International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 02 Issue: 04 | July-2015 www.irjet.net p-ISSN: 2395-0072

Assessment of Underground water Quality around Hadapsar region in Pune, Maharashtra.

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Abstract - *Water is one of the vital needs of all living beings. Present work is analysis of ground water pollution in hadapsar region. This area has got many open wells which are connected by ground water table of surrounding area. As the water is used for drinking and irrigation purposes, it becomes essential to find the suitability of these open wells for drinking and irrigation purpose. In current work sample from 9 Open wells from study area were Selected and tested for various parameters. The hydro chemical analysis has been done by using piper diagram for both the seasons, i.e. pre and post monsoon. The groundwater quality is tested based on Sodium percent, Sodium Absorption Ratio and Residual Sodium Carbonate & suitability of water for irrigation purpose is examined and found out it is suitable for irrigation purpose. From the result it has shown the sampling points having hardness, TDS, conductivity and chlorides exceed the permissible limit as per APHA standards. So that it is not safe for drinking purpose. Thus from the overall analysis some suggestions & remedial measures are provided in the paper for the same.*

Key Words: Ground water pollution, hadapsar, hydro chemical analysis, Piper diagram.

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I. INTRODUCTION

The chemistry of water is very vibrant, mostly controlled by its medium of contact. in view of the fact that the chemistry of water directly hints the quality of water for various purposes, its monitoring and evaluation gained considerable importance in the present century. A terrific raise in the population increased the stress on surface water and the groundwater. From the ancient times the ground water is used mostly for drinking because of the filtering effect of aquifers. Though, in at present one cannot drink the water directly from the source without treatment. Various chemical, physical and biological processes alter the original quality of water when it moves through the hydrological cycle; the reactions of soil, rock, organic matter, Natural processes and human activities are causes behind changes in groundwater quality.

So this study examines the quality of ground water throughout the hadapsar region &
It is seen that the ground water quality at some places is not fulfilling the desired parameters.

The ground water quality may affect due to industrial activities in surrounding area, human activities, unlimited use of chemical fertilizers etc. such factors lead to decrease in water qualities in wells & bores in the area. Water from such wells & bores is currently used by the people in the area for drinking, domestic & agricultural purpose which might affect the health of people.

Therefore it is necessary to assess the ground water quality status of the areas around hadapsar region during the pre monsoon and post monsoon period to frame the policy and management plan for the protecting it from the contamination and further detoriation of water quality.

II. STUDY AREA AND METHODOLOGY

Hadapsar is an eastern suburb of Pune City, Maharashtra, India. Hadapsar is situated at18.4967° N, 73.9417° E. Groundwater samples are randomly collected from rural areas like Keshavnagar, Ghulewasti and Bhapkar mala.

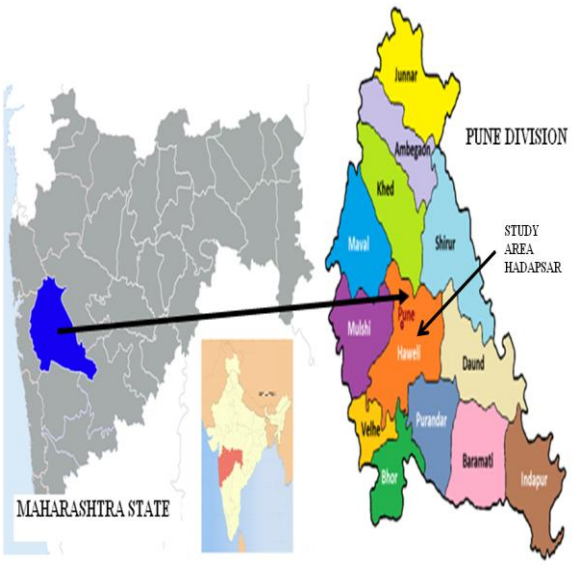

Figure-1: Showing Location of Hadapsar, Pune

All the three areas are surrounded by agricultural land and residential area. The 4 open well samples from Keshavnagar, 4 open well samples from ghule wasti and 2 open well samples from bhapkar mala were collected. All the samples were collected by grab sampling method in plastic bottle from all the sampling stations.

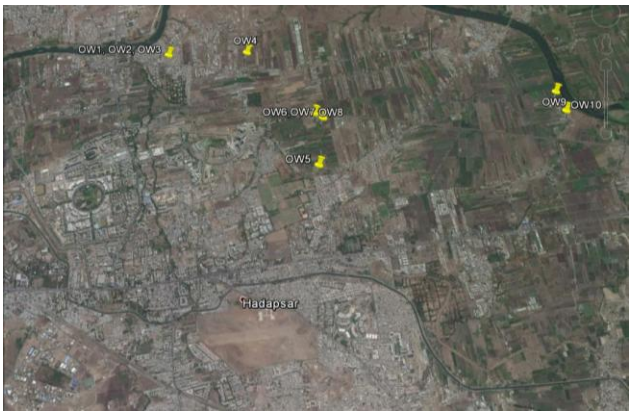

Figure-2 Showing Location of Sample wells

The collected samples were analyzed for various parameters like pH, Total Dissolved Solids, Hardness, Conductivity, Turbidity, Alkalinity, Chlorides,Sulphates, Calcium, Magnesium,Na,K

Bicarbonates and Temperature. All the samples were tested as per APHA standards.
The parameters are selected on the basis of two steps. First one is the cations and anions that required for plotting of piper diagram which indicates the concentration of ions in water. Second one is to check the suitability of water for irrigation purpose on the basis of Residual sodium carbonate (RSC), Sodium Hazard and Sodium adsorption ratio (SAR). The Ground water quality parameters analyzed for open wells around Hadapsar region. These samples were analyzed during post monsoon (Nov 2014) and pre monsoon (Apl 2015) period for below mentioned water quality Parameters. The results are as shown in table.

Table-1: Post Monsoon Season Test Analysis Results.

Sr. no.	Parameters	Desired limit	Result(post monsoon)								
			OW1	OW2	OW3	OW4	OW5	OW6	OW7	OW8	OW9
1	PH	6.5-8.5	6.48	6.76	6.46	6.64	6.83	6.73	6.74	6.78	6.82
2	TDS	500mg/l	490	515	569	519	393	405	410	283	295
3	Total Hardness	300 mg/l	316	470	554	400	380	398	401	250	262
4	Conductivity	600us/cm	963	1028	1144	1039	779	795	801	561	572
5	Turbidity	5NTU	8	1	1	1	1	1	1	1	1
6	Alkalinity	200mg/l	160	120	100.4	110	101	110	108	80.1	75.3
7	Chlorides	250mg/l	56.3	88.20	108	108	60.30	62.3	70.2	41.4	46
8	Sulphate	200mg/l	19	32	28	21	18	21	22	11	13
9	Calcium	75mg/l	110.4	180	235	168	152	155	153	78	81
10	Magnesium	Mg/l	105	125	180	151	171	178	180	95	98
11	Sodium	300mg/l	110	131	121	126	151	155	152	156	162
12	Potassium	-mg/l	48	41	49	45	31	36	35	36	42
13	Biocarbonate	Desired limit	20	22	18	21	12	14	16	14	19
14	Temperature	$-^0c$	29.30	29	29	29	29	28.9	29.1	29	29
15	Carbonates	Mg/l	0.100	0.100	0.100	0.200	0.200	0.200	.200	0.00	0.2

Table-2: Table for result of analysis for pre monsoon season

Sr. no.	Parameters	Desired limit	Result(pre monsoon)								
			OW1	OW2	OW3	OW4	OW5	OW6	OW7	OW8	OW9
1	PH	6.5-8.5	7.28	7.14	7.19	7.10	7.5	7.1	7.16	7.22	7.3
2	TDS	500mg/l	1082	1012	597	895	512	526.23	622	486	450
3	T. Hardness	300 mg/l	248.24	352.30	316.72	375.12	375.20	451.2	355.24	258.8	248.3
4	Conductivity	600us/cm	1576	789	896	900	852.1	789.23	944	742	652.3
5	Turbidity	5NTU	9.1	7.5	4.5	6.5	3.1	4.2	0.4	2.1	3.2
6	Alkalinity	200mg/l	681.38	751	303.14	551.46	456.2	426.12	327.6	264.74	250.21
7	Chlorides	250mg/l	111.54	100.23	74.38	95.12	100.2	75.26	66.53	50.88	62.33
8	Sulphate	200mg/l	48.636	35.13	29.35	42.13	45.2	52.3	31.1	24.3	35.6
9	Calcium	75mg/l	96.06	86.15	69.2	72.13	82.3	76.13	87.49	70.33	71.23
10	Magnesium	Mg/l	36.98	45.12	55.28	48.13	56.3	62.3	65.06	45.3	42.3
11	Sodium	300mg/l	10.37	9.15	10.37	8.26	11.3	15.2	10.37	10.37	15.23
12	Potassium	-mg/l	2.0	3.5	2.0	4.6	3.1	2.5	2.0	2.0	2.6
13	Bicarbonates	Desired limit	12.56	10.52	8.58	9.12	32.1	29.1	27.64	23.2	32.4

14	Temperature	-^{0}c	4.2	2.3	2.5	1.2	6.3	5.2	2.3	6.3	2.3
15	Carbonates	Mg/l	28	27.2	28	28	27	28	28	28	27.8

IV.RESULT AND DISCUSSION

From the above result it can be seen that the pH was within the range. The TDS was ranging from 450-1082 mg/lit. It can be seen that many of the samples were above desirable limits i.e.500 mg/l, The total hardness was ranging from 248.24-554 mg/lit. Thus it can be seen that the open well water for all sampling points is hard. Alkalinity was ranging from 250.21-681.38Mg/lit and was above the desirable range. Chlorides, Sulphates, Sodium, Potassium, Bicarbonates were within the range. Calcium, Magnesium were above the desirable limits. Conductivity and Turbidity were almost above the range.

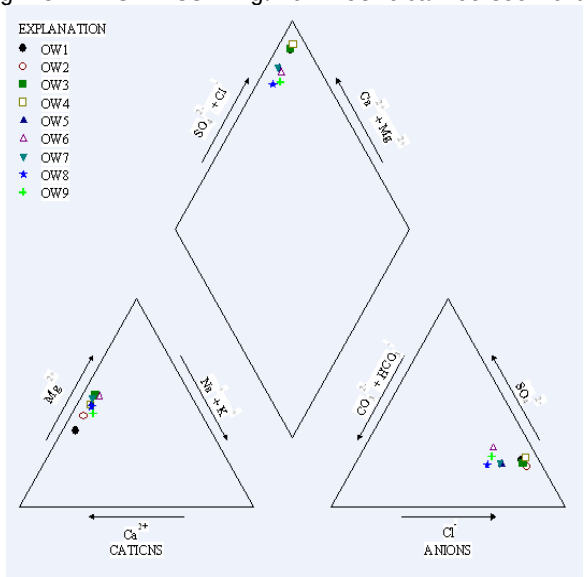

Fig-3: shows piper diagram for Pre Monsoon season.

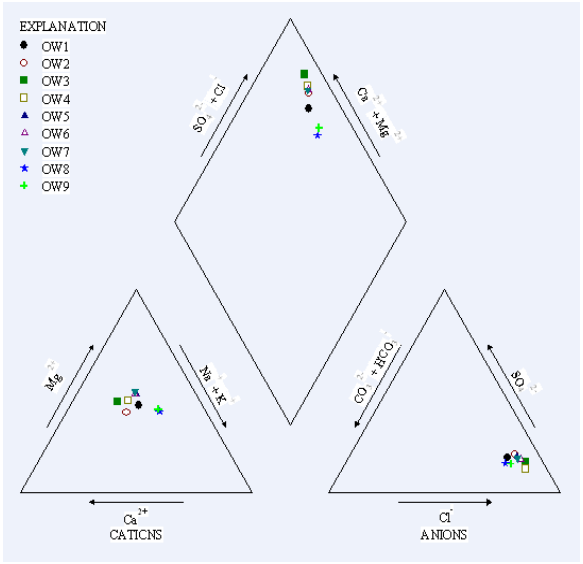

Fig-4: shows piper diagram for Post Monsoon season.

The piper diagram shows the result plotted in graphical form. On the basis of Piper diagram we obtained the following results which are tabulated in table.

Sodium Hazards:

Table- 3: shows Classification of groundwater based on Sodium percent

Sodium (%)	Water class	Pre-monsoon Samples	Post-monsoon samples
<20	Excellent	4.41-8.53(9samples)	19.97(1 sample)
20-40	Good	-	21.91-34.95(8samples)
40-60	Permissible	-	-
60-80	Doubtful	-	-
>80	Unsuitable	-	-

From the above table it is observed that 9 samples and 1 sample are excellent in pre and post monsoon season respectively and 8 samples are good for post monsoon season.

Residual Sodium Carbonate (RSC)

Table – 4: shows Classification of groundwater based on Residual Sodium Carbonate

RSC	Remark on quality	Pre-monsoon samples	Post-monsoon Samples
<0	None	9 samples	9 samples
0-1.25	Good	-	-
1.25-2.5	Doubtful	-	-
>2.5	Unsuitable	-	-

All the values for RSC were found to be negative i.e. <0. A negative RSC indicates that more Ca and Mg are in water than Carbonates, where the excess Ca and Mg have been precipitated and excess Ca and Mg can act as counter ions to displace Na

Sodium Absorption Ratio

Table-5: Classification of groundwater based on Sodium Absorption Ratio

Sodium Hazard Class	SAR in Equivalents per mole	Remark on quality	Pre monsoon Samples	Post monsoon samples
S1	10	Excellent	0.18-0.35 (9 samples)	1.44-2.86 (9samples)
S2	10-18	Good	-	-
S3	18-26	Doubtful	-	-
S4 and S5	>26	Unsuitable	-	-

From above table it is observed that 9 samples are Excellent during pre and post monsoon respectively for irrigation purpose

Table-6: shows Characterization of groundwater of Hadapsar, Pune on the basis of Piper Tri-linear diagram

Sub-division Of the diamond	Characteristics of corresponding subdivisions of diamond-shaped fields	Percentage of samples in this category	
		Pre Monsoon	Post Monsoon
1.	Alkaline earth (Ca+Mg) Exceed alkalies (Na+K)	100	100
2.	Alaklies exceeds alkaline earths	0	0
3.	Weak acids(CO_3+HCO_3) exceed Strong acids (SO_4+Cl)	0	0
4.	Strong acids exceeds weak acids	100	100
5.	Magnesium bicarbonate type	0	0
6.	Calcium-chloride Type	100	100
7.	Sodium-chloride Type	0	0
8.	Sodium-Bicarbonate type	0	0
9.	Mixed type (No cation-anion exceed 50%)	0	0

Based on the classification diagram from figure for anion and cation facies in the form of major-ion percentages, water types are designed according to the domain in which they occur on the diagram segments. It is clearly depicted that water type is predominantly of Cl type for post-monsoon seasons and Mg-Cl Type for Pre Monsoon. There was no significant change in hydro-chemical facies for both the seasons.

CONCLUSION: From the above observation, it may concluded that almost all the parameters like pH, sodium, potassium, carbonate, bicarbonate, chloride are within the permissible limits prescribed by APHA but calcium, magnesium and nitrate values were exceeding the limits. The piper diagram shows that alkaline earth(Ca2+ + Mg2+) exceed over alkaline (Na+ + K+) where in anion strong acids (SO42_+ Cl-) were predominated. On the other hand most of the sampling station considered suitable for irrigation uses according to EC, SAR, %Na & RSC values

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