JETIR.ORG ISSN: 2349-5162 | ESTD Year : 2014 | Monthly Issue
JOURNAL OF EMERGING TECHNOLOGIES AND INNOVATIVE RESEARCH (JETIR)
An International Scholarly Open Access, Peer-reviewed, Refereed Journal

ASSESSMENT OF PHYSICO - CHEMICAL PARAMETERS OF GROUND WATER IN VEMULA MANDAL AROUND TUMMALAPALLE VILLAGE, YSR DISTRICT, ANDHRA PRADESH.

M. Renuka, Siva Prathap. T*, M. Sasi Kumar Naik, T. Lakshmi Prasad.

Department of Earth Sciences, Yogi Vemana University, Kadapa, Andhra Pradesh

Corresponding Author: Siva Prathap. T

Abstract

Groundwater is water that exists under the Earth's surface and fills all or part of the void spaces in soils and geologic strata. Subsurface water is another name for it. Precipitation provides the majority of ground water. Precipitation seeps into the soil zone beneath the ground surface. In both urban and rural locations, ground water is an important supply of drinking water. For more than half of the country's population, ground water is the only supply of drinking water, and for many rural towns and several large cities, it is the only source of drinking water. Ground water has been an important source of water for many countries' household, industrial, and irrigation sectors in recent years. Because of the greater interaction of groundwater with diverse elements in geologic strata, it contains higher quantities of dissolved components than surface water. The quality of groundwater is determined by a variety of hydrological, physical, chemical, and biological elements. The study area's mining growth necessitates the prudent use of natural resources within the boundaries of acceptable assimilative capacity. As a result, in the region, water quality and management measures have become increasingly crucial. pH, EC, TDS, Total Hardness, Chloride, total alkalinity, Iron, Fluoride, Sulphate, Calcium, Sodium, Magnesium, and Potassium are among the physico-chemical parameters that will be evaluated in this study. The investigation will also determine whether ground water is suitable for drinking and irrigation in the Tummalapalle area. Bore wells in and around Tummalapalli village, Vemula mandal, YSR district, Andhra Pradesh, yielded a total of 12 samples. The data clearly reveal that some quantities in each of the 12 samples fall within the WHO permitted limits. The remaining metrics, such as EC, total alkalinity, total hardness, magnesium, and sodium, exceed the WHO acceptable limit.

Keywords: Ground water, physico-chemical parameters, Thummalapalli village, Vemula.

Introduction

In many aspects of life, water is a key indicator of one's standard of living. Water is essential for the survival of all living things. There are two sorts of water: surface water and subsurface water. Ground water is another name for subsurface water. Ground water refers to all water under the Earth's surface. Rain, snow, and other forms of precipitation provide ground water. There are two types of ground water: saturated and unsaturated. Hydrogeology is the scientific study of groundwater. The geological history of rocks, as well as signs of ground water recharge, outflow, and storage, are all revealed by ground water quality data. The current research is focused on determining physico-chemical characteristics in ground water in the thummalapalle village of the Vemula mandal. Host-mineralization along the papagni group of rocks overlain by the gulcheruvu quartzite has had health and environmental consequences in Tummalapalli hamlet. To determine the water quality, major inorganic elements are measured. Quality is also a function of physical, chemical, and biological characteristics, and it might be subjective depending on the intended purpose. Tummalapalli is a well-known uranium mining area in India, and mining activities frequently have an impact on ground water. The goal of this article is to compile a list of physicochemical properties of ground water in and around Tummalapalli village. Uranium is one of numerous economically valuable mineral resources found in India's Proterozoic Cuddapah basin. The Cuddapah basin is a middle-upper Proterozoic basin in Andhra Pradesh that is rich in economically important minerals as well as strata-bound Uranium deposits. The compositional dolostones Ca and Mg (CO3)2 from the Vempalli formation serve as host rocks for Uranium mineralization, whereas granites from the Archaean basement serve as source rocks, particularly in the Cuddapah basin.

Metal pollution, mining, and related industrial operations are now partially alleviated by tight deployment of clean technologies and modern land-use applications, but global demands for water supply have limited both the quality and quantity of globally critical ground water resources. Furthermore, because quality is a function of physical, chemical, and biological parameters and can be subjective depending on the intended use (Ravi Kumar and Somsekhar 2013), an attempt has been made to study ground water quality based on an integrated analysis of physico-chemical parameters in the Tummalapalli village area around uranium mining.

Understanding the hydraulic properties of aquifers and the hydrochemical characteristics of water in the studied area is critical for ground water planning. The concentration of chemical species is generally increased by the movement of ground water along its flow routes beneath the ground surface (Domenico etal.; Freeze and Cherry,1979; Kortatsi2007). The chemistry of ground water is influenced by a variety of factors, including general geology, the degree of chemical weathering of distinct rock types, the quality of recharge water, and input from sources other than water rock interaction. Ground water quality is complicated as a result of these elements and their interactions. In India's arid and semi-arid regions, intensive agricultural and urban growth has resulted in a high demand on ground water supplies.

Water sources, agricultural soils, and food crops are all threatened by the vast volume of mining waste released into tailings and garbage containing heavy metals. As water washes over the rock surface, metals are leached out and moved downstream. Although metals can become mobile in neutral pH environments, leaching is increased in low pH environments such as those caused by acid mine drainage. Mining activities have been documented to have negative effects such as metal sulphide oxidation, which causes soil acidity, inhibiting natural vegetation colonisation, which causes soil erosion, and degradation of aquatic ecosystems, which leads to the extinction of aquatic life.

In addition, acid mine water has an impact on agricultural regions that are irrigated with it. Deficits in key micronutrients have been documented as a result of the effects. As a result of this effect, agrochemicals are used as soil nutrients to increase soil fertility. Furthermore, this research highlights the primary processes that contribute to this hydrochemical data, such as weathering of silicate minerals, ion exchange between alkalis and alkaline earths, precipitation, and anthropogenic activities such as irrigation and fertilisation.

The goal of this research was to better understand ground water hydro geochemistry, identify its regulatory mechanisms, and assess the ground water as a whole. Furthermore, by comparing the concentrations of chosen water quality criteria, ground water quality and suitability for residential use are determined.

Objectives

1. To study the physico-chemical parameters in and around Tummalapalle village.
2. To assess the ground water suitability for drinking and Irrigation purpose.
3. Health and environmental impact of Tummalapalle area.

Study Area

Tummalapalli is rich in dolomite and, as a result of host-mineralization along the papagni group of rocks overlain by the gulcheruvu quartzite, ore of Uraninite mineral / Pitchblende supported by dolomitic limestone. Geographically, the location is located in the "Cuddapah" basin's southwest corner. Purple shale, massive limestone, intra-formational conglomerate, dolostone (uraniferous), shale, and cherty limestone make up the strata of the Vempalle Formation. Pitchblende, coffinite, and the U—Ti complex are the radioactive minerals found in the ore zone. The marker horizons are the impersistent conglomerate and purple shale bands that occur immediately below and above the mineralized rock, respectively.

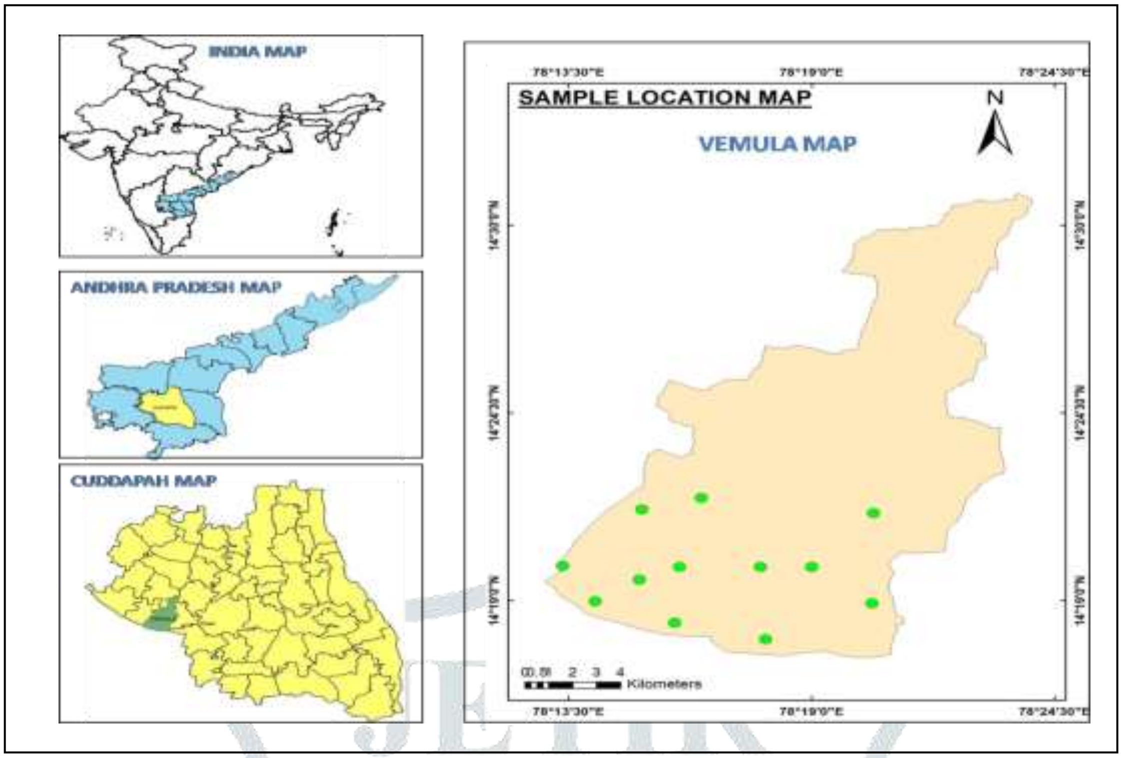

Fig.1. **Location Map**

Materials and methods

The current study includes a field examination of physico-chemical properties as well as laboratory analysis to provide a detailed description of the chemical criteria for ground water quality. Water samples were taken in and around the village of Tummalapalle in the Vemula mandal of the YSR district. A total of 12 ground water samples were obtained, with their locations recorded using a portable GPS device and depicted in Figure 1. Electrical conductivity (EC), PH, Total dissolved solids (TDS), Major cat ions such as Calcium, Magnesium, Sodium, and Potassium, and anions such as bicarbonates and carbonates were measured using established procedures. The sampling methods are chosen based on the investigation's goals and geology (lithology and hydrology of the area).

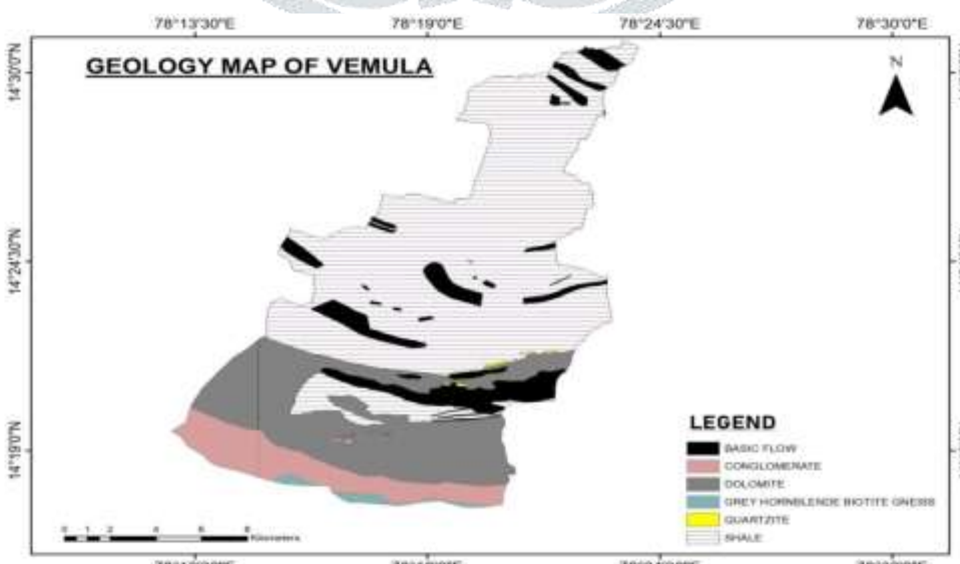

Fig. 2. **Geological Map**

The qualitative data from the samples are presented in Table 1, and Pearson's correlation coefficient was used to determine the strength of the linear relationship between these variables. The water analysis was studied and interpreted using a variety of methodologies and graphics.

Results and discussions

The analyzed laboratory results of the above mentioned parameters are tabulated as follows and then compared with WHO, BIS, standards for various utilities and discussed in the individual parameter wise details.

S.No	P.H.	E.C µS/cm	T.D.S ppm	TH mg/l	Cl mg/l	F mg/l	Nitrate mg/l	Sulphate mg/l	Iron mg/l	Ca mg/l	Mg mg/l	Hco3 mg/l	Na mg/l	K mg/l
1	8.08	857	548	992	42.6	0.60	21.5	36	0.07	448	572.16	108	474.60	2.84
2	7.79	1942	464	1242	421	0.58	3.0	27	0.14	146	701.4	468	70.94	1.96
3	7.87	1012	645	200	708	0.50	24.2	69	0.06	147	113.92	708	85.45	1.62
4	7.73	2423	1624	1602	78	0.64	53.9	74	0.82	218	540.16	1260	119.50	0.96
5	7.57	742	478	260	76	0.90	2.4	47	0.08	94	106.24	434	282.90	2.78
6	7.89	854	546	306	82.4	0.96	1.9	82	0.02	108	122.8	452	323.86	2.54
7	7.53	106.5	656	681	162.3	1.06	2.0	15	0.45	426	163.2	504	481.22	1.62
8	7.73	2423	1624	1602	78	0.64	53.9	74	0.82	218	540.16	1260	891.64	1.21
9	7.51	744	476	944	22.15	0.52	7.8	14	0.15	73.6	398.09	132	208.22	2.98
10	7.20	3360	2150	2736	292.52	0.90	84.9	118	1.90	89.6	1719.04	206.4	479.87	1.78
11	7.77	589	827	784	36.92	1.11	7.2	41	7.2	57.6	387.34	84	314.89	2.12
12	7.37	756	503	412	90	0.58	2.8	30	0.08	170	154.8	451	911.79	0.96

Table 1. Experimental results

pH

The pH of water is an important indicator of its quality and is used in a variety of solubility calculations (Hem, 1985). In the research region, the pH of the groundwater ranges from 7.2 to 8.08. The pH value for drinking water must be between 6.5 and 8.5. (ISI, 1983). It has been discovered that 100% of groundwater is within acceptable levels.

Electrical Conductivity (EC):

Ionic concentrations can be determined by measuring conductivity. Temperature, concentration, and the sorts of ions present all play a role (Hem 1991). In drinking water, the maximum limit of electrical conductivity is 1500Siemens/cm (WHO,1983). Groundwater electrical conductivity in the studied area ranges from 83.9 to 443 s/cm. The maximum EC value of 443 s/cm was found in the groundwater of sample S11, while the lowest EC value of 83.9 s/cm was found in the groundwater of sample S04. A conductivity metre was used to measure electrical conductivity. The allowable limits for ground water are exceeded in 45 percent of cases.

Total Dissolved Solids (TDS):

The salinity behavior of groundwater is determined by total dissolved solids (Sawyer C.N. et al., 1994 and Trivey, S.N et al., 1990). Water with a TDS concentration of greater than 500 mg/l is not recommended for drinking water supply. TDS of ground water ranged from 464 mg/l to 2150 mg/l, with the exception of three samples, all sampling stations in the study region meeting WHO requirements.

Bicarbonates

The ability of water to neutralise a strong acid is determined by the presence of bicarbonate, carbonate, and hydroxide compounds of calcium, sodium, and potassium in the water (C.N. Sawyer, et al., 1994). For ordinary drinking water, a total alkalinity limit of 30-150 mg/l is recommended. Groundwater alkalinity in the studied area ranges from 108 to 1260 mg/l. nine ground water samples have been found to exceed the allowed level. All mineral waters contain bicarbonate as a natural component. Mineral waters with high bicarbonate content are typically sourced from limestone-rich areas. Bicarbonate is necessary for buffering acids and ensuring that the mineral water tastes clean and refreshing. Excessive sodium bicarbonate use has been linked to complications such as stomach rupture and significant alterations in electrolyte balance.

Total Hardness (TH)mg/l:

The concentration of total hardness in the study area varies from 200mg/l to 1602mg/l. The limit of total hardness for drinking water is specified as 200 to 600mg/l. It is observed that eight groundwater samples in the study area exceed the permissible limit of WHO standards. The hardness of water is due to presence of alkaline earths such as calcium and magnesium. Hard water can interfere with the action of soaps and detergents and can results in deposits of calcium carbonate, calcium sulphate, and magnesium hydroxide inside pipes and causing lower water flows. Most obvious effect of hard water is skin irritation and Eczema is an example to it.

S.No	Water class	Hardness mg/lascaco3
1	Soft	0-75
2	Moderately hard	75-150
3	Hard	150-300
4	Veryhard	>300

Table 2. Water Classification

Calcium(Ca^{2+})

The solubility of calcium carbonate, sulphate, and, in rare cases, chloride, determines the range of calcium concentration in groundwater. Calcium carbonate solubility varies greatly depending on the partial pressure of CO2 in the air in contact with the water. The hardness of water is determined by calcium and magnesium salts. Calcium levels in drinking water are limited to 75 mg/l (ISI 1983). The content of ground water in the research area ranges from 57.6 to 1260 mg/l. The allowable limit is exceeded in 90% of the samples. Four of the samples surpass the WHO's acceptable level. When calcium comes into touch with the skin, eyes, or mucous membranes, it corrodes.

Chloride(Cl)

In surface water, chloride is one of the most common inorganic ions. Tiny sources of chloride in ground water include chloride-bearing rock minerals such as sodalite and chlorapatite, which are minor elements of igneous and metamorphic rocks, and liquid inclusions, which make up a small fraction of the rock volume. The majority of chloride in ground water is sodium chloride, however due to base-exchange events (Karanth,1985), as well as weathering of phosphate minerals and residential sewage, the chloride level may exceed the sodium (Karanth, 1987). Chloride concentration standards for drinking water range from 200mg/l to 600mg/l (ISI, 1983). The concentration of chloride in the ground water in the studied area ranges from 76 to 454.4 mg/l. All of the samples are within the acceptable range.

Fluoride(F^-):

Fluoride is an important component of human and animal health, especially in the prevention of tooth cavities. High fluoride levels in drinking water, on the other hand, cause harm to humans and animals. Fluoride shortage, on the other hand, may have a negative impact on tooth development. Fluorosis is a sickness that is caused by consuming too much fluoride. The upper limit of fluoride concentration in drinking water has been set at 0.5 to 1.5 mg/l by the World Health Organization (WHO). The content of fluoride in the ground water in the studied area ranges from 0.5 to 1.10 mg/l. All of the ground water samples in the research region are found to be within the acceptable level.

Sodium(Na^{2+}):

Sodium (salt) and potassium are both abundant in nature and extremely water soluble. The solubility of sodium determines how much sodium can be found in ground water. Some groundwater containing moderate levels of dissolved material may undergo Base Exchange and become soft at higher depths after travelling through sodium- and potassium-rich rock formations. The use of water for irrigation is frequently limited due to high sodium concentration. In steam boilers, sodium salts (50 ppm or higher) can generate foaming. In the research region, the sodium concentration in the ground water ranges from 70.94 to 891.64 mg/l. eight samples in the study region have been found to exceed WHO limits. Sodium imparts a saline flavour to drinking water. High salt levels in drinking water can cause high blood pressure, heart disease, and kidney difficulties in humans.

Potassium(K^{2+}):

Potassium is a vital nutrient for humans, although it is rarely, if ever, found in drinking water at levels that are harmful to healthy people. The recommended daily intake is in excess of 3000 mg. Potassium is found in abundance throughout the environment, including all natural waterways. It can also be found in drinking water as a result of potassium permanganate being used as an oxidant in water treatment. In some countries, potassium chloride is used instead of or in combination with sodium chloride in ion exchange for domestic water softening, allowing potassium ions to exchange with calcium and magnesium ions. It has been claimed that potassium salts could be used to replace or partially replace sodium salts in desalinated water conditioning. Given the cost disparity, the latter appears to be an implausible prospect at this time. Groundwater potassium concentrations in the study area range from 62.5 to 174.1 mg/l. All of the samples are appropriate for consumption.

Magnesium(Mg^{2+}):

Magnesium ions are smaller than sodium or calcium ions, hence their geochemical behaviour differs significantly from that of calcium. Magnesium is found in a variety of rocks, including dunites, pyroxenites, and amphibolites, as well as volcanic and metamorphic rocks like talc and tremolite-schists, and sedimentary rocks. Magnesium-bearing minerals include olivine, augite, biotite, hornblende, serpentine, and talc. The Mg concentration in the research area's ground water ranges from 38 to 236 mg/l. Magnesium concentration standards for drinking water range from 50mg/l to 150mg/l. In the research area, eleven ground water samples were found to exceed the WHO's permitted level. High magnesium levels have been linked to an increased risk of hypertension, heart disease, type 2 diabetes, and osteoporosis.

Nitrate(NO3):

Plants require nitrates (NO3) as a source of nitrogen (N). Nitrate contamination of groundwater can be caused by human and animal waste. Increased nitrate levels could indicate the presence of other contaminants such as disease-causing organisms, pesticides, or other inorganic and organic substances that could be harmful to your health. Nitrate concentrations greater than 45 mg/l will have an impact on the aquatic ecology in freshwater. The content of nitrate in the ground water in the studied area ranges from 0.7 to 21.1 mg/l. Nitrate levels are within acceptable limits in all of the research area's samples.

Sulphate($SO4^{2-}$):

Sulphate is one of the principal dissolved components of rain, and sulphate minerals can be found in various soils and rocks. The World Health Organization (WHO) recommended a maximum sulphate level of 200 to 400 mg/l in 1998. Groundwater sulphate levels in the study area range from 14 to 118 mg/l. Sulphate levels are within acceptable limits in all of the research area's samples.

Iron(Fe^{2+}):

One of the most prevalent elements on the planet is iron. It is a necessary component of human life and is employed in a wide range of industrial activities. It's also in the water we drink. Rainfall pouring through soil causes iron to dissolve and drain into ground water, including drinking water wells and aquifers. In wells and aquifers, iron concentrations typically range from 0.02 to 1.90 mg/l. The amount of iron in your system is within acceptable limits.

Conclusion

In ground water investigations, water quality analysis is critical. Groundwater was gathered in and around Tummalapalli village in the Vemula mandal of the YSR Kadapa district. The findings demonstrate that certain metrics in the research area are within allowed limits, while others show surpassing values when compared to WHO criteria in areas near mine sites. The water quality parameters like PH, EC, Chloride, Total dissolved solids, Hardness, Bicarbonates, Nitrate, Sulphate, Calcium, Fluoride, Iron, Sodium, Magnesium, and Potassium were analysed in ground water taken from various locations in and around Tummalapalli village, Vemulamandal, YSR kadapa district, and the analysis report of the water quality parameters like PH, EC, Chloride, Total The pH of the groundwater in the studied area varies between 7.20 and 8.08. The electrical conductivity of ground water varies between 589 and 3360 micrograms per litre. In the research area, total dissolved solids in ground water range from 464mg/l to 2150mg/l. Groundwater bicarbonates in the research area range from 84 mg/l to 1260 mg/l. The hardness of the groundwater in the studied area ranges from 200 to 1602 mg/l. Groundwater calcium concentrations in the research area range from 57.6 mg/l to 1260 mg/l. Groundwater nitrate concentrations in the study area range from 1.9 mg/l to 84.9 mg/l. The concentration of sulphate in ground water in the studied area ranges from 14 mg/l to 118 mg/l. The concentration of chloride in the research area ranges from 76mg/l to 706mg/l. The fluoride levels in the study area range from 0.50 mg/l to 1.11 mg/l. In the research area, iron concentrations range from 0.02 to 1.90 mg/l. Groundwater magnesium concentrations in the research area range from 113.92 mg/l to 1719.04 mg/l. In the research area, the sodium concentration in ground water ranges from 70.94mg/l to 891.64mg/l. Ground water potassium concentrations in the research area range from 52.5mg/l to 174.1mg/l. The data demonstrate that numerous above-ground water samples exceed legal limits, whereas just a few groundwater ones do.

The chemical makeup of the ground water in and around Tummalapalli village cannot be attributed solely to the breakdown of host rock dolomite, according to this study. Dolomite, the host rock, is responsible for a portion of the dissolved magnesium, calcium, and sodium concentrations in groundwater. As a result, it is recommended that all required measures be taken before consuming the water. Only the treated water should be consumed by residents of the research area. People must be made more aware of the importance of maintaining the highest possible quality and purity of groundwater.

REFERENCES:

1. APHA.2007. Standard methods for the examination of Water and Waste Water. American PUBLIC Health association, Washington, DC.
2. Amad, M., et al 2003. Water resources accounting and management of limestone Areas.
3. BIS, 1983. Standards for water for drinking and other purposes, Bureau of Indian standards publication. New Delhi
4. Basu H (2007) Geological and geochemical aspects of The Gulcherus Formation in the southwestern margin of the Cuddapah Basin and its potentiality for Uranium Mineralization.J Geo SocIndia 70: 686-688..
5. Brown, E., Skougstad, M.W. and Fishman, M.J., 1970 Methods for Collection and Analysis of Water Samples for Dissolved Minerals and Gases. Techniques of Water Resources Investigations of the U.S. Geological Survey, Book,5, Chap.A1, P.160.

6. Basu H, KumarMK, PannerselvamS, Chakri A(2009). Study of Provenance Characteristics and Depositional History on the Basis of U,Th and K Abundances in the Gulcheru Formation, Cuddapah Basin in Tummalapalle-Somalollapalle Areas, Cuddapah-Anantapur Districts,
7. C.Sadashivaiah, C.R.Ramakrishnaiah and G. Ranganna, "Hydro chemical Analysis and Evaluation of Groundwater Quality in Tumkur Taluk, Karnataka State, India, International Journal of Environmental Research and Public Health, 2008, 5(3)158-164.
8. Chakraborty,MK., etal. 2001. Hydrological conditions around an open-cast mine. Minetech.22(l):41-53.
9. Gupta S, Mahato A, Roy P, Datta JK (2008) Geochemistry of groundwater, Burdwan District, West Bengal, India.
10. ISI.1983. Drinking water standards. Substances and characteristics affecting the acceptability of water for domestic use18, Indian Standard Institution, NewDelhi.
11. Karnath,K.R., etal1989. Groundwater assessment, development and management. TataMcGrew-Hill, New Delhi. PP 20.
12. M.R.G.Sayyed, G.S.Wagh, A.Supekar,"Assessment of impact on the groundwater quality due to urbanization by hydro geo chemical facies analysis in SE part of Pune city,India", Proceedings of the International Academy of Ecology and Environmental Sciences,2013,3(2): 148-15.
13. Morris, B. L., et al 2003. Groundwater and its susceptibility to degradation: A global assessment of the problem and options for management. Early Warning and Assessment report of series.
14. Nagaraju A Sreedhar Y, Kumar KS, Thejaswi A and Sharifi Z (2014) Assessment of Groundwater Quality and Evolution of Hydro chemical Facies around Tummalapalle Area, Cuddapah District, AndhraPradesh, South India. J Environ Anal Chem 1: 112.
15. Rao NBK, RajurkarST, RamalingaswamiG, RavindraBabu B(1987) Stratigraphy structure and evolution of Cuddapah Basin. In: Radhakrishna BP (ed) Purana Basins of peninsular India.
16. RajmohanN, ElangoL (2004) Identification and evolution of hydrogeochemical processes in the groundwater environment in an area of the Palar and Cheyyar river basins, southern India.
17. Shimaa M. Ghoraba&A.D.Khan, "hydrochemistry and groundwater quality assessment in balochistan province, Pakistan", IJRRAS17(2) November2013,185-199.
18. Siva Prathap, T., Yamini ,Y., Mohd Akhter A,. Kamraju, M., 2019. Change detection in land use land cover using geospatial technology and open source data in Lankamalla forest and the neighbourhood – A case study in Andhra Pradesh, India, Journal of Emerging Technologies and Innovative Research, 6 (4) 557-573.
19. Siva Prathap Thummalakunta, Sunandana Reddy Machireddy and T. Lakshmi Prasad (2019) "Model Builder and Arc Hydro tools of Geospatial Technology to extract Drainage Network and Watershed Delineation using Digital Elevation Model" *International Journal of Creative Research Thoughts (IJCRT)* ISSN 2320-2882, Vol 7 Issue 4, Page No. 537-544
20. Siva Prathap T, Shaik Asiya, Mohd Akhter Ali, M. Kamraj "Enumeration of Springs in Buggavanka Watershed, Kadapa, Andhra Pradesh, India." International Journal of Innovative Knowledge Concepts, 7(5) May, 2019, 189-195
21. Siva Prathap, T., Karun Tej, Mohd Akhter Ali, M. Kamraju "A Geotechnical study of salt affected areas in Yogi Vemana University Watershed area". International Journal of Research and Analytical Reviews. 2019, 6(2): 912-916. E-ISSN 2348-1269, PRINT ISSN 2349-5138
22. Siva Prathap, T., Mohd Akhter Ali, Anupreet Singh Tiwana, M. Kamraju, Sagar M Waghmare "Site Selection for Sub Surface Dams across Papagni river in Chakrayapeta Mandal using Geospatial Technologies". J. Emerging Technoloies and Innovative Research. 2019, 6(3): 82-94. ISSN-2349-5162, www.jetir.org
23. Siva Prathap, T., M Sasi Kumar Naik, Mohd Akhter Ali, M. Kamraju. "Digital estimation of Dumps of Mining over burden quantities in open cast Baryte Mine of Mangampeta, Andhra Pradesh, India". Journal of Emerging Technologies and Innovative Research. 2019, 6(4): 498-506. ISSN-2349-5162, www.jetir.org
24. Siva Prathap, T., Y Yamini, Mohd Akhter Ali, M. Kamraju. "Change detection in land use land cover using geospatial technology and open source data in Lankamalla forest and the neighbourhood – A case study in Andhra Pradesh". J. Emerging Technoloies and Innovative Research. 2019, 6(4): 557-573. ISSN-2349-5162, www.jetir.org
25. Siva Prathap, T., Rajput NS, Joshi D., Vishwakarma J. (2016) "Framework for GIS Enabled Campus: Design & Deployment Methodology" International Journal of Research in Engineering and Applied Sciences (ISSN 2249-3905) Volume 6,Issue 5,May-2016 138-146.

26. Siva Prathap T, Ch Latha, M Prasad, Mohd Akhter Ali "A Study on Oppidan Course of Buggavanka Environs, Kadapa, Andhra Pradesh, India using Geospatial Technologies" International Journal of Humanities, Arts, Medicine and Sciences (BEST: IJHAMS) ISSN (P): 2348-0521, ISSN (E): 2454-4728 Vol. 4, Issue 6, Jun 2016, 63-70
27. Siva Prathap T, Ganesh Reddy .G & Vijaya Bhole "Morphometry of Buggavanka watershed in Kadapa, Andhra Pradesh, India using spatial information technology" International Journal of Humanities, Arts, Medicine and Sciences (BEST: IJHAMS) ISSN 2348-0521 Vol. 3, Issue 2, Feb 2015, 1-8
28. Siva Prathap, T. & Srikanth Reddy, D.(2015) "Spatio-Temporal Analysis of Pulivendula Mandal, Andhra Pradesh using Remote Sensing and GIS" *International Journal of Research in Engineering and Applied Sciences* (ISSN 2249-3905) Vol. 5, Issue 11, November, 2015, 133-143.
29. Siva Prathap, T., V. Sunitha, M. Sunandana Reddy., M. Ramakrishna Reddy., (2011) Geoinformatic Applications in Resource Management – A Watershed Approach, *Journal of Spatial Science,* Vol. IV No.2. pp 44-54 ISSN No 0974-7125.
30. TriveyAK., Pandey SN Waterpollution, Asish Publishing house, NewDelhi
31. Todd, DK.2007.Groundwater hydrology.Wiley-Indian edition.