Drinking Water Quality Assessment and Suitability of Groundwater for Human Utilization in Upland Area of the West Godavari District

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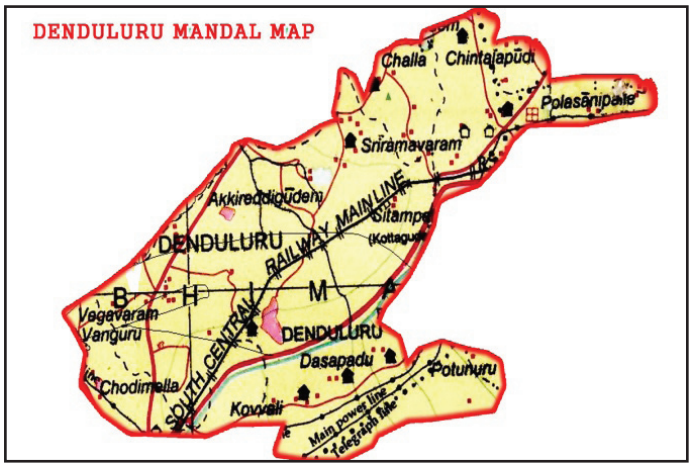
Abstract
Water is called elixir of life and is a basic commodity on planet. It is difficult to visualize the sustenance of any life forms without this resource. In India about 65% of water used for irrigation and 85% of drinking water sources depends on ground water resources. Under natural conditions groundwater is generally fresh, but may not of good chemical quality. India's declining ground water resources both in quality and quantity is a product of many driving factors. Though groundwater contamination is due to natural and anthropogenic activities, ground water pollution is mostly due to knowingly or unknowingly human activities.It is in this context, the ground water quality is determined in twenty four mandals in the upland area of the West Godavari dt. A systematic study is proposed to assess the water quality of ground water resources. In this perception, water samples were collected from sources in different villages of Dendulurumandalin the upland region of W.G.Dt. and are analyzed for various Physico-chemical and biological parameters such as pH, Turbidity, Electrical Conductivity (EC), Total Dissolved Solid (TDS), Total Hardness (TH), Total Alkanity (TA), DO, COD, BOD, MPN, Fluoride (F^-), Chloride (Cl^-), Nitrite (NO_2^-), Nitrate (NO_3^-), Sulphate (SO_4^{-2}), Phosphate (PO_4^{-3}), Sodium (Na^+), Potassium (K^+), Calcium (Ca^{+2}), Magnesium (Mg^{+2}), Iron(Fe^{+2}) using standard techniques. The results are compared with standards of WHO, and ICMR. Water quality index depicts the composite influence of different water quality parameters and communicates water quality information to the public and legislative decision makers. The introduction of Water Quality Indices (WQI) is an effective tool for measurement of level of contamination. A systematic correlation and regression study showed significant linear relationship among different pairs of water quality parameters.

Keywords
Water Quality, WQI, Physico-Chemical Parameters, Correlation, Regression

I. Introduction
"Water" is essential to the survival of mankind. We need Consumption of water for our good health. It is essential to our lives.Next to air (oxygen), water is the most essential element to human life. The human body needs water in order to survive. True health cannot occur without proper hydration of the body. Water pollution is one of the major and most critical issues in India, as almost 70 per cent of the surface water resources and various groundwater reserves are contaminated by biological, toxic, organic and inorganic pollutants.
In India about 65% of water used for irrigation and 85% of drinking water sources depends on ground water resources. However, it was estimated that within the next 20 years, 60% of groundwater resources will be in a critical state of degradation if current usage of ground water continues. Under natural conditions groundwater is generally fresh, but may not of good chemical quality. India's declining ground water resources both in quality and quantity is a product of many driving factors. Though groundwater contamination is due to natural and anthropogenic activities, ground water pollution is mostly due to knowingly or unknowingly human activities.
In most parts of India, groundwater is used intensively for irrigation as well as for industrial purposes, resulting water pollution or degradation of ground water resources. The over exploitation of ground water is not only causing aquifer contamination but also more mineralization of ground water. The chemical composition of groundwater is the result of climate and pedological influences. Human activities have a high impact on water quality in and around highly populated and intensive agricultural area. In India, groundwater is not only used for irrigation but also for drinking and other purposes. People living in those areas where high concentration of different pollutants present in ground water used for drinking will be effected by water borne diseases like cholera, fluorosis, jaundice, typhoid etc, severalty is more in premature babies and in infants. In this study we discussed about quality of ground water in a rural set up of West Godavari district of Andhra Pradesh.

II. Study Area
West Godavari District, one among the nine coastal districts of Andhra Pradesh, is located between North longitude 16051' and 17030' and East latitude 80050' and 81055' covering an area of 7795sqkm. The district is having both surface and ground water resource potential. . The delta area is mainly served by surface irrigation, whereas in the upland areas of the district drinking and the irrigation is chiefly by ground water. It is in this context, the ground water quality is determined in twelve mandals in the upland area of the West Godavari dt. A systematic study is proposed to assess the water quality of ground water resources. In this perception, in this study water samples were collected from sources in 22 villages of Dendulurumandal in the upland region of W.G.Dt. It lies betweenNorth Longitude 16.7972 to 16.7666 and East latitude 81.1444 to 81.1139.



III. Experimental

In the present investigation ground water samples were collected from different locations of the study area. The samples were collected in cleaned and well-dried polythene bottles. These bottles were labelled with respect to collecting points, date and time in order to avoid any error between collection and analysis. The collected samples were brought to the laboratory for determining both physical and chemical parameters. All the chemicals used were AR grade of pure quality. Double distilled water was used for the preparation of all the reagents and solutions. Glasswares were cleaned with commercial HCl followed by distilled water. The pH was measured by using Systronics digital pH meter with an accuracy of ± 0.01 and Electrical Conductivity Elico digital Conductivity meter with an accuracy of ± 0.01. TDS was determined by using evaporating EUTECH Digital. Total Hardness, Calcium, Magnesium were measured by EDTA Complexometrictitration. Total Alkalinity was measured by Acid-Base titration method. Chloride was measured volumetrically by silver nitrate (precipitation) titrimetric method using potassium chromate as indicator. Iron, Fluoride, Sulphate, Phosphate and Nitrite was measured by using Systronics Spectrophotometer. DO was measured by Winkler's titration method. BOD was measured by using Dilution method and COD by using Redox titration.

IV. Results and Discussion

The water from the study area has no colourand odour. Taste of the water of the water sample in most of the locations pleasant in taste. GPS Values and Soil Nature in different villages of Dendulurumandal are represented in Table – 1. Names of the 22 villages are represented in Table 2.The results of the physico-chemical analysis for 22 different villages in different seasons i.e., Pre monsoon, Monsoon and Post monsoon are represented in Tables 3A, 3B & 3C respectively and compared with IS and WHO standards. Similarly, a systematic correlation and regression study are presented in Tables 4A, 4B, & C .

The pH of water shows variation in its ranges. It indicates that they are in range of water quality parameter permissible limits. The EC of water samples shows wide variation in all the samples. TA within the limits. Chloride content in water is low, the fluoride content in water is low due to this no dental and Skelton problem arises in the study area. The value of DO, BOD, COD were in limits. Turbidity was higher of all the observed parameters of almost all the samples . The Ca^{2+} was showed wide variation in all the accepted limits. Mg^{2+} values were within the limits. Sulphate data was low. Also classification on the basis of Total hardness shows that maximum samples contain higher values of hardness. TDS were in permissible limits except very samples where it is high.

Table 1: GPS Values and Soil Naturein Dendulurumandal

S. No	Name of the Village	GPS Values	Geology / Soil type	Health	Landmark	Command Population
		Latitude & Longitude				
1.	Akkireddygudem	N 16^{0}47'834"E 81^{0}08'669"	Black Cotton Soil	Good	Near Anganwadi	3000
2.	Challchintalapudi	N 16^{0}50'423"E 81^{0}12'732"	Red soil	Good	Near Panchayathi	4500
3.	Challapalli	N 16^{0}45'984"E 81^{0}06'060"	Red soil	Good	Near church	2500
4.	Denduluru	N 16^{0}45'641"E 81^{0}09'866"	Black Cotton Soil	Good	Near school	7000
5.	Dosapadu	N 16^{0}44'417"E 81^{0}12'077"	Alluvial soil	Good	Near Panchayathi	5000
6.	Galayagudem	N 16^{0}47'026"E 81^{0}07'574"	Red Soil	Good	Near co-operative bank	3000
7.	Gopannapalem	N 16^{0}46'174"E 81^{0}06'937"	Red Soil	Good	Near temple	4500
8.	Komirepalli	N 16^{0}55'858"E 81^{0}36'124"	Black Cotton Soil	Good	Near church	2500
9.	Kothapalli	N 16^{0}46'248"E 81^{0}06'279"	Black Cotton Soil	Good	Near church	2500
10.	Kovvali	N 16^{0}43'846"E 81^{0}1'392"	Alluvial soil	Good	Near Panchayathi	6000
11.	Malakacharla	N 16^{0}49'559"E 81^{0}12'081"	Red Soil	Good	Outside of village	3000
12.	Medinaraopalem	N 16^{0}50'077"E 81^{0}11'203"	Red Soil	Good	Near school	5000
13.	Muppavaram	N 16^{0}48'841"E 81^{0}13'616"	Black cotton Soil	Good	Near school	3000
14.	Naguladevunipadu	N 16^{0}47'571"E 81^{0}07'967"	Red Soil	Good	Near temple	5000
15.	Narasimhapuram	N 16^{0}49'266"E 81^{0}13'258"	Black Cotton Soil	Good	Near temple	2500
16.	Pothunuru	N 16^{0}44'634"E 81^{0}13'070"	Alluvial soil	Good	Near Panchayathi	6000
17.	Ramaraogudem	N 16^{0}49'677"E 81^{0}11'813"	Red soil	Good	Near Panchayathi	5000
18.	Sanigudem	N 16^{0}46'532"E 81^{0}08'752"	Black Cotton Soil	Good	Near temple	4500
19.	Somavarapadu	N 16^{0}44'648"E 81^{0}06'870"	Black Cotton Soil	Good	Near RO plant	5000
20.	Sriramavaram	N 16^{0}48'851"E 81^{0}11'678"	Red Soil	Good	Near veterinary Hospital	4000
21.	Thimmannagudem	N 16^{0}49'889"E 81^{0}13'427"	Red Soil	Good	Near temple	3500
22.	Vegavaram	N 16^{0}46'001"E 81^{0}06'834"	Red Soil	Good	Near school	4500

Table 2:

	DenduluruMandal	
01.Akkireddygudem	09.Kothapalli	17.Ramaraogudem
02.Challchintalapudi	10.Kovvali	18.Sanigudem
03.Challapalli	11.Malakacharla	19.Somavarapadu
04.Denduluru	12.Medinaraopalem	20.Sriramavaram
05.Dosapadu	13.Muppavaram	21.Thimmannagudem
06.Galayagudem	14.Naguladevunipadu	22.Vegavaram
07.Gopannapalem	15.Narasimhapuram	
08.Komirepalli	16.Pothunuru	

V. Water quality index;

Water quality index depicts the composite influence of different water quality parameters and communicates water quality information to the public and legislative decision makers. The introduction of Water Quality Indices (WQI) is an effective tool for measurement of level of contaminationi.e., for the assessment and management of groundwater. Water quality Index (WQI) were calculated using nine indicator parameters of water quality and the National Sanitation Foundation (NSF) WQI calculator. WQI may be defined as a rating reflecting the composite influence of a number of water quality parameters on the overall quality of water. The main objective of the WQI is to turn complex water quality data into information that understandable and usable by the public. WQI is the based on some important parameters viz., pH, EC, TDS, Total alkalinity, Total hardness, Calcium, Magnesium, Chloride, Sulphate, dissolved oxygen and biological oxygen demand which can provide simple indicator of water quality.

Pre monsoon season:

Table 3A:

S. No	pH	EC µS/cm	TDS ppm	Alkalinity ppm	Total Hardness ppm	Calcium ppm	Magnesium ppm	Chloride ppm	Sulphate ppm	DO ppm	BOD ppm	WQI	Rating
1.	7.2	1520	1020	572	230	44	29.2	220	14	9.2	7.8	196.3	Poor
2.	6.76	970	650	282	172	39.2	18	81	22.77	8	7.2	140.1	Poor
3.	7.44	2780	1860	483	240	61.7	20.9	502	27.31	10	7.6	301.5	Unsuitable
4.	8.21	440	290	148	68	11.2	9.7	60	6.36	9	6	98.06	Good
5.	7.0	320	210	160	82	16.8	9.7	80	6.2	8.4	6.5	80.29	Good
6.	7.58	1660	1110	542	148	32	16.5	156	28.70	8.4	6.2	202.7	Very Poor
7.	7.72	2080	1390	412	226	49.6	24.8	292	24.44	8	5	236.2	Very Poor
8.	7.9	490	330	92	68	14.4	7.8	120	44.5	8.4	6.3	102.0	Poor
9.	7.60	2210	1480	447	260	56.1	29.2	318	26.3	8	6.2	253.5	Very Poor
10.	6.8	980	660	230	68	16.8	6.3	80	5.7	8	5.8	132.0	Poor
11.	7.38	1360	910	412	200	48	19.5	122	19	9	6.4	174.2	Poor
12.	7.55	1060	710	217	166	37.6	17.5	135	31.98	8	6	149.9	Poor
13.	7.0	2520	1690	746	180	44	17	520	32.6	8.8	6.4	273.8	Very Poor
14.	7.29	1640	1100	447	260	76.1	17	192	25.9	9	5	191.8	Poor
15.	7.3	1320	880	422	248	59.3	24.3	272	16.5	6.4	4.2	167.9	Poor
16.	7.5	360	240	172	72	16.8	7.3	68	32	7.6	5.2	84.07	Good
17.	7.43	1060	710	217	190	43.2	19.9	102	32.18	9.2	7.4	152.5	Poor
18.	7.54	3040	2040	373	300	73.7	28.2	542	44.48	7.8	5.4	319.8	Unsuitable
19.	7.28	2170	1460	423	296	64.1	33.1	352	24.43	8.6	6	244.1	Very Poor
20.	6.69	920	620	308	140	32	14.6	95	10.34	9	6.4	128.6	Poor
21.	7.2	1130	760	350	228	55.3	21.9	215	11.1	8.8	7.2	158.4	Poor
22.	7.30	1940	1300	534	294	72.1	27.7	223	24.6	9	6	224.6	Very Poor

Monsoon season:

Table – 3B :

S. No	pH	EC µS/cm	TDS ppm	Alkalinity ppm	Total Hardness ppm	Calcium ppm	Magnesium ppm	Chloride ppm	Sulphate ppm	DO ppm	BOD ppm	WQI	Rating
1.	7.0	1380	920	556	216	41.6	27.2	179	11	9.2	6.8	176.7	Poor
2.	7.3	900	600	328	194	40.8	22.4	100	12.9	8.4	6.4	136.1	Poor
3.	7.0	2620	1760	608	360	77.7	40.4	507	29	8.8	6.8	287.3	Very Poor
4.	7.0	1880	1260	390	300	64.1	34.1	361	28	10.4	7.6	220.7	Very Poor
5.	7.0	460	310	190	70	16.8	6.8	70	5.0	6.4	4.0	84.58	Good
6.	7.2	1560	1050	710	164	36.8	17.5	168	15.8	8.4	5.2	187.8	Poor
7.	7.0	2000	1340	612	276	80.1	18.5	307	28.8	8.8	6.4	229.1	Very Poor
8.	8.2	350	230	114	52	9.6	6.8	76	48.5	8.4	6.0	92.5	Good
9.	7.3	2030	1360	546	292	64.1	32.1	357	25.6	9.2	7.2	238.7	Very Poor
10.	7.2	340	230	160	64	16	5.8	45	3.5	8.4	6.0	84.06	Good
11.	6.9	1350	900	512	214	48.8	22.4	157	14.7	7.6	5.6	170.4	Poor
12.	6.8	980	660	230	178	52.1	11.6	147	18.4	9.2	6.8	135.8	Poor
13.	7.3	2860	1920	736	166	44.8	13.1	496	29.9	9.2	6.8	306	Unsuitable
14.	7.3	1560	1050	510	298	81.7	22.9	212	20.5	8.8	6.4	194.2	Very Poor
15.	7.0	1540	1030	436	232	56.1	22.4	265	14.2	6.0	3.6	181.3	Poor
16.	7.4	310	210	156	58	12	6.8	60	2.3	8.8	4.8	73.06	Good
17.	7.3	980	660	246	186	44.8	18	119	16	9.6	6.4	138.5	Poor
18.	7.2	280	190	116	48	9.6	5.8	56	2.2	9.6	4.8	65.82	Good
19.	7.4	2180	1460	460	266	54.5	31.6	429	16.2	9.2	6.8	249.4	Very Poor
20.	7.2	910	610	376	152	37.6	14.1	166	11.0	9.6	7.2	136.1	Poor
21.	7.4	1080	720	370	206	51.3	19	175	9.3	9.2	6.8	152.6	Poor
22.	7.5	1770	1190	500	310	76.9	28.7	305	19.2	8.4	6.4	215.9	Very Poor

Post monsoon season:

Table – 3C

S. No	pH	EC µS/cm	TDS ppm	Alkalinity ppm	Total Hardness ppm	Calcium ppm	Magnesium ppm	Chloride ppm	Sulphate ppm	DO ppm	BOD ppm	WQI	Rating
1.	7.23	1350	900	376	190	17.6	19	181	23.3	8.0	4.8	165.9	Poor
2.	6.97	730	490	220	138	32	14.1	71	11.2	8.0	4.4	106.0	Poor
3.	7.22	2440	1630	528	308	72.1	31.1	517	43.9	8.0	5.2	265.9	Very Poor
4.	7.57	1220	820	270	184	40	20.4	227	14.0	8.4	5.2	158.6	Poor
5.	7.48	270	180	108	50	11.2	5.3	37	6.2	7.6	5.4	75.22	Good
6.	7.42	1490	1000	560	162	44	12.6	156	18.5	8.0	5.2	183.1	Poor
7.	7.27	1920	1290	474	288	32	31.1	297	41.3	8.4	5.6	220.8	Very Poor
8.	7.56	180	120	64	38	10.4	2.9	21	0	7.6	4.4	62.64	Good
9.	7.50	2030	1360	452	288	65.7	30.2	340	32.4	9.6	6.8	236.5	Very Poor
10.	7.53	220	150	110	48	11.2	4.8	28	0	7.6	3.2	60.64	Good
11.	7.13	1210	810	388	196	48	17.5	134	13.6	6.0	2.8	139.0	Poor
12.	7.02	920	620	180	166	48	11.2	140	25.6	8.0	4.8	126.2	Poor
13.	6.87	2110	1410	530	244	49.6	29.2	337	37.4	8.0	4.4	233.8	Very Poor
14.	7.01	1480	990	388	284	76.1	22.9	198	23.7	8.4	4.8	177.1	Poor
15.	7.30	1790	1200	408	284	64.1	30.2	334	17.4	8.0	5.2	209.7	Very Poor
16.	7.00	270	180	128	60	12.8	6.8	27	0	8.4	5.2	68.46	Good
17.	7.27	930	620	188	172	43.2	15.6	107	21.5	8.0	4.8	128.5	Poor
18.	7.47	260	170	114	56	11.2	6.8	35	0	8.8	5.6	72.43	Good
19.	7.08	1920	1290	392	270	62.5	37.5	366	37.6	7.2	4.8	218.8	Very Poor
20.	6.80	790	530	256	136	32	13.6	96	5.7	8.0	5.2	114.5	Poor
21.	7.51	960	640	454	188	45.6	18	137	7.5	8.0	5.2	138.8	Poor
22.	7.16	1720	1150	404	280	72.9	23.8	248	25.4	8.0	5.2	200.9	Very Poor

VI. Correlation Matrix:

A systematic correlation and regression study showed significant linear relationship among different pairs of water quality parameters.

Table - 4A

Premonsoon season:

	pH	*EC*	*TDS*	*Turbidity*	*Alkalinity*	*Total Hardness*	*Sodium*	*Potassium*	*Calcium*	*Magnesium*	*Chloride*	*Fluoride*	*Sulphate*	*DO*	*COD*	*BOD*
pH	1															
EC	0.01527	1														
TDS	0.012914	0.999985	1													
Turbidity	0.200204	0.058657	0.05825	1												
Alkalinity	-0.21171	0.756333	0.756087	0.009973	1											
Total Hardness	-0.04502	0.785762	0.786134	0.081875	0.641847	1										
Sodium	-0.23021	-0.45918	-0.45888	-0.30879	-0.45193	-0.65619596	1									
Potassium	-0.29881	-0.35103	-0.35141	-0.41586	-0.19924	-0.493449672	0.677127	1								
Calcium	-0.07905	0.773877	0.774248	0.123438	0.619656	0.972146432	-0.64619	-0.4824	1							
Magnesium	0.013708	0.714522	0.71486	0.006797	0.602731	0.929919965	-0.59753	-0.4553	0.817828	1						
Chloride	0.046799	0.917912	0.917797	0.005243	0.662553	0.665219169	-0.34279	-0.26613	0.657742	0.60120296	1					
Fluoride	0.345921	0.03862	0.037215	-0.01598	0.088457	0.120783975	-0.51859	-0.26622	0.082694	0.16642117	-0.21347	1				
Sulphate	0.373142	0.406161	0.40663	-0.00858	0.101013	0.244431139	-0.12957	-0.01863	0.272922	0.17160833	0.423529	-0.00361	1			
DO	-0.01008	0.155248	0.15598	0.0253	0.212314	0.073866743	-0.14425	-0.0586	0.09472	0.03238761	0.07047	0.339405	-0.09629	1		
COD	-0.19313	-0.08446	-0.08388	-0.21935	-0.11468	0.089391384	-0.08205	0.119983	0.051904	0.13787214	-0.30266	0.452843	0.089756	0.023647	1	
BOD	-0.22408	-0.02155	-0.02051	-0.39056	0.066504	-0.052641356	0.115821	0.166708	-0.12032	0.05938844	-0.03957	0.203989	-0.11461	0.697076	0.24823	1

Monsoon season:

Table – 4B

	pH	*EC*	*TDS*	*Turbidity*	*Alkalinity*	*Total Hardness*	*Sodium*	*Potassium*	*Calcium*	*Magnesium*	*Chloride*	*Fluoride*	*Sulphate*	*DO*	*COD*	*BOD*
pH	1															
EC	-0.22306	1														
TDS	-0.22382	0.99998	1													
Turbidity	0.047835	-0.39087	-0.38961	1												
Alkalinity	-0.26668	0.877542	0.87721	-0.27628	1											
Total Hardness	-0.28253	0.803901	0.803387	-0.42259	0.689004	1										
Sodium	0.045987	-0.44365	-0.44129	0.155788	-0.56606	-0.625557911	1									
Potassium	-0.10969	-0.29378	-0.29221	0.443938	-0.37263	-0.462479476	0.676181	1								
Calcium	-0.30332	0.77382	0.773933	-0.4641	0.679515	0.961494337	-0.57755	-0.5058561	1							
Magnesium	-0.21749	0.742307	0.740991	-0.31089	0.61367	0.924883037	-0.61167	-0.3430834	0.784767	1						
Chloride	0.482464	0.549037	0.547546	-0.27254	0.331896	0.344482729	-0.31083	-0.2527781	0.292799	0.371764003	1					
Fluoride	0.567819	-0.31214	-0.31366	0.1315	-0.40592	-0.425141713	-0.01756	-0.1046605	-0.41895	-0.37912235	0.478946	1				
Sulphate	0.398131	0.484439	0.483322	-0.29224	0.325794	0.367481483	-0.32624	-0.3885376	0.373873	0.311455384	0.903042	0.412896	1			
DO	0.106571	0.165212	0.166029	0.133884	0.040624	0.163607157	-0.06329	0.05753549	0.132627	0.185465922	0.113356	-0.23514	0.161574	1		
COD	0.125896	-0.13742	-0.13804	0.488948	-0.23136	-0.206953417	-0.08315	0.07245936	-0.28044	-0.07870493	0.316223	0.469873	0.381818	0.265486	1	
BOD	0.089219	0.478544	0.477643	-0.33982	0.312724	0.516096259	-0.29031	-0.1908506	0.466409	0.518581288	0.381931	-0.33341	0.393909	0.763879	-0.00124	1

Post monsoon season:

Table – 4C

	pH	*EC*	*TDS*	*Turbidity*	*Alkalinity*	*Total Hardness*	*Sodium*	*Potassium*	*Calcium*	*Magnesium*	*Chloride*	*Fluoride*	*Sulphate*	*DO*	*COD*	*BOD*
pH	1															
EC	-0.21616	1														
TDS	-0.21617	0.999983	1													
Turbidity	-0.17616	-0.248	-0.24703	1												
Alkalinity	-0.13643	0.89769	0.897253	-0.265458226	1											
Total Hardness	-0.24397	0.950286	0.950395	-0.261112343	0.834339	1										
Sodium	0.064881	-0.55468	-0.55489	0.468541401	-0.59036	-0.6344336	1									
Potassium	-0.18055	-0.30764	-0.30875	0.460466438	-0.31111	-0.416136418	0.690679	1								
Calcium	-0.24472	0.809073	0.809109	-0.247552824	0.704198	0.885454186	-0.53328	-0.3438	1							
Magnesium	-0.24296	0.936126	0.936564	-0.170469891	0.787533	0.941106526	-0.55069	-0.31742	0.771316	1						
Chloride	-0.13735	0.954865	0.954832	-0.213876855	0.784624	0.894607433	-0.47441	-0.30287	0.764143	0.9284634	1					
Fluoride	0.305074	0.37572	0.377186	-0.104748759	0.303029	0.35159431	-0.12866	-0.32045	0.130816	0.3688184	0.348063	1				
Sulphate	-0.29997	0.913726	0.914046	-0.265929088	0.735272	0.863069815	-0.46106	-0.29366	0.688723	0.8594796	0.881263	0.397727	1			
DO	0.197705	0.124846	0.124263	-3.85865E-17	0.053544	0.136498412	0.047972	-0.35145	0.063854	0.1158891	0.148547	0.5586	0.122932	1		
COD	-0.0102	0.35358	0.353563	0.117044568	0.48417	0.352610875	-0.04165	0.029343	0.388192	0.2750076	0.334349	-0.01302	0.168296	0.046305	1	
BOD	0.207256	0.269063	0.268687	-0.198188552	0.201355	0.266619633	-0.1135	-0.3567	0.184041	0.2781584	0.306271	0.539235	0.251808	0.817344	0.141239	1

Hardness:

Premonsoon season:

DESCRIPTION	HARDNESS	NO OF SAMPLES
Soft	0-75	4
Moderately Hard	75-150	3
Hard	150-300	15
Very Hard	>300	0

Monsoon season:

DESCRIPTION	HARDNESS	NO OF SAMPLES
Soft	0-75	5
Moderately Hard	75-150	0
Hard	150-300	15
Very Hard	>300	2

Post monsoon season:

DESCRIPTION	HARDNESS	NO OF SAMPLES
Soft	0-75	5
Moderately Hard	75-150	2
Hard	150-300	14
Very Hard	>300	1

Chemical analysis of water supplies was necessary to guarantee the quality, compliance with established quality criteria and efficiency of operation of water treatment plants and distribution systems. The experimental study of groundwater by means of different physical and chemical parameters of the study area identify with the intention of water quality was good, poor in most of the samples and appropriate for drinking purpose. Water quality was very poor in very few samples.

The calculated WQI values lies between 65.82 to 306 during monsoon period, values lies between 60.64 to 265.9 during Post monsoon period and values lies between 80.29 to 319.8 during Post monsoon period respectively. The Percentage of water quality index shows that maximum in pre monsoon& monsoon season and minimum in postmonsoon period. Results of correlation analysis show that EC, TH and TDS are having high correlation with most of the parameters for all the seasons. This indicates the increase in the pollution load due to the intrusion of domestic sewage and industrial effluents into the Groundwater.

VII. Conclusion

This study shows that ground water is the only source for people in the study area and the results indicate not much considerable variation. In few areas TDS is comparatively high, thus if people drink water then health problems like stomach diseases and gastric troubles may arise. Total hardness is the main problem in this area. Also the contamination is found to be due to both anthropogenic as well as from geological sources. It must be noted that a regular analysis must be done to ensure that the quality of water in this area is not contaminated. Hence, consistent monitoring measures are very important to assess the impact of the percolation of the wastewater, causing contamination of the groundwater in the study area, and a preventive mechanism coupled with remedial measures is necessary for the benefit of mankind. It is also recommended that water analysis should be carried out from time to time to monitor the rate and kind of contamination. It is need of human to expand awareness among the people to maintain the cleanness of water at their highest quality and purity levels to achieve a healthy life.

Observed results shows that the technology to be applied for the treatment of ground water is source dependent and in most cases, effective and simple treatment solutions are sufficient without blindly implementing RO Technologies.

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