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ASSESSMENT OF PHYSICOCHEMICAL PARAMETERS OF WELL WATER OF VILLAGES IN ROHA TAHSIL, DIST-RAIGAD (MAHARASHTRA)

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Abstract

Assessment of physicochemical parameters of well water in the six villages of Roha Tahsil has been carried out during the year 2015-16 for instance water moving through underground rocks and soils may pick up natural contaminates, even with no human activity or pollution in the area. In addition to nature's influence, water is also polluted by human activities, such as open defecation, dumping garbage, poor agricultural practices, and chemical spills at industrial sites. The present study was undertaken for six villages of Roha taluka,viz. Khamb, Shiravali, Nadavali, Talavali, Chilhe and Devkhane where the well water is the second source of drinking water . The water analysis was performed for the selected parameters such as Temperature, pH, Total Dissolved Solids, Total Suspended Solids ,Sulphates, Iron, COD, etc. It was concluded from the study that the well water can be used for the drinking purpose after a suitable treatment.

Keywords: Khamb, Shiravali, COD ,pH , Sulphates, Iron physicochemical parameters .

I. INTRODUCTION

Having safe drinking water and basic sanitation is a human need and right for every man, woman and child. People need clean water and sanitation to maintain their health and dignity. Having better water and sanitation is essential in breaking the cycle of poverty since it improves people's health, strength to work, and ability go to school. Yet 884 million people around the world live without improved drinking water and 2.5 billion people still lack access to improved sanitation, including 1.2 billion who do not have a simple latrine at all (WHO / UNICEF, 2008). Many of these people are among those hardest to reach: families living in remote rural areas and urban slums, and families living in the poverty- disease trap, for whom improved sanitation and drinking water could offer a way out.

The World Health organization (WHO) estimates that 88% of diarrheal disease is caused by unsafe water, inadequate sanitation and poor hygiene. As a result, more than 4,500 children die every day from diarrhea and other diseases. For every child that dies, countless others, including older children and adults, suffer from poor health and missed opportunities for work and education. To safe guard the long term sustainability of well water and ground water resources, the quality of water needs to be continuously monitored (NEERI 1981).

Study area:

Roha is a small city and taluka in the Raigad district of the Maharashtra state of India. It is located 120 km south east of Mumbai. It is the starting point of kokan railways and end point of central railways. Raigad is one of the industrially developed districts in the Maharashtra state. It lies at the bank of Arabian Sea. The geometrical position of it has latitude 18.45^0 and 73.12^0 longitude. Hilly area is one of the silent features of this area. The present investigation was carried out at the six selected villages in

the Roha tahsil between March 2015 to June 2016 by considering the different physico-chemical parameters.

II. MATERIALS AND METHODS

For the purpose of study of well water quality in some selected rural villages, the samples were collected quarterly, in early morning hours, in clean plastic carboy of 2 litres capacity. Air temperature, water temperature was recorded on the spot. Other parameters such as Temperature, pH, Total Solids, Sulphates, Iron, COD etc., were analysised as per the methods describe in the standard methods (APHA, 1990); Trivedi and Goel (1984) and Kodarkar (1992).

III. RESULT AND DISCUSSION

The variations in analysised physical and chemical characteristics are tabulated along with the standard values in the Table No. 1 to 8.

Water Temperature

The surface water temperature depends on air temperature, wind, turbulence in water and biological activities taking place in the water. During the present study the water temperature ranged from 19 to 25.7^{0}C (Table No. 2). The minima was noted in the month of December 15. The maximum temperature was in March 2016 corresponding to air temperature.

pH

It is important to determine pH because most of the plants and animals can survive within a narrow range of pH from slightly acidic to slightly alkaline (Pawar and Pulley, 2005). pH also governs the distribution , transport and fate of heavy metals in aquatic ecosystems (Manna and Das, 2004).

The average pH values during the present study show water was slightly alkaline except in the village Khamb- S1. (Table No. 3). Alkalinity of pH is seen at every site except S1 due to unknown reason. Eutrophication and Sewage inflow are few of the causes of increased pH as stated by Ghavzan et al.(2005) and Chatterjee and Raziuddin, (2001)

Total Solids

The amount of total solids depend on various parameters such as geological character of the water shed, rainfall and the amount of surface run off (Akuskar and Gaikwad, 2006). The highest total solids elevate the density of water and such medium increases the stress on aquatic biota (Verma et al. 1978).

The present study indicates total solids ranging from 570 mg to 1100 mg/l (Table No. 4). The ISI-limit for total solids is 1000 mg/l. Present study indicates values crossing the permissible limit during some period of the year(March-15 to June-16), especially at Chilhe and Devkhane.

Total Suspended Solids

The amount of particles that suspended in a water sample is called total suspended solids (TSS). It is mentioned as mg/l. Total Suspended Solids (TSS), also known as non-filterable residue, are those solids (minerals and organic material) that remain trapped on a 1.2µm filter (U.S.EPA, 1998). TSS has no drinking water standard. Therefore, data in this report are compared to the general standards for surface water discharge of effluents that indicate the value 100mg/L.

The present study reveals that the suspended particles were found to be very noticeable (Table No. 5) for most of the period, however, it was found to be ranging between 100 and 310mg/l. Chatterjee and Raziuddin (2003) noted high values in monsoon. However such seasonal trend was not noted during the present study.

Total Dissolved Solids

Elevated TDS has been due to natural environmental features such as, mineral springs, carbonate deposits, salts deposits, and sea water intrusion, but other sources may include, salts used for road deicing, anti-skid materials, drinking water treatment chemicals, storm water and agricultural runoff, and point/non-point wastewater discharges. The most common chemical constituents are calcium, phosphates, nitrates, sodium, potassium and chloride.

The present study indicates high concentration of dissolved solids throughout the study period ranging from 340 to 990 mg/l (Table No. 6).However, the highest permissible limit according to ICMR and WHO is 500 mg/l. During the present study, high dissolved solids were noted almost throughout the year. The open wells and the direct run off from the surface might be some of the reasons.

Sulphates:

In the present study the sulphate concentration observed in the range from 25mg/lit to 260 mg/lit during the study period. In rainy season it ranges from 42 to 260 mg/lit in winter season 25 to 250 mg/lit and in summer season 38 to 245 mg/lit sulphate content in all sample sites was found to fall within the BIS permissible limit of 400 mg/lit. Sulphates, if it exceeds, produce laxative effect on human system. Sulphate content in the water samples showed a marked seasonal variation ; an observation in agreement with similar study done at jodhpur, Rajasthan (Jakher and Rawat,2003).

Iron :

Fe_3^+ is moderately toxic to many species of aquatic plant. This made iron more toxic than Cr,Mn,B,Pb, but less than Se,Cu,Ni, and Cd. Fe_2^+ and Fe_3^+ are only moderately toxic to most invertebrate species. Iron may present in tap water as Fe_2^+ but quickly get oxidized to Fe and is unavailable for plants. (Vediya and Shrivastva,2008).

The range of Iron concentration was found to be in between 0.1 to 1.4 mg/l. At few sampling stations there was maximum iron content and may be due to the presence of industrial influents near to the wells. The iron content of ground water samples i.e.S5 (Sept.) is high. When the iron content is more in water, water may produce rust spots on fabrics and plumbing fixtures. Higher concentration of Iron imports bitter taste and flavor to water (Ramamurthy, et al., 2007).

COD:

Chemical Oxygen Demand is a method to determine the organic load of water body i.e. susceptible to oxidation. COD as a result of pollution is largely determined by the various organic and inorganic materials (Calcium , magnesium , potassium , sodium,etc.). (Ramana et al., 2008). The level of chemical oxygen demand seems to be the appropriate indices for assessing the pollution level of water bodies (Jakher., 2003). The high COD values are found mainly in water, which may be due to the mixing of domestic and industrial waste (Murugesan et al.,2007).

In the present study, the COD for ground water was ranged from 4.0 mg/l to 30.2 mg/l. The prescribed limit of COD is 4 mg/l as per USPH Standards for drinking water. The 90% of water samples shows high COD and remaining is below the standard limit. Similar trends were also observed at Raghograh in M.P.(Megha Rai and Shrivastava, 2006).

IV. CONCLUSION

The water was slightly acidic to alkaline but within permissible limit. Total solids were very high at some sites. Turbidity is also high due to excess dissolved and suspended solid. A relatively higher concentration of Sulphates and Iron indicate the unsuitability of water for domestic use.

Hence application of water quality techniques for the overall assessment of the water body could be useful tools. The awareness must be created in the villagers about safe drinking water. The villagers should be made aware of basic water treatments to improve water quality. Finally safe drinking water must be made available for the villagers.

Table No. 1: Quarterly values of Water Temperature (^{0}C) at 6 Sampling Stations from Mar.2015 to June. 2016,

Site / Month	Khamb (S1)	Shiravali (S2)	Nadavali (S3)	Talavali (S4)	Chilhe (S5)	Devkhane (S6)
Mar-15	25.6	25	25.5	25.6	24.9	25.2
June-15	23.1	22	21.5	21.9	21.3	22.1
Sept-15	20.1	20	21	21.2	21.4	20.2
Dec-15	21.5	19.2	21.3	19.5	21	19
Mar-16	24.8	24.5	25.2	25.7	25.4	25.5
June-16	22.8	21.5	21.6	22	21.4	22.5
Max.	25.6	25	25.5	25.7	25.4	25.5
Min.	20.1	19.2	21	19.5	21	19
Average	22.98	22.03	22.68	22.65	22.57	22.42

Table No. 2: Quarterly values of pH (range of 1 to 14) at 6 Sampling Stations from Mar.2015 to June. 2016,

Site / Month	Khamb (S1)	Shiravali (S2)	Nadavali (S3)	Talavali (S4)	Chilhe (S5)	Devkhane (S6)
Mar-15	7.1	6.8	7.3	7.4	7.3	7.4
June-15	6.9	7.2	7.5	7.2	7.6	7.6
Sept-15	6.8	7.3	6.9	7.3	7.5	7.8
Dec-15	7.3	7.0	7.3	7.1	7.6	7.7
Mar-16	7.1	6.9	7.2	7.3	7.2	7.5
June-16	6.9	7.0	7.3	7.1	7.2	7.6
Max.	7.3	7.3	7.5	7.4	7.6	7.8
Min.	6.8	6.8	6.9	7.1	7.2	7.4
Average	7.02	7.03	7.25	7.23	7.4	7.6

Table No. 3: Quarterly values of Total solids mg/l at 6 Sampling Stations from Mar.2015 to June. 2016,

Site / Month	Khamb (S1)	Shiravali (S2)	Nadavali (S3)	Talavali (S4)	Chilhe (S5)	Devkhane (S6)
Mar-15	750	800	880	850	910	980
June-15	570	740	670	770	880	950
Sept-15	620	630	780	870	750	1000
Dec-15	610	850	790	780	860	800
Mar-16	750	750	860	900	900	950
June-16	620	960	800	700	1100	840
Max.	750	960	880	900	1100	1000
Min.	570	630	670	700	750	800
Average	653.33	788.33	796.67	811.67	900	920

Table No. 4: Quarterly values of Total Suspended solids mg/l at 6 Sampling Stations from Mar.2015 to June. 2016,

Site / Month	Khamb (S1)	Shiravali (S2)	Nadavali (S3)	Talavali (S4)	Chilhe (S5)	Devkhane (S6)
Mar-15	150	210	140	250	200	290
June-15	200	180	210	130	160	180
Sept-15	160	250	160	210	250	160
Dec-15	240	130	100	210	210	260
Mar-16	160	150	210	300	200	310
June-16	260	160	250	150	140	210
Max.	260	250	250	300	250	310
Min.	150	130	100	130	140	160
Average	195	180	178.33	208.33	193.33	235

Table No. 5: Quarterly values of Total Dissolved Solids mg/l at 6 Sampling Stations from Mar.2015 to June. 2016,

Site / Month	Khamb (S1)	Shiravali (S2)	Nadavali (S3)	Talavali (S4)	Chilhe (S5)	Devkhane (S6)
Mar-15	570	640	700	580	550	770
June-15	500	490	540	650	850	670
Sept-15	450	420	600	640	570	860
Dec-15	340	730	690	600	660	520
Mar-16	600	600	660	550	650	640
June-16	450	580	600	600	990	610

Max.	600	730	700	650	990	860
Min.	340	420	540	550	550	520
Average	485	576.67	631.67	603.33	711.67	678.33

Table No. 6: Quarterly values of Sulphates mg/l at 6 Sampling Stations from Mar.2015 to June. 2016,

Site / Month	Khamb (S1)	Shiravali (S2)	Nadavali (S3)	Talavali (S4)	Chilhe (S5)	Devkhane (S6)
Mar-15	38	40	140	85	245	50
June-15	45	44	152	80	254	59
Sept-15	60	56	168	90	260	62
Dec-15	25	27	110	250	220	30
Mar-16	39	38	135	85	235	49
June-16	48	42	150	83	253	59
Max.	60	56	168	250	260	62
Min.	25	27	110	80	220	30
Average	42.5	41.17	142.5	112.17	244.5	51.5

Table No. 7: Quarterly values of Iron as Fe mg/l at 6 Sampling Stations from Mar.2015 to June. 2016,

Site / Month	Khamb (S1)	Shiravali (S2)	Nadavali (S3)	Talavali (S4)	Chilhe (S5)	Devkhane (S6)
Mar-15	0.2	0.2	0.4	0.2	0.25	0.25
June-15	0.3	0.2	0.5	0.4	1.3	0.3
Sept-15	0.4	0.3	0.5	0.3	1.4	0.1
Dec-15	0.5	0.2	0.3	0.2	0.3	0.4
Mar-16	0.2	0.3	0.4	0.3	0.4	0.5
June-16	0.3	0.4	0.5	0.4	0.3	0.7
Max.	0.5	0.4	0.5	0.4	1.4	0.25
Min.	0.2	0.2	0.3	0.2	0.3	0.1
Average	0.32	0.27	0.43	0.3	0.658	0.375

Table No. 8: Quarterly values of COD mg/l at 6 Sampling Stations from Mar.2015 to June. 2016,

Site / Month	Khamb (S1)	Shiravali (S2)	Nadavali (S3)	Talavali (S4)	Chilhe (S5)	Devkhane (S6)
Mar-15	24.0	23.0	26.2	20.2	29.3	24.2
June-15	24.0	25.0	25.2	20.2	30.2	26.3
Sept-15	8.3	7.5	6.3	6.0	9.0	6.5
Dec-15	4.0	5.0	4.0	5.2	5.0	4.2
Mar-16	20.8	23.3	24.0	20.0	28.5	24.6
June-16	25.2	24.0	26.2	18.5	30.0	25.2
Max.	25.2	25.0	26.2	20.2	30.2	26.3
Min.	4.0	5.0	4.0	5.2	5.0	4.2
Average	17.72	17.97	18.65	15.02	22	18.5

Table No. 9: Standards of various physico-chemical parameters

Sr.No.	Parameters	USPH Standards	ISI Standards	WHO Standards	BIS Standards
1	pH	6.0-8.5	6.0-9.0	-	-
2	Conductivity	300µmhocm-1	-	-	-
3	Turbidity	<5NTU	-	-	-
4	TDS	500mg/lit	-	-	-
5	Free CO_2	-	-	-	-
6	Alkalinity	-	200 mg/lit	-	-
7	Total Hardness	-	300 mg/lit	-	-
8	Calcium	0.05	100-500 mg/lit	150 mg/lit	-
9	Magnesium	< 10 mg/lit	30-50 mg/lit	150 mg/lit	-
10	Chlorides	250 mg/lit	600 mg/lit	500 mg/lit	600 mg/lit
11	Sulphates	< 0.3 mg/lit	-	200-400 mg/lit	1000 mg/lit
12	Iron	< 0.3 mg/lit	0.3 mg/lit	0.1-1.0 mg/lit	-
13	DO	4-6 ppm	3.0 ppm	-	-
14	COD	4.0 ppm	10.0 ppm	-	-

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