

Analysis of Water Quality of Dug Wells from Ajara Town, Western Maharashtra, India

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Abstract: The present study deals with physico-chemical analysis of the dug well water quality from Ajara Town, Maharashtra, India. The water samples from 24 dug wells were collected during the month of October, 2016. The physico-chemical parameters such as pH, E. C., Alkalinity, Total Hardness, Calcium Hardness, Magnesium Hardness, Chloride, T. D. S. and Salinity were analysed. The observed values were compared with water standards specified by WHO (1963), ICMR (1975) and BIS (1991). On the basis of total hardness, all samples were found to be under the acceptable limit and appropriate for drinking and domestic purposes.

1. Introduction

First life was originated in water and it is essential for the survival of any form of life. The poorer segments of the population both in urban and rural areas generally use dug well water as a main source of drinking water [1]. Groundwater is an important source of water supply throughout the world. It is used in irrigation, industries and domestic [2].

Ajara is a historic small town from Kolhapur district of Maharashtra state, India. It is located at latitude 16.12°N 74.2°E. It is situated on the banks of Hiranyakeshi and Chitri rivers and surrounded by several hills. Ajara is considered as last place of Desh region before Konkan on this route. It is 84 km away from Kolhapur. According to Indian census, 2001, Ajara had a population of 14,845. Ajara experiences heavy rainfall varying from 1800 to 3500 mm. For drinking and domestic purpose, people residing in this town are provided with water from the rivers. But during summer season, the water supply by Grampanchayat becomes irregular and water quality is also gets reduced.

The alternatives like dug wells and bore wells serve as main source of water during that period. Many families have their own dug wells near their homes. Therefore, the present investigation deals with the study the physico-chemical parameters of dug wells from Ajara town.

2. Materials and Methods

Collection of samples

Total 24 samples were collected from the dug wells of Ajara town, all of which are privately

owned. Samples were collected in clean, tight packed plastic containers. The collection was done in the month of October, 2016. These samples were brought to the laboratory and were analyzed using standard procedures.

3. Analysis of physico-chemical parameters:

The standard methods recommended by Trivedi and Goel (1984) were used for analyzing physico-chemical parameters of the collected water samples [3]. The obtained results were compared with water standards specified by WHO (1963), ICMR (1975) and BIS (1991) [4], [5], & [6].

4. Results and Discussion:

The Physico-chemical parameters of the collected water samples are presented in Table 2 and the drinking water standards are given in Table 1.

E.C.: Electrical Conductivity indicates the ability of water to carry an electric current. It is depend upon various factors such as the presence of ions, mobility, nutrient status, variations in dissolved solid contents and temperature of water. The conductivity is proportional to the amount of salts dissolved in water. Electrical conductance values fall between 0.32 to 1.12 mmho, which are quite high.

pH: The pH of water is significantly governed by CO₂, carbonates and bicarbonates equilibrium (Chapman, 1996). The pH values of the samples were range from 8.23 to 8.57. All samples are found to be within the permissible limit of WHO and ICMR.

Total Alkalinity: Total alkalinity in itself is not harmful to human beings, the water samples having less than 100 mg l⁻¹ are desirable for domestic purpose. Also, the high alkalinity imparts an unpleasant taste. The samples show Total Alkalinity values from 14 to 42 mg l⁻¹. All samples are within the permissible limit.

Total Hardness: The sum of concentration of alkaline earth metal cations present in water is called as the total hardness of water. The total hardness value ranges from 100 to 310 mg l⁻¹. Kanan (1991) has classified hardness of water in four categories. 0-60 mg l⁻¹ soft, 61-120 mg l⁻¹ moderately hard, 121-180 mg l⁻¹ hard and above 180mg l⁻¹ is very hard [7].

Out of 24 water samples, one sample is

moderately hard, thirteen samples are hard and ten samples are very hard. Hardness of water is within the permissible limit. As the hardness below 300 mg/l is considered as potable, all the water samples are suitable for drinking purpose.

Calcium Hardness: The level of Calcium hardness fluctuates from 20.04 mg l⁻¹ to 62.13 mg l⁻¹. As per Ohle (1934) all water samples are rich in Calcium [8]. Present results are within permissible limit and suitable for domestic purpose.

Magnesium Hardness: It associated with Calcium in all kinds of water. It is an important cation which causes water hardness. The values of magnesium hardness range from 19.43 mg l⁻¹ to 60.23 mg l⁻¹.

Chloride: Higher chloride concentration imparts salty taste to water and water becomes inappropriate for drinking purpose. Chlorides are present in lower concentration in fresh water. Minimum value is 68 mg l⁻¹ (A24) while the maximum value is 128 mg l⁻¹ (A15). The desirable limit of Chloride concentration in drinking water is 250 mg l⁻¹ WHO [9]. All water samples are lies in the acceptable limit.

TDS: The values varied from 68 to 248 mg l⁻¹. TDS more than 500 mg l⁻¹ is not considered desirable. Higher TDS values can cause excessive scaling in water pipes, water heaters, boilers and other household appliances. All the values are within the desired limit.

Salinity: Salinity concentrations and precipitates can corrode irrigation equipment and cause scaling. The values lie between 64 mg l⁻¹ to 226 mg l⁻¹. Total salinity in drinking water should be less than 1000 mg l⁻¹ based on taste considerations. All the water samples are showing fairly low salinity.

Conclusion:

The present investigation has shown that all dug well water samples are within permissible limit specified by WHO, ICMR and BIS. The water from all the dug wells is suitable for drinking as well as domestic purpose.

5. Acknowledgement:

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6. References

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Table 1: Drinking water standards of WHO (1963), ICMR (1975) & BIS (1991).

| Parameters | WHO | ICMR | BIS |
|----------------|---------|----------|--------|
| Total Hardness | 500 | 300 | 500 |
| Calcium | 75 | 75 | 75 |
| Magnesium | 50 | 50 | 50 |
| Chloride | 200 | 250-1000 | 200 |
| Alkalinity | 75 | -- | -- |
| pH | 6.5-8.5 | 7-8.5 | 7 to 8 |
| E.C. | 0.300 | 0.300 | 0.300 |
| TDS | -- | 500 | -- |

All are in mg/L except E.C.& Ph

Table 2: Physico-chemical parameters of dug well water from Ajara Town.

| Site / Parameters | pH | E. C. | Total Alkalinity | Hardness | | | Chloride | TDS | Salinity |
|-------------------|------|-------|------------------|----------|---------|-----------|----------|-----|----------|
| | | | | Total | Calcium | Magnesium | | | |
| A1 | 8.38 | 0.88 | 28 | 250 | 50.1 | 48.57 | 76 | 214 | 208 |
| A2 | 8.56 | 0.78 | 22 | 210 | 42.09 | 40.80 | 96 | 206 | 202 |
| A3 | 8.57 | 0.94 | 26 | 190 | 38.08 | 36.41 | 76 | 110 | 98 |
| A4 | 8.42 | 1.02 | 24 | 220 | 44.09 | 42.74 | 88 | 68 | 76 |
| A5 | 8.4 | 0.91 | 24 | 200 | 40.08 | 38.86 | 72 | 118 | 186 |
| A6 | 8.25 | 0.96 | 16 | 200 | 40.08 | 38.86 | 84 | 250 | 226 |
| A7 | 8.23 | 0.98 | 18 | 200 | 40.08 | 38.86 | 88 | 80 | 64 |
| A8 | 8.54 | 1.12 | 16 | 166 | 33.27 | 32.25 | 96 | 248 | 288 |
| A9 | 8.49 | 0.98 | 28 | 100 | 20.04 | 19.43 | 96 | 140 | 124 |
| A10 | 8.31 | 0.86 | 14 | 146 | 29.26 | 28.36 | 92 | 160 | 130 |
| A11 | 8.42 | 0.85 | 20 | 142 | 28.46 | 27.59 | 92 | 104 | 68 |
| A12 | 8.56 | 0.32 | 18 | 154 | 30.86 | 29.92 | 88 | 205 | 164 |
| A13 | 8.47 | 0.89 | 16 | 162 | 32.47 | 31.47 | 92 | 284 | 72 |
| A14 | 8.41 | 0.57 | 16 | 164 | 32.87 | 31.86 | 84 | 88 | 80 |
| A15 | 8.57 | 0.6 | 42 | 310 | 62.13 | 60.23 | 128 | 110 | 84 |
| A16 | 8.53 | 0.84 | 28 | 200 | 40.08 | 38.86 | 116 | 176 | 180 |
| A17 | 8.58 | 1.12 | 24 | 166 | 33.27 | 32.25 | 108 | 210 | 204 |
| A18 | 8.57 | 0.97 | 20 | 174 | 34.87 | 33.80 | 80 | 192 | 198 |
| A19 | 8.36 | 0.83 | 24 | 144 | 28.86 | 27.97 | 96 | 146 | 162 |
| A20 | 8.34 | 0.99 | 24 | 182 | 36.48 | 35.36 | 80 | 208 | 202 |
| A21 | 8.49 | 0.94 | 28 | 168 | 33.67 | 32.64 | 76 | 186 | 182 |
| A22 | 8.43 | 0.83 | 22 | 160 | 32.06 | 31.08 | 96 | 174 | 162 |
| A23 | 8.36 | 0.87 | 18 | 162 | 32.47 | 31.47 | 76 | 148 | 164 |
| A24 | 8.26 | 0.52 | 16 | 148 | 29.66 | 28.75 | 68 | 170 | 178 |