A study on assessment of groundwater quality and its suitability for drinking in Shivajipalem area, Visakhapatnam, A.P.

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***Abstract* - Assessment of groundwater quality is necessary as it controls it's usability for drinking purpose. This study was carried out to deal with physicochemical and biological characteristics of groundwater and to assess the suitability of groundwater for drinking purpose by determining the quality of water of the Shivajipalem area, Visakhapatnam which was a dumpyard earlier. Water samples are collected from bore wells of sample stations and are analyzed FOR concentrations.The concentrations of physical, chemical and biological parameters in groundwater samples were compared with the Bureau of Indian Standards (BIS) and World Health Organization (WHO), and observed that the water quality parameters were exceeding the permissible limits in some places of the study area. The water quality index is determined using weighted arithmetic index method. The conclusion of the analysis is that the groundwater in some places of study area is good for drinking and many areas have poor water quality. However the quality can be improved after undergoing the treatment processes.**

***Keywords* - Groundwater quality, Shivajipalem, Water quality index**

I. INTRODUCTION

It is essential to ensure proper quality of water used for drinking and irrigation purposes. Use of inferior quality of water for drinking will adversely affect human health. In developing countries like India, most of the population use untreated groundwater for various purposes, as they do not have access to good quality water. The suitability of water for drinking depends on various constituents such as suspended particles and dissolved inorganic, organic, radiological, and biological constituents. The Bureau of Indian Standards (BIS 2003) and the World Health Organization (WHO 2006) have prescribed maximum permissible limits for various dissolved ions in water used for human intake. Researchers around the world have studied the quality of water based on these standards.

II. OBJECTIVES

The main objectives of the present study are

- To identify the status of water quality in Shivajipalem area with respect to physico–chemical parameters.
- To assess the suitability of groundwater for drinking.

III. EXPERIMENTAL PROGRAM

Groundwater is to be analyzed for various physico-chemical parameters such as pH, Electrical conductivity (EC), Total dissolved solids (TDS), Alkalinity (TA), Total hardness (TH), Sulphate (SO_4^{-2}), Chloride (Cl), Nitrate (NO_3^{-2}), Iron (Fe), calcium (Ca) and magnesium (Mg) using water & waste water quality laboratory manual standard methods and WQI can be computed using weighted arithmetic index method. Water quality index, as a reflection of composite influence quality parameter on the overall quality of water. WQI assesses water quality trends for management purpose even though it is not meant for an absolute measure of the degree of pollution or the actual the water quality. Application of WQI is a useful method in assessing the water quality of groundwater. For calculation of WQI, selection of parameters has great significance since number of parameters widens the WQI and their selection depends on the intended use.

$$WQI = \frac{\sum_{i=1}^{n} w_i q_i}{\sum_{i=1}^{n} w_i} \quad \text{..... Eq.1}$$

$$w_i = k / S_i \quad \text{..... Eq.2}$$

$$qi = [(va-vi)/(si-vi)]*100 \quad \text{..... Eq.3}$$

Where,
w_i is a Weight age factor computed using Eq.(3.2).
V_a= Actual value of the i^{th} water quality parameter obtained from laboratory Analysis,
V_i = Ideal value of the i^{th} water quality parameter obtained from standard tables,
V_i for p^H is 7, for DO is 4 and for other parameters it is equivalent to zero.

IV.RESULT

The experimental results are presented in the following table, Table 4.1, 4.2, 4.3. Computing the values of WQI and comparing them with standard values of WQI, quality of groundwater shall be categorized for all the bore wells at different locations in the study area.

Table.(1) Results – Sampling Duration from March 10th – March 25th

S No	p^H	EC	TDS	TH	Ca	Mg	Cl	Alkalinity	NH_4-N	DO	SO_4^{-2}	Fe	NO_3^{-2}	BOD	MPN Coliform	WQI
1	6.776	0.448	1290	96	68	28	56.8	784	0.4	5.4	85	0.3	15.6	4.8	4	97
2	5.865	1.967	1280	216	202	14	211.2	320	NIL	6.6	110.9	0.25	9.8	1.6	A	84
3	6.218	1.870	1218.1	132	84.2	47.8	188.5	310	0.6	4	109.1	0.14	17	5.6	5	49
4	6.713	1.53	994.5	224	162	62	93.15	244	NIL	6.8	191.1	0.13	8.4	2.4	A	45
5	6.478	0.89	585	102	28	74	81.79	250	0.1	5.4	215	0.15	17.3	6	1	51

A – Absent

Table.(2) Results - Sampling Duration from March 25th – April 10th

S No	pH	EC	TDS	TH	Ca	Mg	Cl	Alkalinity	NH_4-N	DO	SO_4^{-2}	Fe	NO_3^{-2}	BOD	MPN Coliform	WQI
1	6.548	1.17	760.5	108	89	19	68.1	186	0.3	5.3	87	0.31	15.2	4.7	3	99
2	6.33	1.36	884	227	112	115	213.7	322	N	6.4	113	0.24	9.5	1.5	A	82
3	7.571	1.17	760.5	129	74	55	176.3	308	0.6	3.9	107.6	0.12	17.2	5.4	5	42
4	6.693	1.22	793	109	85	24	94.36	238	N	6.7	193.1	0.13	8.12	2.4	A	43
5	6.665	0.83	539.5	136	52	84	82.11	253	0.1	5.3	216.1	0.12	17	5.8	1	42

A – Absent

Table.(3) Results - Sampling Duration from April 10th – April 25th

S No	pH	EC	TDS	TH	Ca	Mg	Cl	Alkalinity	NH_4 - N	DO	SO_4^{-} ₂	Fe	NO_3^{-2}	BOD	MPN Coliform	WQI
1	6.5	1.15	760.5	97	76	21	70	188	0.3	5.3	88	0.27	14.7	4.8	4	88
2	6.29	1.33	884	230	125	105	215	324	N	6.4	111	0.25	9	1.6	A	85
3	7.6	1.15	760.5	131	77	54	172	310	0.6	3.9	105	0.11	16	5.5	6	40
4	6.8	1.2	793	111	88	23	96	240	N	6.7	192	0.14	8.5	2.2	A	46
5	6.56	0.91	539.5	135	58	77	80	255	0.1	5.3	217	0.21	15	5.1	2	70

A – Absent

Table.(4) RESULTS –Average values - Sampling Duration from March 10th – April 25th

Parameter	Average Values		
	Sampling 1	Sampling 2	Sampling 3
p^H	6.321	6.61856	6.582

Electrical Conductivity	0.32	0.83	0.89
Total Dissolved Solids	1039.6	800.02	800.32
Total Hardness	141.36	155.04	155.84
Calcium	93.808	102.48	106.52
Magnesium	41.832	52.76	49.32
Chlorides	108.6928	112.092	111.896
Alkalinity	282.64	241.08	243.08
Ammonical Nirtrogen	0.253	0.26	0.26
DO	5.872	5.836	5.836
Sulphate	143.084	143.848	142.32
Iron	0.1804	0.175	0.1876
Nitrate	11.3968	11.3564	10.844
BOD	3.912	3.852	3.668
MPN Coliform	3.99	3.69	3.9

TABLE.(5) RESULTS - Water Quality Index

S. No.	WQI	STATUS	SAMPLE LOCATION
1	0-25	Excellent	--
2	26-50	Good	S No.8 - 9-34-3, Pithapuram Colony road
			S No.13 - Adarsh nagar, MVP colony
3	51-75	Poor	S.No.20 - Shivaji park, MVP double Road,sector5
4	76-100	Very Poor	S.No.1 - Shivaji Palem, Pithapuram colony
			S.No.2 - Mangapuram colony, Pithapuram
5	100 and above	Unsuitable For Drinking (U.F.D.)	--

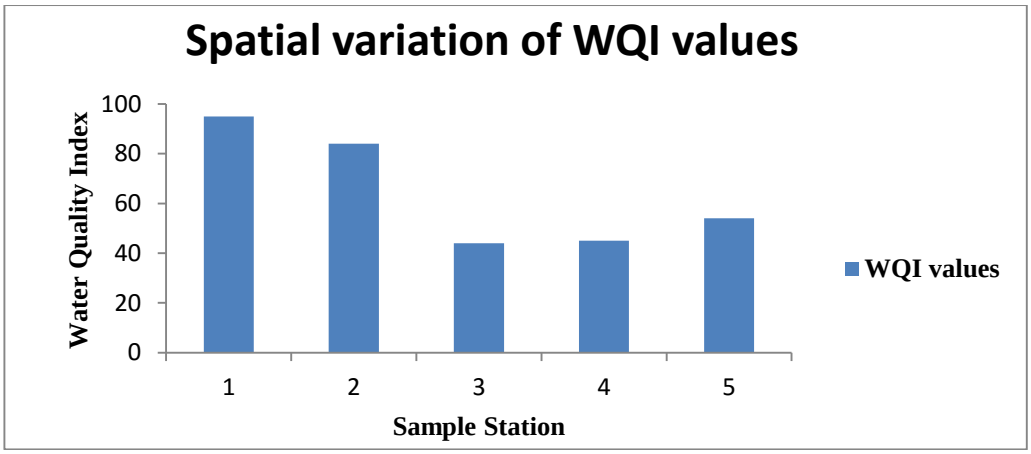

Fig.(1) Bar Chart Explaining Spatial Variation of WQI values

V. CONCLUSIONS

1. The status of ground water quality is identified in all the sample stations of the study area with respect to physical and chemical parameters.
2. Based on water quality index the suitability of groundwater in 5 sample stations of the study area is determined.
   a. The quality of ground water in Shivaji Palem, Pithapuram colony (S.No.1), Mangapuram colony, Pithapuram (S.No.2) is very poor.
   b. The groundwater collected from the Shivaji park, MVPdouble RD, sector5 (S.No.5) has the poor quality.
   c. The quality of groundwater in 9-34-3, Pithapuram Colony road (S.No.3), Adarsh nagar, MVP colony (S.No.4) has been found as good.

VI. SCOPE FOR THE FURTHER STUDY

The investigations into groundwater contamination can be done in unexposed areas in Visakhapatnam like in present study area. Water suitability can also be found out. By calculating Water Quality Indices further treatment can be done to the poor and very poor water quality areas by adopting the required methodologies.

VII. REFERENCES

[1] S. Parimala renganayaki & L. Elango, Department of Geology, Anna University, Chennai, Tamil Nadu, India, "Groundwater quality assessment of suitability for drinking and irrigation purposes" Arab J Geosci, Saudi Society for Geosciences 05,jul,2013,Spinger journal

[2] Ashifa Soomro, Altaf Ali Siyal, Muhammad Saffar Mirjat, Allah Wadhayo Gandahi, Abdul Latif Qureshi, "Seasonal Variation Of Groundwater Quality Assessment For Irrigation And Drinking Purpose In Phuleli Canal Command Area (Sindh), Pakistan", International Water Technology Journal, IWTJ Vol. 4 - No. 4, December 2014
[3] Environmental engineering laboratory manual, Environmental and water resources engineering division, Department of civil engineering, Indian institute of technology madras, Chennai -600 036
[4] M. Dinesh Kumar and Tushaar Shah, "Groundwater Pollution and Contamination in India:The Emerging Challenge",Consultant and Principal Scientist, respectively, International WaterManagement Institute, South Asia Regional Programme, India Project Office, Vallabh VidhyaNagar, PIN 388 120.
[5] Water Quality Assessments - A Guide to Use of Biota, Sediments and Water in Environmental Monitoring - Second Edition, Edited by Deborah Chapman© 1992, 1996 UNESCO/WHO/UNEP, ISBN 0 419 21590 5 (HB) 0 419 21600 6 (PB)
[6] Dr. Reeta kori, expert resource person, Mrs. Suniti Parashar, SSA, under the guidance of Dr. D.D. Basu, Scientist 'e' &Sh. J.S.Kamyotra, member secretary, CPCB. Ms. Sarita Kumari, S.P.Gautam, "Guide Manual-Water and Waste water analysis
[7] Bereau of Indian Standards (BIS) for drinking Water Specification IS: 10500, BIS, New Delhi, India, 2012
[8] Usharani K., Umarani K., Ayyasamy P.M., Shanthi K., Lakshmana perumalsamy P,, "Physico-Chemical and Bacteriological Characteristics of Noyyal River and Ground Water Quality of Perur, India" Journal of Applied Sciences and Environmental Management, Vol. 14, No. 2, June, 2010, pp.29-35
[9] Standard Methods for the Examination of Water and Waste Water, 1995. 20thEdition, APHA.