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HYDROCHEMICAL ANALYSIS OF GROUND WATER QUALITY, IN BORIGAON AREA, MAHARASHTRA

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ABSTRACT

The present study deals with hydro chemical analysis of ground water in Borigaon area. Borigaon is situated near the western coast of India at the Maharashtra-Gujarat border. The area is famous for its horticultural development for chikoo. Ground water samples were collected from 26 sites during pre-monsoon and post-monsoon season of the year 2008 and were analysed for physico-chemical characters. The results were plotted on Piper- Hill tri-linear diagram and conclusions were drawn.

KEY WORDS : Ground water, Physico-chemical characters, Piper-Hill tri-linear diagram.

INTRODUCTION

The physical and chemical parameters of ground water play a significant role in classifying and assign water quality. For irrigation water quality point of view, analysis of water generally related with determination of electrical conductivity, pH, water soluble cations and anions, salinity, water infiltration rate, specific ion toxicity etc. The chemical parameters of ground water play a significant role in classifying and assessing the water quality.

The suitability of ground water for irrigation purpose depends upon its mineral constituents. The characteristics of irrigation water that have been most important in determining its quality depends upon climatic conditions, irrigation practices, soil-water retention characteristics, crop tolerance, depth to water table and agronomic practices etc (Gupta and Gupta, 2003).

The Piper-Hill diagram is used to infer hydrogeo-chemical facies. These plots include two triangles, one for plotting cations and the other for plotting anions. The cation and anion fields are combined to show a single point in a diamond-shaped field, from which inference is drawn on the basis of hydrogeo-chemical facies concept. These tri-linear diagrams are useful in bringing out chemical relationships among ground water samples in more definite terms rather than other possible plotting methods (Kumaresan and Riyazuddin, 2006).

The US Salinity Laboratory of the Department of Agriculture adopted certain technique based on which the suitability of water for agriculture is explained.

The sodium in irrigation water is usually denoted as percentage sodium (%Na). The relative proportion of sodium in water is increased in the form of residual sodium carbonate (RSC). The measure of sodium hazard is the sodium adsorption ratio (SAR) which is used to express the reaction with the soil.

The objective of present work is hydro chemical analysis of ground water in Borigaon area.

MATERIALS AND METHODS

The present study area Borigaon is situated near the western coast of India at the Maharashtra-Gujarat border. The Borigaon is situated in Talasari Taluka in Maharashtra state. The Borigaon lies between latitude 20^0 7′ 31.23″ N and longitude 72^0 45′ 19.10″ E. The Borigaon area is famous for its horticultural development for chikoo. 80% of the land is covered by plantation of chickoo, mango, coconut, vegetables etc. The lion's share of this development

is availability of plenty of water. For irrigation of farms 95% of farmers use bore-well system. For irrigation ground water is pumped out in excessive amount. Industrial estates are situated in nearby area of Borigaon. Coast line is 2 Km away from this area.

26 ground water samples were collected from Borigaon area during pre-monsoon (April 2008) and post-monsoon period (October 2008). The locations for collection of ground water samples during pre-monsoon and post-monsoon period were kept same. The intervals between the locations were maintained more than 100m.

All the samples were collected from bore well of 60 to120 feet's depth. The pump was run for about 10 minutes prior to sampling. The water samples were collected into precleaned (and rinsed with water sample) polythene container for analysis. The proper labeling was made on each sample.

The samples were brought to laboratory for further analysis and following physico- chemical characters were analyzed. Electrical conductivity, acidity, alkalinity, chlorides, calcium, total hardness, sulphate, sodium and potassium. The analysis was done by standard methods given by APHA (1976).

RESULTS AND DISCUSSION

Table 1 presents the results of ground water analysis during pre-monsoon season.

Table 2 presents the results of ground water analysis during post-monsoon season.

Chemical classification throws light on the concentration of various predominant cations, anions and their interrelationships. A number of techniques and methods have been developed to interpret the chemical data. Presentation of chemical analysis in graphical form makes understanding of complex ground water system simpler and quicker.

Piper-Hill Tri-linear Diagram

Chemical data of the study areas are presented by plotting them on a Piper-Hill tri-linear diagram for pre-monsoon and post-monsoon season (Fig. 1 and 2 respectively). These diagrams reveal the analogies, dissimilarities and different types of waters in the study area.

Table 1. Results of water analysis during pre-monsoon season

Sample	Sp. Cond. (micro S)	Total Alka. (mg/L)	Ca^{2+} (mg/L)	Mg^{2+} (mg/L)	TH (mg/L)	Cl- (mg/L)	SO_4^- (mg/L)	Na^+ (mg/L)	K^+ (mg/L)
1.	517	225	72.14	29.23	300	35.30	16.40	200	0.2
2.	670	275	88.17	26.80	330	49.70	57.00	97	—
3.	716	290	88.17	34.11	360	69.58	8.20	300	0.2
4.	760	305	92.18	53.60	450	99.40	8.20	300	0.2
5.	955	400	76.15	51.16	400	69.58	8.23	200	0.4
6.	1240	450	76.15	58.47	430	109.34	41.00	900	1.0
7.	2640	320	60.12	141.31	730	556.64	16.40	3300	34
8.	1200	410	72.14	48.72	380	109.34	24.60	1100	1.0
9.	3060	335	120.24	134.0	850	616.28	8.20	2900	22
10.	1353	460	64.12	65.78	430	159.04	24.60	800	4.0
11.	1045	390	72.14	65.78	450	119.28	49.00	600	1.0
12.	1740	400	120.24	92.58	680	278.32	16.40	2100	2.0
13.	2220	375	188.37	92.58	850	397.60	65.00	800	3.0
14.	2680	340	72.14	75.53	490	546.70	57.00	2000	34
15.	1960	470	120.24	95.02	690	427.42	98.00	800	7.0
16.	3280	340	136.27	197.35	1150	725.62	32.90	2000	28
17.	2750	390	184.36	285.06	1170	566.58	49.00	700	7.0
18.	3800	435	140.28	231.46	1300	864.78	16.40	1500	14
19.	3610	340	136.27	141.31	920	864.78	16.40	2000	26
20.	3650	375	400.80	63.34	1260	864.78	74.00	1100	9.0
21.	3880	210	39.27	25.33	202	934.36	32.90	3800	52
22.	3400	325	112.22	114.51	750	805.14	41.15	2600	16
23.	1980	440	88.17	95.02	610	675.92	8.00	900	7.0
24.	2420	395	84.16	131.56	750	467.18	57.61	2000	15
25.	1360	480	68.13	77.96	490	178.92	24.00	600	8.0
26.	1230	450	96.19	51.16	450	129.22	57.60	400	8.5

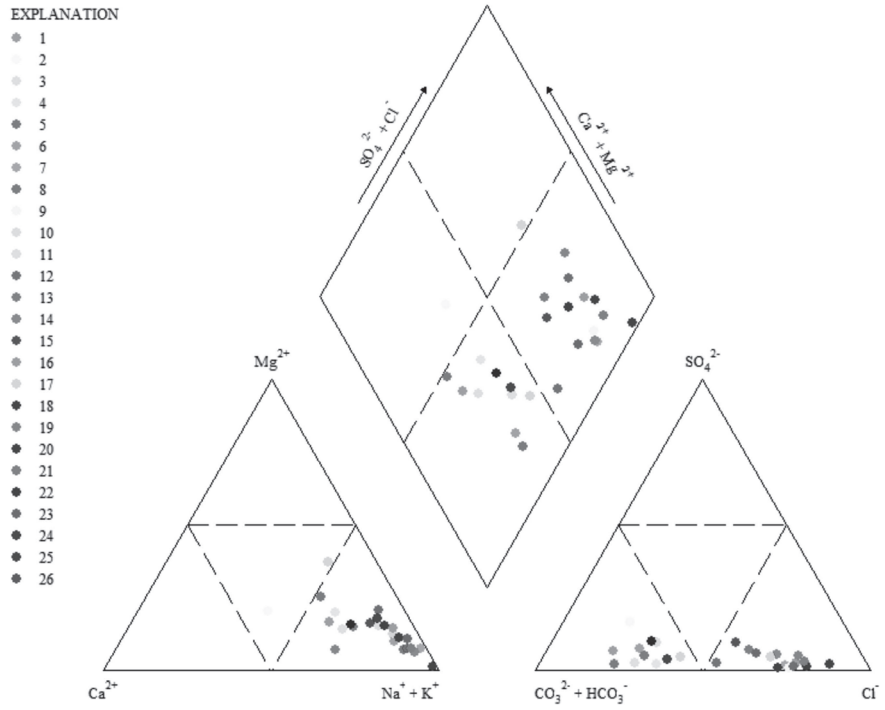

Fig. 1. Pre-monsoon ground water samples plotted in Piper Tri- linear diagram

Table 2. Results of water analysis during post-monsoon season

Sample	Sp.Cond. (micro S)	Total Alka. (mg/L)	Ca^{2+} (mg/L)	Mg^{2+} (mg/L)	TH (mg/L)	Cl- (mg/L)	SO_4^- (mg/L)	Na^+ (mg/L)	K^+ (mg/L)
1.	382	195	48.09	131.56	660	48.09	74.00	28	—
2.	656	285	124.24	77.96	630	124.24	41.15	36	—
3.	513	265	76.15	85.27	540	76.15	32.00	30	—
4.	606	290	80.16	19.49	280	80.16	32.00	36	—
5.	966	420	84.16	56.04	440	84.16	41.15	88	—
6.	2180	620	96.19	226.59	1170	96.19	115.20	500	1.0
7.	1967	505	72.14	53.60	400	72.14	205.75	600	6.0
8.	1130	450	80.16	141.31	780	80.16	74.00	60	—
9.	3140	470	200.04	109.64	950	200.04	337.43	600	2.0
10.	1292	470	68.13	119.38	660	68.13	49.00	100	2.0
11.	1077	365	92.18	119.38	720	92.18	90.00	68	0.4
12.	1953	500	156.31	82.84	730	156.31	444.42	100	1.0
13.	1710	370	168.33	82.84	1060	168.33	65.00	79	1.0
14.	1470	450	112.24	199.79	1100	112.24	57.00	200	2.0
15.	1610	370	108.21	238.77	1250	108.21	172.80	200	2.0
16.	2530	455	140.28	170.55	1050	140.28	172.83	400	6.0
17.	2470	370	168.33	165.68	1100	168.33	49.00	500	3.0
18.	3930	555	160.32	233.90	1360	160.32	222.21	700	3.0
19.	2400	340	140.28	204.66	1190	140.28	197.52	400	3.0
20.	3880	360	208.41	190.04	1300	208.41	65.80	400	3.0
21.	3360	300	84.16	41.42	380	84.16	172.83	1300	14
22.	2680	400	152.30	197.35	1190	152.30	148.14	300	3.0
23.	2270	380	96.19	221.71	1150	96.19	164.60	300	5.0
24.	1660	465	68.13	136.44	730	68.13	82.30	100	4.0
25.	1360	465	72.14	168.11	870	72.14	213.00	100	4.0
26.	1298	460	92.18	207.10	1080	92.18	148.00	100	2.0

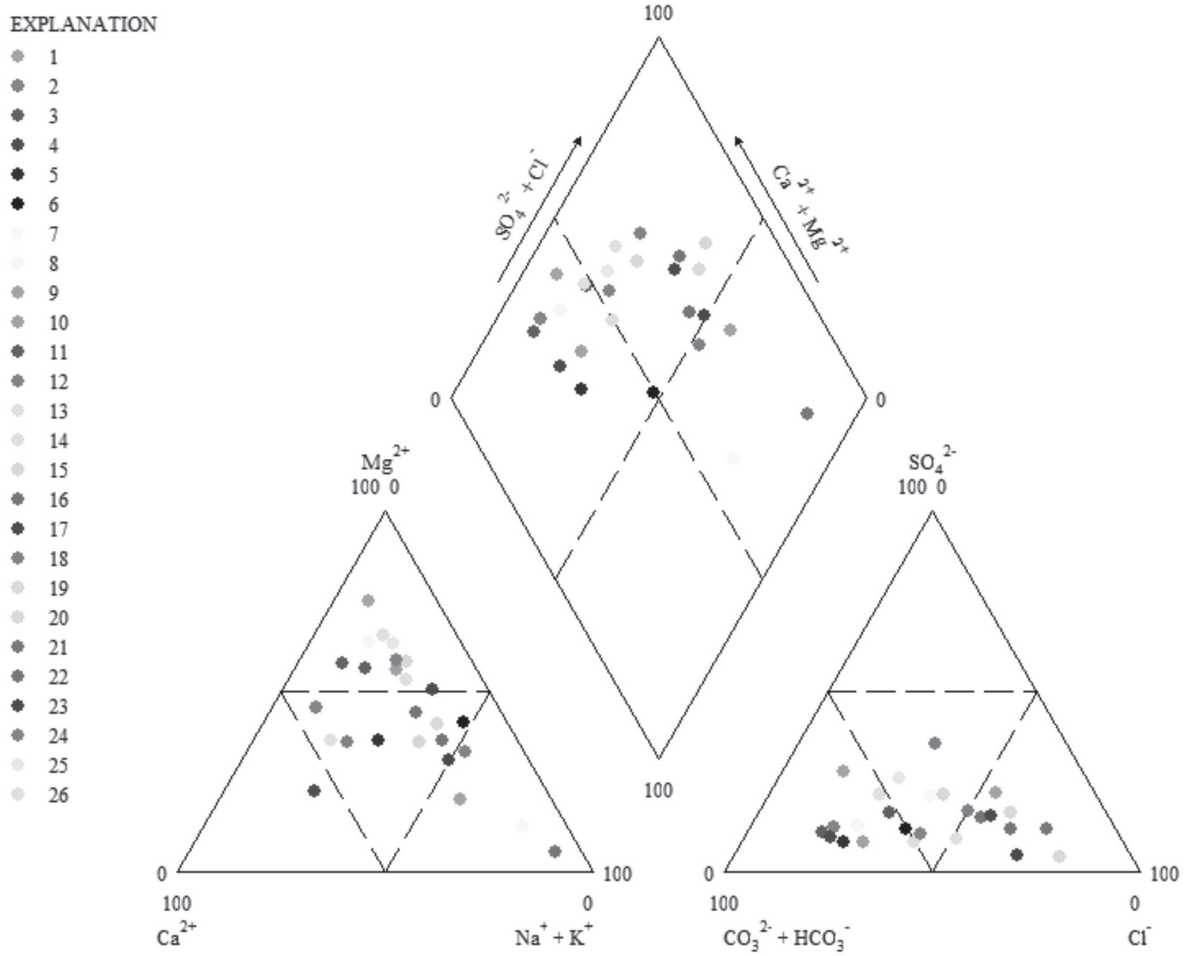

Fig. 2. Post-monsoon ground water samples plotted in Piper Tri- linear diagram

The ground water of Borigaon area is in general Na-type during pre-monsoon, which tends to change after the monsoon as indicated by the change in hydro-chemical facies, i.e. Na-type water92% samples (24 samples) to Ca–Mg type water 85% samples (22 samples) may be due to increase in solubility of calcium and magnesium minerals during rainfall. As rainfall increases there is a gradual change in the cation facies.

For anion concentration, Cl-type water with 58% samples (15 samples) during both seasons and the HCO_3-type water with 42% samples (11 samples) during both seasons.

Ground water in Borigaon area is Na-Cl type during pre-monsoon, which tends to change after the monsoon to Ca-Mg-HCO_3 type of the year 2008 as indicated by the change in hydro-chemical facies. This is may be due to increase in solubility of calcium and magnesium minerals during the rainfall.

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