

Assessment of Physico-Chemical Status of Ground Water Quality of Sillod City

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ABSTRACT: Quality of water is an important criterion for evaluating the suitability of water for drinking and irrigation. The ground water samples were collected and subjected for a comprehensive physico-chemical analysis. The following 15 parameters have been considered viz. pH, Electrical conductivity, Total Dissolved Solid, Turbidity, Total Alkalinity, Total Hardness, Calcium, Magnesium, Sodium, Potassium, Chloride, Fluoride, Nitrate, Sulphate and Phosphate. By observing the result it can be concluded that some parameters which were taken for study the water quality are above the permissible limits and some were not. Moreover this study may help other region in understanding the potential threats to their ground water resources.

KEYWORDS: Sillod, Ground water, Total Hardness, pH, Alkalinity.

I. INTRODUCTION

Natural resources are the important wealth of our country, water is one of them. Water is wonder of nature. "No life without water" is a common saying depending upon the fact that water is one of the naturally occurring essential requirement of all life supporting activities [1]. In India, most of the population is dependent on the ground water as the only source of drinking water supply. The groundwater is believed to be comparatively much clean and free from pollution than surface water. But prolonged discharge of industrial effluents, domestic sewage and solid waste dump causes the groundwater to become polluted and create health problems[2]. The rapid growth of urban areas has further affected groundwater quality due to overexploitation of resources and improper waste disposal practices. Hence there is always a need for and concern over the protection and management of ground water quality [3]. The most of water bodies in India needs to be treated before using it in domestic applications by various means. Groundwater contain high amount of various ions, salts etc. So if we were using such type of water as portable water then it leads to various water borne diseases [4]. An understanding of water chemistry is the bases of knowledge of the multidimensional aspects of aquatic environmental chemistry which involve the source, composition, reactions and transportation of water. The quality of water is vital concern for mankind since it is directly linked with human welfare. Therefore, monitoring the quantity of water is one of the essential issue of drinking water management [5]. Once groundwater is contaminated, its quality cannot be restored back easily and to device ways and means to protect it. Considering the above aspects of groundwater contamination and literature survey it reveals that no water quality management studies are made in this region so far hence the present study was undertaken to investigate the impact of groundwater quality of some bore well water samples of Sillod city of Aurangabad District, Maharashtra state. Thus in this research work an attempt has been made to assess the physical and chemical parameters of groundwater like, Temperature (T), pH, Electrical Conductivity (EC), Total Dissolved Solid (TDS), Turbidity, Total Alkalinity (TA), Total Hardness (TH), Calcium (Ca⁺⁺), Magnesium (Mg⁺⁺), Sodium (Na⁺), Potassium (K⁺), Chloride (Cl⁻), Fluoride (F⁻), Nitrate (NO₃⁻), Sulphate (SO₄⁻⁻) and Phosphate (PO₄⁻³) of bore well was determined. The analyzed data were compared with standard values recommended by WHO [6].

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I.I SITE DESCRIPTION

Study area Sillod City is lies within longitude 20° 3' 0" North and latitude 75° 65' 0" East. Situated 65 Km away from Aurangabad in North-East direction. Sillod is a major city and municipal council in Aurangabad District of Indian state of Maharashtra with average elevation of 612 M (2008 feet) above sea level.

II.MATERIAL & METHODS

Analytical grade reagent and distilled water would used throughout the study. All glass ware and plastic container used were washed with double distilled water.

II.1 SAMPLE COLLECTION

Ten water samples were collected in the above said area. Standard methods were adapted for the analysis of various water qualities. 1 liter polythene bottle were used for water quality parameter analysis and all bottles were washed with dilute nitric acid followed by distilled water and were dried. At each sampling location, water were collected in two polythene bottle. Before taking final water sample, the bottles were rinsed three times with the water to be collected. Two liter of each sample was collected and homogeneous sample is prepared for analysis physico-chemical parameters. Sampling sites are as shown in table number 1.

S. No	Sample Location	Source	Sample Number
1	Mhasoba Temple old city	Bore Well	S1
2	Athawadi Bazar	Bore Well	S2
3	Shastri Colony	Bore Well	S3
4	Kale Colony	Bore Well	S4
5	Shahu Nagar	Bore Well	S5
6	Tilak Nagar	Bore Well	S6
7	Samata Nagar	Bore Well	S7
8	Shivaji Nagar	Bore Well	S8
9	Teachers Colony	Bore Well	S9
10	MayurPark	Bore Well	S10

TABLE-I Sampling sites in Sillod City.

III.EXPERIMENTAL SECTION

Sampling was done in morning in October 2015. The parameters selected for analysis were water Temperature (T), pH, Electrical Conductivity (EC), Total Dissolved Solid (TDS), Turbidity, Total Alkalinity (TA), Total Hardness (TH), Calcium (Ca⁺⁺), Magnesium (Mg⁺⁺), Sodium (Na⁺), Potassium (K⁺), Chloride (Cl⁻), Fluoride (F⁻), Nitrate (NO₃⁻), Sulphate (SO₄⁻⁻) and Phosphate (PO₄³⁻) of bore well water samples. The pH and water temperature were recorded on the spot by using pH paper and thermometer respectively. Remaining parameters were analyzed in laboratory by standard methods [7].

IV.RESULTS & DISCUSSION

The results obtained from analysis of ten ground water samples are given in table number II.

pH: pH is a measure of the hydrogen ion concentration in water and indicates whether the water is acidic or alkaline. The measure of alkalinity and acidity is pH. pH is required to determine the corrosiveness of the water. The standard value of pH for drinking water by WHO (World Health Organization) is between 7.0 to 8.5. High value of pH may

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results due to waste discharge, microbial decomposition of organic matter in water body [8]. Most of the water samples are slightly alkaline due to presence of carbonates and bicarbonates. In the present study all the samples have pH values below prescribed values by WHO.

Electrical conductivity in Micro-ohm/cm: Electrical conductivity is a measure of water capacity to convey electric current. It signifies the amount of total dissolved salts [9]. High electrical conductivity affects the germination of crops and it may result in much reduced yield [10]. In the present work electrical conductivity values were in the range of 530 $\mu\text{m}\Omega/\text{cm}$ (S10) to 1640 $\mu\text{m}\Omega/\text{cm}$ (S3). High electrical conductivity values were observed for five sampling points namely S1, S3, S4, S6 and S7 indicating the presence of high amount of dissolved inorganic substances in ionized form.

Total Dissolved Solids (TDS) in mg/l: TDS indicates the salinity behavior of ground water. Water containing more than 500 mg/l of TDS is not considered desirable for drinking water supplies, but in unavoidable cases 1500 mg/l is allowed [11]. In above studied water samples TDS values vary from 111 mg/l (S9) to 1560 mg/l (S1). The sampling points S1, S2 & S5 showed higher TDS values than the prescribed limit given by WHO.

Turbidity in NTU: Most of the times in water turbidity is due to colloidal and extremely fine dispersion [12]. The turbidity values varied between 0.00 to 1.00 NTU and found within limit prescribed by WHO.

Total Alkalinity (TA) in mg/l: An alkalinity value of water provides an idea of natural salts present in water. Alkalinity of water is its capacity to neutralize a strong acid and it is normally due to presence of bicarbonates, carbonates and hydroxide compounds of calcium, sodium and potassium. The total alkalinity values for all the investigated samples were found to be greater in samples S1, S2, S4 & S5 than the value prescribed by WHO.

Total Hardness in mg/l: Hardness is property of water which prevents the lather formation with soap and increases the boiling point of water [13]. Hardness of water mainly depends upon the amount of calcium and magnesium salts or both. Hardness although has no health effects it can make water unsuitable for domestic and industrial use. Total hardness of bore well water under the area determined in the present investigation ranged from 240 mg/l to 660 mg/l. The values for sample from points S1, S2 and S3 were higher than prescribed limit by WHO.

Calcium (Ca^{++}) in mg/l: Calcium is directly related with hardness. Calcium concentration ranged between 48 mg/l (S5) to 118 mg/l (S3) and found below permissible limit of WHO, except S1, S2, S3 & S4.

Magnesium (Mg^{++}) in mg/l: Magnesium is also directly related with water hardness. Magnesium content in the investigated water sample was ranging from 40.2 mg/l (S10) to 147 mg/l (S3), which were found within WHO limit.

Sodium (Na^+) in mg/l: Sodium concentration was found in between 162 mg/l (S3) to 484.4 mg/l (S5). All the samples were found greater than permissible limit of WHO except the sampling point S3 and S10.

Potassium (K^+) in mg/l: The major source of potassium in natural fresh water is weathering of rocks. The potassium content in present study varied from 0.3 mg/l (S3) to 10.2 mg/l (S7)

Chloride (Cl^-): Chloride a major anion in portable and industrial water has no adverse effect on health, but imparts bad taste to drinking water. The chloride concentration serves as an indicator of pollution by sewage. People accustomed to higher chloride in water are subjected to laxative effects. Chloride of bore well water in the study area ranged from 32.8 mg/l (S10) to 295 mg/l (S9). The values are within limit except water sample collected from sites S8 and S9. Higher chloride concentration in samples from site S8 & S9 may be due to discharge of sewage near the sampling sites.

Fluoride (F^-) in mg/l: Probable source of high fluoride in Indian water seems to be that during weathering and circulation of water in rocks and soils, fluorine is leached out and dissolved in ground water. Excess intake of fluoride through drinking water causes fluorosis on human being. In the present analysis, fluoride concentration was found zero for all sites.

Nitrate (NO_3): The high nitrogen content is an indicator of organic pollution. It results from the added nitrogenous fertilizers, decay of dead plants and animals, animal urine etc. They are all oxidized to nitrate by natural process and hence nitrogen is present in the form of nitrate of bore well water. Under the area determined in the present investigation amount of nitrate ranged from 0.16 mg/l to 5.60 mg/l. Slightly higher concentration of nitrate found for sampling point S3 than limit given by WHO.

Sulphate (SO_4^{--}) in mg/l: Sulphate is found in small quantity in ground water. Sulphate may come in ground water by industrial or anthropogenic addition in the form of Sulphate fertilizers. Sulphate occurs naturally in water as a result of leaching from gypsum and other common minerals [14]. The Sulphate content in the study area was found in the range of 43.17 mg/l (S9) to 81.39 mg/l (S10). The Sulphate values for all sampling points lie within the permissible limit of WHO.

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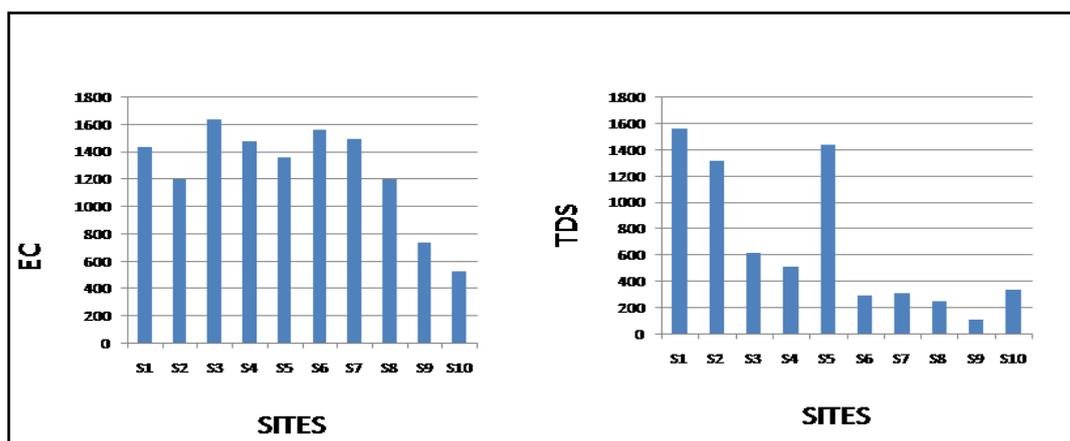
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Phosphate (PO_4^{3-}) in mg/l: Phosphate may occur in ground water as a result of contamination of domestic sewage, detergents, fertilizers and industrial waste [15-20]. No phosphate content found within study area.

All the data is summarised in Table number II and graphical representation of values of physico-chemical parameters of different sites in Sillod city as shown in fig. 1 (a-f).

Parameters	WHO	Sampling sites in SillodCity									
		S1	S2	S3	S4	S5	S6	S7	S8	S9	S10
Temperature in $^{\circ}\text{C}$		27	26	26	27	26	24	25	27	26	24
pH	7-8.5	8.2	8.1	7.2	7.9	7.8	8.4	7.1	7.7	7.8	7.9
EC in $\mu\text{m } \Omega/\text{cm}$	1400	1440	1200	1640	1480	1360	1563	1500	1200	740	530
TDS in mg/l	1000	1560	3200	620	511	1440	300	311	250	111	340
Turbidity in NTU	5.0	0.4	0.8	1.0	0.3	0.2	0.2	0.4	0.00	0.00	0.7
TA in mg/l	120	190	185	110	175	180	111	120	118	112	114
TH in mg/l	500	513	784	660	240	336	440	340	320	295	350
Ca^{2+} in mg/l	100	110	105	118	108	48	90	52	71	60	85
Mg^{2+} in mg/l	150	142	142	147	130	128	131	135	60.8	45.0	40.2
Na^{+} in mg/l	200	255	313	162	375	484.4	431.9	207	204	218	199
K^{+} in mg/l	--	5.6	3.8	0.3	1.9	8.4	0.00	10.2	9.8	8.5	7.8
Cl^{-} in mg/l	250	170	140	160	92	65	70	78	280	295	32.8
F^{-} in mg/l	1.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NO_3^{-} in mg/l	15	2.47	1.25	5.60	0.18	3.11	0.20	2.78	2.41	0.18	0.16
SO_4^{2-} in mg/l	250	78.82	74.05	80.90	62.3	43.46	56.8	61.57	47.4	43.5	81.39
PO_4^{3-} in mg/l	--	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

TABLE-II Results of the Physico-chemical parameters of different sites in Sillod City

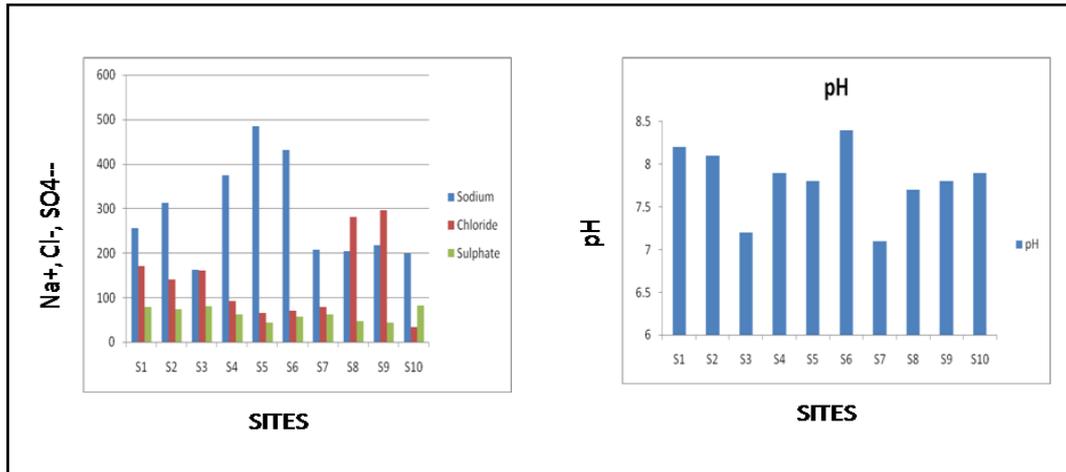


a) Graphical presentation of EC b) Graphical presentation of TDS

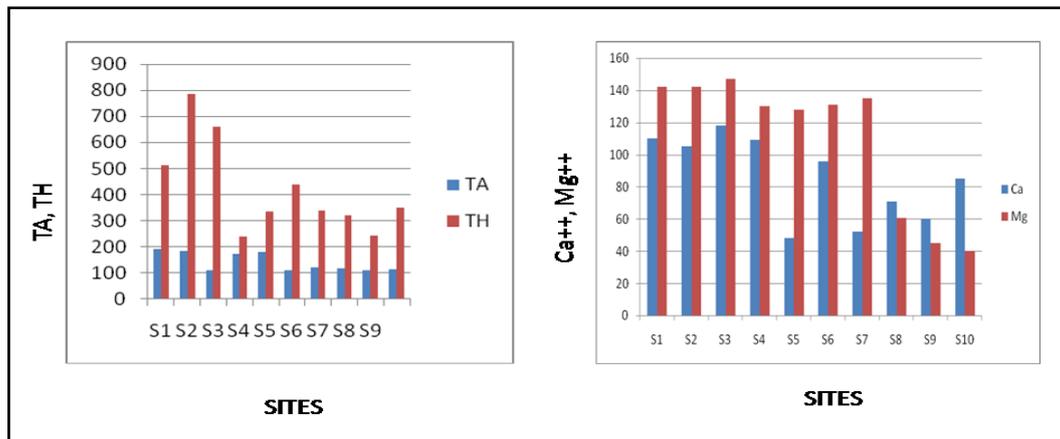
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c) Graphical presentation of Na⁺, Cl⁻, SO₄²⁻ d) Graphical presentation of pH



e) Graphical presentation of TA, TH

f) Graphical presentation of Ca⁺⁺, Mg

Fig. 1 Graphical presentation of different physico-chemical parameter of water of Sillod city (a) Graphical presentation of EC (b) Graphical presentation of TDS (c) Graphical presentation of Na⁺, Cl⁻, SO₄²⁻ (d) graphical presentation of Ca⁺⁺, Mg⁺⁺

IV. CONCLUSION

The present study was undertaken with an aim to analyze certain physico-chemical parameters in the ground water samples of Sillod city of district Aurangabad, Maharashtra. Deviations were observed by some ground water samples in Sillod city. The water samples from sampling sites S1, S2 and S3 showed poor water quality compared to other water samples, probably due to improper dumping of garbage and animal faces and urine. The water samples from the site S1, S2 & S3 are polluted and unfit for drinking purpose. The sampling sites S8, S9 & S10 showed all parameters within the water quality standard and water quality is good for drinking purpose. It may conclude that ground water in Sillod city region requires precautionary measures before drinking so as to prevent adverse health effect on human being.

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