

T-test Analysis of Ground Water from Borigaon area, Maharashtra

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Abstract—26 borewell water samples were analyzed during pre-monsoon and post-monsoon seasons of the year 2008 from Borigaon area which is situated near the western coast of India at the Maharashtra-Gujarat border. The ground water quality was evaluated on the basis of total hardness, percent sodium and residual sodium carbonate.

Results were statistically analyzed using Student's t-test and conclusion was drawn.

Keywords: Ground Water, Total Hardness, Percent Sodium, Residual Sodium Carbonate-test.

1. INTRODUCTION

Quality of water in the study area was deteriorating in premonsoon time. In order to take précised decision about quality of water before and after monsoon t-test analysis was done.

2. MATERIAL AND METHOD

26 borewell water samples were analyzed during pre-monsoon and post-monsoon seasons of the year 2008 from Borigaon area which is situated near the western coast of India at the Maharashtra-Gujarat border. Number of parameters were analyzed like Ca^{+2} , Mg^{+2} , Na^+ , K^+ , HCO_3^- , CO_3^{2-} during premonsoon and post monsoon seasons. The ground water quality was evaluated on the basis of total hardness, percent sodium and residual sodium carbonate. Null hypothesis and alternative hypothesis were decided. By using different formulae calculated values at 0.05 level of significance and 25 degrees of freedom were calculated and compared with standard table values and conclusions were drawn.

Null hypotheses: - There is no significant improvement in the parameter after monsoon.

Alternative hypotheses: - There is improvement in the parameter after Monsoon.

3. CONCLUSION

Parameters	Cv0.05 at df 25	Tv0.05 at df 25	Conclusion
%Na	1.62	1.71	Null hypothesis is accepted.
S.A.R.	9.36	1.71	Null hypothesis is rejected.
R.S.C.	0.007	1.71	Null hypothesis is accepted.

Hence we can conclude that for %Na and R.S.C. there was improvement in quality after rain. whereas for S.A.R. there was no improvement after rain.

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Table 1. Classification of ground water samples on the basis of %Na

Sample No.	Pre-monsoon Water		Post-monsoon Water	
	%Na	Class	%Na	Class
1	59.155	Permissible	8.437	Excellent
2	38.985	Good	11.046	Excellent
3	64.415	Doubtful	10.770	Excellent
4	59.151	Permissible	21.850	Good
5	52.045	Permissible	30.296	Good
6	81.933	Unsuitable	48.110	Permissible
7	90.260	Unsuitable	76.182	Doubtful
8	86.246	Unsuitable	14.317	Excellent
9	87.989	Unsuitable	57.786	Permissible
10	79.981	Doubtful	24.691	Good
11	74.288	Doubtful	17.015	Excellent
12	86.989	Unsuitable	22.911	Good
13	67.066	Doubtful	13.895	Excellent
14	89.067	Unsuitable	28.264	Good
15	71.323	Doubtful	25.750	Good
16	78.558	Doubtful	45.102	Permissible
17	48.126	Permissible	49.600	Permissible
18	71.200	Doubtful	52.717	Permissible
19	82.009	Unsuitable	42.123	Permissible
20	65.290	Doubtful	39.996	Good
21	96.850	Unsuitable	87.656	Unsuitable
22	87.998	Unsuitable	35.312	Good
23	75.957	Doubtful	36.040	Good
24	84.960	Unsuitable	22.809	Good
25	72.271	Doubtful	19.884	Excellent
26	65.357	Doubtful	16.710	Excellent

Table 2. Percent sodium water class

% Na	Water class
< 20	Excellent
20 to 40	Good
40 to 60	Permissible
60 to 80	Doubtful
> 80	Unsuitable

$$\% Na = \frac{Na^+}{Ca^{2+} + Mg^{2+} + Na^+ + K^+} \times 100$$

Table 3. Classification of ground water samples on the basis of RSC

Sample No.	Pre-monsoon RSC Water Suitability		Post-monsoon RSC Water Suitability	
	1	-2.315	Safe	-10.022
2	-2.096	Safe	-7.939	Safe
3	-2.451	Safe	-6.468	Safe
4	-4.009	Safe	-0.848	Safe
5	-1.450	Safe	-1.924	Safe
6	-1.232	Safe	-13.272	Safe

7	-9.376	Safe	0.269	Safe
8	-0.886	Safe	-7.344	Safe
9	-11.529	Safe	-11.312	Safe
10	-3.118	Safe	-5.513	Safe
11	-2.616	Safe	-8.434	Safe
12	-7.056	Safe	-6.416	Safe
13	-10.866	Safe	-15.158	Safe
14	-4.238	Safe	-14.655	Safe
15	-6.110	Safe	-18.971	Safe
16	-16.637	Safe	-13.568	Safe
17	-26.250	Safe	-15.960	Safe
18	-18.905	Safe	-18.971	Safe
19	-12.848	Safe	-13.568	Safe
20	-19.062	Safe	-15.960	Safe
21	-0.601	Safe	-18.129	Safe
22	-9.690	Safe	-18.258	Safe
23	-5.002	Safe	-20.127	Safe
24	-8.544	Safe	-2.688	Safe
25	-2.123	Safe	-9.803	Safe
26	-1.631	Safe	-14.091	Safe

Table 4. Suitability for irrigation water based on RSC

RSC epm	Suitability for irrigation
<1.25	Safe
1.25 to 2.5	Moderate
>2.5	Unsuitable

$$RSC = (HCO_3^- + CO_3^{2-}) - (Ca^{2+} + Mg^{2+})$$

Table 5. Classification of ground water samples on the basis of SAR

Sample No.	Pre-monsoon SAR Water Quality		Post-monsoon SAR Water Quality	
	1	5.022	Excellent	0.473
2	2.321	Excellent	0.623	Excellent
3	6.876	Excellent	0.561	Excellent
4	6.149	Excellent	0.935	Excellent
5	4.348	Excellent	1.824	Excellent
6	18.872	Doubtful	6.354	Excellent
7	53.093	Unsuitable	13.044	Good
8	24.538	Doubtful	0.933	Excellent
9	43.240	Unsuitable	8.464	Excellent
10	16.770	Good	1.692	Excellent
11	12.290	Good	1.101	Excellent
12	35.015	Unsuitable	1.609	Excellent
13	11.932	Good	1.054	Excellent
14	39.282	Unsuitable	2.621	Excellent
15	13.241	Good	2.459	Excellent
16	25.638	Doubtful	5.366	Excellent
17	7.537	Excellent	6.554	Excellent
18	18.085	Good	8.251	Excellent
19	28.667	Unsuitable	5.040	Excellent
20	13.478	Good	4.823	Excellent
21	116.275	Unsuitable	29.00	Unsuitable
22	41.276	Unsuitable	3.780	Excellent

23	15.842	Good	3.845	Excellent
24	31.748	Unsuitable	1.608	Excellent
25	11.784	Good	1.473	Excellent
26	8.199	Excellent	1.322	Excellent

Table 6. Suitability of water for irrigation purpose based on USSL classification

Sodium hazard class	SAR epm	Remark on quality
S1	<10	Excellent
S2	10 to 18	Good
S3	18 to 26	Doubtful
S4	>26	Unsuitable