PHYSICO-CHEMICAL ANALYSIS OF GROUND WATER IN THE SELECTED AREAS OF ANAKAPALLI, VISAKHAPATNAM, ANDHRA PRADESH, INDIA.

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***Abstract*:** The growing population has induced great stress on the natural resources and water being a life line to human survival is of no exception facing great anthropogenic stresses. Ground water which is acting as a one of water resource to millions world wide is also under hammer from the pollution aspects. In the present study an honest attempt has been made to study the several physico-chemical aspects of some ground water samples in the Anakapalli town of Visakhapatnam, Andhra Pradesh, India.

Keywords: Ground water , Anthropogenic Stress, Ground water.

I. INTRODUCTION:

Water resources form an important economic asset of a country. Increasing standards of life, rate of population growth and geographical concentration of human activities, have intensified the pressure on the available water resources at an alarming rate. Groundwater represents the world's largest and is one of the most important sources of fresh potable water. It is generally considered least polluted compared to other inland water resources, but studies indicate that ground water is not absolutely free from pollution through it is likely to be free from suspended solids (Mishra and Sahoo, 2003).

Water quality depends on various chemical components and their concentration, derived mostly from the geology of that particular region. The quality of ground water varies from place to place, season to season, and with the depth of water table and is primarily governed by the extent and composition of dissolved solids present in it (Borah *et. al.*, 2009; Sinha *et. al.*, 2007). Water quality may be described according to the physico-chemical and micro-biological characteristics of the waters. The major problem with the ground water is that once contaminated, it is difficult to restore its quality (Garg, 2000). In most cases surface water reservoirs are protected from the contaminations with the help of some warning signals, but unfortunately groundwater reservoirs are not protected effectively.

Unrestricted pumping of ground water has led to serious depletion of water table in the aquifers. Temporal changes in the origin and composition of the recharged water, hydrology and human interferences can cause periodic changes in groundwater quality. Unscientific disposal of Municipal solid wastes that is dumped in enormous heaps forming landfills is a common site in almost all the rural and urban areas in Andhra Pradesh. Hydrological connectivity between groundwater and the land surface provides the opportunity for the contamination of groundwater and a subsequent reduction in water quality (Stamatis et al.2001).

The present study of ground water quality is a matter of great concern as this limited resource is under tremendous pressure and is deteriorating gradually and at an alarming rate on global scale. The objective of the study is to study and identify the principal pollutants in the study area and the impacts of groundwater pollution on human health in order to determine the portability of the water being used in the study area.

II. LITERATURE SURVEY:

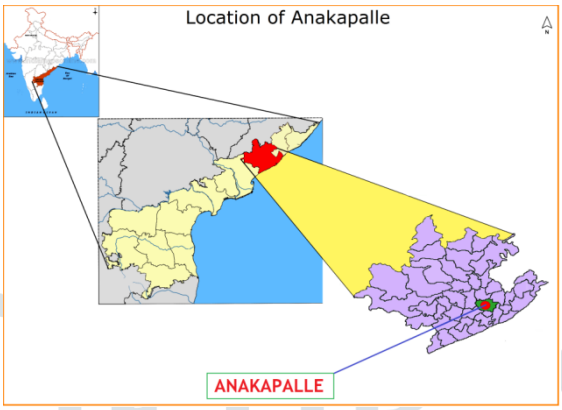
Studies on ground water chemistry to determine the suitability of water for domestic and irrigation purposes in Sangamner area of Maharashtra was carried out by (**Deshmukh and Pawar, 1999)** have studied the influence of tank irrigation on ground water quality in the Vizianagaram district of Andhra Pradesh. **Nageswara Rao et al (2007)** studied the physic-chemical characteristics of groundwater in the Meghadrigadda watershed area of Visakhapatnam. Temporal changes in groundwater quality in the industrialised areas of Visakhapatnam from 1982 to 2006 were studied by **Srinivasa Rao et al (2007)** based on available literature. Increase in concentrations of sulphate ion in aquifers may be attributed to a prolonged industrial activity. **Geetha et.al (2014)** have studied the pysico-chemical and microbiological characteristics of water sampes collected from open-wells, bore-wells and streams in Anakapalli Municipality area and reported that Six isolates of bacteria namely: E.coli, Enterobacter aerogenes, Klebsiella pneumonia, Salmonella, Shigella, and Staphylococcus were isolated, which are highly pathogenic, which indicated that the water samples are highly contaminated and not safe for drinking and utility purposes.

III. STUDY AREA:

Anakapalle is bustling town located at around 34 km west of Visakhapatnam in the state of Andhra Pradesh and lies at 17.6913°N 83.0039°E, on the banks of the holy river Sarada at an altitude of 29 m (95 ft) with a spread over area of 23.28 km2. Anakapalle is well known for its jaggery market, which stands as the second largest in India. The town is also famous for sugarcane,

guava fruits and for the manufacture of brass utensils and household utensils. It houses the Mandal headquarter of Anakapalle Mandal and is also an administrative sub-division in the District of Visakhapatnam of Andhra Pradesh. Anakapalle town which has been governed by a Municipal Council was merged in the Greater Visakhapatnam Municipal Council (GVMC) in July 2013. This town now contains 20 wards under GVMC. However the study also focuses on some of the suburban areas around Anakapalle town where the population is directly or indirectly connected with the main town and their livelihoods as well as the lifestyles are dependent and interconnected. The suburban areas are experiencing a rapid urbanisation due to the expansion of city and population explosion in recent times and are sowy getting engulfed into the main town.

Figure 3.1: Map showing the study area.



IV. METHODOLOGY:

Ground water samples from bore-wells were carefully collected in properly sterilized glass bottles labelled with sample codes designated to the respective sampling stations for a period of the year during two seasons i.e., pre-monsoon and post-monsoon periods of 2018. The samples were analysed for physic-chemical parameters viz., pH, EC, TDS, Cl, F, Alkalinity, Hardness, Nitrates, Sulphates and D.O., as per standard procedure prescribed by APHA 2005.

V. RESULTS & DISCUSSION:

The Groundwater is a more reliable natural source of portable water as it is usually clean, colorless and odorless, with little or no traces of suspended solids and relatively constant temperature. Assessment of groundwater quality has always been a vital field of environmental quality management as appropriate evaluation of water quality before its usage may help in arresting any ill effects on humans, other living organisms and also on groundwater recharge.

pH has no direct adverse effect on human health but it alters the taste of water. The pH of ground waters generally lies in the range of 6.5 to 8.5. Most of bio-chemical and chemical reactions are influenced by the pH (Manjare et al., 2010). In the present study the values of pH ranged from 7.3 to 8.1 and 7.1 to 1.8 in the pre monsoon and post monsoon seasons respectively. Maximum value was recorded in S08 in both the seasons.

Electrical conductivity of the water increases with increased concentrations of Na^+, K^+, Cl^-, alkalinity and total dissolved solids and a marked increase in conductivity of water is an indication of addition of pollutants to the water (Trivedi & Goel, 1986 and Prakash & Somasekhar, 2006). In the present study the values of EC ranged from 699.3 to 1467.6 and 743.2 to 1509.8 in the pre monsoon and post monsoon seasons respectively. Maximum value was recorded in S04 in both the seasons.

The general nature of water quality is determined by the range of total dissolved solids (TDS). TDS affects the taste of drinking water. Fresh water is usually considered to be water containing less than 1,000 ppm total dissolved solids (Drever, 1988). In the present study the values of TDS ranged from 37.22 to 953.47 and 381.73 to 997.53 in the pre monsoon and post monsoon seasons respectively. Maximum value was recorded in S04 in both the seasons.

The concentration of chlorides in the present study ranged from 100.0 to 325.0 and 87.5 to 290.0 in the pre monsoon and post monsoon seasons respectively. Maximum value was recorded in S04 in both the seasons. The fluoride value in the study area ranged from 0.04 to 1.35 and 0.06 to 1.46 in the pre monsoon and post monsoon seasons respectively. Maximum value was recorded in S08 in both the seasons.

Alkalinity is a measure of the acid neutralizing ability of a sample, which can be the result of several ions in solution. The constituents of alkalinity in natural system mainly include Carbonate, Bicarbonate and Hydroxide. These constituents result from dissolution of mineral substances in the soil and atmosphere (Mittal and Verma 1997). The concentration of chlorides in the present study ranged from 135.0 to 465.0 and 125.0 to 505.0 in the pre monsoon and post monsoon seasons respectively. Maximum value was recorded in S09 in both the seasons.

Hardness is one of the natural features of any water sample reflecting Ca & Mg as carbonates & bicarbonates. Calcium and magnesium get added to the ground water system during it passage through soil rock containing large amounts of these elements in mineral deposits (Renn, 1970). The hardness values in the study area ranged from 230.0 to 495.0 and 215.0 to 495.0 in the pre monsoon and post monsoon seasons respectively. Maximum value was recorded in S10 in both the seasons.

Nitrate is one of the most common groundwater contaminants in rural areas. Nitrate enters into groundwater system primarily from fertilizers, septic systems, and manure storage or spreading operations. The concentration of nitrates in the present study ranged from 4.95 to 11.34 and 5.03 to 11.05 in the pre monsoon and post monsoon seasons respectively. Maximum value was recorded in S05 in both the seasons.

Sulphates in water are naturally contributed by dissolution through rocks and soil but however sewage and industrial effluents are some of the anthropogenic sources of sulphates in waters. The concentrations of sulphates in the present study ranged from 77 to 193 and 73 to 162in the pre monsoon and post monsoon seasons respectively. Maximum value was recorded in S02 in both the seasons.

Dissolved oxygen is a highly fluctuating factor and this value varies depending upon water temperature and the partial pressure of oxygen in its gas phase (Renn, 1970). The concentration of dissolved oxygen in the present study ranged from 2.4 to 5.3 and 2.3 to 5.3 in the pre monsoon and post monsoon seasons respectively. Maximum value was recorded in S05 and S06 in pre-monsoon and S10 in post-monsoon seasons. Due to physical chemical and biological activities, the dissolved oxygen seems to be low in all the ground water. The DO values may also vary with the temperature and altitudinal change.

Table 5.1: Physico- Chemical parameters of Anakapalli during pre and post monsoon seasons, 2018

S. No.	Sampling Station Code	Name of the Sampling Station	pH	EC	TDS	Cl	F	Alkalinity	Hardness	Nitrates	Sulphates	DO
Pre-Monsoon												
1	S 01	Ch. Argharam	7.9	717.4	435.63	100.0	0.88	280	290	8.16	107	2.80
2	S 02	Sarada nagar	7.8	699.3	379.22	102.5	0.98	135	235	7.85	193	3.60
3	S 03	Islampet	7.6	989.2	602.76	145.0	0.83	350	325	9.08	94	3.10
4	S 04	Anakapalle RTC Complex	7.3	1467.6	953.47	325.0	0.05	390	435	9.23	113	2.40
5	S 05	Anakapalle Railway Station	7.9	811.6	518.86	177.5	0.92	175	245	11.34	77	5.30
6	S 06	Anakapalle Police Station	7.6	1308.7	891.06	180.0	1.12	330	470	7.95	117	5.30
7	S 07	NTR Hospital	7.5	1233.5	681.93	175.0	1.08	315	440	4.95	94	5.20
8	S 08	Satyanarayanapuram	8.1	850.5	493.03	162.5	1.35	145	230	6.80	120	5.20
9	S 09	Vijayaramarajupeta	7.9	1459.7	854.24	220.0	1.12	465	250	10.75	137	3.60
10	S 10	Gopal Rao Kalashetram	7.5	1453.2	870.78	235.0	1.28	290	495	6.52	109	3.90
Post-Monsoon												
1	S 01	Ch. Argharam	7.8	743.2	381.73	87.5	0.95	270	295	7.96	93	2.70
2	S 02	Sarada nagar	7.6	764.7	403.41	105.0	1.12	125	230	7.85	162	3.10
3	S 03	Islampet	7.4	1016.6	588.61	162.5	0.88	305	325	8.86	101	3.20
4	S 04	Anakapalle RTC Complex	7.1	1509.8	997.53	290.0	0.06	345	430	9.28	104	2.20
5	S 05	Anakapalle Railway Station	7.5	851.4	547.82	155.0	1.18	170	245	11.05	73	3.70
6	S 06	Anakapalle Police Station	7.5	1179.0	790.40	192.5	1.32	310	445	7.73	117	3.60
7	S 07	NTR Hospital	7.4	1230.4	712.37	190.0	1.26	295	450	5.03	89	3.80
8	S 08	Satyanarayanapuram	7.8	1043.7	508.86	162.5	1.46	180	235	6.80	120	5.10
9	S 09	Vijayaramarajupeta	7.7	1451.5	856.27	207.5	1.32	505	215	10.77	144	3.30
10	S 10	Gopal Rao Kalashetram	7.5	1485.3	905.44	250.0	1.42	270	495	6.63	130	5.30

VI. CONCLUSION:

Rapid industrialization and urbanisation are resulting in an increase of pollution and degradation of available water resources. Ground water resources are experiencing an intense stress due to continuous extraction for various human usages. Further it is under serious threat of getting polluted due to its indiscriminate usage and disposal of pollutants which ultimately reach the aquifers through percolation. Though not feasible with today's technology pump-and-treat is commonly used with the goal of restoring the water drinking quality: water is pumped to the surface, treated to remove pollutants and then returned to its source. Boiling of ground water is advisable before human consumption, in-order to minimise the risk of getting effected.

References:

1. APHA (American Public Health Association). (2005) Standard method for examination of water and wastewater, NW, DC 20036.
2. BIS (Bureau of Indian Standards) 10500.1991. Indian standard drinking water- specification, First revision, pp 1-8.
3. BIS Tolerance limits for Inland surface water IS: 2296-1982 and BIS standard 2006.
4. Borah, K.K., Bhuyan, B and Sarma, H.P. (2009) Heavy metal contamination of Ground water in the Tea Garden Belt of Darrang District, Assam, India, J. Chemistry, 6(S1), 501-507.
5. Bureau of Indian Standards (BIS) (1991). Indian standard specification for drinking water, IS 10500, pp. 2-4.
6. Deshmukh K. K. and N. J. Pawar (1999), " The chemistry of groundwater in Sangamner area (Maharashtra) with regard to their suitability for domestic and irrigation purposes", CIE 99 (National conference on Industry and Environment), Karad of Maharashtra (India), (Abstract Vol.) pp. 43-35.
7. Drever, J.I. (1988) The Geochemistry of Natural Waters. 2nd Edition, Prentice-Hall, Englewood Cliffs, 437 p.
8. Garg, V.K., Gupta, R., Goel, S., Taneja, M. and Khurana, B. (2000) Assessment of Underground Drinking Water Quality in Eastern part of Hisar.Indian J. Env.Prot.. 20 (6):407-412.
9. Geetha S, Chandrababu P.J., Rao L.N., and Mohan M.M., (2014) Physico-chemical and microbial analysis of water samples in Anakapalli Municipal Corporation Int J Curr Sci 2014, 10: E 57-65.
10. Kataria, H.C. and Iqbal, S.A., (1995) Chloride Content in Borewells (Ground Water) of Bhopal City. Asian J. Chem Rev. 6: 35-38.
11. Khabade, S. K., Mule, M.B. and Sathe, S.S., (2002) Studies on physicochemical parameters of Iodhe water reservoir from Tasgaon Teshil (Maharastra): Indian. J. Environ and Ecoplan. 6(2): 301-304.
12. Krupanidhi, K. V. J. R.. (1984) Mechanism of groundwater pollution in village wells. Journal of the Geological Society of India, 25(5), 301–302.
13. Manjare, S.A., Vhanalakar, S.A., and Muley, D.V. (2010) Analysis of water quality using physico-chemical Parameters tamdalge tank in kolhapur district, Maharashtra. International Journal of Advanced Biotechnology and Research ISSN 0976-2612, Vol 1, Issue 2, Dec-2010, pp 115-119;
14. Mishra, N.K. and Sahoo, H.K. (2003) Evaluation of groundwater quality in and around Deogarh. Ind. J. of Env. Prot. 23(6): 667-672.
15. Mittal, S.K., and Neha Verma (1997): Critical analysis of groundwater quality parameters IJEP Vol. No. 17 (6) 426-429.
16. Mohemmad Rafi K., Akram, N.Md., Umamahesh M. and Ramachar T., (2011) A Chemical Analysis of Groundwater and Study on its Pollution Impact in and Around Jammalamadugu Area of YSR District, Andhra Pradesh, India. International Journal of African Studies ISSN 1451-213X Issue 4, pp.41-49.
17. Nageswara Rao, K., Narendra, K. & Venkateswarlu, P. (2007) Assessment of groundwater quality in Meghadrigadda watershed, Visakhapatnam district, A.P, India: GIS approach. Pollut. Res. 26(3): 15-26.
18. Prakash, K.L. and Somashekar, R.K. (2006) Groundwater quality - Assessment on Anekal Taluk, Bangalore Urban district, India. Journal of Environmental Biology 27(4):633-7.
19. Ramaswami, V. and Rajaguru, P., (1991).Studies on ground water quality of Madras, Indian J. Environ. Hlth., 3 J. Environ. Hlth., 33, pp. 481-4867.
20. Renn, C.E.: (1970) Investigating water problems. Educational products division, La Molte chemical products company, Maryland.
21. Sameer. V. Yamakanamardi, Hampannavar. U.S, Purandara. B.K., (2011) Assessment of Chloride Concentration in Groundwater: A Case Study for Belgaum City; International Journal of Environmental Sciences Volume 2 No.1.
22. Sarma, V.V.J. and Swamy, A.N., (1981) Ground water quality in Visakhapatnam basin, India. Jour. Water, air and Soil
23. Sinha, A.K., Setho, G. and Garg, J. (2007) Physico chemical characteristics of ground water at Churu Tehsil, Rajasthan, Journal of Environment Sci. & Engineering Vol. 49, No.(3). pp.203-206.
24. Srinivasa Rao, K.V., Subba Rao, N., Murali Krishna, B., Srinivasa Rao, P., Subrahmanyam, A., John Devadas, D. & Tirupathi Rao, B. (2007) Temporal changes in groundwater quality in an industrial area of Andhra Pradesh, India. Current Science. 93(11): 1616-1619.

25. Stamatis, G., Voudouris, K., and Karefilakis, F. (2001) Groundwater pollution by heavy metals in historical mining area of Lavrio, Attica, Greece. Water, Air, and Soil pollution, 128, 61–83.
26. Trivedi, R.K., and Goel, P.K. (1984) Chemical and biological methods for water pollution studies. Karad Environmental Publication, pp. 1-251.
27. Trivedi. P, and Goel, P.K., (1986) Chemical and Biologiccal methods for water pollution studies. Environment Publications. pp.215.
28. WHO (World Health Organization) (1984) Guidelines for drinking water quality. vol. 2 Pp 80-95.
29. WHO (World Health Organization) (1996) Health criteria and other supporting information; second ed. Guidelines for drinking water quality, Vol. 2. World Health Organization. Geneva. Switzerland.