

Study of Physicochemical Characteristic of Ground Water

Pavan M. Kadam

Department of Chemistry, Shri Vyankatesh Arts and Commerce College, Deulgaon Raja, Maharashtra, India

ABSTRACT

An investigation was undertaken to study of physiochemical properties of ground water from various places in Deulgaon Raja city. Groundwater is a major source of drinking water in both urban and rural areas of Deulgaon Raja. Ten different locations were selected for the study and physicochemical characteristics are compared. The parameters studied were pH, total alkalinity, total hardness, turbidity, chloride, sulphate, total dissolved solids and conductivity. Observed results were compared with Bureau of Indian Standards (BIS) and World Health Organization (WHO). The ground water quality varies from place to place.

Key words: - Ground water, physicochemical parameter, pH, TH, conductivity.

I. INTRODUCTION

Water plays an essential role in human life. Groundwater is ultimate, most suitable fresh water, resource with nearly balanced concentration of the salt for human consumption. Among the various source of water, ground water is considered to be the safe for drinking and also used for other domestic purpose for long time. In the last few decades, there has been a tremendous increase in the demand for fresh water due to rapid growth of population and the accelerated pace of industrialization. Ground water contributes an important component of total water system for human consumption. Rapid urbanization, especially in developing countries like India, has affected the availability and quality of groundwater due to its overexploitation and improper waste disposal, especially in urban areas. According to WHO organization [7], about 80% of all the diseases in human beings are caused by water. Due to inadequate availability of surface water, to meet the requirements groundwater is the only last option to supplement the ever-increasing demand of water. The ground water is generally polluted due to urbanization, industrial growth and other man made problems. Contamination of water resources available for household and drinking purposes with heavy metals, metal ions and harmful microorganisms is one of the serious major health problems. Hence, it is highly essential to assess the quality of drinking water.

Water quality index is one of the most effective tools to communicate information on the quality of water to the concerned citizens and policy makers. The objective of this study was to carry out qualitative analysis of some physico-chemical parameter of groundwater in study area and to discuss the suitability of groundwater for human consumption based on computed, groundwater characteristics, quality assessment and water quality index values. Physicochemical studies of ground water have been carried out at different eight areas of the city.

II. METHODS AND MATERIAL

2.1 Study Area

The study area was Dulgaon Raja a Taluka Place in Buldana District, Maharashtra. It is located at Latitude 20° 01' N and Longitude 76°02' E. Population of Deulgaon Raja is 30,827. Deulgaon Raja is known for the Balaji temple. Most of people from city are depend on ground water for their daily use.

2.2 Sample Collection

The ground water samples were collected from 10 different areas of Deulgaon Raja city Maharashtra India by Standard method [6]. Before collecting the water samples all double stoppered polythene containers were

cleaned and rinse thoroughly with water sample. Water samples were brought to laboratory in an insulating box.

2.3. Physico-Chemical Analysis

The collected samples were analyzed for different physico-chemical parameters such as pH, Electrical conductivity (EC), Total Dissolved solids (TDS), Total hardness (TH), Ca^{2+} , Mg^{2+} , SO_4^{2-} and Chloride as per the standard methods. A.R. grade chemical were used for preparations of standard solutions. The pH was measured using pH meter, the temperature was recorded using centigrade thermometer and Conductance is

measured using standard Conductometer. Total alkalinity of the water samples were determined by titrating with 0.01M HCl using phenolphthalein and methyl orange as indicators. The chloride ions were generally determined by titrating the water samples against a standard solution of $AgNO_3$ using potassium chromate as an indicator. The total hardness of the water samples was determined by complexometric titration with EDTA using Erio chrome balck-T as an indicator. The Na, K and Ca were determined by flame photometer.

Table II. Physicochemical data of ground water samples

Sample	W1	W2	W3	W4	W5	W6	W7	W8	W9	W10
Temp. °C	26.4	26.8	27.0	26.5	26.8	27.5	26.6	27.2	26.6	26.8
pH	6.9	7.2	6.5	6.8	7.2	7.4	7.8	7.2	6.8	7.4
Cond. ms-1	618	782	745	654	640	580	625	724	541	650
T.A. mg/l	95	122	105	194	110	156	135	152	133	125
TDS mg/l	455	618	551	610	522	650	552	602	515	544
TH mg/l	282	400	350	380	328	430	385	354	340	364
Cl Mg/l	135	164	122	175	162	144	145	130	156	145
SO4 mg/l	78.6	101	80.4	75.2	82	72.1	70.5	78	68	74.2
Ca mg/l	65	108	82	90	78	112	90	85	82	88
Mg mg/l	32.5	45.4	35.2	38	34.6	47.5	36.2	35.2	36.5	37.1
Na mg/l	3.5	4.5	6.8	6.5	4.3	4.2	3.8	4.2	3.6	5.2
K mg/l	1.30	1.90	1.20	1.0	1.40	1.55	1.25	1.50	0.8	1.60

Table II. The minimum, maximum and standard deviation of chemical parameters with standard water quality

	Observed Value		Standard Value		
	Min.	Max.	WHO	BIS	CPHEEO
Temp. °C	26.4	27.5	30-32° C	-	-
pH	6.5	7.8	6.5-8.5	6.5-8.5	6.5-9.2
Cond. ms-1	541	782	500	-	-
T.A. mg/l	95	194	200	200	-
TDS mg/l	455	650	500	500	500

TH mg/l	282	430	200	300	200
Cl mg/l	122	175	250	250	200
SO4 mg/l	68	101	200	200	400
Ca mg/l	65	112	75	75	75
Mg mg/l	32.5	47.5	150	30	150
Na mg/l	3.5	6.8	100	100	100
K mg/l	0.8	1.9	10	10	10

III. RESULTS AND DISCUSSION

Physicochemical properties of various ground water samples from Deulgaon Raja are shown in Table no. 1. The Physicochemical parameters observed are compared with standard value.

Temperature

Temperature of water sample was observed in range 26.4 – 27.5 °C. The temperature observed shows some variation which is due to change in collection time of samples. The temperature of water sample was within the permissible limit 30 °C as given by WHO.

pH

The pH value of water is indication of how acidic or basic the water is on the scale of 0 to 14. The pH of water sample was found in the range 6.5–7.8. According to WHO and BIS [8] the range of pH recommended for drinking water is 6.5- 8.5. Thus pH of all samples was in desirable limit as prescribed for drinking water standard.

Electrical Conductivity

The Electrical conductivity determines the concentration of salt in water. Electrical conductivity of the ground water sample varied from 541 -782 ms-1. Some sample shows high value of EC which may be due to high concentration of ionic compounds present in water.

Alkalinity

The alkalinity of water samples was observed in the range of 95 – 194 mg/l. Total alkalinity for water is permissible to 200 mg/l as per WHO. High value of

alkalinity may cause unpleasant taste. Total alkalinity of water sample was found in the permissible limit, but some sample shows high value of total alkalinity which may be due to presence of bicarbonate and some other alkaline salts.

Total Dissolved Solid

TDS is one of the important parameter to determine the quality of drinking water. High concentrations of total dissolved solids may cause undesirable taste and also gastrointestinal irritation. TDS of water sample was found in the range 450 – 650 mg/l. Acceptable limit of TDS value for drinking water is 500 mg/l as per WHO and BIS, the permissible limit of TDS is 2000 mg/l as per BIS. Thus some samples show high value of TDS than acceptable limit but are under the permissible limit as per BIS.

Total Hardness

Mainly Ca and Mg ions are responsible for hardness of water. Total hardness will also result in excessive soap consumption and subsequent “scum” formation. On heating, hard waters form deposits of calcium carbonate scale. Total hardness of water sample was found in the range of 282 – 430 mg/l. The standard desirable limit of hardness in potable water is 300 mg/L and maximum permissible limit is 600 mg/L. Total hardness of some sample was found to be more than the standard value as per WHO and BIS, but it is under permissible limit as per BIS. No health-based guideline value is proposed for hardness in drinking water.

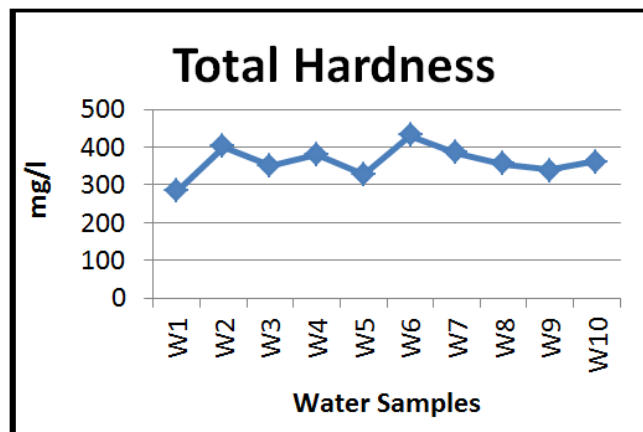
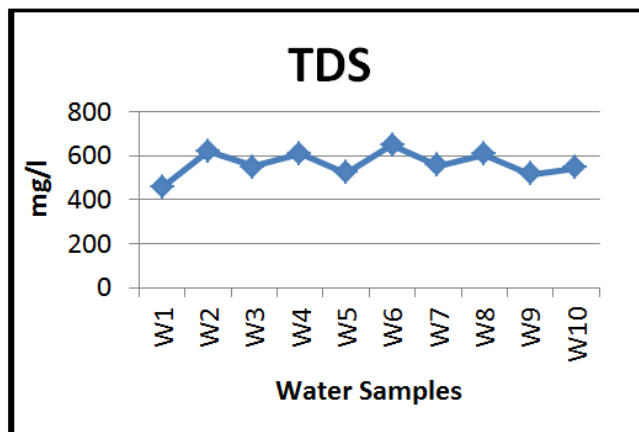
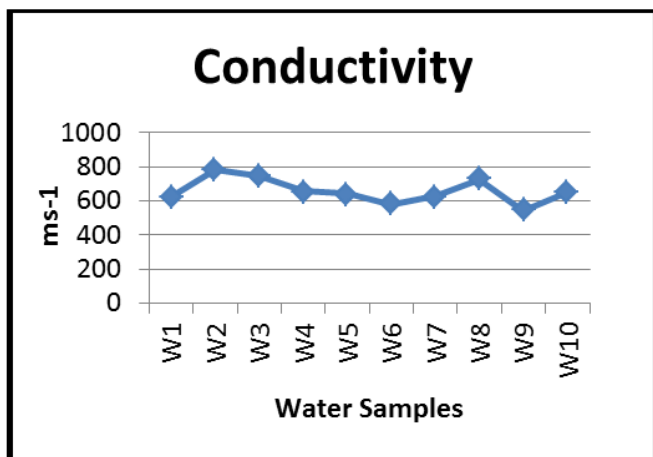
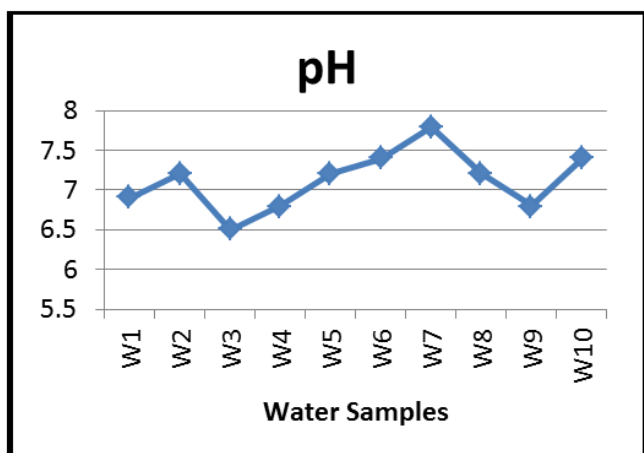
Chloride

The chloride content of water sample was found in the range of 122 – 175 mg/l. According to WHO the

chloride limit for drinking water is 250 mg/l. Chloride content of all water sample was found below the desirable limit of WHO. Chlorides are relatively harmless except when converted to Cl_2 , ClO^- and ClO_3^- which are toxic.

Calcium and Magnesium

Calcium and magnesium are the most abundant substances found in natural water in higher quantities in the rocks. Since calcium and magnesium are directly related to hardness and hence they are discussed in combined. The acceptable limits for calcium and magnesium for domestic use are 75 mg/L and 30 mg/L. The concentration of Calcium and Magnesium is in the desirable limit according to BIS and WHO standards.



IV. ACKNOWLEDGEMENT

We are highly indebted to Dr. G. B. Jadhav Principal of Shri Vyankatesh Arts and Commerce College, Deulgaon Raja for encouragement during this research work. We are also thankful to all the Teaching and non-teaching staff of Shri Vyankatesh Arts and Commerce College for helping us for this entire research work.

V. CONCLUSION

On the basis of analysis of groundwater samples of the study area, it was found that most of the physicochemical parameters were found within the permissible limit as per BIS and WHO. In some water samples parameter like TDS and TH were found to exceed the respective limits set by BIS and WHO. Present study indicate that the ground water of tube well located in the various area of Deulgaonraja city are below the pollution level and it can be used for various purposes like domestic, agricultural, Industrial etc. In this investigation it was found that the maximum parameters were not at the level of pollution except few

parameters like TDS and TH in ground water. So ground water of this city satisfies the requirement for the use in.

VI. REFERENCES

- [1] A. K. De., Environmental chemistry, third edition.
- [2] Alka Gupta, Analytical chemistry. Pragati prakashan.
- [3] R.M. Varma, Analytical chemistry, third edition
- [4] N Manivaskam. Physicochemical examination of water Pragati prakashan , Meerut, India, 1983.
- [5] S. Hooda, Kaur. Laboratory manual for Environmental chemistry S. Chand and Co. Ltd. 1999.
- [6] American Public Health Association (APHA). 2005. Standard Methods for the Examination of Water and Wastewater. 21st Edition. Published by the American Public Health Association (APHA), the American Water Works Association (AWWA), and the Water Environment Federation (WEF).
- [7] WHO. 2004. Guidelines for drinking water quality. World Health Organization, Jeneva. pp.186.
- [8] Jayaraman P.R. , Gangadevi .T. and Vasuena Naya , Poll. Res. 32(1),89-100 (2003).
- [9] Indian Standard DRINKING WATER — SPECIFICATION BIS, New Delhi 2012
- [10] Prakash, K.L., Somashekar, R.K. 2006. Groundwater Quality-Assessment on Anekal Taluk, Bangalore Urban District, India. Journal of Environmental Biology.27(4):633-637.
- [11] Physico-Chemical Characteristics of Ground Water at Pappankuppam (Tamil nadu), India Int.J.Curr.Res.ACA.Rev.2015 3(10) 234-238