



Short Communication

An Evaluation of Physico-chemical Parameters to Assess Borewell Water Quality from Madyal and Vadgaon Villages of Kagal Tahsil, MS, India

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Abstract

Water of good drinking quality is of basic importance to human physiology and man's continued existence depends very much on its availability. The assessment of borewell water quality for suitability for drinking and domestic purpose was carried out from Madyal and Vadgaon villages of Kagal Tahsil, Maharashtra. 24 borewell water samples were collected from these villages during March 2013. The physico-chemical parameters like pH, E.C., total alkalinity, total hardness, calcium hardness, magnesium hardness, chloride, salinity, TDS and DO have been analyzed. The result were compared with WHO, BIS & ICMR drinking water standards. On the basis of hardness, Out of 24 borewell water samples, 8 samples were above 300 mg/l so it causes harmful effect on Human health.

Keywords: Borewell water, physico-chemical parameters, drinking water quality, potability, madyal and vadgaon villages.

Introduction

Water is basic precondition for life. Quality and quantity of water at a place plays a vital role in Health, Wealth and Prosperity of the region. The modern civilization, rapid industrialization and increased population have led to fast degradation of our environment. Water is indispensable and one of the precious natural resources of our planet. Groundwater is an important source of water supply throughout the world. It's used in irrigation, industries and domestic uses continue to increase where perennial surface water sources are absent¹.

Groundwater meets domestic needs of more than 80 % rural and 50 % urban population, besides fulfilling irrigation needs of around 50% irrigated agriculture. Around two-fifth of Indias agriculture output is contributed from area irrigated by groundwater. Assessment of groundwater quality and its suitability for drinking is the objective of present study.

Kagal is one of the important Tahsil of Kolhapur district of Maharashtra. The population of Kagal Tahsil is 2, 48,237. Peoples residing in this Tahsil are depends on borewell water for domestic and agriculture purpose, so these borewell acts as a lifeline for the peoples. So, the present study deals with Physico- chemical parameters of Madyal and Vadgaon villages of Kagal Tahsil of Kolhapur district.

Material and Methods

Collection of samples: Borewell water samples (24) were collected from two villages (Madyal and Vadgaon) of Kagal Tahsil in March 2013. Samples were collected in plastic container and brought to the laboratory for analysis.

Analysis of Physico-Chemical Parameters: For the analysis standard methods were followed^{2,3}. Some parameters like E.C., pH, Salinity, TDS and DO were analyzed by Microprocessor based Water and Soil analysis kit. All physico-chemical parameters were analyzed within 24 hrs.

Results and Discussion

The results obtained from analysis of water samples of 2 villages (Madyal & Vadgaon) of Kagal Tahsil are given in table 1. These result were compared with WHO (1963), BIS (1991) and ICMR (1975) drinking water standard⁴⁻⁶. Drinking water standard in table 2. All the water samples were collected during the month of March 2013.

E.C.: Electrical conductance values ranged from 0.11 to 0.53 mmho. Electrical Conductivity is used to measure the ability of water to carry an electric current. Absolutely pure water is a poor conductor of electricity. Water shows higher conductivity when dissolved salts are present. The conductivity is proportional to the amount of salts dissolved in water⁷.

pH: pH values ranged from 7.40 to 9.20. All samples were ranged within the permissible limit of WHO. However higher values of pH hasten the scale formation in water heater and reduce the germicidal potential of Chlorine⁸.

Alkalinity: The Total Alkalinity of water samples were ranges from 30 to 88 mg/l. All samples are within the permissible limit. Alkalinity in itself is not harmful to human being; still the water samples with less than 100 mg/l are desirable for domestic use⁹. The high alkalinity imparts an unpleasant taste.

TDS: The values of TDS in a different water samples ranges from 50 to 520 mg/l .The most important aspect to drinking water quality is its effect on taste¹⁰. The drinking water containing more than 5000 mg/l of TDS is not considered desirable¹¹ and it can also cause excessive scaling in water pipes, water heaters, boilers and household appliances¹². Out of 24 samples, only 1 sample (V₇) has excess limit of 500 mg/l by BIS.

D.O.: There is no standard for dissolved oxygen for water quality assessment. Low D.O. gives bad odour to water due to anaerobic decomposition of organic wastes. In the present study dissolved oxygen values of water samples varied from 0.9 to 8.4 mg/l.The D.O. level in natural waters depends upon physical, chemical and biological activities prevailing in the water bodies. The amount of D.O. also varies with water temperature and altitude. Depletion of D.O. is enhanced by high concentration of organic matter of the water bodies¹³.

Salinity: Salinity of water samples were ranges from 120 to 450 mg/l.

Table-1
Physico- chemical analysis of Borewell water samples from Madyal and Vadgaon village of Kagal Tahsil

Sr.No	E.C.	pH	DO	S.	TDS	CL.	T.H.	Ca.H.	Mg.H.	A.
M1	0.28	8.17	3.8	205	200	34.08	200	68.35	33.20	46
M2	0.44	8.21	3.2	310	300	51.12	310	35.28	66.75	84
M3	0.33	8.45	2.4	220	220	68.16	320	25.68	71.51	40
M4	0.45	8.22	0.9	180	300	45.44	265	32.08	56.59	40
M5	0.39	8.79	1.2	340	250	14.2	240	25.66	52.08	66
M6	0.45	7.48	1.4	390	250	51.12	250	68.97	43.98	88
M7	0.38	7.53	1.7	400	300	19.88	280	14.43	64.53	80
M8	0.46	8.11	1.7	420	300	34.08	298	28.07	65.59	34
M9	0.33	8.31	4.1	290	210	25.56	206	48.17	38.35	46
M10	0.27	7.59	3.2	240	180	28.4	196	55.31	44.18	40
M11	0.11	8.09	3.0	120	080	25.56	090	24.06	16.02	60
M12	0.53	8.34	2.8	450	350	130.64	320	42.50	67.43	44
M13	0.36	8.59	2.6	310	230	59.64	184	36.09	35.94	30
M14	0.21	8.10	2.7	190	140	51.12	146	28.07	28.65	30
V1	0.25	8.58	7.2	310	170	25.56	250	49.72	48.66	48
V2	0.33	7.40	6.1	310	070	34.08	134	74.58	14.43	50
V3	0.32	7.50	7.3	300	060	39.76	310	80.2	55.84	60
V4	0.18	9.20	3.3	170	050	22.72	120	32.08	21.36	30
V5	0.41	7.86	6.7	300	210	36.92	500	104.26	101.02	60
V6	0.25	7.78	7.0	380	230	68.16	104	56.14	11.62	52
V7	0.49	7.54	7.4	440	520	48.28	380	61.71	77.34	80
V8	0.18	8.04	8.4	200	370	25.56	400	56.14	83.55	40
V9	0.14	8.07	1.4	430	270	48.28	320	80.2	58.27	80
V10	0.26	8.83	4.3	230	160	31.24	200	40.1	38.85	44

Where M. - Madyal Villages and V.- Vadgaon Villages, DO-Dissolved oxygen, S- Salinity, TDS- Total Dissolved Solid, CL- Chloride, T.H- Total Hardness, Ca.H.- Calcium Hardness, Mg. H.-Magnesium Hardness and A.-Alkalinity

Table-2
Drinking Water Standards of WHO (1963), BIS (1991) and ICMR (1975)

Parameters	WHO	BIS	ICMR
pH	6.5 -8.5	7-8	7-8.5
E.C.	300	300	300
Total Hardness	500	500	300
Calcium Hardness	75	75	75
Magnesium	50	50	50
Chloride	200	200	250-1000
Alkalinity	75	---	---
D.O	4-6 ppm	4-6 ppm	4-6 ppm

Chloride: Chloride values ranged from 14.2 to 130.64 mg/l. High chloride content can cause high blood pressure in people. Chloride in excess (<250 mg/l) imparts a salty taste to water and people who are not accustomed to high chloride may be subjected to laxative effect. High Chloride concentration is also an indicator of large amount of organic matter¹⁴.

Total Hardness: The classification of groundwater, based on total hardness shows that majority of the groundwater samples fall in the very hard water category. The maximum allowable limit of total hardness is 500 mg/l and the most desirable limit is 100 mg/l as per the WHO standards. For total hardness, the most desirable limit is 80 mg/l to 100 mg/l¹⁵. Hardness below 300 mg/l is considered potable but beyond this limits cause gastro-intestinal irritation (ICMR 1975). Normal water hardness does not pose any direct health problems. Jain et.al 1998 reported that high concentration of hardness (150 to 300 mg/l and above) may cause kidney problems¹⁶.

All 24 water samples have total hardness content within the WHO and BIS permissible limit. The Total hardness values ranged from 90 to 500 mg/l. Out of 24 samples, 3 samples (M₁₁, V₄, V₆) fall in the medium, 2 samples (M₁₄, V₂) are hard and 19 samples are very hard category.

Calcium hardness values ranged from 14.43 to 104.26 mg/l. Magnesium hardness values ranged from 11.62 to 101.02 mg/l.

Conclusion

In the present investigation, out of 24 water samples, only 8 water samples (M₂, M₃, M₁₂, V₃, V₅, V₇ and V₈) have the total hardness value above 300 mg/l. These samples affect the human health. Therefore, it is recommended that water from these bore are to be used for drinking purpose only after pretreatment like filtering, boiling, reverse osmosis and electro dialysis.

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