Water Quality Analysis for Drinking Purpose in GOPALAPURAM MANDAL, West Godavari, Andhra Pradesh, India

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Abstract
The quality of water was analyzed for drinking purpose in rural areas like GOPALAPURAM Mandal of West Godavari district, Andhra Pradesh. The samples were collected in three seasons and water quality parameters like pH, EC, Turbidity, Alkalinity, Hardness, calcium, Magnesium, Sodium, Potassium, Iron, Nitrate, Phosphate, Chlorides, Fluorides, Sulphate and Dissolved Oxygen(D.O) were determined using standard procedures. The mean values of the results were compared with Indian Council of Medical Research (ICMR) standard values. The variation in the water quality parameters with respect to the seasons and lithology were also studied. Ultimately, Suggested whether the water is suitable for human consumption.

Keywords
Lithology, Gopalapuram mandal, ICMR, Water Quality

I. Introduction

Today, India is one of the developing countries in the world. The People living in this country need a sophisticated standards of living. One of the preliminary and prominent needs to maintain the high level of living standards is Public Health. So, the crucial factor that impacts the public health is quality of drinking water. Especially, in India the water resources are Seas, Rivers, Canals, Water Tanks, Wells and Ground water. The water is to be treated and filtered for domestic use. The urban areas have well-equipped and well-functioned treatment plants and distribution system. On the other hand the rural areas are faced with paucity of funds to improve their drinking water facilities. Ultimately this scenario turned the rural area as a origin of waterborne diseases like Cholera, Cryptosporidiosis, Hepatitis etc. So, here lies an appreciable need to ameliorate the drinking water facilities in rural areas. As a part in development of country, the research is to be concentrated mostly on rural needs. As a result the research was carried out on drinking water quality in different villages of the Gopalapuram mandal

The results varied from season to season because of the rock composition and its characteristics underneath that area. Due to different types of rock configuration, the water prevailed over the entire zone consists of desperate minerals in the form of Khondalite, Quartz and Charnockite.

The results are compared with Indian Council of Medical Research(ICMR) standard values and accessed for their water quality.

II. Materials and Methods

A. Study area and Sampling

The Gopalapuram mandal is positioned in the West Godavari of Andhra Pradesh at a latitude 17.21110N and longitude of 81.54820 E. The water samples were taken from various places around the Gopalapuram in all summer, rainy and winter seasons . The collected samples were stored in polyethylene bottles at room temperature. Each sample has labeled with their respective latitude and longitude parameters.

B. Analytical Methods

Table 1: Analytical Methods followed to test parameters

S. No	Parameter	Method/Meter
1	pH	pH meter
2	Turbidity	Nephelo turbidity meter
3	Alkalinity, Hardness, Calcium, Magnesium	Titration Methods
4	Sodium, Potassium	Flame photo meter
5	Iron, Nitrate, Phosphate	Spectrophotometer
6	Chlorides, Fluorides	Ion-Selectivity meter
7	Sulphate	Turbidity metric method
8	Dissolved Oxygen	D.O Meter

III. Results and Discussion

The analytical results of ground water samples collected from different sampling sites of Gopalapuram mandal, West Godavari district. Table 2 presents the values of parameters groundwater in Gopalapuram mandal, West Godavari district.

Table-1:Phisco-chemical parameters in Rainy Season

S.No	Village code	pH	E.C	TDS	Turbidity	Alkalinity	Hardness	Na	k	Ca	Mg	Fe	Cl^{+2}	F^{-}	NO^{-2}	$^{-2}$	$^{3-}$	DO
01	Dondapudi	7.56	1600	1024	000	360	215	61	6.0	44.00	25.58	0	113	0.872	0	84	0	4.0
02	Jaganadhapuram	7.37	700	448	000	518	230	117	3.7	48.00	26.80	0	316	2.13	0	80	0	3.2
03	Sanjeevapuram	7.79	1100	704	000	272	190	54	2.4	42.00	20.71	0	71.5	1.23	0	23	0	4.0

04	Karicheralagu-dem	7.14	700	448	000	330	185	56	9.2	52.00	13.40	0	440	0.434	0	103	0	2.8
05	Komathikunta	7.29	600	384	000	182	175	77	5.5	44.00	15.83	0	103	0.148	0	56	0	3.6
06	Vadalakunta	7.08	800	512	000	126	125	28	3.0	36.00	8.53	0	27.7	0.149	0	45	0	3.2
07	Vadalakunta	7.33	600	384	000	344	255	88	14	70.00	19.49	0	186	0.768	0	31	0	3.2
08	Gopalapuram	7.59	1000	640	000	230	155	33	2.6	46.00	9.74	0	17.6	0.571	0	103	0	4.0
09	Gopalapuram	7.21	500	320	000	346	335	87	3.2	82.00	31.67	0	492	1.56	0	52	0	3.2
10	Guddigudem	7.66	1200	768	001	430	330	92	2.2	46.00	52.37	0	305	1.16	0	68	0	3.6
11	Kovvurupadu	7.57	1200	768	002	404	265	92	9.2	56.00	30.45	0	274	0.363	0	113	0	4.0
12	Butchyapalem	7.46	1100	704	000	324	205	77	2.65	50.00	19.49	0	111	0.239	0	64	0	3.6
13	Butchyapalem	7.59	800	512	001	410	250	86	0	46.00	32.89	0	146	0.55	0	64	0	3.6
14	Kargapadu	7.50	900	576	001	390	230	52	4.5	46.00	28.01	0	50.1	1.02	0	36	0	3.6
15	Rajampalem	7.33	700	448	001	562	315	145	6.6	40.00	52.37	0	856	1.09	0	35	0	2.8
16	Gangolu	7.60	1100	704	001	688	230	130	4.6	22.00	42.63	0	303	2.71	0	71	0	3.2
17	Saggonda	7.25	1400	896	002	342	240	114	0	76.00	12.18	0	247	0.666	0	61	0	8.4
18	Venkatayapalem	7.08	1100	704	000	178	120	20	1.5	28.00	12.18	0	14.6	0.490	0	52	0	4.0
19	Chityala	7.57	400	256	001	160	110	20	8.4	28.00	9.74	0	10.4	0.525	0	18	0	3.6
20	Cherukumilli	7.37	400	256	000	536	200	92	8.6	62.00	10.96	0	87.2	0.914	0	12	0	3.6
21	Vellachintalagu-dem	7.13	800	512	000	418	180	88	9.0	30.00	25.58	0	88.8	0.680	0	84	0	2.8

Table 2: Phisco-Chemical Parameters in Winter Season

S.No	Village code	pH	E.C	TDS	Turbidity	Alkalin-ity	Hardness	Na	k	Ca	Mg	Fe	Cl^{+2}	F^{-}	NO^{-2}	$^{-2}$	$^{3-}$	DO
01	Dondapudi	7.92	1800	1152	001	540	350	101	20	50.00	54.81	000	308	1.21	000	94	000	3.6
02	Jaganadhapuram	7.46	900	576	001	460	230	163	4.3	38.00	32.89	000	96.3	1.46	000	26	000	4.4
03	Sanjeevapuram	7.48	1500	960	000	586	195	116	6.3	38.00	24.36	000	288	0.006	000	26	000	4.0
04	Karicheralagudem	8.07	700	448	000	332	160	120	0.6	38.00	15.83	000	59.5	1.87	000	92	000	5.2
05	Komathikunta	7.12	800	512	001	294	165	38	14.9	42.00	14.62	000	237	0.766	000	56	000	4.8
06	Vadalakunta	7.33	900	576	001	230	150	41	19.8	36.00	14.62	000	564	1.432	000	46	000	5.2
07	Vadalakunta	7.08	600	384	001	200	120	33	3.3	28.00	12.18	000	435	0.375	000	34	000	3.6
08	Gopalapuram	7.43	1300	832	001	384	170	56	15.6	36.00	19.49	000	260	1.19	000	98	000	4.8
09	Gopalapuram	7.43	600	384	001	326	140	70	2.0	46.00	6.09	000	241	1.08	000	55	000	4.0
10	Guddigudem	7.11	1900	1216	002	412	240	112	10.6	34.00	37.76	000	855	2.33	000	68	000	4.8
11	Kovvurupadu	7.79	1400	896	001	470	290	24	2.3	22.00	57.25	000	570	1.789	000	103	000	4.4
12	Butchyapalem	7.44	1400	896	000	410	200	128	1.8	48.00	19.49	000	417	0.665	000	69	000	4.8
13	Butchyapalem	7.39	1000	640	000	438	190	92	2.9	42.00	20.71	000	388	0.453	000	62	000	5.2
14	Kargapadu	7.34	1200	768	001	450	220	126	19.5	36.00	31.67	000	160	0.0990	000	42	000	4.8
15	Rajampalem	7.27	500	320	000	404	320	82	4.4	44.00	51.16	000	71.5	1.43	000	42	000	5.2
16	Gangolu	7.12	500	320	000	524	220	178	5.5	40.00	29.23	000	689	1.67	000	78	000	5.6
17	Saggonda	7.15	1100	704	020	610	245	192	5.4	30.00	41.41	000	241	3.48	000	105	000	8.0
18	Venkatayapalem	7.29	1500	960	017	344	165	136	20.1	34.00	19.49	000	169	1.12	000	88	000	5.2
19	Chityala	7.37	2200	1408	007	204	100	32	1.3	26.00	8.53	000	40.4	0.804	000	21	000	4.0
20	Cherukumilli	7.50	1000	640	001	216	105	30	1.2	30.00	7.31	000	24.0	0.976	000	18	000	4.2
21	Vellachintalagu-dem	7.32	1200	768	000	402	160	149	19.8	46.00	10.96	000	103	1.02	000	76	000	1.8

Table 3: Phisco-Chemical Parameters in Summer Season

S.No	Village code	pH	E.C	TDS	Turbidity	Alkalinity	Hardness	Na	k	Ca	Mg	Fe	Cl^{+2}	F^{-}	NO^{2-}	$^{2-}$	$^{3-}$	DO
01	Dondapudi	7.56	1600	1024	000	360	215	61	6.0	44.00	25.58	0	113	0.872	0	84	0	4.0
02	Jaganadhapuram	7.37	700	448	000	518	230	117	3.7	48.00	26.80	0	316	2.13	0	80	0	3.2
03	Sanjeevapuram	7.79	1100	704	000	272	190	54	2.4	42.00	20.71	0	71.5	1.23	0	23	0	4.0
04	Karicheralagudem	7.14	700	448	000	330	185	56	9.2	52.00	13.40	0	440	0.434	0	103	0	2.8
05	Komathikunta	7.29	600	384	000	182	175	77	5.5	44.00	15.83	0	103	0.148	0	56	0	3.6
06	Vadalakunta	7.08	800	512	000	126	125	28	3.0	36.00	8.53	0	27.7	0.149	0	45	0	3.2
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08	Gopalapuram	7.59	1000	640	000	230	155	33	2.6	46.00	9.74	0	17.6	0.571	0	103	0	4.0
09	Gopalapuram	7.21	500	320	000	346	335	87	3.2	82.00	31.67	0	492	1.56	0	52	0	3.2

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13	Butchyapalem	7.59	800	512	001	410	250	86	0	46.00	32.89	0	146	0.55	0	64	0	3.6
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21	Vellachintalagu-dem	7.13	800	512	000	418	180	88	9.0	30.00	25.58	0	88.8	0.680	0	84	0	2.8

A. pH:

The pH of water samples collected from Gopalapuram mandal in three seasons is tabulated above. The minimum value recorded was 7.4 in rainy season and maximum value was 7.74 in summer season. The fluctuation of pH from season to season was change in the factors like temperature and air. As per ICMR standard values of pH is 7- 8.5.So,the water has within the limits.

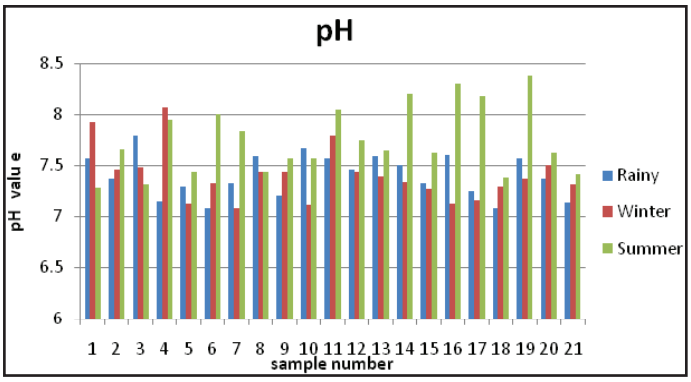

Fig. 1: Graphical Representation of pH Values

B. Total Dissolved Solids

As per ICMR standard values, the desirable limit is 500 mg/L. In Rainy season, 569.90mg/L was recorded which is minimum value and 1142.85mg/L is maximum value .Owing to heavy rainfall the TDS levels raises.

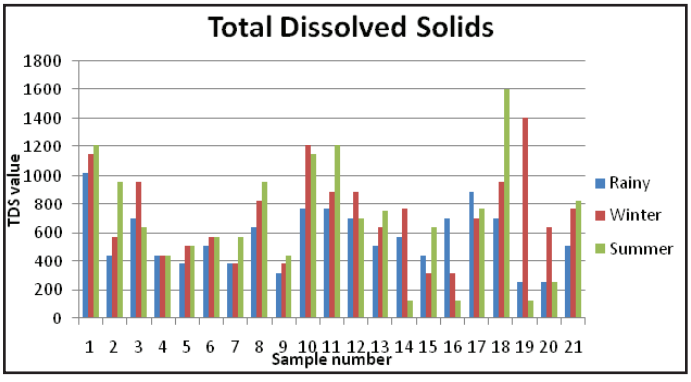

Fig. 2: Graphical Representation of TDS values

C. Alkalinity

The minimum value was 314.667 mg/L noted in summer season and maximum was 392.1905 mg/L in winter season, The difference in alkalinity is due to the increase in the bicarbonate levels. The permissible limit as per ICMR standards is 600mg/L.

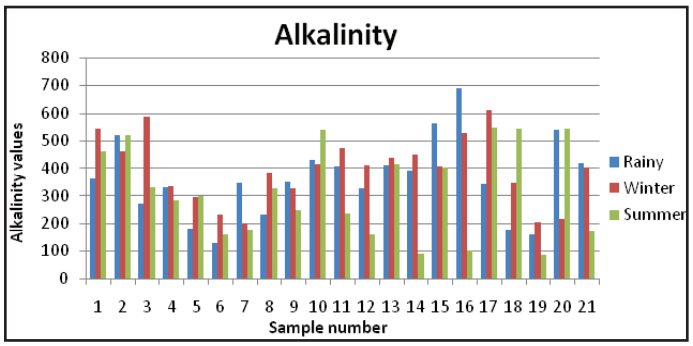

Fig. 3: Graphical representation of ALKALINITY value

C. Total Hardness

In three seasons, the least value recorded was 196.90 mg/L in winter seasons and highest value is 216.1905mg/L in rainy season. The least value lies below the permissible limit 300 mg/L which is taken into account by ICMR. The Gopalapuram area has composed of Khondalite, Quartz and Charnockite rock forms. The majority mineral found in rock composition is Magnesium(Mg), Calcium(Ca) and Aluminum(Al) which is the reason of fluctuation of value from season to season.

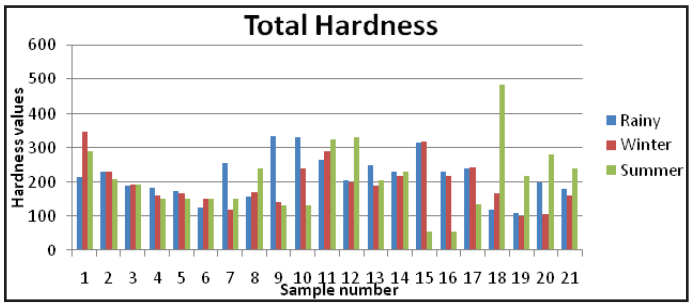

Fig. 4: Graphical representation of TOTAL HARDNESS values

D. Calcium

As per ICMR standard values,75 mg/L is the permissible limit for calcium. But 37.33 mg/L was the minimum recorded value in winter season and 47.33 mg/L was the maximum value in rainy season. The Gopalapuram mandal is covered more than half of with Khondalite rock form in which calcium is one the mineral found. It resulted in variation of calcium levels from rainy season to winter season.

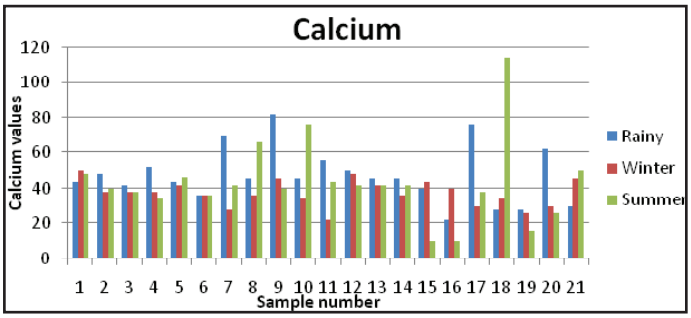

Fig. 5: Graphical representation of CALCIUM values

E. Magnesium

The smallest value recorded was 20.93 mg/L in summer season and largest value was 23.83 mg/Lin rainy season. The magnesium levels is within the permissible limit , 60mg/L proposed by ICMR.

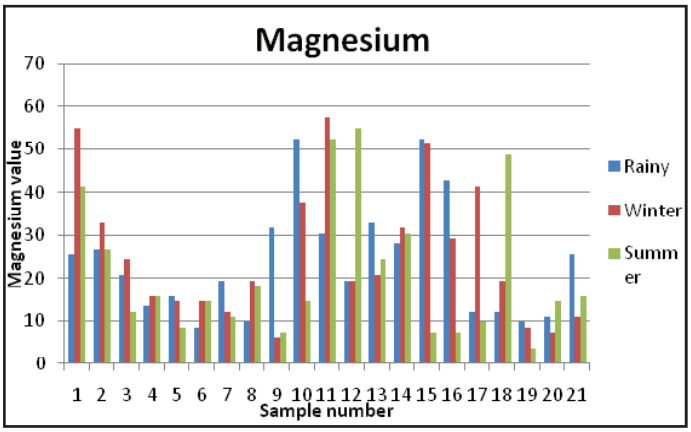

Fig. 6: Graphical Representation of MAGNESIUM valu

F. Chlorides

The value of chlorides were 186.61 mg/L which was minimum recorded in summer and 296.03 mg/L which is maximum recorded in winter. There was a sharp fall in the values of chlorides in water. It is because of lithology which mainly consisted Khondalite(Kh),Quartz and Charnockite as rock forms.

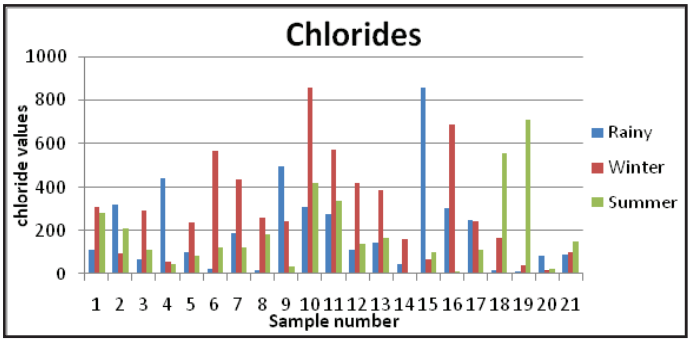

Fig. 7: Graphical representation of CHLORIDES value

G. Fluorides

The minimum and maximum of fluorides in water sample were 0.869 mg/L and 1.201mg/Lin rainy and winter seasons respectively. As per ICMR standard values 1mg/L is the permissible limit for fluorides. Owing to rainfall the water get contaminated with several minerals composited rock forms like Charnockite, Khondalite and Quartz. So, this enhanced the alteration of fluoride content in water from rainy season to winter season

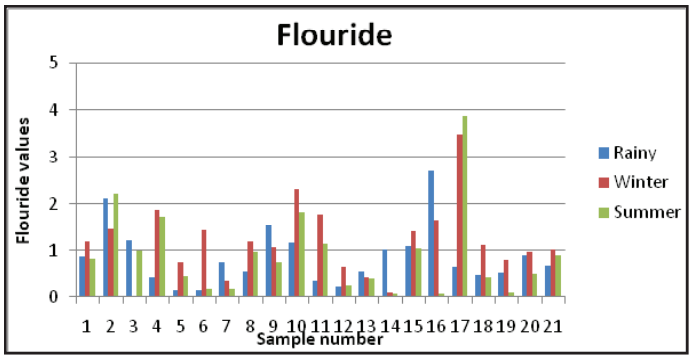

Fig. 8: Graphical representation of FLUORIDE values

H. Sulphate

The least value noticed was 52.95 mg/L and highest value was 61.85 mg/L in summer and winter seasons respectively. The variation of Lithology resulted in the change of values from season to season.

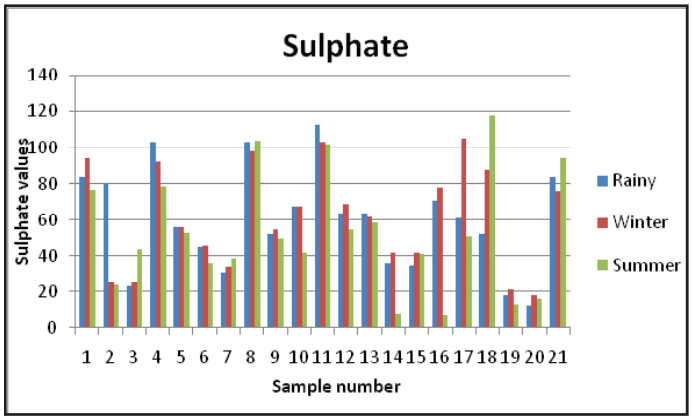

Fig. 9: Graphical representation of SULPHATE values

IV. Conclusion

All the tested parameter values lies within the permissible limit proposed by Indian Council of Medical Research (ICMR) except TDS and Alkalinity in rainy and winter season due to pollution effects and lithology of the researched area. The drinking water is to be treated before its domestication.

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