, the values of fluoride varies between 2.18 mg/L to 3.02 mg/L. All the four water samples were above permissible level of fluoride. Due to this higher concentration, many peoples have dental as well as skeletal fluorosis.

3.13. Correlation Matrix

In this study, correlation matrix was applied using 12 parameters which are helpful in showing relationship between various parameters and to determine degree of association with various parameters involved. The coefficient of correlation (r) degree of linear association between any two parameters. The value of r lies between -1 to +1. 1 or near to 1 shows strongest positive linear relationship while -1 or near to -1 shows strongest negative linear relationship. The strongest positive correlation was obtained between conductivity and TDS (0.963), Cl (0.903), TH (0.995), Ca (0.992), Mg (0.971), Nitrate (0.970), Mg and TDS (0.999),

Cl(0.979), TH (0.982), Ca(0.929) and Nitrate and TDS (0.912), TH(0.957), Ca(0.961), Mg(0.929). Above correlation shows the weathering and erosion of minerals [15].

Table 4: Correlation Analysis of the Physico-chemical parameters

	pH	*EC*	*Alkalinity*	*TDS*	*Chloride*	*TH*	*Ca*	*Mg*	*Nitrate*	*Iron*	*Sulphate*	*Fluoride*
pH	1											
EC	-0.562	1										
Alkalinity	-0.481	0.871	1									
TDS	-0.735	0.963	0.903	1								
Chloride	-0.826	0.903	0.876	0.985	1							
TH	-0.628	0.995	0.891	0.984	0.941	1						
Ca	-0.444	0.990	0.851	0.917	0.837	0.973	1					
Mg	-0.726	0.971	0.891	0.999	0.979	0.990	0.929	1				
Nitrate	-0.582	0.970	0.728	0.912	0.848	0.957	0.961	0.929	1			
Iron	-0.633	0.823	0.455	0.768	0.722	0.809	0.801	0.793	0.934	1		
Sulphate	-0.967	0.657	0.458	0.772	0.830	0.702	0.558	0.775	0.721	0.804	1	
Fluoride	-0.633	0.823	0.455	0.768	0.722	0.809	0.801	0.793	0.934	1	0.804	1

4. CONCLUSION

The above conducted study has shown that the various results obtained from four different groundwater stations are compared with as per standards of WHO, ICMR and BIS. Most of the parameters exceeds their desirable level and some parameters such as TH, Nitrate and Fluoride are exceeds their permissible level indicating that groundwater of all stations should not be used for drinking purposes without prior treatment, which may result in severe medical problem for human being and other living organisms.

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Conflict of Interest

None declared

6. REFERENCES

1. Ravikumar P, Somashekar RK. *Appl Water Science*, 2017; **7**:745-755.
2. Ananthimalini VC, Senthamilselvi MM, Manikandan S. *International Journal of Applied Research*, 2017; **3(1)**:337-344.
3. Google, Kalinagar Maharashtra, https://goo.gl/maps/iuaBR3koF2Xuahs2A accessed on 20 Aug 2021.
4. APHA, Standard methods for the examination of water and waste water, *American Public Health Association*, Washington; 2005.
5. BIS, Indian Standards Drinking Water Specifications IS 10500, *Bureau of Indian Standards*, New Delhi; 2012.
6. Sawyer GN, McCarthy DL. *Chemistry of sanitary engineers*, 2nd edn. Mc Graw Hill, New York,1967; **518.**
7. Prasad M, Sunitha V, Sudharshan Reddy V. Suvarna B, Muralidhara Reddy B, Ramakrishna Reddy M. *Journal Data of brief*, 2019; **24**:103-846.
8. W.H.O, Guidelines for drinking water quality, Vol.1, Recommendations WHO, Geneva; 1984.
9. ICMR, Manual Standards of Quality of Drinking Water Supplies; 1975.
10. Sasikaran S. Sritharan S Balakumar, Arasaratnam. V. *Ceylon Medical Journal*, 2012; **57(3):**111-116.
11. Sengupta P, *Int J PrevMed*, 2013; **4(8)**:866–875
12. Lanjwani MF, Khuhawar MY, Khuhawar TM. *Appl Water Science*, 2020; **10**:26.
13. Kothari V, Suman V, Sharma S, Gupta N. *Environmental &Sustainability Indicators*, 2021; **9**.
14. Chaudhary V, Satheeshkumar S. *Appl Water Science*, 2018; **8**.
15. Varshney R, Jamal A. *Rasayan Journal of chemistry*, 2019; **12(1)**:251-256.