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# ASSESSMENT OF GROUND WATER QUALITY OF PEESANGAN BLOCK OF AJMER DISTRICT

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## ABSTRACT

Physicochemical study of the ground water of some rural areas of Peesangan Block of Ajmer district has been carried out to examine the suitability of water for drinking, irrigation and other domestic purposes. Water samples from these areas were collected during Pre-Monsoon (April-June) and Post monsoon seasons (Oct-Dec) of the year 2013. The data were analyzed for mainly Electrical Conductivity (EC), Total Dissolve Solids (TDS), Chloride (Cl<sup>-</sup>), Fluoride (F<sup>-</sup>), Nitrate (NO<sub>3</sub><sup>-</sup>), Total Hardness, Alkalinity, Sodium (Na<sup>+</sup>), Potassium (K<sup>+</sup>), Carbonates (CO<sub>3</sub><sup>2-</sup>), Bicarbonates (HCO<sub>3</sub><sup>-</sup>) etc. with reference to BIS and WHO standards. It has been observed that most of the water samples have concentration of different parameters beyond the permissible limits. The ground water of the present study area was not found suitable for drinking and other domestic purpose.

**Key Words:** Ground water of rural area, Physicochemical characteristics, Drinking water, Water pollution.

## INTRODUCTION

Water is one of the five (Earth, Air, water, fire and space) essential elements of life. The safe potable water is absolutely essential for healthy living. Ground water is ultimate and most suitable fresh water resource for human consumption in both urban as well as rural areas. There are several states in India where more than 90% population is dependent on groundwater for drinking and other purpose (Ramachandriah, 2004). Ground water is also being used frequently as the alternative source for agriculture and industry. Importance of ground water for existence of human society cannot be overemphasized.

India is a vast country with varied hydrogeological situations resulting from diversified geological, climatological and topographic settings. The natural chemical composition of ground water is influenced predominantly by type & depth of soils and subsurface geological formations through which ground water passes. Ground water quality is also influenced by the atmosphere and surface water bodies. There are various ways of contamination of ground water such as use of fertilizers in farming seepage from effluent bearing water body, industrial discharge etc.

Now a days qualitative analysis of ground water is very important as compared to the quantity available (Hem. J. D.). However ground water quality have not received much attention al-

though it is a one of the most important tool in Environmental impact assessment (EIA) (Krishna Rao, P.R. 1971.), so attention on quality of ground water and to aware each person for their right of safe water for drinking and other domestic uses. Water is one of the most important compounds to the ecosystem. Better quality of water can be described by its Physical, Chemical and Biological characteristics. But some correlations are possible among these parameters and the significant one would be useful to indicate quality of water. Due to increased population, industries, use of fertilizers in agriculture and Man-made activity, drinking water gets contaminated and due to use of Contaminated Drinking water, Human Population Suffers From a variety of water borne diseases, so it becomes necessary to evaluate the Quality of Drinking water which should be done at regular intervals of time. It is difficult to understand The Biological Phenomena fully because the Chemistry of water reveals much about the metabolism of the ecosystem and explain the general Hydro biological relationship. The physicochemical parameters of water and the dependence of all life process of these.

## STUDY AREA

Peesangan is a Tehsil in Ajmer District of Rajasthan State of India. The latitude 26.38°37'195" and longitude 74.41°05'291" are the geo-coordinates of the Peesangan

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tehsil. It belongs to Ajmer Division. It is located 31 KM towards west from District headquarters Ajmer, 180 km from State capital Jaipur towards East. Peesangan Tehsil is bounded by Riyan Badi Tehsil towards North, Ajmer Tehsil towards East, Beawar Tehsil towards South, Masooda Tehsil towards South. Ajmer City, Beawar, Nasirabad, Merta City are the nearby Cities to Pisangan. It is in the 438 m elevation (altitude). Near destinations for visit of tourist are Pushkar, Ajmer, Kishangarh, Kuchaman, Khimsar.

## MATERIALS AND METHODS

Water samples were collected from various ground water sources covering the study area in two different seasons Pre-monsoon and Post-monsoon season of the year 2013. Samples were collected into pre-cleaned polyethylene bottles of one liter capacity with utmost care to avoid any kind of contamination and were brought to laboratory for the estimation of various physicochemical parameters. Volumetric and instrumental techniques were adopted for systematic analysis of the water samples using Standard procedures [APHA, BIS]. The analysis was carried out for estimation of pH, EC, TDS, Alkalinity, Hardness, Chloride, fluoride, Nitrate etc. The reagents were standardized from Standard solutions and instruments were calibrated by known standards before analysis. The reagents of AR grade were used for analysis work and double distilled water was used for preparation of solutions.

## RESULTS AND DISCUSSION:-

The results of Physicochemical Parameters obtained and seasonal variation are presented in Table 1.1 & 1.2

In general Salinity, alkalinity, fluoride, nitrate and TDS are the major factors, which affect the water quality most.

**pH:** As observed in the tables 1.1 & 1.2 the pH of ground water in this area varies within minimum 7.5 to maximum 8.5 in both seasons. Almost all the water samples in this area are alkaline in nature though the values of pH of all water samples were found to be within the permissible limits in both seasons. The standard limits prescribed by WHO and IS 10500:2012 are 6.5- 8.5.

**Electrical Conductivity (EC):** E.C. depends on the concentration of dissolved mineral matter content. The salt concentration is generally measured by detecting EC. In the present study area the EC has been observed from 942 to 9771  $\mu\text{S}\cdot\text{cm}^{-1}$ . About 60 % water samples have EC more than permissible limit. If the TDS is high then EC will be high [Tiwari, T.N.; Das, S.C.; Bose, P.K. Poll. Res 1986].

**Total Dissolved Solids(TDS):**The value of T.D.S. is very important for the assessment of water quality (Ahmad Ashfaq and Faizan Ahmad 2014). High TDS value of water indicates the higher mineralization of water. The desirable limit for TDS is 500 mg/L and maximum permissible limit is 2000 mg/L (Maruthi and Rao, 2004). As the result of analysis the values of total dissolved solid ranges from 660 to 6840 mg/L during pre-monsoon and 780 to 6280 mg/L in Post-monsoon season. Maximum TDS has been observed at handpump, Gomawat Mohalla near tanki in Tabiji village. About 46% samples have TDS beyond permissible limit of 2000 mg/L. It concludes that mostly water is saline in Peesangan block of Ajmer district. This shows that anthropogenic impact which can be due to agricultural activity leading to local spatial and temporal variability of runoff (Chatterjee, R. Gourab 2010). Away from the permissible level, palatability decreases and may cause gastrointestinal irritation.

**Alkalinity:** Alkalinity of the water is due to presence of carbonates, bicarbonates and hydroxide salts. The alkalinity values in the study area were recorded between 260 to 1220 mg/L in pre monsoon season and 220 to 1220 mg/L during Post-monsoon season. The hydroxide, carbonates and bicarbonate probably released from limestone sedimentary rocks, carbonate rich soils, cleaning agents etc.( Tiwari, T.N. Mishra). The Maximum value (1220 mg/l) is observed in Open well situated at Mayapur Road in Naharpura village and minimum value (220mg/l) recorded at Handpump, Bus stop, Daurai village. The Maximum permissible level of alkalinity is 600 mg/L (BIS Standard). About 83 %of water samples tested were found to be within permissible limits. High amount of alkalinity in water is harmful for irrigation which leads to soil damage and reduces crop yields.

**Chloride (Cl):** All the natural types of water contain chlorides. Chloride is added to water due to the agricultural activities, industries and chloride rich rocks. it is a widely distributed element in all types of rocks in one or the other form. Its affinity towards sodium is high. High concentration of chloride is due to the invasion of domestic wastes and disposals by human activities (Jha and Verma, 2000). Soil porosity and permeability also play a key role in building up the chlorides concentration (Chanda D K, 1999). According to IS:10500:2012 the desirable limit of chloride is 250 mg/L and the permissible limit is 1000mg/l. In the present analysis, chloride concentration lies between the range of 90 mg/L to 2370 mg/L in pre-monsoon season and Minimum and Maximum values are decreasing in post monsoon seasons.(120 to 2270 mg/l). The highest value of 2370 mg/l is observed at Handpump of Gomawat Mohalla of Tabiji village. Excessive chloride in water is particularly not harmful but increase of chloride level in water is injurious to People suffering from heart and kidney diseases.(Sudhir Dahiya and Amarjeet Kaur, 1999).

**Hardness:** The total hardness is the measure of the capacity of water to precipitate soap. Hardness of the water is due to presence of Ca and Mg salts. Usually the hardness is not harmful to health but it has been suspected to play some role in heart diseases (Ahmad Ashfaq and Faizan Ahmad 2014). In this study area, the range of total hardness was found to be from 260 mg/L to maximum 3880mg/L in Pre-monsoon season and 320mg/L to 3050mg/L in Post-monsoon season in more than 50% of samples hardness as crossed permissible limit. The hardness of the water is due to dissolved minerals from sedimentary rocks through seepage and runoff (Milovanovic, M. Desalination 2007), Detergents and soaps also aggravate the situations. The standard limits of total hardness are 200 to 600 mg/l. as per IS 10500:2012.

**Sulphate (SO<sub>4</sub>):** In Present study area the sulphate values exhibited between 16 to 660 mg/l in pre monsoon season, and 16 mg/l to 555 mg/l. in Post-monsoon season Sulphate occurs naturally in water as a result of leaching from gypsum and other common minerals(Gupta S, Kumar A, Ojha C K and Singh G, 2004).Discharge of industrial wastes and domestic sewage tends to increase concentration of sulphate in water. Only 3 samples have concentration beyond the permissible limit as prescribed by IS 10500:2012 (400 mg/l.).High concentration of sulphate may cause gastro intestinal irritation particularly when concentration of magnesium and sodium is high.

**Nitrate(NO<sub>3</sub>):** The values of nitrates in the study area were recorded between 30 mg/L and 860 mg/L.About 75% of samples exceed the desirable limit of 45 mg/L. If the concentration of nitrate is higher than 45 mg/L, it will cause a disease called blue baby disease or methaemoglobinaemia in infants [Maruthi Devi, C.H.; Usha Madhuri, T. Nature, 2011]. The high level of nitrate in study area has reported that nitrate contamination of water is due to increasing use of nitrogenous fertilizers and nitrites can cause depletion of dissolve oxygen content of water [D. Fairchild,1987&A.T.Ajao, G. B. Adebayo and S. E. Yakubu J. Microbiol. Biotech. Res., 2011]. NAEP have concluded that residual nitrate in the soil in the major cause of nitrate contamination in ground water. The appreciable quantities of nitrates and nitrites found in these investigations have some public health implications.

**Calcium:** The Calcium in the sampling sources ranges from 48 to 808 mg/L during pre-monsoon season and 48 to 660 mg/L during Post-monsoon season of 2013. In most of the samples it falls above the desirable limit of 75 mg/L(IS:10500:2012), and only 30% samples have calcium concentration above the permissible limit of 200 mg/L. The higher value is mainly attributed due to the abundant availability of lime stone in the area. Consequently more solubility of calcium ions is present.

**Magnesium** In these samples, the minimum concentration

of magnesium has been increased from 26 mg/L in Pre-monsoon to 36 mg/L in Post- monsoon season. But the maximum value decrees from 446 mg/L to 336 mg/L in post-monsoon season 2013.In all most of all the samples magnesium falls above the standard desirable limit 30 mg/L in both seasons. The concentration of magnesium may be due the dissolution of magnesium calcite, gypsum and dolomite [Garrels, R.M.;Christ, C.L. 1965 , Rao, S.N. 1997].

All the major parameters in both seasons were found to be in excess of the desirable limit given by WHO / ICMR / IS (10500:2012) standards, so that water quality of the study areas of poor quality as shown in the analysis tables 1.1& 1.2 Further the comparative Water Quality values have been shown in the bar Diagrams.

## CONCLUSION

The above observations in the present study indicate that about 75% samples exceed he permissible limits of most of the parameters of the samples. So the ground water of the Peesangan belt is saline in nature and unpotable for drinking and other domestic uses. They need to minimize the use of ground water for drinking purposes without treatment. The government is making new plans for supply of clean fresh treated water for drinking and other domestic uses for the population of the study area.

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**TABLE 1.1**  
**PHYSICO - CHEMICAL CHARACTERIZATION OF WATER SAMPLES OF PEESANGAN BLOCK OF AJMER DISTRICT**  
**( PRE MONSOON 2013)**

S. NO.	pH	EC	TDS	TA	TH	Ca	Mg	CO3	HCO3	SO4	Cl	F	NO3	Na	K	% Na	SAR	RSC
		µS/cm	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	meq/L	meq/L
1	7.7	2086	1460	320	510	108	58	0	390	98	350	0.5	122	232	4.0	49.66	4.48	-3.73
2	7.8	6414	4490	690	1500	352.0	148.8	0.0	841.8	294	1460	0.3	167	758	22.0	52.05	8.54	-16.01
3	7.6	5143	3600	350	1130	200	151	0	427	220	1200	5.8	350	636	35.0	54.27	8.26	-15.42
4	7.5	8286	5800	790	2230	508.0	230.4	0.0	963.8	256	1670	0.7	860	856	17.0	45.42	7.91	-28.51
5	7.6	5029	3520	590	1430	348.0	134.4	0.0	719.8	220	1120	0.3	120	396	162.0	34.60	4.57	-16.62
6	7.8	3429	2400	290	660	172	55	0	354	48	830	1.1	222	478	2.0	61.21	8.12	-7.33
7	7.8	1843	1290	390	440	96.0	48.0	0.0	475.8	16	340	1.8	45	210	14.0	50.10	4.37	-0.94
8	7.6	7414	5190	710	2450	536.0	266.4	0.0	866.2	480	1490	0.6	481	522	96.0	30.76	4.60	-34.46
9	7.6	9771	6840	440	3880	808.0	446.4	0.0	536.8	550	2370	0.6	560	422	54.0	18.97	2.96	-68.24
10	7.7	2143	1500	310	440	92	50	0	378	46	430	0.7	95	272	4.0	57.24	5.66	-2.54
11	8.1	1314	920	380	320	80.0	28.8	0.0	463.6	52	90	1.5	125	82	104.0	28.34	2.00	1.24
12	7.8	1843	1290	260	410	48	70	0	317	22	390	1.4	92	226	2.0	54.61	4.88	-2.92
13	7.8	1786	1250	370	450	92.0	52.8	0.0	451.4	142	200	1.3	61	172	12.0	44.74	3.54	-1.54
14	7.8	2043	1430	440	410	80.0	50.4	0.0	536.8	218	210	1.2	42	171	148.0	38.42	3.69	0.66
15	8.2	2800	1960	490	600	124.0	69.6	0.0	597.8	262	450	1.4	58	362	8.0	56.51	6.45	-2.12
16	8.3	5500	3850	1220	2220	512.0	225.6	12.0	1464.0	660	580	1.2	30	242	4.0	19.23	2.24	-19.71
17	8.2	2400	1680	320	260	60.0	26.4	0.0	390.4	132	340	1.7	250	299	174.0	57.49	8.09	1.23
18	7.9	1643	1150	360	630	92.0	96.0	0.0	439.2	52	230	1.9	97	82	2.0	22.15	1.43	-5.29
19	7.9	1986	1390	280	780	164.0	88.8	0.0	341.6	92	260	0.8	261	82	4.0	18.62	1.28	-9.89
20	7.9	3286	2300	410	870	212.0	81.6	0.0	500.2	232	490	0.6	310	264	124.0	35.95	3.91	-9.09
21	7.8	1071	750	270	370	80.0	40.8	0.0	329.4	42	110	0.9	60	64	4.0	27.20	1.45	-1.95
22	8.3	2071	1450	560	440	92.0	50.4	24.0	634.4	110	170	0.8	140	232	55.0	49.87	4.83	2.46
23	7.9	943	660	280	360	76.0	40.8	0.0	341.6	16	90	0.8	50	48	2.0	22.48	1.10	-1.55
24	8.0	3700	2590	370	830	168.0	98.4	0.0	451.4	148	690	0.9	417	420	78.0	49.72	6.36	-9.08
25	7.8	2614	1830	480	570	108.0	72.0	0.0	585.6	112	430	0.6	70	312	12.0	53.88	5.71	-1.71
26	7.6	1471	1030	300	390	84.0	43.2	0.0	366.0	142	160	0.9	32	148	5.0	44.98	3.27	-1.75
27	7.8	3229	2260	520	790	224.0	55.2	0.0	634.4	72	430	0.4	478	354	26.0	48.45	5.49	-5.32
28	7.7	7059	4941	690	1570	388.0	144.0	0.0	841.8	370	1230	0.8	820	790	154.0	49.44	8.70	-17.41



**TABLE 1.2**  
**PHYSICO - CHEMICAL CHARACTERIZATION OF WATER SAMPLES OF PEESANGAN BLOCK OF AJMER DISTRICT**  
**( POST MONSOON 2013)**

Sample no.	pH	EC	TDS	TA	TH	Ca	Mg	CO3	HCO3	SO4	Cl	F	NO3	Na	K	% Na	SAR	RSC
		µS/cm	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	meq/L	meq/L	meq/L
1	7.7	2000	1400	300	480	100	55	0.0	366	98	340	0.2	112.0	222.0	8.0	49.80	4.42	-3.53
2	7.7	6143	4300	740	1400	316	146	0.0	903	220	1380	0.3	155	760.0	8.0	54.13	8.87	-13.02
3	7.6	5000	3500	400	1120	200	149	0.0	488	220	1120	4.5	325	615.0	38.0	53.56	8.03	-14.22
4	7.6	8143	5700	790	1920	408	216	0.0	964	200	1680	0.7	860	950.0	62.0	50.99	9.46	-22.33
5	7.7	4971	3480	580	1380	312	144	0.0	708	207	1120	0.5	120	400.0	180.0	35.21	4.70	-15.82
6	7.5	3429	2400	350	700	180	60	0.0	427	42	800.0	0.5	190.0	444.0	4.0	57.94	7.32	-6.92
7	7.9	1714	1200	360	440	84	55	0.0	439	16	310	1.8	45	186.0	2.0	47.95	3.87	-1.53
8	7.7	6929	4850	520	2180	392	288	0.0	634	498	1440	0.6	460	550.0	58.0	34.84	5.14	-32.85
9	7.5	8971	6280	480	3050	660	336	0.0	586	386	2270	1.1	475	620.0	54.0	30.33	4.90	-50.98
10	7.8	1843	1290	290	420	92	46	0.0	354	28	380	1.0	66.0	222.0	4.0	53.35	4.73	-2.54
11	7.9	1571	1100	420	350	80	36	0.0	512	48	150	1.5	110	144.0	82.0	40.90	3.36	1.44
12	7.5	1714	1200	220	360	48	58	0.0	268	22	370	1.2	86.0	220.0	4.0	56.94	5.07	-2.73
13	7.8	1800	1260	430	460	80	62	0.0	525	110	210	1.3	65	186.0	14.0	46.04	3.79	-0.53
14	7.9	2000	1400	380	410	76	53	0.0	464	156	300	1.2	35	184.0	140.0	40.59	3.97	-0.54
15	8.3	2743	1920	460	600	120	72	24.0	512	190	460	1.5	52	334.0	12.0	54.32	5.95	-2.71
16	7.9	5357	3750	1220	2220	488	240	0.0	1488	555	590	1.2	30	204.0	4.0	16.72	1.89	-19.70
17	7.9	2400	1680	380	320	56	43	0.0	464	110	340	1.7	250	330.0	102.0	61.58	8.06	1.25
18	7.9	1643	1150	350	600	112	77	0.0	427	52	230	1.9	97	98.0	4.0	26.20	1.75	-4.91
19	8.0	1986	1390	300	730	160	79	0.0	366	58	280	0.8	261	110.0	10.0	24.49	1.78	-8.50
20	7.6	3286	2300	500	810	160	98	0.0	610	180	490	0.5	300	298.0	126.0	40.18	4.57	-6.08
21	7.6	1171	820	300	360	68	46	0.0	366	30	130	1.0	60	92.0	8.0	35.26	2.12	-1.15
22	8.5	1971	1380	520	460	88	58	60.0	512	90	180	1.1	120	222.0	22.0	49.91	4.52	1.27
23	7.8	1114	780	310	370	76	43	0.0	378	35	120	1.1	42	68.0	12.0	27.88	1.54	-1.15
24	7.8	3457	2420	390	750	132	101	0.0	476	150	610	0.6	380	420.0	42.0	53.38	6.70	-7.08
25	7.6	2543	1780	530	570	112	70	0.0	647	60	440	0.6	60	300.0	25.0	52.19	5.49	-0.72
26	7.5	1586	1110	350	380	80	43	0.0	427	94	190	1.1	45	172.0	4.0	49.45	3.85	-0.55
27	7.9	3171	2220	530	790	176	84	0.0	647	60	480	0.5	370	350.0	18.0	48.52	5.44	-5.10
28	7.9	7000	4900	720	1440	320	154	0.0	878	300	1290	0.8	790	854.0	156.0	53.26	9.82	-14.21





