



STUDIES ON UNDERGROUND WATER QUALITY OF SOME VILLAGES OF NORTH REGION OF WARUD TALUKA, DIST. AMRAVATI

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ABSTRACT

Some physico-chemical parameters of underground water collected from 5 wells at a distance of 5 km. along north left side of Warud from different locations of five villages (five sampling points) of Warud tehsil were studied in July 2006 to April 2007. In case of underground water, it was found that there was a marked variation in the physico-chemical parameters of various sample points in different seasons.

Key words: Physico-chemical characters, Underground Bore water, Water quality.

INTRODUCTION

From the literature survey, it is known that no investigation has been carried out on the quality of underground water in Tembhurkheda, She-Ghat, Malkhed, Pusla and Warud of Warud tehsil. Five villages are selected for this study situated in north side of the Warud. Warud is a taluka place located on the border of Maharashtra and M.P. States. It is situated at the base of Satpuda ranges and covered by dense woods with many medicinal plants and water bodies. It is famous for its juicy, tasty and quality oranges and commonly known as 'California of Vidarbha'.

EXPERIMENTAL

Material and methods

Water samples collected from five sampling points of different localities in north side of Warud taluka. These points are namely (i) Tembhurkheda (ii) She-Ghat (iii) Malkhed

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(iv) Pusla and (v) Warud. The sampling points and places are given in Table 1.

Table 1: Sampling points and places

Sampling point	Place
1	Tembhurkheda (Tube well)
2	She-Ghat (Tube well)
3	Malkhed (Tube well)
4	Warud (Tube well)

Table 2: Methods used for estimation of various physico-chemical parameters

S. No.	Parameters	Method
1	Temp.	Thermometer (0 to 300°C)
2	pH	pH metry
3	Conductivity	Conductometry
4	TDS	Filtration method
5	DO	Zoelometric method
6	Free CO ₂	Titration method
7	Total hardness	EDTA titration
8	Total alkalinity	Titration method
9	Magnesium	EDTA titration
10	Calcium	EDTA titration
11	Chloride	Silver nitrate method
12	Sulphate	Turbidometric method
13	Nitrate	Brucine method

The selection of well and bore well from these villages were made with a distance of about 5 Km. from each sampling point along the north side of Warud. The underground water samples were collected from deep well from these villages. Water samples were collected in 3 liter polyethylene cans, which were previously cleaned and washed with

deionised water and rinsed with this sample several times. These samples were collected in the spell of July 2006 to April 2007 in rainy, winter and summer seasons.

The physicochemical parameters such as pH, temperature, conductivity, TDS, DO, free CO₂, total hardness, alkalinity, magnesium, calcium, chloride, sulphate and nitrate were determined using standard methods²⁻⁶. Reagent used for the present investigations were A. R. grade and double distilled water was used for preparing various solutions.

RESULTS AND DISCUSSION

Thirteen physico-chemical parameters of water samples were determined and recorded. The temperature of the sample was noted at the sample spot during collection. At the same time, dissolved oxygen was measured by the chemical method. Other parameters like electrical conductivity, pH, total dissolved solids, total alkalinity, total hardness, calcium, magnesium, chloride, free CO₂, sulphate and nitrate were measured within few hours from sampling. The parameter were analysed by prescribed standard method¹.

The analysis of ground water samples includes the determination of the concentration of the inorganic constituents present in addition to the measurement of pH, electrical conductance, total dissolved solid and other minor constituents. Each of these properties is useful in evaluating the chemical character of underground water. In the present study, under ground water from 5 wells tapping various aquifer formation in area been sampled and analyzed for a period of an year in rainy, winter and summer seasons. The variation in the concentration of the parameter is shown in Table 3.

From these data, it is evident that the concentration of all ions in winter season were low and exhibiting increasing trends in rainy and summer seasons. This is due to fact that minerals, which are present in soil decrease due to the rise in water table. Kripanidhi et al.³ have reported similar trend in ground water of typical hard rock terrain and pollution in villages wells in Karnataka State.

It was found that the temperature of all fives wells varied from 23 to 25 during July to April. Various chemical and biological reactions in water depends to a great extent on temperature. The observed values of temperature indicates that the water quality would be certainly affected by this parameter.

The pH of water varied between 7.79 to 8.55. It is found that in summer, pH of all sample is high. On an overage, pH of all samples was in desirable limit as prescribed for drinking water standard (8.5 ICMR).

The specific conductivity of water samples under study varies between 150 to 900 μ mho/cm. The maximum permissible limit of this parameter for drinking water is 300 μ mho/cm. but average specific conductivity exceeds this limit because of its high values during rainy season. In rainy season due to floods and rains, water level in the well increases, which contains more electrolytes.

The permissible limit of T. D. S. of drinking water is 500 mg/L (WHO). The observation shows that the TDS is in the range of permissible range as compared to WHO.

The good quality water has solubility of oxygen 7.0 to 7.6 mg/L at 30° to 35°C but except in rainy season, all the samples showed higher values of D. O. Low values of D. O. in rainy season may be due to high values of conductivity of water.

CO₂ contents in well water is due to rain, from plant roots and decaying vegetation⁷. The factors responsible for solubilisation of CO₂ are temperature, pressure, pH and total alkalinity. The free CO₂ contents of water of the bore wells varied from 1.67 to 7.81. However, the permissible limit of free CO₂ has not been prescribed.

Hardness has no known adverse effects on health⁷. However, maximum permissible level has been prescribed for drinking water in 500 mg/L (WHO). According to some classification, water having hardness upto 75 mg/L is classified as soft, 76-150 mg/L is moderately soft, 151-300 mg/L as hard and more than 300 mg/L as very hard⁸. On this basis, the results show that (i) all the water samples in rainy season were moderately soft and (ii) most of the observations in winter season show that hardness increases moderately.

Total alkalinity of bore well water in terms of CaCO₃ varied between 340.2 to 630.8. The values of total alkalinity were comparately large. The water for domestic use having alkalinity less than 100 mg/L is safe. The high content of alkalinity is shown in the Table 3, which is relatively high.

Present investigation shows the concentration of calcium in the water samples is in the range of 25.9 to 37.8 mg/L from July 2006 to April 2007. According to Ohle⁹, the water having calcium values more than 25 mg/L is classified as 'Calcium rich'. Thus, as per the recommendation of Ohle, most of the water samples are 'Calcium rich'. The observed values of magnesium were between 29.6 to 41.7 mg/L during 2006-2007. The observation show that maximum contents of magnesium occurred during winter. Present investigation also shows that the magnesium contents in majority of samples do not exceed the limit as prescribed by ISI as well as WHO.

**Table 3: Seasonal variation in the underground water quality of north side of Warud region
(July 2006 to April 2007)**

Parameter	Rainy Season/Sample station					Winter season/Sample station					Summer season/Sample station				
	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
Temp (°C)	23.4	23.3	23.5	23.3	23.0	24.2	24.5	24.2	24.6	24.5	25.5	25.3	25.5	25.2	25.5
pH	0.01	8.24	8.15	8.20	8.40	7.79	8.15	7.40	7.81	8.10	8.25	8.30	8.20	8.35	8.55
Conductivity (μ S)	900	800	850	950	1000	400	450	475	400	450	500	550	550	500	550
TDS (mg/L)	500	450	700	600	550	600	550	625	600	650	475	500	600	550	600
D. O. (mg/L)	2.2	2.8	2.9	2.4	2.5	7.1	8.5	7.0	6.5	5.6	4.5	8.6	5.4	6.8	5.2
Free CO ₂ (mg/L)	2.43	3.58	2.71	1.82	1.67	5.21	6.16	5.72	7.81	5.68	4.21	3.66	4.42	3.98	4.52
Total hardness (mg/L)	132	183	179	167	188	265	244	190	215	210	271	365	305	262	245
Total alkalinity (mg/L)	340.5	360.4	420.2	521.6	480.0	415.0	560.2	582.3	561.2	523.9	630.8	587.3	525.6	420.8	590.6
Magnesium (mg/L)	34.8	36.2	35.8	31.7	40.1	41.7	38.6	29.6	36.5	30.5	32.5	31.5	33.8	37.9	34.8
Calcium (mg/L)	31.7	33.8	31.7	28.7	35.6	37.8	31.8	25.9	31.8	27.9	30.8	38.7	30.5	32.9	31.3
Chloride (mg/L)	102.5	87.3	77.8	83.9	111.6	121.6	130.0	137.8	109.8	102.8	189.5	179.9	135.2	115.8	134.7
Sulphate (mg/L)	50.01	59.27	53.1	54.2	56.9	43.29	40.2	41.9	45.0	50.7	52.4	62.3	60.43	66.3	58.4
Nitrate (mg/L)	0.042	0.026	0.12	0.098	0.135	0.040	0.022	0.03	0.072	0.09	0.052	0.03	0.12	0.12	0.18

Chloride contents of the water sample were low in rainy season and very low in winter season. According to WHO, maximum permissible limit for chloride is 500 mg/L. The values observed in present study are well below this permissible limit.

The sulphate content varies between 40.20 to 62.3 mg/L and the nitrate content varies between 0.022 to 0.18 mg/L. The sulphate and nitrate values were also found within the prescribed limits.

CONCLUSION

There was a marked variation in the physico-chemical parameters (Table 3).

- (i) Water purification process is a natural system. The physical process involved in self purification of water sources are dilution, sedimentation, suspension, filtration, gas transfer and heat transfer. Many of the chemical reactions involved in the self purification process must be biologically mediated.
- (ii) In rainy season, conductivity is high as compared to winter and summer seasons.
- (iii) Similarly, TDS, DO, free CO₂, magnesium and calcium were high in winter season as compared to rainy and summer seasons.
- (iv) Also, pH, temperature, total hardness, total alkalinity, chloride, sulphate and nitrate were high in summer season as compared to rainy and winter seasons. The data in Table 3 for various physico-chemical parameters were found within the prescribed limits, and hence, water from all the sampling points are suitable for drinking purposes.

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Accepted : 19.08.2009