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Periodic Research

Assessment of Drinking Water Quality From Ground Water Sources in Satara District Maharashtra. India

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Abstract

The quality of drinking water is of vital concern for the mankind. Clean and safe drinking water is very essential for the human being. The quality of drinking water from ground water sources has been assessed and results are presented in this paper Twenty two samples were collected from different sources viz.dug well and bore well . Physicochemical parameters pH, Total hardness, Total alkalinity, Electrical conductance and Total dissolved solids were estimated. The present study indicates that samples collected found to have total hardness ranging from 162 to 578 ppm . pH of collected samples were between range 6.3 to 7.2 Electrical conductance was found to be in the range of 137 to 997 µs/cm. Samples from bore well were found to have higher values of total hardness and electrical conductance. Most of the samples were found to have higher values of total hardness. Higher values of total hardness suggest that presence of lime stone rock which consist of Calcium carbonate or mixture of Calcium carbonate and Magnesium carbonate. When ground water flows through lime stone rock a small amount of Calcium carbonate and Magnesium carbonate dissolves in water. In Maharashtra number of kidney stone patients is ever increasing .The present study suggest to investigate the co-relation between use of hard water for drinking and cooking purpose and increasing number of kidney stone patient

Keyword: Ground water, Physicochemical parameters, Total hardness, Satara Distric

Introduction

The quality of drinking waters is of vital importance for human being. In the area of Koregaon and Satara tehsil of Satara district the sources of drinking water are mainly ground water and surface water, but the main source is ground water. Ground water is the part of precipitation that seeps down through the soil until it reaches the rock material that is saturated with water. The ground water is the major source for dug wells and bore wells in the region under study. Ground water may be polluted due to contamination of industrial ,domestic and agricultural waste. Ground water is generally irreversible. Excess presence of minerals in ground water decreases water quality producing objectionable taste and excess hardness .It is necessary to assess physicochemical parameters like pH, total hardness, electrical conductivity, total dissolved salts and total alkalinity of ground water samples collected from dug wells and bore wells in the region. In the present study an attempt is made to evaluate the physicochemical parameters of drinking water from ground water sources.

Materials and Method

Study area

Satara District is located in the south eastern part of India. It is about 145 kilometer East- West long and 120 kilometer South- North wide region having area of about 17400 sq kilometer. It is at 17^{o}, 50'to 18^{o}, 11' North latitude and 73^{o}, 33' to 74^{o},18'East longitude. Villages from Satara District are situated at the east of Sahyadri hills. The area comes under semi drough region. The topology of villages in Satara District is nearly flat and average height from sea level is 800 meter. .(Satara District Gazetteer -1999)

Sample Collection

Samples of bore well water and dug well water which is used for drinking purpose from different villages were collected in cleaned and rinsed polythene bottles

Table-1
Sample code, source and locations of samples collected from Satara District.

Sr.No.	Sample code	Source	Location(Village Name)
1	S1	Bore well	Wagholi
2	S2	Bore well	Padali (Satara Road)
3	S3	Bore well	Pimpode
4	S4	Bore well	Khodad
5	S5	Bore well	Mattyapur
6	S6	Dug well	Bhose
7	S7	Dug well	Rahimatpur
8	S8	Bore well	KIodoli
9	S9	Bore well	Atit
10	S10	Bore well	Kumathe
11	S11	Bore well	Borgaon
12	S12	Bore well	Nalawadewadi(Targaon)
13	S13	Bore well	Kashil
14	S14	Dug well	Mahuli
15	S15	Bore well	Targaon
16	S16	Bore well	Degaon
17	S17	Dug well	Sonake
18	S18	Bore well	Jarewadi
19	S19	Bore well	Varne
20	S20	Bore well	Arvi
21	S21	Dug well	Pimpari
22	S22	Dug well	Navhi

Analysis of water samples

Analysis of water samples was carried out within twelve hours. To determine various physicochemical parameters standard methods of APHA (2005) were adopted. To determine total hardness, method WHO/M/26.R 1(1999) was used. Various physicochemical parameters pH, electrically conductivity, total hardness, total dissolved solids and total alkalinity as $CaCO_3$ were determined.

Comparison with standard

Physicochemical parameters measured and analyzed of collected water samples were compared with IS: 10500 standards for drinking water.

Table-2
BIS, IS-10500 standards for drinking water

Sr.No.	Parameter	IS-10500 standards, Permissible limit
1	Colour	Colourless
2	Odour	Agreeable
3	pH	6.5 to 8.5
4	Total hardness as CaCo3 in mg/l (ppm)	300
5	Electrical Conductivity in µS/cm	750
6	Total dissolved solids in mg/l (ppm)	500
7	Total alkalinity as CaCO3 in mg/l (ppm)	200

Table-3
:Physicochemical parameters of drinking water samples collected from different villages in Satara District.

Sr. No	Sample code	Colour	Odour	pH	TH	Ec	Tds	TA
1	S1	Colourless	Agreeable	7.2	426	828	562	382
2	S2	Colourless	Agreeable	7.1	500	938	624	502
3	S3	Colourless	Agreeable	6.9	400	704	504	420
4	S4	Colourless	Agreeable	7.1	420	728	502	396
5	S5	Colourless	Agreeable	6.8	385	601	422	332
6	S6	Colourless	Agreeable	7.1	410	738	512	488
7	S7	Colourless	Agreeable	7.1	512	997	683	448
8	S8	Colourless	Agreeable	7.2	578	965	622	392
9	S9	Colourless	Agreeable	6.8	386	349	228	302
10	S10	Colourless	Agreeable	6.7	436	899	522	516
11	S11	Colourless	Agreeable	6.3	298	634	472	402
12	S12	Colourless	Agreeable	6.9	319	549	338	306
13	S13	Colourless	Agreeable	6.6	420	454	272	536
14	S14	Colourless	Agreeable	6.7	232	638	358	352
15	S15	Colourless	Agreeable	7.1	518	442	376	326
16	S16	Colourless	Agreeable	6.6	428	990	558	352
17	S17	Colourless	Agreeable	7.1	458	905	542	402
18	S18	Colourless	Agreeable	7.1	348	805	508	442
19	S19	Colourless	Agreeable	6.8	308	533	342	392
20	S20	Colourless	Agreeable	6.3	162	137	242	198
21	S21	Colourless	Agreeable	7.2	398	492	308	322
22	S22	Colourless	Agreeable	6.9	449	938	602	412

TH=Total Hardness in mg/l Ec= Electrical Conductivity in µS/cm
Tds=Total dissolved solids in mg/l
TA=Total alkalinity in mg/l

Results and Discussion

The results of analysis of bore well and dug well water samples are shown in table-3 pH Values of all the samples from bore well and dug well were found in the desirable limit ranging from 6.3 to 7.2. The desirable limit recommended by IS-10500 is 6.5 to 8.5. All the samples had pH in the permissible limit.

Total hardness of most of the samples were found to have higher values than desirable limit. Except sample S_{20} was found to have lowest total hardness of 162 ppm and samples S_{11} and S_{14} had values 298 and232ppm respectively which are within permissible limit. All other 19 samples were found to have higher values ranging from 308 to 578ppm. The analysis predominantly showed that large number of samples had higher value of total hardness ranging from 308 to 578ppm. Study also reveals that there is no differentiation of total hardness values on the basis of source of ground water, both bore wells and dug wells water samples were found to have same range values.. Source of most hard water is lime stone rock which consist of calcium carbonate or mixture of calcium carbonate and magnesium carbonate. When ground water flows through lime stone rock a small amount of calcium carbonate and magnesium carbonate dissolves in the water.[Chemistry in context-Applying chemistry to

society] Higher values of total hardness suggest that presence of lime stone rock in the region under study. The statement is supported from the soil analysis data of Satara which states that underground soil in the Satara region consist of limestone clay.[Satara District Gazetteer-1999, p-389] Local newspaper 'Sakal' had predicted that increasing number of kidney stone patients in Satara District may be due to use of hard water used for drinking and cooking purpose. Also the news paper reports from other parts of Maharashtra and north India suggest that kidney patients are increasing and may be due to use of salty water. The higher values of total dissolved solids in most samples indicates presence of large number of dissolved salts which may be cause of kidney diseases. The present study suggest further investigation to establish co-relation between use of hard water and water containing more dissolved solids for drinking and cooking purpose and kidney stone patients.

Total alkalinity as calcium carbonate in mg/l analyzed for samples collected shows that all the samples from bore wells and dug wells were found to have higher values than desirable limit except sample S_{20} The analysis showed direct co- relation between total hardness and total alkalinity as $CaCO_3$ as expected. Electrical conductivity in µS/cm of the samples collected had varying values from137 to 997µS/cm Bore well and dug well water samples S_3, S_4, S_5, S_6, S_9, S_{11}, S_{12}, S_{13}, S_{14}, S_{15}, S_{19}, S_{20} and S_{21} had conductivity values in the desirable limits of 750µS/cm. While other samples found to have higher values than permissible limit indicating more quantity of soluble salts. Similar trend as that of electrical conductivity was observed for total dissolved solids, Water samples S_1,S_2, S_3,S_4,S_6 S_7, S_8, S_{10}, S_{16} S_{17}, $S_{18}$and S_{22} were found to have higher values of total dissolved solids than desired limit.

Conclusion

The present study indicates that water samples from bore wells and dug wells were found to have higher values of total hardness, indicating ground water in different villages of Satara District is hard. The reason for this may be presence of lime stone rock or lime stone clay underground of area under study. If hard water is used for drinking purpose it may cause undesirable effects on digestive system. The study suggests need of further investigation to study relation between use of hard water and water containing more dissolved solids for drinking and cooking purpose and kidney stone disease.

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