Physico-Chemical and Microbiological Analysis of Under Ground Water in V.V Nagar and Near by Places of Anand District, Gujarat, India

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Abstract: A report of physico-chemical and microbial study of the water samples taken from the region nearby Anand district of central Gujarat is presented here. Six water samples are subjected to physico- chemical analysis like pH, TDS, hardness, conductivity, dissolved oxygen and chemical oxygen demand. The MPN count resulted from the bacteriological study of these samples has given the information regarding the suitability of the water for drinking and other domestic applications. The results are analyzed comparatively and conclusions regarding the suitability of the use of such waters are made.

Keywords: COD, DO, Sulfate, TDS, Physico-chemical analysis

Introduction

Water plays a vital role in human life. The consequence of urbanization and industrialization leads to spoil the water. For agricultural purposes ground water is explored in rural areas especially in those areas where other sources of water like dam and river or a canal is not available. During last decade, this is observed that the ground water get polluted drastically because of increased human activities^{1,2}. Consequently number of cases of water borne diseases has been seen which a cause of health hazards^{3,5,6}. So, basic monitoring on water quality has been necessitated to observe the demand and pollution level of ground water⁴. A good number of water analysis experiments are regularly conducted by different groups of chemists and biologists across the country⁷⁻¹⁰.

The present work is an attempt to examine the water quality of various potable water sources viz. ground water at GIDC, ground water at Vidyanagar, tape water, Mahi river water in Anand district.

Experimental

All the samples were collected in the month of January 2007. The locations selected for the investigation are Vallabh Vidyanagar, Bakrol, Anand, Vithal Udyognagar, mineral water

and Mahi River. The samples are collected in sterilized and phosphate free bottle. The collected samples were analyzed on various physico-chemical and biological parameters. The procedure for analysis followed "Standard Methods of Analysis of Water and Wastewater"¹¹ (APHA). The various parameters included analysis of temperature, pH, dissolved oxygen, cations and anions, hardness, total *E-coli* count/100mL for the analysis chemical used were of analytical grade and instruments are of limit of precise accuracy.

Results and Discussion

The physical, chemical and bacteriological parameters exhibited considerable variations from sample to sample. All the measurements were carried out in the vicinity of temperature 30 °C.

The observations are summarized in the table shown below, the results are also analysed graphically (Figure 1-8). Instead of plotting the values of parameters individually against the samples, it was thought appropriate to plot some of the interrelated values together against the samples. This effort has enabled us in reinstating our premise of the relation between the properties like TDS & Conductivity and Ca, Mg & Total hardness of the samples.

S.No	Parameter	S-1 VV Nagar	S-2 Bakrol	S-3 Anand	S-4 VVNagar	S-5 Mineral water	S-6 River Mahi
1.	Temperature, °C	29	30	29	31	28	30
2.	pH	7.8	7.7	7.6	8.1	7.7	8.3
3.	TDS, mg/L	230	140	217	280	50	480
4.	Ca Hardness mg/L	110	113	115	200	30	150
5.	Mg Hardness mg/L	50	43	46	120	15	60
6.	Total Hardness mg/L	160	156	161	320	45	210
7.	Chloride mg/L	120	142	202	222	17.5	80
8.	Sulphate mg/L	40	64	87	90	22.4	45
9.	D.O mg/L	7.2	5.9	6.5	5.9	7.1	5.7
10.	C.O.D.mg/L	10.2	9.0	11.0	13.3	-	14
11.	EC, mho/cm	1210	830	1105	760	170	1302
12.	MPN (coliforms /100mL)	340	380	280	440	Nil	540

Based on the above tabulated values and the figures, the following observations are made:

It is observed that the pH of the water was slightly alkaline (7.6 to 8.3) and only minor fluctuation in pH was recorded. The pH levels were within the limits set for domestic use as prescribed by APHA¹¹.

Figure 1. pH

Figure 2. TDS & Conductivity

Figure 3. Calcium, Magnesium & Total Hardness

Figure 4. Chloride content

Figure 5. Sulfate content

Figure 6. Dissolved Oxygen (DO).

Figure 7. Chemical Oxygen Demand (COD).

Figure 8. Bacterial Count (MPN).

The WHO has suggested a limiting value of 500mg/L of TDS for potable water. In the present investigation this limit is not crossed on either side by any of the samples under study. However in the S-6, the TDS value is about to reach the maximum permissible limit. The waters of the remaining samples have registered handsome values of TDS (140 – 280). These values are acceptable for domestic use and agricultural purposes. An overwhelming value of TDS has also increased the conductivity values of the different water samples ranging from 170 to 1300.

The summation of calcium hardness and magnesium hardness is regarded as the total hardness of water. In the present investigation, it has been observed that the calcium concentration is at least two folds greater than that of magnesium. Each of the samples has registered a high value of calcium hardness (30-200 mg/L), magnesium hardness (15-120 mg/L) and in turn the total hardness (45-320 mg/L) as shown in the table. The limiting values prescribed by ISI are much less than reported.

A significant presence of anions like chloride and sulfate is also observed in the water samples under investigation. It has been observed that greater amount of sulfate in drinking water causes diarrhea. The chloride and sulfate amounts in the samples range from 17-222 mg/L and 22-90 mg/L respectively. Here it is observed that the sulfate concentration in the samples fall well within the prescribed limit but the chloride content is much higher than the permitted values of WHO and ISI.

Dissolved oxygen present in drinking water adds taste and it is highly fluctuating factor in water. In this study dissolved oxygen content varied in a limited range of 5.7 to 7.2. The maximum allowed value of chemical oxygen demand (COD) is 10 mg/L in drinking water. The present samples have registered a range of 9 to 14 mg/L. This values are little higher than that expected for a good quality potable water. However, the higher values of COD are observed only in sample taken from industrial area and river.

Most of the water samples contain significant amount of organic matter that provides nutrition for the growth and multiplication of microorganisms. The most probable number (MPN) is a suitable and widely used method to determine the microbial quality of water. The present investigations have rendered the values (280-540) of MPN coliforms per 100mL of water, which have exceeded the prescribed limit.

Conclusion

The present investigations has led us to conclude that the quality of water samples subjected to study was acceptable from majority of physico - chemical parameters while as per the bacteriological standards, the water needs to be treated before using it in domestic applications. Thus as far as sample waters are concerned the potential risk of getting infected by water borne diseases is always there if used without proper disinfections. The water can be definitely used after practicing suitable disinfections system. The mineral water is found to be safest for drinking.

References

1. Abdul Jameel A, *Poll. Res.*, 1998, **17(2)**, 111-114.
2. Sirkar A G *et al*, *J IWWA*, 1996, Oct.-Dec. 1996, 215-220.
3. Desai P V, *Poll. Res.* 1995 **(4)**, 377-382.
4. Guidelines for drinking water quality- WHO, Geneva, 1999, 2nd Ed., 97-100.
5. Elizabeth K M & Premnath Naik L, *Poll. Res.*, 2005, **24(2)**, 337-340.
6. Muller E E, Ehlers, M M & Grabow, 2001, *Wat. Res.*, **35**, 3085-3088.
7. Nath D, *J Inland Fresh. Soc. India*, 2001, **33(2)**, 37-41.
8. Kelkar H P S *et al*. *J. IWWA*, 2001, Jan -Mar. 39-43.
9. Ramteke P N, Battacharjee J W and Karlo N, *J. Appl. Bact.*, 1992, **72**, 352.
10. Vijender Singh, *Res. J. Chem. & Env.*, 2006, **10(3)**, 62-66.
11. Standard methods for examination of waters and waste waters, 1985, 16th Ed., APHA, AWWA and WPCF Inc. Newyork.