International Journal of Engineering and Technical Research (IJETR)
ISSN: 2321-0869 (O) 2454-4698 (P), Volume-10, Issue-10, October 2020

The Study of Ground Water Quality in the School Zones of Visakhapatnam, Andhra Pradesh

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***Abstract*—Though the sustainability of water resources is imperative; its quality is more significant for a balanced ecosystem. The present case the study is focused on the quality of groundwater in Visakhapatnam city principally in the school zones as children are more prone towards water-borne diseases. Total 15 school zones identified for the present study. Physico-chemical parameters, including some heavy metals, are analyzed. pH, Total hardness, Calcium Hardness, Alkalinity, Chlorides, Total Dissolved solids, Sulphates, Fluorides, Iron, Nitrates, MPN, Zn and total Chromium, are tested and analyzed. Results revealed that excessive concentration of specific parameters has not yet reached alarming levels. Interestingly, MPN with positive signs reported in 50% of the sampling areas. School zones in industrial areas reported with traces of heavy metal concentrations.**

***Index Terms*—groundwater, school zones, physico-chemical, heavy metals, MPN.**

I. INTRODUCTION

In between air and soil, water occupies its exceptional place in maintaining a balanced ecosystem (Bishnoi, 2007). Its quality always measured as specific criteria to assess its usage for various domestic purposes (Gupta et al., 2004). Furthermore, 1/3rd population in India depends on groundwater for all their domestic demands, in particular drinking (Hem,1985). With pressurized urbanization and uncontrolled population growth, made the natural water ecosystem scanty. Extensive studies are carried out in assessing the groundwater quality in rural and urban areas of every state and districts in India (Subba Rao, 1993; Gupta et al., 2004; Laluraj, 2005; Srinivasamoorthy, 2008; Vennila, 2008; Yidana, 2010; Ramesh, 2011; Ramkumar, 2013; Magesh, 2013). It is very much lucid from the literature that no research work is carried out so far to assess the groundwater quality in school zones of Visakhapatnam. Hence in this paper, school zones are identified to carry out the groundwater quality analysis as children are more prone towards water-borne diseases. Indeed this work is useful to take necessary steps and precautions towards the improvement of groundwater quality. Furthermore, it paved to carry area-specific studies where the parameters exceeded the limits specified by WHO. (2012) & Bureau of Indian Standards (BIS).

II. MATERILAS AND METHODS

One litre groundwater grab samples have collected with the utmost care in high-density polyethene (HDPE) bottles with proper rinsing. The same type of HDPE bottles with 100ml capacity has used to collect samples for bacteriological analysis. Concentrated HNO3 has added to the samples for the metal analysis. Total 15 school zones identified in the present study. 13 different parameters (pH, Alkalinity, Total hardness, Calcium Hardness, Chlorides, Total Dissolved solids, Sulphates, Fluorides, Iron, Nitrates, MPN, Zinc and Chromium have analyzed in Environmental Engineering Lab, Civil Department, GITAM, Visakhapatnam as per the standard procedures (APHA,1995). The laboratory experiments have carried for three months (February, March, April) in the year 2019. The sampling has not carried out further as most of the schools declared summer holidays.

III. RESULTS AND DISCUSSION

From the analysis of groundwater samples, Total hardness value is as measured as more than 200 mg/L in the area of Hanumanthwaka, particularly in February. However, the value remains moderately soft in the remaining two months. Near to the school zone of Chandrampalem, the total hardness value exceeded the maximum limit and reached up to 320mg/L in the three months of the study(Figure-I)

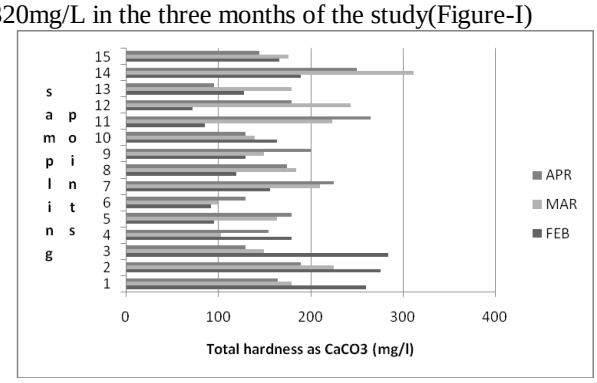

Figure-I : Total hardness in the studyarea

Though the value of pH fluctuates, its value is in between 6.5 to 8.5. The average value of chlorides in the Hanumanthwaka area is 210 mg/L, which is just above the acceptable limit, and the remaining areas covered were well within the acceptable limit (Figure-II).

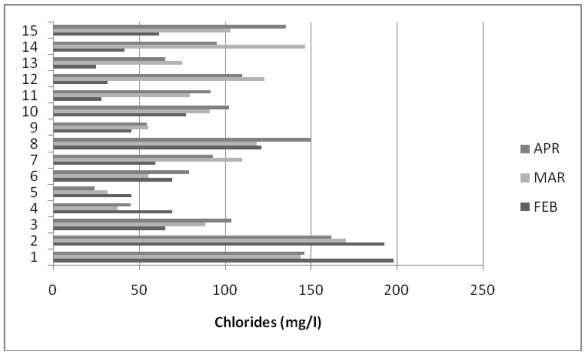

Figure-II: Chlorides in the studyarea

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As pH values are not less than six on the pH scale, alkalinity measured at all the locations. Out of 15 sampling locations, Total alkalinity at 8 points is identified with more than the acceptable limit and during April. Value of Fluoride is well within the acceptable limits at all sampling locations. Sulphates were also within the acceptable limit. Nitrate concentration exceeded with an acceptable limit in the old dairy farm area (Figure-III).

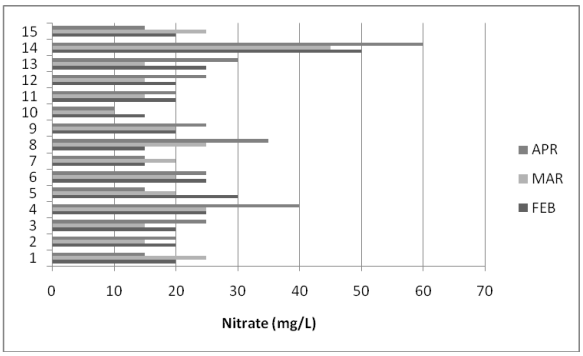

Figure-III: Nitrates in the studyarea

Though 50% of sampling locations identified with more total dissolved solids, overall values are well within the permissible limit. It is interesting to identify positive MPN samples in the areas of Bhutchirajupalem, MVP colony and Madhurawada(Figure-IV).

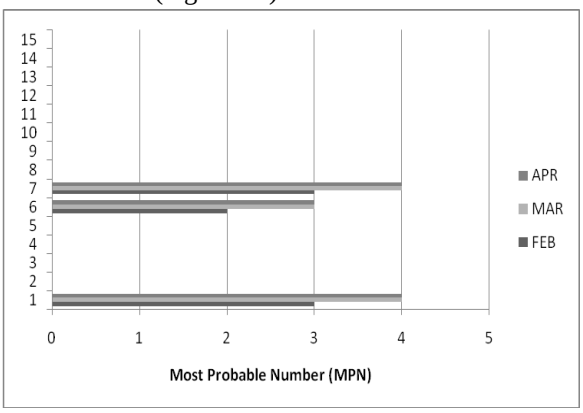

Figure-IV: MPN in the studyarea

Furthermore, the concentration of iron exceeded its acceptable limits in all sampling locations (Figure-V).Traces of Zinc and Chromium observed in Kurmanapalem area and municipal waste dumping yard areas (Madhurawada). Physico-chemical test results of all 15 sampling locations tabulated in Table –II.

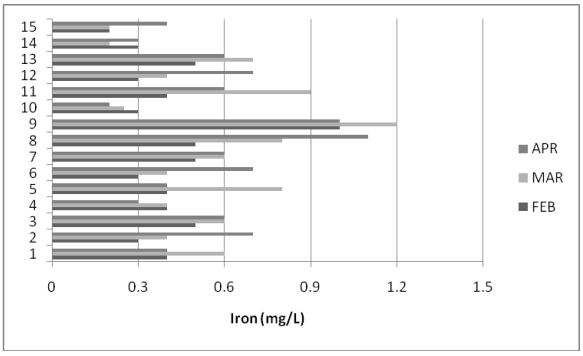

Figure-V: Iron in the studyarea

IV. CONCLUSION

Based on the study performed at fifteen different locations, Physico-chemical characteristics of groundwater quality in the study area is not exactly suitable for drinking purpose. Groundwater drainage pipeline needs to examine thoroughly to understand the reason for positive cases of MPN test. Method of disinfection should need to carry before supplying the water to school children. Industrial and municipal waste dumping yard areas have identified with the traces of heavy metals. Leachate of hazardous metals might be the cause of groundwater pollution in those areas

REFERENCES

[1] Bishnoi, M. S and Arora, S. 2007. Potable groundwater quality in some villages of Haryana, India: Focus on fluoride. Journal of Environmental biology, 28, 291–294

[2] Gupta, S.K.andDeshpande R.D, 2004.Water for India in 2050 : First-order assessment of available options Current Science, 86, 1216–1223

[3] Hem, 1985.The studyand Interpretation of the Chemical Characteristics of Natural water. 3rdedition, Vol. 2254, 100-104

[4] Subba Rao, N.1993. Environmental impact of industrial effluents in groundwater regions of Visakhapatnam Industrial Complex. Ind. Jourof Geology, 65, 35–4

[5] Laluraj, Gopinath and Dineshkumar.2005. Groundwater chemistry of shallow aquifers in the coastal zones of Cochin, India. Appl Ecol Environ Res 3:133–139

[6] Srinivasamoorthy,K..,Chidambaram,S. and Vasanthavigar ,M.2008. Geochemistry of fluorides in groundwater, Salem District, Tamilnadu, India. J. Env. Hydrol., 1, 16-25

[7] Vennila G., Subramani T and Elango L.2008. GIS Based GroundwaterQuality Assessment of Vattamalaikarai Basin, Tamil Nadu, India. Nat.Env.and Poll.Tech.V. 7(4), pp. 585-592

[8] Yidana SM, Banoeng-Yakubo B, Akabzaa T.2010. Analysis of groundwater quality using multivariate and spatial analyses in the Keta basin, Ghana. J Afr Earth Sci 58:220–234

[9] Ramesh, K. and Elango, L. 2011. Groundwater quality and its suitability for domestic and agricultural use in Tondiar river basin, Tamil Nadu, India. Environ Monit Assess., DOI 10.1007/s10661-011-2231-3

[10] Ramkumar, T., Venkatramanan, S. and Anithamary.2013.. Arab J Geosci. 6: 101. https://doi.org/10.1007/s12517-011-0327-2

[11] Magesh N.S.,K Kumar S., Chandrasekar N. and Soundranayagam J.P. 2013. Groundwater quality assessment using WQI andGIS techniques, Dindigul district, Tamil Nadu, India. Arab J Geosci. DOI 10.1007/s12517-012-0673-8, 4179–418

[12] WHO.2012. Guidelines for drinking water recommendations, world health organization .Geneva:WHO

[13] APHA 1995, Standard Methods for the Examination ofWater and Wastewater, American Public Health Association, Washington, DC

[14] Bureau of Indian Standards (BIS) 1991. Indian standard specification for drinking water, IS 10500. 24.

Table II: Physico-chemical characteristics of samples collected

No.of points	TH as $CaCO_3$	CH-as $CaCO_3$	pH	T.A	Cl	TDS	S	F	Fe	N	Zn	T.Cr	MPN
Month of February													
1	260	128	7.7	243	198	800	150	0.5	0.4	20	2	0.04	3
2	276	140	7.8	230	193	750	120	0.2	0.3	20	3	0.02	0
3	284	86	7.9	310	66	1020	160	0.5	0.5	20	5	0.01	0
4	180	74	6.91	130	69	500	85	0.2	0.4	25	2	Nil	0
5	96	68	7.7	96	46	250	90	Nil	0.4	30	3	Nil	0
6	92	64	7.8	192	69	600	75	0.6	0.3	25	8	0.08	2
7	156	76	6.95	142	60	650	85	Nil	0.5	15	2	Nil	3
8	120	60	7.93	298	121	950	100	0.7	0.5	15	3	Nil	0
9	130	52	7.33	312	46	1020	110	0.5	1	20	2	Nil	0
10	164	64	7.5	492	77	1400	95	0.4	0.3	15	6	0.06	0
11	86	40	7.43	368	28	1200	60	Nil	0.4	20	1	Nil	0
12	72	40	7.1	192	32	600	75	0.2	0.3	20	4	0.01	0
13	128	90	7.38	60	25	200	80	Nil	0.5	25	2	Nil	0
14	190	50	7.42	404	42	1340	100	0.6	0.3	50	3	0.01	0
15	166	52	7.01	114	62	300	65	0.6	0.2	20	1	Nil	0
Month of March													
1	180	165	7.65	60	144	200	120	0.4	0.6	25	3	0.05	4
2	225	185	7.33	115	171	240	100	0.3	0.4	15	5	0.02	0
3	150	95	7.5	97	89	240	80	0.5	0.6	15	2	Nil	0
4	103	80	6.76	32	38	100	45	0.8	0.4	25	4	Nil	0
5	164	40	7.18	52	32	120	60	0.7	0.8	20	2	Nil	0
6	100	92	6.5	36	56	80	75	0.6	0.4	20	10	0.06	3
7	210	132	6.89	106	110	180	45	0.5	0.6	20	4	Nil	4
8	185	92	7.09	78	119	90	50	0.5	0.8	25	4	Nil	0
9	150	120	7.22	126	55	80	80	0.2	1.2	20	2	Nil	0
10	140	144	6.3	60	91	40	25	Nil	0.25	10	5	0.04	0
11	224	146	7.06	44	79	40	20	Nil	0.9	15	2	Nil	0
12	244	136	7.1	100	123	60	80	0.2	0.4	15	4	0.02	0
13	180	88	6.6	24	75	40	20	0.4	0.7	15	3	Nil	0
14	312	208	6.83	52	147	80	40	0.2	0.2	45	3	0.04	0
15	176	120	7.18	40	103	60	35	0.4	0.2	25	2	Nil	0
Month of April													
1	165	152	7.69	74	146	100	70	0.02	0.4	15	4	Nil	4
2	190	105	7.3	111	162	120	80	0.04	0.7	20	4	Nil	0
3	130	86	7.6	177	104	180	60	Nil	0.6	25	3	0.04	0
4	155	120	7.33	51	45	60	50	0.04	0.3	40	4	0.04	0
5	180	140	7.04	44	24	60	80	0.04	0.4	15	2	Nil	0
6	130	89	6.85	64	79	80	90	0.04	0.7	25	8	Nil	3
7	225	75	6.8	133	93	140	55	Nil	0.6	15	5	0.08	4
8	175	62	7.25	53	150	80	70	0.02	1.1	35	4	Nil	0
9	200	150	7.5	112	55	160	60	Nil	1	25	2	Nil	0
10	130	66	7.23	86	103	140	40	Nil	0.2	10	5	Nil	0
11	265	65	7.09	35	92	60	50	0.02	0.6	20	4	0.06	0
12	180	65	6.95	142	110	180	50	0.04	0.7	25	4	Nil	0
13	96	60	6.76	65	65	100	60	0.02	0.6	30	3	0.01	0
14	250	140	7.3	73	95	120	30	0.06	0.3	60	3	0.02	0
15	145	80	7.1	60	136	130	20	0.06	0.4	15	4	0.04	0