

## Study of Some Physical & Chemical Characteristic Properties of Ground Water in the Villages of Veeraghattam and Palakonda Mandals in Srikakulam District, A.P, India

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### ABSTRACT

Human beings require potable water for drinking to keep them healthy. Clean, safe and adequate fresh water is vital to the survival of all living organisms. Drinking water affects the health of human beings due to the presence of various dissolved chemical constituents. Problems arising out of chemical constituents in drinking water are different from the problems of microbial contamination. Therefore, consumers should have at least minimum knowledge on quality of drinking water. People across the world depend on ground water for drinking. Ground water is a major source, so based on the importance of the matter; a research topic is taken up on the assessment of quality of groundwater in the selected areas of villages in Veeraghattam and Palakonda Mandals of Srikakulam District, Andhra Pradesh. This preliminary study assessed the quality of physical and chemical characteristic properties of underground water in the selected locations of 40 villages in Veeraghattam and 39 villages in Palakonda Mandals of Srikakulam District. Some physico chemical characteristic parameters are estimated in the samples and the results obtained are compared with the available standard values such as WHO and BIS.

**Key words:** Quality of underground water, Veeraghattam and Palakonda Mandals.

### INTRODUCTION

Water is renewable natural resource of earth and sustains the needs of all living creatures in the world<sup>1</sup> and health depends on the availability of drinking water. It is considered a basic human right and a part of effective policy<sup>2</sup> for protection of health.

Groundwater is one of the major sources of drinking water in both urban and rural India and the quality comprises the physical, chemical, and biological properties of ground water. *Quantity and Quality Management*<sup>3</sup> of groundwater presents the best of current thinking on managing groundwater resources. It focuses on the interrelationship

between quantity and quality. Potable ground water is an essential resource, yet it is exploited and contaminated<sup>3</sup> in developed and developing countries.

Water quality has significant role in human health and both natural and anthropogenic effects<sup>4</sup> govern the quality of ground water within a region. Availability of potable drinking water is essential to human health<sup>5</sup> all over the world. If groundwater contains high amount of various ions and salts, using it for leads to various water borne diseases<sup>6</sup>.

Groundwater is considered as one of major part of the purest forms of water available in Nature to serve the needs of rural and urban people. Major

part of the Indian populace depends upon freshwater supplies from open wells, ponds, bore wells, natural springs etc. In addition to this, also groundwater is continuously used for irrigation in rural India. Due to increased human population, growth of industrial activities, dumping of industrial waste, improper disposal of garbage, use of fertilizers in agriculture and manmade activities, quality of water is polluted in most areas. Rapid growth in population and the quick pace of industrialization required more potable water and this need affected the quality of water<sup>7</sup>. Enormous use of fertilizers and poor conditions in agricultural development led to the damage of human health<sup>8</sup>. Taking all these factors are consideration, the researchers conclude that people should have at least minimum knowledge on quality of drinking water.

The groundwater quality is assessed to find out the presence of physico-chemical substances and these substances widely change<sup>9</sup> due to the conditions like pollutions of various types, variations in monsoon and overutilization of potable groundwater etc. Therefore, it is mandatory to monitor the quality of potable ground water to alleviate the problem of pollution in water and pollution causing agents are to be controlled. Human welfare has directly related to the quality of ground water. Therefore, monitoring the water quality is one of the essential<sup>10</sup> issues of drinking water management. This research work attempts to evaluate the some physical and chemical parameters of potable groundwater in the selected locations of villages in Veeraghattam and Palakonda Mandals of Srikakulam District, Andhra Pradesh.

## EXPERIMENTAL

### Water sampling

The water samples are collected as per standard procedure<sup>11</sup> in the month of February 2013 and March 2014 from the selected sites in the villages of Veeraghattam and Palakonda Mandals. They are analyzed immediately for various parameters or preserved safely by taking care with suitable standard precautionary methods to avoid deterioration/alteration. All the water samples are collected in 2 Liters plastic bottles that were washed and double rinsed with distilled water before sampling. The list of sample collection areas/villages

in Veeraghattam and Palakonada are given in the Table 1.

### Instruments used

The following instruments like UV-Visible Double beam Spectrophotometer (Model AU – 2701, Systronics), Digital pH meter (Model 335, Systronics), Nefleometer (Model 132, Systronics), Digital Conductometer (Model 306, Systronics), Micro processor based bunch P<sup>H</sup> / Ion meter, Cyber scan 2100, Eutech instruments (USA) with fluoride sensitive electrode are used to analyze for various constituents present in groundwater samples.

### Chemicals used

All the Chemicals used are of Analytical Reagent Grade (Merck, BDH and Qualigens) and the solutions are prepared by using triply distilled water. The following solutions are used in this research work like Potassium hydrogen phthalate, Potassium hydrogen phosphate, Potassium dihydrogen phosphate, Calcium Carbonate, EDTA, Na<sub>2</sub>CO<sub>3</sub>, HCl, NaCl, AgNO<sub>3</sub>, Sodium oxalate, Potassium permanganate, Ferrous Ammonium Sulphate, K<sub>2</sub>Cr<sub>2</sub>O<sub>7</sub>, concentrated nitric acid, Hypo, 10 % BaCl<sub>2</sub>, 10% KI, 1000 ppm of fluoride and Nitrite solution, stock phenol solution, 4-aminoantipyrine, Potassium ferricyanide, chloroform, Ammonium chloride-ammonium hydroxide buffer solution, TISAB Buffer, AgNO<sub>3</sub> – Nitric acid reagent, Vanadate – molybdate reagent, 0.5% Sulphanalamide reagent and indicators of phenolphthalein, methyl orange, EBT, Muroxide, K<sub>2</sub>CrO<sub>4</sub> and 1% Starch.

### Estimation of various constituents in water

Estimation of various constituents present in the groundwater like pH, Electrical Conductivity (EC), Turbidity, Total Dissolved Solids (TDS), Alkalinity, Total Hardness (TH), Fluoride (F<sup>-</sup>), Chloride (Cl<sup>-</sup>), Nitrite (NO<sub>2</sub><sup>-</sup>), Dissolved Oxygen (DO) and Phenol are estimated by respective methods<sup>12</sup>.

## RESULTS AND DISCUSSION

Forty water samples are collected from Veeraghattam Mandal and thirty-nine water samples in the Palakonda mandal of Srikakulam District in the month of February 2013 and March 2014. The results related to analyzed physico chemical parameters in

**Table1: List of sample collection sites in Veeraghattam and Palakonda Mandal**

Sample	Veeraghattam mandal		V38	Hussenpuram	Open well
	Location/Villages	Source			
V1	Veeraghattam	Open well	V39	Venkampeta	Open well
V2	Veeraghattam	Bore well	V40	Achipuvalasa	Bore well
V3	Veeraghattam	Bore well	P1	Sirikonda	Bore well
V4	Veeraghattam	Open well	P2	Velaga vada	Open well
V5	Veeraghattam	Bore well	P3	Velaga vada	Tap water
V6	Veeraghattam	Open well	P4	P.R.Rajupeta	Bore well
V7	Talavaram	Bore well	P5	Singannavalasa	Bore well
V8	Panasa Nandivada	Bore well	P6	Parasurama puram	Bore well
V9	Neelanagaram	Bore well	P7	N.K.Rajapuram	Open well
V10	Tettangi	Bore well	P8	Kondapuram	Bore well
V11	Bitiwada	Bore well	P9	Vadama	Bore well
V12	Adaru	Open well	P10	Ampili	Open well
V13	Bodlapadu	Bore well	P11	Annavam	Bore well
V14	Regulapadu	Open well	P12	Goidapeta	Open well
V15	Kella	Open well	P13	Chinna Mangalapuram	Bore well
V16	Nadimikella	Bore well	P14	PeddaMangalapuram	Bore well
V17	Kambar	Bore well	P15	Gopalapuram	Bore well
V18	Kambaravalasa	Bore well	P16	Navagam	Open well
V19	Vikrampuram	Bore well	P17	Avalangi	Bore well
V20	Nadukuru	Bore well	P18	G.Venkatapuram	Open well
V21	Santha Narsipuram	Bore well	P19	Potli	Open well
V22	Mahadevavalasa	Bore well	P20	R.B.R.Peta	Open well
V23	Dasamanthuram	Bore well	P21	Dolamada	Open well
V24	Chalivendri	Open well	P22	Jamparakota	Bore well
V25	Buruga	Bore well	P23	Baddumasingi	Bore well
V26	S.Gopalapuram	Open well	P24	Singupuram	Bore well
V27	Kottugummada	Bore well	P25	Malle veedu	Open well
V28	Kottugummada	Open well	P26	Padmapuram	Bore well
V29	Gadagamma	River water	P27	Basuru	Bore well
V30	Tudi	Bore well	P28	V.P.Rajupeta	Bore well
V31	Tudi	Open well	P29	Lovidi Laxmipuram	Bore well
V32	Chdimi	Bore well	P30	Kotipalli	Open well
V33	Palametta	Bore well	P31	Gudivada	Open well
V34	Kummidi	Open well	P32	Garugubilli	Bore well
V35	Gangampeta	Bore well	P33	Lumburu	Bore well
V36	Rajapuram	Open well	P34	Tampatapalli	Open well
V37	Kattula Kaviti	Open well	P35	Tumarada	Open well
			P36	Attali	Bore well
			P37	Panukuvalasa	Bore well
			P38	Voni	Bore well
			P39	Chintada	Bore well

V samples - Veeraghattam Mandal area and P samples - Palakonda Mandal area.

the sample areas are presented in the Tables 2, 3, 4 & 5 and these values are compared to established standard values like WHO<sup>13</sup> and BIS<sup>14</sup>.

#### pH

It is one of the important factors of ground water. pH is under the desirable limit all the samples of study area as per WHO and BIS.

**Electrical conductivity**

Ground water can be assessed with the measurement of conductivities and this indicates

level of the concentration of the TDS and major constituents. In the samples of (V1 to V6, V20 and V32) Veeraghattam Mandal and the samples of

**Table 2: Various constituents present in the water samples in Veeraghattam mandal (February 2013)**

Sample	EC	pH	Turbidity	TDS	TH	F <sup>-</sup>	Cl <sup>-</sup>	DO	Total alkalinity	Nitrite	Phenol
V1	2370	7.70	6.04	1731	359	0.62	243	6.31	753	0.011	
V2	2410	7.75	1.24	1565	268	1.90	291	5.47	907	0.012	
V3	2480	7.43	2.68	1695	608	0.95	363	4.63	716	0.014	
V4	2050	7.80	0.14	1073	450	0.90	267	4.52	481	0.015	
V5	3541	7.01	1.84	2860	1751	0.58	737	7.94	605	0.016	
V6	2000	7.72	2.74	1318	297	0.79	273	5.05	580	0.065	
V7	788	7.15	4.72	521	349	0.72	127	5.05	185	0.015	
V8	526	7.80	0.24	272	287	0.97	39	7.57	278	0.016	
V9	1870	7.90	1.54	1100	502	2.90	366	5.05	426	0.021	
V10	593	7.54	4.52	366	249	0.80	94	5.47	179	0.025	
V11	1270	7.36	1.64	288	612	1.20	249	6.31	297	0.020	
V12	685	7.49	2.94	1660	273	0.66	96	5.89	241	0.023	
V13	848	7.46	0.84	543	368	1.50	140	5.89	315	0.021	
V14	867	7.57	1.04	44	416	1.20	141	6.31	321	0.030	
V15	656	7.48	1.54	454	340	1.20	77	7.15	352	0.113	
V16	627	7.65	1.14	548	244	1.20	50	6.73	377	0.023	
V17	1220	7.50	0.74	293	550	2.30	152	5.05	481	0.032	
V18	1880	7.35	0.64	953	579	0.90	326	5.05	537	0.099	
V19	1080	7.45	0.64	1200	545	0.90	153	5.47	377	0.027	
V20	2280	7.24	1.14	1050	833	1.80	440	7.15	722	0.091	
V21	716	7.14	2.74	451	391	0.20	36	5.47	441	-	
V22	1230	7.66	1.44	1154	574	0.12	232	7.85	335	-	
V23	446	6.99	0.84	303	267	0.09	48	4.63	288	-	
V24	689	7.09	0.84	406	326	0.11	116	5.89	259	-	
V25	1380	7.29	2.84	936	445	0.10	259	7.99	288	-	
V26	605	7.12	0.54	439	257	0.33	77	5.05	347	-	
V27	1300	6.92	1.05	780	505	0.45	222	5.89	359	-	
V28	1690	6.86	0.74	190	594	0.39	326	7.57	412	-	
V29	316	7.64	0.40	775	148	0.09	43	6.89	177	-	
V30	1160	6.56	0.36	969	485	0.14	208	4.63	265	-	
V31	574	7.49	1.08	261	242	0.09	90	5.89	229	-	
V32	2200	6.90	0.38	1809	658	0.64	404	3.94	535	-	
V33	831	7.12	0.47	585	406	0.34	109	4.26	365	-	
V34	710	7.10	0.46	574	262	0.18	75	3.36	265	-	
V35	368	7.09	0.68	250	208	0.11	38	4.21	229	-	
V36	1600	6.70	0.50	1653	544	0.39	357	3.52	312	-	
V37	791	6.95	0.94	517	361	0.5	108	3.36	359	-	
V38	746	7.00	0.80	461	247	0.74	85	3.36	376	-	
V39	1690	7.15	0.62	874	247	2.7	307	3.78	606	-	
V40	680	7.11	4.35	492	292	0.37	87	4.63	347	-	

Phenol constituent is not identified in any sample  
Except pH, EC and turbidity remaining all parameters are expressed in mg/l

(P7, P9, P10, P12, P26, P27, P29, P38 and P39) in Palakonda mandal, these readings are more than the desirable limit<sup>13, 14</sup>.

### Total Dissolved Solids (TDS)

They are the concentration of dissolved chemical constituents in water and it presents the clear idea of salinity. In the sample number V5 in the

**Table 3: Various constituents present in the water samples in Palakonda mandal (February 2013)**

Sample	EC	pH	Turbidity	TDS	TH	F <sup>-</sup>	Cl <sup>-</sup>	DO	Total alkalinity	Nitrite	Phenol
P1	348	6.28	0.72	237	148	0.09	58	2.52	141	-	-
P2	1350	6.58	0.60	783	604	0.27	244	2.52	482	-	-
P3	1370	6.77	3.55	810	485	0.59	225	4.21	564	-	-
P4	1710	6.83	0.65	1078	346	0.59	167	4.21	864	0.057	-
P5	1300	6.57	1.24	846	589	0.31	218	4.21	482	-	-
P6	774	6.69	1.08	471	341	0.28	96	4.63	417	-	-
P7	2440	6.73	0.61	1527	678	0.46	514	4.63	599	-	-
P8	1290	6.76	0.57	766	332	0.52	186	2.52	517	-	-
P9	2260	6.69	0.59	1415	713	0.42	399	4.63	594	0.082	-
P10	2090	6.58	0.58	1442	668	0.95	321	5.47	417	0.035	-
P11	1260	6.78	0.90	752	539	0.42	183	4.63	511	-	-
P12	2050	6.44	4.75	1016	436	0.20	321	5.05	517	-	-
P13	904	6.61	0.79	596	322	0.33	138	4.63	329	-	-
P14	1670	6.52	2.15	1074	594	0.38	271	3.36	488	-	-
P15	706	6.71	7.25	411	381	0.47	84	4.63	388	-	-
P16	1050	6.82	1.95	713	351	0.33	196	7.15	288	-	-
P17	730	6.62	0.61	479	331	0.11	100	6.73	359	-	-
P18	1430	6.73	0.86	883	297	0.09	232	5.47	423	-	-
P19	1090	7.01	0.71	647	416	0.16	121	4.63	559	-	-
P20	725	6.71	1.65	426	297	0.081	100	9.68	335	-	-
P21	886	6.53	0.6	570	228	0.06	109	9.26	288	0.059	-
P22	326	6.82	1.42	222	158	0.079	34	4.63	200	-	-
P23	869	6.23	2.55	718	366	0.064	218	9.26	176	-	-
P24	1330	7.09	0.76	846	470	0.049	300	13.47	312	-	-
P25	852	6.75	4.05	688	341	0.15	137	10.1	223	-	-
P26	2420	6.96	1.08	1538	396	0.09	415	12.6	776	-	-
P27	2590	6.84	8.75	1661	327	1.22	413	9.68	870	0.195	-
P28	1990	6.72	0.60	1175	361	0.91	401	10.52	600	-	-
P29	3620	6.63	1.76	2614	1054	0.46	778	15.15	553	0.151	-
P30	1230	6.82	1.04	722	426	0.24	201	13.05	417	-	-
P31	848	6.75	0.98	554	213	0.43	72	13.89	494	-	-
P32	872	7.05	0.68	499	228	0.38	73	9.68	488	-	-
P33	673	6.63	0.16	405	218	1.41	94	10.94	353	-	-
P34	1100	6.18	0.95	2341	312	0.074	230	13.05	118	-	-
P35	705	6.54	0.78	467	248	0.24	142	10.52	235	-	-
P36	434	6.63	0.68	264	178	0.53	82	11.78	241	-	-
P37	882	6.65	0.87	567	292	0.53	128	12.63	417	-	-
P38	3800	6.56	1.29	2209	1510	0.25	722	11.36	647	0.423	-
P39	3390	6.85	0.69	2789	549	0.56	591	12.63	664	-	-

Phenol constituent is not identified in any sample

Except pH, EC and turbidity remaining all parameters are expressed in mg/l

area of Veeraghattam mandal and samples of P29, P34, P38 and P39 of Palakonda mandal, the TDS content is more than the permissible limit. Based on obtained TDS values except sample V5 & samples

of P29, P34, P38 and P39 in Veeraghattam and Palakonda areas are suitable to drinking as per the limits of WHO/BIS.

**Table 4: Various constituents present in the water samples in Veeraghattam mandal (March 2014)**

Sample	EC	pH	Turbidity	TDS	TH	F <sup>-</sup>	Cl <sup>-</sup>	DO	Total alkalinity	Nitrite	Phenol
V1	2341	7.78	6.11	1720	367	0.64	239	6.20	738	0.012	
V2	2401	7.65	1.30	1582	271	1.98	302	5.50	916	0.013	
V3	2507	7.51	2.91	1712	615	1.06	358	4.71	699	0.012	
V4	1999	7.93	0.16	1097	458	1.09	278	5.38	501	0.013	
V5	3496	7.13	1.93	2901	1802	0.54	748	6.99	599	0.019	
V6	2048	7.80	2.68	1342	303	0.81	264	5.14	563	0.072	
V7	801	7.21	3.63	570	351	0.78	104	5.21	190	0.011	
V8	519	7.93	0.30	261	284	0.91	48	7.61	287	0.020	
V9	1888	8.01	1.68	1098	512	2.83	380	5.10	413	0.026	
V10	584	7.65	4.52	349	243	0.78	98	5.55	192	0.028	
V11	1289	7.49	1.88	293	599	1.11	261	6.48	303	0.017	
V12	704	7.65	3.01	1701	284	0.64	100	5.93	259	0.027	
V13	873	7.55	0.93	563	379	1.62	128	5.94	303	0.019	
V14	851	7.63	1.11	421	428	1.09	131	6.41	309	0.036	
V15	645	7.69	1.63	463	331	1.16	84	7.19	368	0.120	
V16	651	7.51	1.22	584	251	1.23	48	6.80	369	0.020	
V17	1284	7.58	0.82	301	564	2.38	153	5.21	496	0.031	
V18	1912	7.43	0.71	986	590	0.94	333	5.23	528	0.104	
V19	1104	7.51	0.71	1191	538	0.87	148	5.55	390	0.020	
V20	2360	7.36	1.21	1089	844	1.88	454	7.21	709	0.100	
V21	699	7.25	2.81	439	400	0.23	39	5.65	452	-	
V22	1201	7.77	1.51	1202	583	0.16	250	7.91	326	-	
V23	464	7.11	0.92	299	252	0.11	53	4.73	276	-	
V24	709	7.14	0.97	421	319	0.10	124	5.92	248	-	
V25	1354	7.35	2.73	974	458	0.13	248	7.48	274	-	
V26	599	7.25	0.68	438	243	0.32	84	5.15	339	-	
V27	1348	7.10	1.11	793	499	0.44	250	5.92	365	-	
V28	1727	7.01	0.68	184	606	0.41	301	7.68	419	-	
V29	302	7.59	0.36	763	154	0.10	46	7.11	188	-	
V30	1202	6.70	0.38	1001	505	0.16	215	4.81	273	-	
V31	550	7.59	1.16	273	235	0.10	99	5.64	236	-	
V32	2260	7.01	0.42	1844	670	0.68	425	4.15	529	-	
V33	880	7.21	0.52	603	391	0.32	128	4.43	370	-	
V34	690	7.19	0.56	591	253	0.17	93	3.99	259	-	
V35	360	7.01	0.77	241	221	0.11	44	4.30	223	-	
V36	1604	6.61	0.61	1704	558	0.43	384	3.79	301	-	
V37	801	6.69	1.02	499	349	0.51	100	3.42	368	-	
V38	732	6.88	0.97	483	236	0.79	91	3.44	384	-	
V39	1674	7.21	0.79	901	252	2.74	324	3.85	599	-	
V40	693	6.90	4.21	503	301	0.41	99	4.85	351	-	

Phenol constituent is not identified in any sample  
Except pH, EC and turbidity remaining all parameters are expressed in mg/l

**Total Hardness (TH)**

It is considered a main characteristic property of potable drinking water. Calcium and Magnesium are the most common sources of water hardness. Except few samples V3, V5, V11 and V32

in Veeragahattam mandal & samples of P2, P7, P9, P10, P29, P38 in Palakonda mandal, remaining all samples in the study area, the hardness content is within the desirable limit as per BIS.

**Table 5: Various constituents present in the water samples in Palakonda mandal (March 2014)**

Sample	EC	pH	Turbidity	TDS	TH	F <sup>-</sup>	Cl <sup>-</sup>	DO	Total alkalinity	Nitrite	Phenol
P1	350	6.32	0.80	240	156	0.12	62	3.22	150	-	-
P2	1362	6.60	0.65	790	616	0.32	252	3.12	491	-	-
P3	1382	6.80	3.61	822	496	0.55	233	4.31	577	-	-
P4	1719	6.90	0.77	1085	360	0.62	172	4.35	870	0.052	-
P5	1311	6.50	1.30	855	596	0.35	220	4.32	490	-	-
P6	790	6.65	1.12	482	356	0.33	101	4.71	425	-	-
P7	2430	6.68	0.69	1536	697	0.49	520	4.69	602	-	-
P8	1278	6.80	0.55	779	350	0.56	196	3.12	522	-	-
P9	2245	6.75	0.65	1426	733	0.48	385	4.69	601	0.080	-
P10	2078	6.61	0.63	1455	683	1.02	339	5.55	423	0.033	-
P11	1242	6.83	0.98	778	546	0.48	190	4.73	518	-	-
P12	2045	6.52	4.80	1033	456	0.26	329	5.15	521	-	-
P13	912	6.67	0.82	609	339	0.37	146	4.73	333	-	-
P14	1655	6.60	2.20	1089	612	0.42	284	3.53	493	-	-
P15	715	6.77	7.36	426	402	0.52	91	4.66	394	-	-
P16	1055	6.89	2.03	722	366	0.39	202	7.21	294	-	-
P17	742	6.68	0.69	490	346	0.16	107	6.91	365	-	-
P18	1440	6.79	0.92	899	310	0.16	239	5.45	420	-	-
P19	1081	7.06	0.77	660	429	0.21	129	4.69	556	-	-
P20	728	6.79	1.72	439	313	0.091	108	9.71	341	-	-
P21	892	6.61	0.66	586	238	0.05	102	9.12	292	0.052	-
P22	330	6.80	1.56	233	170	0.086	46	4.67	209	-	-
P23	875	6.31	2.60	732	389	0.072	223	9.34	180	-	-
P24	1339	7.16	0.80	857	460	0.055	295	12.33	316	-	-
P25	862	6.82	4.00	696	339	0.22	143	10.20	228	-	-
P26	2416	7.01	1.13	1550	419	0.12	421	12.12	781	-	-
P27	2584	6.91	8.86	1676	339	1.28	420	9.71	877	0.190	-
P28	1994	6.78	0.68	1188	379	1.03	409	10.63	605	-	-
P29	3625	6.71	1.89	2600	1030	0.53	789	15.25	558	0.141	-
P30	1220	6.78	1.12	739	440	0.31	197	13.15	427	-	-
P31	852	6.81	1.02	570	225	0.49	81	13.78	499	-	-
P32	880	7.12	0.74	512	231	0.43	81	9.77	492	-	-
P33	676	6.70	0.20	426	229	1.50	99	10.80	355	-	-
P34	1112	6.25	1.02	2326	329	0.088	239	13.12	123	-	-
P35	713	6.60	0.83	478	261	0.32	151	10.55	239	-	-
P36	445	6.76	0.75	272	192	0.59	90	11.66	245	-	-
P37	879	6.54	0.96	586	303	0.59	136	12.66	424	-	-
P38	3812	6.62	1.33	2225	1501	0.32	728	11.43	651	0.423	-
P39	3396	6.92	0.75	2793	556	0.62	598	12.44	668	-	-

Phenol constituent is not identified in any sample

Except pH, EC and turbidity remaining all parameters are expressed in mg/l

**Chloride (Cl)**

It originates from Sodium Chloride, which is present in water from soil and rock. This shows the quality of potable ground water and if it is in excess concentration, it might have been mixed with sewage or seawater. In this study area, all the samples are having Chloride content within a permissible limit as per BIS.

**Fluoride (F)**

Except the samples V2, V9, V13, V17, V20 and V39 in Veeraghattam mandal, all the remaining samples in the research area, the content of fluoride concentration is within the desirable limit as per standards.

**Total Alkalinity**

Except a few samples in Veeraghattam mandal( samples V1, V2, V3, V5, V20 and V39) and Palakonda mandal( samples P4, P26, P27, P38 and P39), all the remaining samples in both areas are within the desirable limit. The phenol constituent is not identified in the samples and the nitrite is under desirable limit in the entire research area.

Based on the results obtained, evaluation of quality of underground water for potability in the selected areas of Veeraghattam and Palakonda mandals, the underground water quality is good as per the limits WHO and BIS. In some sites, some of the constituents are not within the desirable limit. In this aspect, further studies are carried out to identify the causes and solve the problem.

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