International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395 -0056
Volume: 03 Issue: 05 | May-2016 www.irjet.net p-ISSN: 2395-0072

STUDY OF PHYSICOCHEMICAL CHARACTERISTICS OF GROUNDWATER QUALITY IN ATIGRE VILLAGE, KOLHAPUR, MAHARASHTRA, INDIA

A. A. Lole[1], S. B. Kore[1], A. C. Varute[1] , A. K. Chougule[1], A. R. Kutre[1], A. S. Ambi[1]

Department of Civil Engineering,

Sanjay Ghodawat Institutes, Atigre Maharashtra, India

Abstract – *The study of physicochemical characteristics of groundwater quality in Atigre, Kolhapur District (lat. 160 74' 26'' N to 160 74' 07'' N and long. 740 35' 41'' E to 740 37' 05'' E)was carried out and 25samples were collected. The physico-chemical analyses of water samples reveals that 100% samples of pre and post-monsoon seasons represent Ca +Mg > Na+K (alkaline earths exceedalkalies) hydro chemical facies. Similarly, 100% water samples belongs to HCO3 +CO3> Cl+SO4 (weak acid exceed strong acid) hydro chemical facies in pre and post-monsoon seasons. On the basis of U. S. Salinity diagram, water samples of pre and post-monsoon seasons (100%) belong to C2-S1type suggesting good water quality for irrigation purposes. The Gibbs variation diagram suggests the chemistry of groundwater is controlled by rock dominance.*

Key Words*: *Groundwater quality, , Hydro-chemical facies.

1. INTRODUCTION

Water is the source responsible for life is survived on the Earth. The 97% of total water is available in ocean or sea as saline water bodies. The 2% of fresh water is in icecaps and glaciers of the remaining 3%. For drinking, agriculture and industrial sector groundwater is the major source in both rural and urban areas. Piper [8] developed a tri-linear diagram for the characterization of the hydrochemical facies. Todd [12], Karanth[5] discussed the various aspects of groundwater chemistry. Tiwari [11], Pawar [7], Shenoy and Lokesh[10], Sawant and Joshi [9], Ahmed et al. [1], Panaskar et.al. [6], Yadav et. Al [16], Yadav and Sawant [17] and Yadav and Sawant [18] have worked on the chemical aspect of groundwater from urban areas. In the present paper authors have made an attempt to study the groundwater quality and its suitability for drinking and irrigation purposes.

2. STUDY AREA

The study area is bounded between latitude16^{0}74' 26'' N to 16^{0}74' 07'' Nand longitude74^0 35' 41'' E to 74^{0}37' 05'' E, inSurvey of India Toposheet numbers47 L/6, on scale 1:50000. The area is covered by Deccan trap of Upper Cretaceous to Lower Eocene in age. The main source of water for drinking, irrigation and industrial purposes is from dug wells, bore wells and surface water.

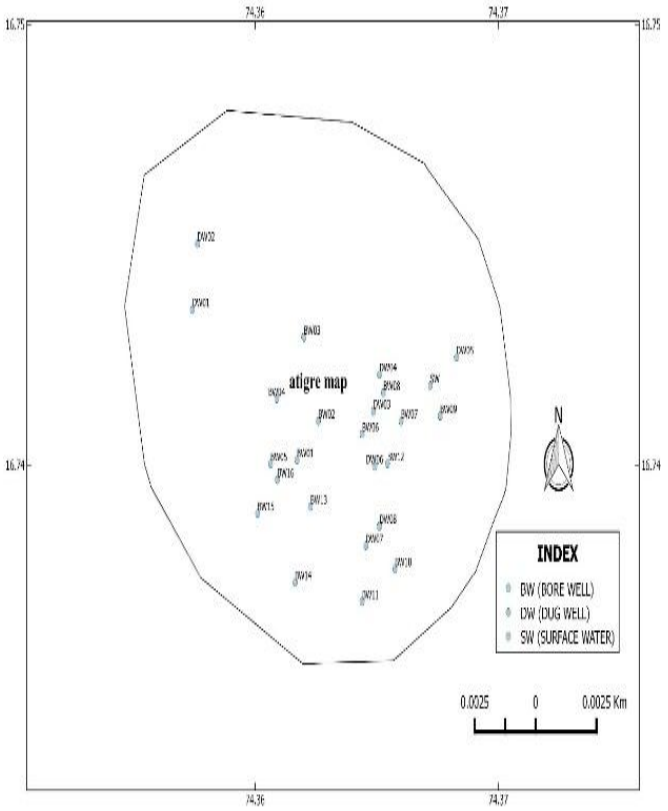


Fig.1: Study area with Sample Location Map.

3. METHODOLOGY

For the appraising of groundwater quality, representative 25 water samples were collected in pre-monsoon and post-monsoon seasons. The samples were collected in one liter plastic bottles. The various physico -chemical parameters were analyzed by following the standard procedures given in standard methods for the examination of water and waste water (APHA, AWWA, WPCF[2]; Trivedy and Goel[13]) Table No. 1 and 2.

Table 1. : Concentration of different chemical parameters of water samples of study area (pre-monsoon season)

Sample No.	Ph	Conduc.	Total Hardness	Total Alkalinity	Tds	Turbi.	Ca	Co_3	Hco_3	So_4	Cl
BW1	7.6	430	80	80	279.5	0	224	0	84	90.44	92.3
BW2	7.9	333	150	71	216.45	1	262	0	92	94.52	96.14
BW3	6.5	356	120	60	231.4	2	250	0	80	88.42	94.12
BW4	7.2	416	105	65	270.4	2	234	0	91	92.41	82.41
BW5	7.6	398	110	52	258.7	1	248	0	94	90.02	88.24
BW6	7.1	356	160	68	231.4	1	210	0	90	88.23	98.14
BW7	6.9	422	110	60	274.3	1	213	0	140	97.88	102.24
BW8	5.4	446	140	130	289.9	1	259	0	138	90.1	98.2
BW9	6.4	286	130	90	185.9	2	268	0	92	88.84	96.14
BW10	5.9	276	110	64	179.4	1	258	0	80	96.14	86.82
BW11	6.9	329	160	86	213.85	1	249	0	98	90.5	96.87
BW12	7.8	371	145	90	241.15	0	247	0	78	82.14	126.13
BW13	6.3	416	122	60	270.4	1	222	0	98	94.1	86.9
BW14	7.3	468	145	84	304.2	1	225	0	81	98.45	101.86
BW15	7.9	354	149	88	230.1	1	220	0	92	92.48	76.9
BW16	6.8	381	180	71	247.65	0	218	0	86	81.82	87.96
DW1	6.7	387	138	65	251.55	1	240	0	80	94.7	114.56
DW2	6.9	381	101	75	247.65	2	246	0	128	94.72	87.33
DW3	7.4	321	168	72	208.65	1	266	0	92	90.9	90.58
DW4	6.9	391	108	90	254.15	1	198	0	86	88.44	102.4
DW5	7.3	413	112	68	268.45	1	208	0	96	86.44	85.6
DW6	6.9	429	95	75	278.85	2	220	0	87	95.48	56.8
DW7	7.5	470	98	80	305.5	1	240	0	92	96.11	90.86
DW8	6.9	390	105	110	253.5	0	254	0	89	90.09	131.35
SW	6.2	299	110	70	194.35	1	260	0	84	94.56	104.17

Table 2: Concentration of different chemical parameters of water samples of study area (post-monsoon season)

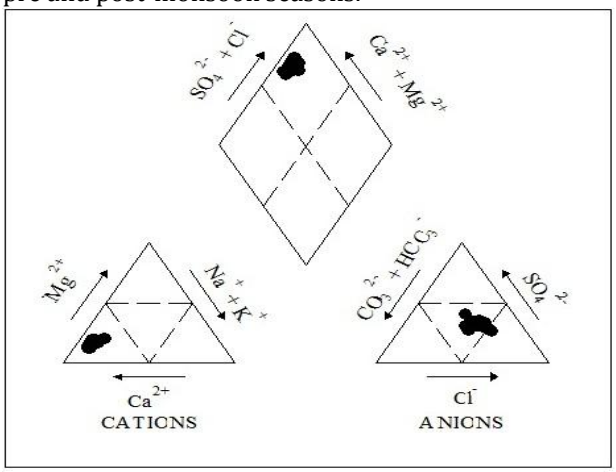
Sample no.	PH	Conduc.	Total hardness	Total alkalinity	TDS	Turbi.	ca	Co_3	Hco_3	SO_4	CL
BW1	7.9	432	100	90	280.8	0	210	0	96	88.23	90.03
BW2	7.7	338	180	70	219.7	2	256	0	80	97.56	94.26
BW3	6.7	359	145	82	233.35	2	243	0	76	86.2	90.14
BW4	6.9	412	135	90	267.8	1	220	0	96	91.2	86.14
BW5	7.8	396	120	76	257.4	1	243	0	104	88.02	90.44
BW6	7.2	352	160	88	228.8	2	210	0	82	88.23	106.14
BW7	6.7	426	150	80	276.9	1	200	0	128	97.56	90.2
BW8	5.6	449	190	152	291.85	2	253	0	132	92.1	100.46
BW9	6.8	289	160	72	187.85	1	256	0	98	87.85	99.76
BW10	6	273	130	90	177.45	1	250	0	88	94.14	88.86
BW11	7.1	324	180	78	210.6	1	244	0	82	92.05	103.14
BW12	8	376	195	72	244.4	1	238	0	108	86.65	120.17
BW13	6.2	419	130	80	272.35	1	210	0	76	88.23	90.86
BW14	7.1	465	180	74	302.25	2	225	0	87	94.52	102.68
BW15	7.2	355	135	78	230.75	1	229	0	98	91.47	80.96
BW16	6.9	386	185	78	250.9	1	220	0	92	86.23	88.76
DW1	6	389	168	72	252.85	2	245	0	86	95.2	120.56
DW2	6.9	388	129	80	252.2	2	250	0	114	96.31	82.54
DW3	7.6	326	180	82	211.9	1	256	0	92	91.82	96.46
DW4	7.1	396	108	78	257.4	0	200	0	96	88.78	104.12
DW5	7.7	410	130	90	266.5	1	210	0	102	86.23	88.97
DW6	7	423	90	72	274.95	2	210	0	82	97.56	58.6
DW7	7	460	105	78	299	1	235	0	96	98.23	78.46
DW8	6.8	316	95	120	205.4	1	255	0	86	88.53	125.43
SW	7.2	255	120	72	165.75	1	256	0	76	91.65	109.14

4. RESULT AND DISCUSSION

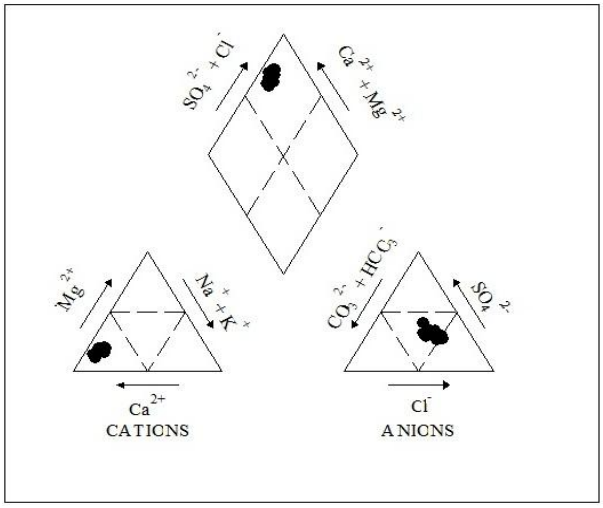
Classification of groundwater based on Piper Trilinear diagram

In order to understand the variation in hydro chemical facies with time and space, the data of chemical analyses of dug well, bore well and surface water samples has been plotted on the Piper Trilinear diagram (Fig.3. a - b).

It is seen from the Fig.3.a - b, that the water samples of pre and post-monsoon seasons, 25 samples (100%) represent Ca + Mg>Na + K(alkaline earths exceed alkalies) hydro chemical facies. Similarly, water samples belongs to HCO3 + CO3>Cl + SO4(weak acid exceed strong acid) hydro chemical facies in pre and post-monsoon seasons.



a. Pre-monsoon season



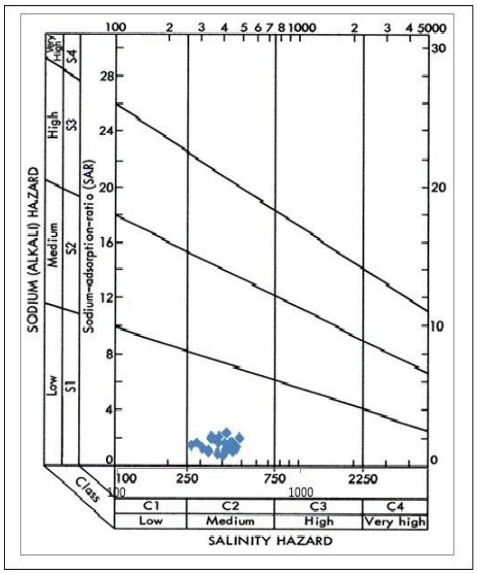
b. Post-monsoon season

Fig. 2.a-b: Piper Trilinear diagram from water samples of the Study area.

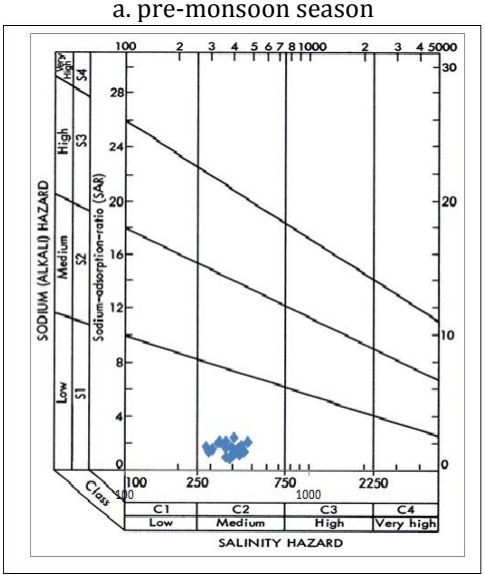
Classification of groundwater based on U.S. Salinity diagram

The classification of groundwater on the basis of its irrigational suitability with reference to alkali and salinity hazards (U.S. Salinity Laboratory Staff [14]). The values of electrical conductivity (EC) and SAR for all samples of the area are plotted on USSL staff diagram (Fig. 4. a - b).

From the Fig. 4.a - b, it is observed that25 water samples (100%) of pre-monsoon and post-monsoon seasons belongs to C_2-S_1 type suggesting good water quality for irrigation purposes.



a. pre-monsoon season



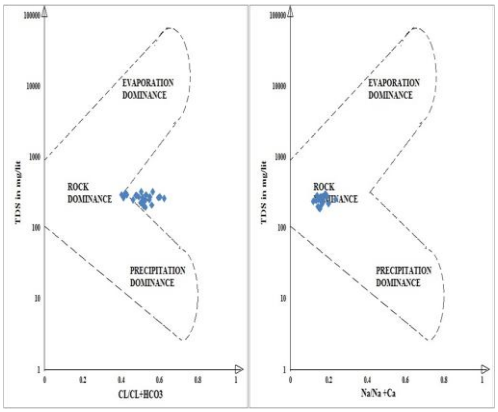
b. Post monsoon season

Fig. 3. a - b: Classification of irrigation water from water samples of Study area.

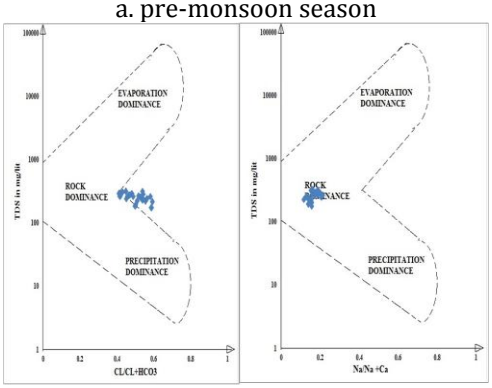
Classification of groundwater based on Gibbs Variation diagram

The Gibbs variation diagram suggests the chemistry of groundwater is controlled by precipitation, evaporation and rock dominance (Gibbs[3]). The values of total dissolved solids (TDS) and Na/Na+K and TDS and Cl/Cl+$HCO_3$for all samples of the area are plotted on Gibbs variation diagram(Fig. 5. a - b).

It is seen from the Fig.5.a - b that all water samples of pre and post-monsoon seasons suggest the chemistry of groundwater is controlled by rock dominance.



a. pre-monsoon season



b. post-monsoon season

Fig. 4.a-b: Gibbs variation diagram for water samples of the study area.

5. CONCLUSIONS

The chemical quality of dug well, bore well and surface water samples of Atigre Village, Kolhapur District reveals that 100% samples of pre and post-monsoon seasons represent Ca +Mg > Na+K (alkaline earths exceed alkalies) hydrochemical facies. Similarly, 100% water samples belongs to HCO3 +CO3> Cl+SO4 (weak acid exceed strong acid) hydrochemical facies in pre and post-monsoon seasons. On the basis of U. S. Salinity diagram, water samples of pre and post-monsoon seasons (100%) belong to C2 - S1type suggesting good water quality for irrigation purposes. The Gibbs variation diagram suggests the chemistry of groundwater is controlled by rock dominance.

REFERENCES

[1] Ahemd,S.S.,Muzumdar,Q.H., Jahan, C. S., Ahmed, M. andIslam,S.(2002):Hydro-chemistryand classification of groundwater, Rajshani city corporation area, Bangladesh, Jr.Geol. Soc.,India, Vol.60(10),pp.441-418.

[2] APHA, AWWA, WPCFC (1992): Standard methods for the estimation of water and waste water (19TH Edn), Washingaton. D. C., pp. 6-187.

[3] Gibbs, R. J. , (1970): Mechanisms controlling World's Water Chemistry, Science, Vol. 170, pp. 1088 – 1090.

[4] ISI, Indian Standards Institution, (1983): Indian Standards Specifications for Drinking water, Pub. No. IS-10500-1983, Indian Standard Institution, New Delhi.
[5] Karanth K. R. (1987): Groundwater assessment, Tata McGraw Hill Publishing Co. Ltd., New Delhi, 720p.
[6] Panaskar, D. B., Yedekar, D.B. and Deshpande, S.M. (2007): Assessment of groundwater quality of Nanded City, Maharashtra, Gondwana Geological Magazine Special Vol. No. 11, pp. 77-86.
[7] Pawar, N. J. (1993): Geochemistry of carbonate precipitation from the groundwater in the basaltic aquifers: An equilibrium thermodynamic approach, Jr. Geol. Soc. , India, Vol. 41, pp. 119 – 131.
[8] Piper A. M. (1953): A Graphic procedure in the geochemical interpretation of water Analysis, U. S. Geol. Surv., Groundwater Note 12, pp. 50-59.
[9] Sawant, P. T. and Joshi, S. B.(1999): Groundwater potential and quality of SolapurMuncipal Corporation area, Maharashtra, Groundwater and Watershed Management, pp.77-84.
[10] Shenoy, K. K. and Lokesh K. N. (1999): Quality of groundwater of bore wells in M.I.T.,campus, Manipal, Karnataka, Ind. Jr. Env. Health, Vol.41(2), pp.144-148.
[11] Tiwari M. P. (1988): Some chemical characters of the groundwater in part of west coast, Ratnagiri and Sindhudurg Districts, Maharashtra, Jr. Geol. Soc. India, Vol.54(7), pp.23-26.
[12] Todd D. K. (1959): Groundwater hydrology, John Wiley and Sons Inc. Publ., 336p.
[13] Trivedy, R. K. and Goel, P. K.(1986): Chemical and biological methods for waste pollution studies, Environmental Publication, Karad, pp.35-96.
[14] U. S. Salinity Laboratory Staff (1954): Diagnosis and improvement of saline and alkali soils, U.S. Dept. of Agriculture Hand Book, No. 60, 160p.
[15] WHO, World Health Organization, (2004): Guideline for Drinking Water Quality, 3rd Edition (Recommendation), World Health Organization, Geneva.
[16] Yadav, A. S., Sawant, P. T., Pishte, J. B. and Sajane, A.S.(2011):Hydrogeological and groundwater quality studies of Jaysingpur town, Kolhapur district, Maharashtra, Env. Poll. Control Jour., Vol.14(6), pp. 71-76.
[17] Yadav, A. S. and Sawant, P. T.(2012): Suitability of groundwater for irrigation in the Sheri Nala Basin, Sangli District, Maharashtra, India, Asian Jr. of Water, Env. AndPollu., Vol.9, No.1, pp. 91-103.
[18]Yadav, A. S. and Sawant, P. T.(2014):Groundwater Quality assessment Studies in Sheri Nala Basin, Sangli District, Maharashtra, India, Jr. Applied Hydrol., Vol. XXVII, No.1-4, pp.