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Studies of Physico-Chemical Parameters to Evaluate Quality of Water at Different Zones of Nalagonda District of Telangana, India

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Abstract

The objective of this research is to study the Physico-chemical parameters of water by sampling Hand pump, Bore well, Vagu and Cheruvu water of 6 selected sites of Polkampally, Ghanapuram, Kodhandapuram, Mallaiahpallem, Nemalipuram, Pinnavura of Nalgonda district of Telangana, India. The variation of physical and chemical parameters such as temp, pH, TDS, SP and Co_3, $CaCl_2$, F, So_4, Mg, Na, k, No_3 contain were analysed for a period of one year. All parameter were within the permissible limits. From the result it was found that water of Polkampally Vagu was marginal for agriculture and other sources of water was probably safe or it can be used for domestic or irrigation purpose only. Therefore it offers as a significant value to physico-chemical water quality standards.

Keywords: Physio-chemical parameters; Water quality standards

Introduction

Ecosystem is known as the lifeline of earth which most significantly uses the water compound. By physical, chemical and biological characteristics we can describe better quality of water. But some correlation is possible among these parameters and the significant one would be useful to indicate quality of water [1-3]. Due to increased human population, industrialization, use of fertilizers in agriculture and man-made activity, the natural aquatic resources are causing heavy and varied pollution in the aquatic environment leading to water quality and depletion of aquatic biota. It is therefore necessary that the quality of drinking water should be checked at regular time interval because due to use of contaminated drinking water, human population suffers from a variety of water borne diseases [3-5]. It is difficult to understand the biological phenomena fully because the chemistry of water reveals much about the metabolism. The ecosystem and explain the general hydro biological relationship. The physico-chemical parameters of water and the dependence of all life process of these factors make it desirable to take as an environment. It is therefore necessary that the quality of drinking water should be checked at regular time of interval, because due to use of contaminated drinking water, human population suffers from varied of water borne diseases. It is difficult to understand the biological phenomena fully because the chemistry of water revels much about the metabolism of the ecosystem and explain the general hydro-biological relationship [6-8].

The present study involves analysis of water quality in terms of physico-chemical parameters of six sites Polkampally, Ghanapuram, Kodhandapuram, Mallaiahpallem, Nemalipuram, Pinnavura of Nalgonda district. It is located in Nalgonda district, Telangana. Water samples of these sites are basically used for domestic and agriculture purpose.

Materials and Methods

Water sample were collected in polythene bottle from Hand pump, Bore well, Open well, Vagu and Cheruvu from Polkampally, Ghanapuram, Kodhandapuram, Mallaiahpallem, Nemalipuram and Pinnavura of Nalgonda district (Table 1). Water samples were collected and brought into the laboratory for the analysis of various physical and chemical parameters—pH, Conductivity, TDS, Carbonate, Nitrate, Calcium, Magnesium, Sulphate, Chloride, Fluoride, and Sodium. All parameters were within the permissible limits (Table 2).

pH

In present study, pH value was found between 7.29-8.35. It shows the alkalinity of water sample throughout the periods. The high value of pH is due to the deposition of sewage and agriculture waste. pH value is essential for the growth of aquatic flora [9,10].

Conductivity

The conductivity of water ranges from 529-3070 at 25°C. The correlation between conductivity and physio-chemical parameters were beneficial for understanding the quality of water. It can measure by controlling the conductivity of water by EC meter. The conductivity of water sample was observed by standardized with KCL solution through standard instrument [11-14].

Sodium absorption ratio

In present study the SAR ratio ranges between 1.25-5.53. SAR is an acceptability of water for agriculture purpose. SAR ratio was analysis by the concentration of total solid in the water. If the SAR ratio were higher it is less satisfactory for irrigation. High SAR ratio will damage the quality of soil. Its sodium ratio decreases the calcium and magnesium from the soil [15].

Total dissolves oxygen

Total dissolved oxygen range 339-1965 mg/l. TDS were affected by the deposition of sewage and agriculture wastes. TDS analysis is the significant association for monitoring the quality of water [16].

Carbonate

The values of carbonate fluctuate from 0-40 mg/l and 0.00-0.80 ppm. In water sample high pH shows the presence of carbonate if the

S. No.	Lab. No.	Particulars of the Sample Village/Mandal	Location of Well	Date of Collection	Latitude / Longitude
1	1860	Polkampally/Peddavura	Hand pump	22..07.2014	164542.773N 790748.238E
2	1861	Polkampally/Peddavura	Bore well	22..07.2014	164541.560N 790750.225E
3	1862	Polkampally/Peddavura	Open well	22..07.2014	164528.901N 790745.500E
4	1863	Polkampally/Peddavura	Vagu	22..07.2014	164521.735N 790747.871E
5	1864	Ghanapuram/Peddavura	Hand pump	22..07.2014	164420.075N 790720.596E
6	1865	Ghanapuram/Peddavura	Cheruvu	22..07.2014	164417.707N 790723.459E
7	1866	Ghanapuram/Peddavura	Bore well	22..07.2014	164425.364N 790712.483E
8	1867	Kodhandapuram/Peddavura	Cheruvu	22..07.2014	164342.015N 790828.204E
9	1868	Kodhandapuram/Peddavura	Hand pump	22..07.2014	164342.591N 790833.003E
10	1869	Kodhandapuram/Peddavura	Open well	22..07.2014	164343.257N 790834.054E
11	1870	Mallaiahpallem(or) Madhapuram/Peddavura	Hand pump	22..07.2014	164436.535N 790923.925E
12	1871	Mallaiahpallem(or) Madhapuram/Peddavura	Hand pump	22..07.2014	164437.795N 790926.861E
13	1872	Mallaiahpallem(or) Madhapuram/Peddavura	Bore well	22..07.2014	164436.621N 790928.181E
14	1873	Mallaiahpallem(or) Madhapuram/Peddavura	Open well	22..07.2014	164434.979N 790928.178E
15	1874	Nemalipuram/Peddavura	Cheruvu	22..07.2014	164353.251N 790900.830E
16	1875	Nemalipuram/Peddavura	Hand pump	22..07.2014	164342.231N 790859.352E
17	1876	Pinnavura/Peddavura	Cheruvu	22..07.2014	164334.991N 791044.115E
18	1877	Pinnavura/Peddavura	Vagu	22..07.2014	164354.755N 791043.161E
19	1878	Pinnavura/Peddavura	Vagu	22..07.2014	164325.755N 791051.048E
20	1879	Pinnavura/Peddavura	Vagu	22..07.2014	164322.437N 791053.015E

Table 1: Lab, place, sample collection medium, dates and latitude/longitude details.

S. No.	Lab No.	pH	SP Conductivity at 25°C	TDS Calculated mg/l
BIS Permisable Limits		6.50 to 8.50	< 750=Good 750 to 1500=Safe 1500 to 2250= Permissible >3000 U.S.	500-2000
1.	1860	7.78	2120	1357
2.	1861	8.19	1541	986
3.	1862	7.91	785	502
4.	1863	8.30	1185	758
5.	1864	7.91	1547	990
6.	1865	7.96	951	609
7.	1866	7.71	2790	1786
8.	1867	8.24	529	339
9.	1868	7.91	1023	655
10.	1869	7.78	1146	733
11.	1870	7.69	1071	685
12.	1871	7.88	1030	659
13.	1872	7.74	1245	797
14.	1873	7.81	1311	839
15.	1874	7.67	555	355
16.	1875	7.76	2030	1299
17.	1876	8.27	867	555
18.	1877	8.35	639	409
19.	1878	8.05	3070	1965
20.	1879	8.26	815	522

Table 2: Physical (pH, SP Conductivity & TDS) parameters of Nalgonda district water sample.

pH is reduced it shows the conversion of carbonate into bicarbonate. It can be examine with the help of titration by standard HCl using phenolphthalein as indicator.

Chloride

The values of Chloride 40-560 mg/l and 1.41-15.79 ppm. It is examine by titrate the know value of sample by standardized silver nitrate solution using potassium chromate solution in water (Table 3).

Fluoride

The values of fluoride range from 0.37-2.05 mg/l. The presence of fluoride is observed by the assimilation of rocks or minerals near the surrounding water bodies [17-20].

Nitrate

The values of nitrate are ranges from 0.40-72.00 mg/l and 0.03-5.14 ppm. The presence of N_2 compound in the water was sample

S.No.	Lab No.	CO_3 as $CaCO_3$		HCO_3 as $CaCO_3$		Cl		F
BIS Permisable Limits		mg/l.	ppm	mg/l.	ppm	mg/l.	ppm	mg/l.
		200-600		200-600		250-1000		1.0-1.5
1.	1860	0	0.00	183	3.65	300	8.46	1.89
2.	1861	0	0.00	365	7.30	140	3.95	1.39
3.	1862	0	0.00	182	3.63	100	2.82	0.78
4.	1863	40	0.80	272	5.44	130	3.67	2.05
5.	1864	0	0.00	202	4.04	250	7.05	1.00
6.	1865	0	0.00	212	4.23	110	3.10	1.33
7.	1866	0	0.00	308	6.16	400	11.28	0.47
8.	1867	0	0.00	108	2.15	60	1.69	0.64
9.	1868	0	0.00	230	4.59	120	3.38	1.61
10.	1869	0	0.00	260	5.19	120	3.38	1.59
11.	1870	0	0.00	218	4.35	120	3.38	1.27
12.	1871	0	0.00	198	3.96	140	3.95	1.03
13.	1872	0	0.00	200	4.00	180	5.08	0.92
14.	1873	0	0.00	238	4.77	180	5.08	0.99
15.	1874	0	0.00	135	2.69	50	1.41	0.73
16.	1875	0	0.00	295	5.90	260	7.33	0.55
17.	1876	0	0.00	229	4.57	80	2.26	1.40
18.	1877	40	0.80	156	3.12	40	1.13	0.97
19.	1878	0	0.00	284	5.69	560	15.79	0.37
20.	1879	0	0.00	185	3.69	80	2.26	0.52

Table 3: Chemical (CO_3 as $CaCO_3$, HCO_3 as $CaCO_3$, Cl & F) parameters of Nalgonda district water sample.

S.No.	Lab No.	NO_3 as N		SO_4		Na	
BIS Permisable Limits		mg/l.	ppm	mg/l.	ppm	mg/l.	ppm
		10.16		200-400		No Guidelines	No Guidelines
1.	1860	70.00	5.00	186	3.88	239	10.41
2.	1861	11.45	0.82	153	3.19	132	5.74
3.	1862	0.35	0.03	62	1.29	80	3.48
4.	1863	1.00	0.07	84	1.75	180	7.83
5.	1864	18.25	1.30	140	2.92	198	8.63
6.	1865	1.40	0.10	95	1.98	97	4.22
7.	1866	72.00	5.14	242	5.04	374	16.27
8.	1867	2.00	0.14	60	1.25	38	1.67
9.	1868	6.35	0.45	81	1.70	87	3.78
10.	1869	11.05	0.79	95	1.98	110	4.76
11.	1870	11.00	0.79	99.8	2.08	73	3.19
12.	1871	2.55	0.18	101	2.10	45	1.97
13.	1872	4.05	0.29	142	2.96	92	4.01
14.	1873	4.55	0.33	135	2.81	103	4.50
15.	1874	2.25	0.16	59	1.23	54	2.33
16.	1875	1.35	0.10	325	6.77	183	7.96
17.	1876	1.25	0.09	80	1.67	107	4.67
18.	1877	0.40	0.03	60	1.25	64	2.78
19.	1878	18.00	1.29	366	7.63	304	13.23
20.	1879	0.80	0.06	99	2.06	68	2.95

Table 4: Chemical (NO_3 as N, SO_4 & Na) parameters of Nalgonda district water sample.

by the domestic effluents and factories chemicals. It is estimated by Spectrophotometric methods (Table 4).

Sulphate

The values of Sulphate are ranges from 59-366 mg/l and 1.23-7.63 ppm. Sometime sulphate ions are present naturally in water or addition of industrial effluents.

Sodium

The value of Sodium was estimated by flame-photometer. In this study the range of sodium obtained between 38-374 mg/l and 1.67-16.27 ppm [21].

Potassium

The value of potassium ranges between 1.21-132.1 mg/l and 0.03-3.51 ppm. It was estimated by flame-photometer (Table 5 and 6).

Calcium

The value of calcium ranges observed between 16-120 mg/l and 0.80-6.00 ppm. It was estimated by titration.

S.No.	Lab No.	K		Ca		Mg		T.H. as CaCo$_3$
BIS Permisable Limits		mg/l.	ppm	mg/l.	ppm	mg/l.	ppm	mg/lit.
		No Guidelines		75-200		30-100		200-600
1.	1860	8.2	0.21	56	2.80	97	8.00	540
2.	1861	87	2.23	64	3.20	53	4.40	380
3.	1862	1.92	0.05	24	1.20	39	3.20	220
4.	1863	5.6	0.14	40	2.00	24	2.00	200
5.	1864	54.6	1.40	40	2.00	44	3.60	280
6.	1865	22.89	0.59	16	0.80	49	4.00	240
7.	1866	137.2	3.51	88	4.40	49	4.00	420
8.	1867	2.84	0.07	56	2.80	10	0.80	180
9.	1868	6.14	0.16	16	0.80	68	5.60	320
10.	1869	31.85	0.81	40	2.00	49	4.00	300
11.	1870	1.21	0.03	64	3.20	53	4.40	380
12.	1871	16.98	0.43	32	1.60	78	6.40	400
13.	1872	6.43	0.16	64	3.20	63	5.20	420
14.	1873	44.72	1.14	32	1.60	73	6.00	380
15.	1874	2.88	0.07	48	2.40	10	0.80	160
16.	1875	5.7	0.15	72	3.60	107	8.80	620
17.	1876	3.42	0.09	24	1.20	34	2.80	200
18.	1877	2.85	0.07	32	1.60	24	2.00	180
19.	1878	132.1	3.38	120	6.00	102	8.40	720
20.	1879	3.06	0.08	96	4.80	5	0.40	260

Table 5: Chemical (K, Ca, Mg & T.H. as CaCO$_3$) parameters of Nalgonda district water sample.

S.No.	Lab No.	Conductivity and Sodium Adsorption Ratio	Classification	RSC meq/L	Classification
BIS Permisable Limits		0-10 (Excellent), 10-18 (Good), 18-27 (Doubtful), above 27 (U.S.)		0-1.25 (P.S.), 1.26-2.5 (M.R), 2.5 above (U.S)	
1.	1860	4.48	High, Low	-7.14	Probably safe
2.	1861	2.95	High, Low	-0.30	Probably safe
3.	1862	2.35	High, Low	-0.76	Probably safe
4.	1863	5.53	High, Low	2.24	Marginal (for agriculture)
5.	1864	5.16	High, Low	-1.55	Probably safe
6.	1865	2.73	High, Low	-0.56	Probably safe
7.	1866	7.94	High, Low	-2.24	Probably safe
8.	1867	1.25	Very High, Low	-1.45	Probably safe
9.	1868	2.11	Medium, Low	-1.80	Probably safe
10.	1869	2.75	High, Low	-0.81	Probably safe
11.	1870	1.64	High, Low	-3.24	Probably safe
12.	1871	0.99	High, Low	-4.03	Probably safe
13.	1872	1.96	High, Low	-4.40	Probably safe
14.	1873	2.31	High, Low	-2.83	Probably safe
15.	1874	1.84	High, Low	-0.51	Probably safe
16.	1875	3.20	Medium, Low	-6.50	Probably safe
17.	1876	3.30	High, Low	0.57	Probably safe
18.	1877	2.07	High, Low	0.32	Probably safe
19.	1878	4.93	Medium, Low	-8.71	Probably safe
20.	1879	1.83	High, Low	-1.50	Probably safe

Table 6: Chemical (K, Ca, Mg & T.H. as CaCO$_3$) parameters of Nalgonda district water sample.

Magnesium

The value of magnesium observed between 5-102 mg/l and 0.40-8.40 ppm. It was estimated by titration through EDTA standard [22].

Conclusion

Water quality is dependent on the type of the pollutant added and the nature of mineral found at particular zone of bore well. Monitoring of the water quality of ground water is done by collecting representative water samples and analysis of physico-chemical characteristics of water samples at different locations of Nalgonda district [23,24]. Estimation of water quality index through formulation of appropriate using method and evaluate the quality of different water by statistical analysis by physico-chemical properties. From the result it was found that water of Polkampally Vagu was marginal for agriculture and other sources of water was probably safe or it can be used for domestic or irrigation purpose only. Therefore it offers as a significant value to physico-chemical water quality standards.

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