



Review on ground water quality in the districts of Andhra Pradesh-case study

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ABSTRACT

It is a well-known fact that the quality of drinking water is essential/required to human beings. Quality of drinking water gives an idea about assurance for safety and prevention and control of water borne diseases. Inadequate quality of drinking water leading to water cause diseases due to the presence of dissolved chemical constituents in that water. In our country majority of the people depends upon ground water for their regular domestic needs as well as drinking water purposes at their respective places. So, a minimum knowledge is to be required/awareness in the people for their drinking water quality. Based on the importance of the drinking water quality to human beings, here a case study is taken up to review the available ground water quality in the districts of Andhra Pradesh. In this case study under review from the published work, a remarkable notice is identified, all most all researchers are done a work on the quality of ground water with limited physico chemical parameters like chloride, TDS, Total Hardness, Sulphates, TSS etc... in different areas in districts of Andhra Pradesh. Based on their limited research work, the researchers are drawn the conclusion about quality of drinking water. But a lot of scope is there to do in the analysis of other physico chemical parameters like heavy metals in these study areas. In this case study under review the above points are identified.

Keywords: ground water, physico chemical parameters, Andhra Pradesh

INTRODUCTION

Water is nature's most common, abundant and widespread chemical compound of all living creatures and we all ways think to be available in sufficiently and free gift of nature. Clean, safe and adequate fresh water is vital to the survival of human beings. Assurance of drinking-water safety is a foundation for the prevention and control of waterborne diseases. Drinking water affects the health of human beings due to the presence of various chemical constituents and many diseases associated directly or indirectly depend on the quality of drinking water.

Groundwater is one of the major sources of drinking water; vital resource is vulnerable to contamination throughout the country. It is polluted in most areas due to increased population, human activities, industrialization, dumping of industrial waste; agricultural activities including aqua culture, and increased use of fertilizers etc. In addition to changes in local topography, ineffective drainage system directly affects the quality of the groundwater. Based on these important factors are considered into a review is taken up to assess and identify the availability

of quality of water in the areas of districts in Andhra Pradesh. In the following down to line a review is handled and noted the key points from the published research work on quality of water in the study area.

Samantha et al. [1] studied the ground water quality in Madhurawada area of Visakhapatnam city by took 38 samples in pre and post mansoons in 2018 and 2019. They estimated that 12 physico chemical parameters and in which most of the parameters were exceeded than the desirable limit as prescribed by Bureau of Indian standards. They estimated the water quality index by using the obtained physico chemical parameters and found that 40% samples were unsuitable for drinking purpose. They mentioned the area wise exceeded chemical parameters details in madhurawada region. Finally, they revealed that in this madhurawada area the ground water is getting polluted day by day due to urbanization and manmade activities.

Naveen chowdary et al [2] investigated the ground water quality in surrounding villages of Kuppam town from regularly used point sources. They estimated the physico chemical parameters of Ca^{2+} , magnesium, pH, hardness, turbidity, Cl^- , Total Dissolved Solids, iron, sulphate, F^- and nitrate. As per the experimental results they found that ground water having maximum alkalinity concentrations. Nitrate and fluoride are not within the permissible limit as per BIS/WHO in this study area and other physico chemical parameters are within the limit. They found that in this area domestic sewage is one of the main cause to show the parameters in differentiate in the amount. Based on 'the sample analysis report they found that some of 'the parameters are not within the prescribed ranges, so in some point sources the water is not fit for drinking.

Ganesh et al [3] examined the ground water quality in the villages of Kothacheruvu mandal of Ananthapur district of Andhra Pradesh. They estimated the physicochemical parameters of pH, Total Dissolved Solids [TDS], Total Alkalinity (TA), Total Hardness (TH), Electrical Conductivity (EC), F^- , NO_2^- , SO_4^{2-} , Cl^- , phosphate, Na, K, Ca, Mg and Iron. They have selected eight significant parameters to determine the Water Quality Index [WQI] and WQI values in the villages of Kothacheruvu mandal are noted in the ranges from 45.02 to 254.41. As per the WQI values 83.3% of water samples in this mandal area are not fit for domestic consumption with 12.5% of water samples affectation straight health risk.

Kannan et al [4] determined the ground water quality in Krishna Godavari Delta [K G Delta] province of Andhra Pradesh and the physico chemical parameters are compared with WHO and BIS standards. They are collected 105 water samples from hand pumps and bore wells under this region in pre and post monsoon and these are preserved as per standard methods. They analyzed the parameters such as pH, electrical conductivity, carbonate and bicarbonate, ions of calcium, magnesium, sodium, potassium, sulphate and chloride. Based on the obtained parameters results they calculated water quality index to knowing the quality of drinking water and also they estimated the parameters like SAR [Sodium Adsorption Ratio], PI [Permeability Index], RSC [Residual Sodium Carbonate], MH [Magnesium Hazard] etc.. are used to identify the ground water quality for irrigation to suitability. They reveal that based on 'the WQI results

the qualities of water in many locations are not fine in the drinking and irrigation point of view under geochemical state.

Sivanatha Reddy et al [5], studied the ground water quality in and around Pulivendula of kadapa district of Andhra Pradesh. The ground water samples are collected from 21 villages in Pulivendula area and the physico chemical parameters of PH, Turbidity, Total hardness, Dissolved oxygen, Total dissolved solids, Alkalinity, Chlorides and Fluorides are estimated. These analyzed values are compared with WQI and BIS standards and no more conclusions are not given in this research paper.

Veeraswamy et al. [6] examined the water quality in Gudur area of Nellore district of Andhra Pradesh. They are collected 40 samples and analysed 13 physico chemical parameters. Using the analyzed results data, the authors are calculated WQI and based on that they concluded 99% water samples are poor in quality and are suggested that in this area needs some level of action before consumption as drinking water.

Satyanarayana et al [7] explored a research work on ground water quality in Uddanam region of Srikakulam district. In the research work the authors are chosen 10 bore wells, 38 dug wells and 2 surface sources from this area for analyzed different physico chemical parameters. Researchers are focused on this area because of surrounding in Uddanam region people suffers some health disorders particularly kidney related problems. The researchers are identified in this area water contains more amount of silicates. In this work the results are revealed that the water is not safe for drinking in some parts and also identified that except silicate, the other constituents are lies as per drinking water standards.

Sudharshan Reddy et al. [8] investigated the ground water quality in and around inactive mines Southwestern parts of Cuddapah basin, Andhra Pradesh. In this research work the authors are selected ground water samples in 50 villages around the study area and 14 physico chemical parameters are determined. In this study by using geographical information system [GIS] the distribution maps are prepared. In this study physico chemical parameters are studied such as pH, electrical conductivity, total dissolved solids, total hardness, ions of sodium, potassium, magnesium, calcium, carbonate, bicarbonate, sulphate, nitrate, fluoride and heavy metals. They noticed that except nitrate and fluoride, the other parameters are within the range according to drinking water standards in this selective research area. In this study they observed that GIS and WQI utility s very successfully achieve to access the ground water quality.

Satyanarayana [9] along with other authors are carried out a research work on groundwater quality interpretation in coastal srikakulam. They estimated 10 water quality parameters in the collected 51 sample locations in Uddanam region. The research works was aimed to focus on estimate the variance of water quality by using Principal component analysis [PCA] and identified the three components significantly and make clear more than 77% variance. Syam Kumar [10] has investigated the quality of water and WQI in Dubriguda mandal belongs to tribal area which is located in Visakhapatnam district, Andhra Pradesh. In this study the author has chosen the collection of water samples from open and bore wells and spring by randomly from different villages in this mandal. The physico chemical parameters of pH, EC, TDS)

turbidity, DO, total alkalinity (TA), total hardness (TH), ions of Ca²⁺, Mg²⁺, F⁻, SO₄²⁻, Cl⁻, NO₃⁻, PO₄³⁻, BOD are analyzed. These parameters are compared with WHO Standard values and the author has noticed the high content in the parameter of EC, TDS, Turbidity, Ca²⁺ and Mg²⁺. In addition to that WQI values are calculated and observed that in the water quality in the study area showed poor quality.

Lakshmi Kantha[11] along with the other authors tried to study of impact of industrialization on ground water quality in bore well and canal in and around industrial area of Eluru, West Godavari District of Andhra Pradesh. The parameters like pH, electrical conductivity, and total dissolved solid, total hardness; ions of chloride, sulphate, sodium, potassium as well as metals like iron, cadmium, Manganese and zinc are estimated in the samples.

Janardhana Rao et al. [12] studied the water analysis in and around Badvel of Kadapa district of Andhra Pradesh. They focused on ground water quality and chosen 60 sample locations and measured 9 physico chemical parameters in pre and post monsoon seasons of 2014. Based on the parameters result they found that WQI values are changed during monsoon seasons. According to results revealed that in this research study region calcium ion is mixed with water, it means more calcium is noticed.

Mahammad Rafi[13] along with team monitoring the drinking water quality in Allagadda of Kurnool district. They examined the ground water quality in the town of Allagadda and measured the parameters of PH, turbidity, electrical conductivity, ions of fluoride, chloride, nitrate, sulphate, DO, TDS, total hardness, metals of zinc, copper, manganese, iron, aluminum. As per the published data the observations of the parameters are within the desirable limit as per WHO drinking water characteristics.

In Pedana mandal, Krishna district of Andhra Pradesh, sarita and brahmaji rao[14] did the ground water analysis. In Pedana mandal the authors are chosen 10 sampling stations and measured the physico chemical parameters. As per the results they found average maxima and minima WQI values respectively as 428.02 and 137.24. The results reveal that in this sampling locations water was not fit for drinking without treatment before using.

Vijaya Lalitha and along with team [15] studied the bore wells water quality in Vuyyur area of Krishna Delta region. In vuyyur area sea water intrusion was noticed, the fertility land becomes converted into waste lands and in majorly area of cultivation has been decreased. In this area the in some samples ground water having exceeded the values than the desirable limit

Mohemmad Rafi.K[16], examined the water quality at surrounding villages of Nandyal region of Kurnool district, Andhra Pradesh. they analyzed the parameters like metal of iron, copper, manganese, zins, aluminium, pH, electrical conductivity, ions of nitrate, fluoride and sulphate. As per their results revealed that the selected 10 sampling locations of Nandyal region were within permissible limit as per standards.

Suvarna [17] along with other researchers were determined the quality of water in and around of Lakkireddipalli and Ramapuram. In this research area from different sites from the villages, the ground water and surface water are chosen for analysis of ten parameters. They

measured WQI for these samples and are identified as 7% samples are excellent water quality and 70% samples are in good quality and 23% samples are poor in quality as per standard norms.' Swarna latha G et al. [18] studied the quality of water in the region of Kondapalli of Krishna District, Andhra Pradesh in water quality parameters such as pH, electrical conductivity (EC), Total Dissolved Solids (TDS), Total Hardness (TH), Chloride, sulphate, nitrates, iron, calcium, magnesium, and fluoride. The obtained water samples analysis results are compared with BIS and WHO water quality standards and are identified as due to discharge of industrial wastes affects the groundwater quality and are not fit for drinking directly without ant treatment.

Sunitha et al [19] studied quality of ground water in parts of Kadapa and Anantapur districts and analysed the parameters for pH, electrical conductivity (EC), total dissolved solids (TDS), total hardness (TH), chloride (Cl^-), calcium (Ca^{+2}) and fluoride (F^-). The observations revealed by authors was, in this study area the ground water having alkaline character and also identified as in the village of Kotareddypalli high fluoride concentration was noticed.

Hanumantharao [20] and along with other authors were aimed to assessment of underground water for potable purpose in Vijayawada region. The authors were taken the ground water data taken from department of groundwater and water audit for analysis. The authors have collected the data for 29 bore well samples from 2013 to 2017 under the seasons of pre monsoon and post monsoon. In addition to additional data was also taken for the above said bore wells during February 2019. From the collected data the authors are analyzed the quality of underground water by calculating WQI and they concluded that in 15 locations the water is not good for drinking purpose and in 1 location the water quality was very bad. So overall in this analysis under this area the ground water is not suitable to potable. They identified the water quality reduction I due to the fact that over utilization of ground water, dumping of municipal and construction waste at surrounding this area, industrial waste water lines are laid down etc.. The Authors are suggested that the ground water is not directly useful drinking, so prior purification needed to be before consumption.

Prasad et al [21] examined the water quality based on WQI in Obulavaripalli Mandal, YSR district, Andhra Pradesh. 20 groundwater samples were collected and the physico-chemical parameters viz., pH, EC, TDS, TH, total alkalinity (TA), calcium (Ca^{2+}), magnesium (Mg^{2+}), chloride (Cl^-), sulphate (SO_4^{2-}) and fluoride (F^-) were analyzed from this study area. As per WQI calculations the results are indicated that 30% samples are in excellent, 40% samples are good and 30% samples are poor in quality.

Subba Rao [22] et al are collected the data from ground water department for the analysis of water quality in Guntur region. By using ArcGIS software, the authors are generated attribute tables and also, they used inverse distance weighted (IDW) spatial interpolation technique to know the spatial distribution of water constituents such as pH, hardness, chlorides, sulphates, sodium, magnesium, potassium, carbonates, bicarbonates and specific conductivity. According to the authors analysis of data the results are revealed that the water quality is poor in Guntur region and some suggestions are given to improvement of quality of water.

Sridevi et al [23] collected the water samples and analyzed the constituents like hydrogen ion concentration, turbidity, hardness, ions of Cl^- , F^- , SO_4^{2-} , NO_3^- , whole dissolved solids, entire alkalinity and Fe in and around Ajithsingh nagar area dump yard. The authors are assessed the quality of water in terms of WQI and the results revealed that in this study area the water have poor quality and is not fit for drinking.

The authors [24] are collected 24 ground water samples in K V B Puram Mandal, Chittoor District in different intervals and analyzed the constituents are hydrogen ion concentration, EC, total dissolved solids, hardness, ions of carbonate, bicarbonate, sulphate, sodium, calcium and magnesium and they noticed that the chemical constituents are more than the desirable limit in the aspect of drinking water quality compared to WHO limits. They identified the reason i.e., the rock -water interaction for poor water quality by the Gibb's plot diagram.

Pavan kumar and Ramakrishna [25] was studied the 'physico chemical parameter include with heavy metals such as Zinc, Cadmium, Nickel, Cobalt, Arsenic, Mercury, Chromium, Aluminium, Titanium, Manganese Barium and Silicon in the Denkada anicut in Vizianagaram district to know the water quality for irrigation purposes. Calculated parameters of WQI, SAR, RSC, %Na and magnesium hazard are indicated that water `quality is good for irrigation under this area.

Srinivasa Rao et al [26] are studied the ground water quality in Lakkavarapu kota region of vizianagaram district in premonoon and post monsoon in 2019. 30 sample locations are identified and collected the bore well water and analyzed parameters such as pH, electrical conductivity, total dissolved solids, total hardness, total alkalinity, ions of calcium, magnesium, sodium, carbonate, bicarbonate, chloride, sulphate, nitrate, fluoride and calculated WQI. As per the results are revealed that except 3.33% of the samples, of remaining samples are good for drinking.

Subbarao [27] studied the ground water quality and for this purpose the author has chosen 30 locations from a part of Prakasam district, A.P. In this research work the author has examined the constituents such as pH, EC, TDS, ions of calcium, magnesium, sodium, potassium, bicarbonate, chloride, sulphate, nitrate and fluoride. The results are revealed that ground water showed the alkaline nature. The author has given a valuable information is due to manmade activities, a genetic geochemical evolution and hydro geochemical relations the ground water chemistry reflect in this study area. Finally, the author has suggested that based on the experimental studies in this area the ground water is not suitable to drinking water and also mentioned that it is not good for irrigation.

Yaduvams [28] along with co-authors are studied the groundwater quality in the Visakhapatnam area, the parameters are like pH, electrical conductivity, total dissolved solid, total hardness, dissolved oxygen, ions of chlorides, sulphates, nitrates and total alkalinity are measured. The experimental results are revealed that the water quality parameters are not within the limit as against compared to Bureau of Indian standards

Venkata Raman, et al. [29] studied the physico chemical parameters in and around Gajuwaka area of Visakhapatnam district. As the results are revealed that the constituent is not within the WHO ranges and also concluded that due to urbanization, anthropogenic activities and over exploitation of groundwater in this study area water has been polluted.

Dhilleswararao and Subbarao [30] studied the quality of water by WQI in the successive periodic intervals from 2015 to 2017 in the specified villages of Gara mandal of Srikakulam district of Andhra Pradesh. From 53 location sites, the samples are collected and analyzed the parameters of pH, turbidity, electrical conductivity, total alkalinity, total dissolved solids, total hardness, and ions of calcium, magnesium, fluoride, chloride, sulphate, sodium and potassium. Experimental results are revealed that around 67% of the samples are in line with poor quality of water as per WHO standards. In this area the ground water was contaminated due to the anthropogenic and over exploitation activities are the main causes are suggested by the authors.

Santhosh Kumar et al [31] studied the ground water quality in the Palakonda mandal of Srikakulam district of Andhra Pradesh. In this area 32 water samples are collected during pre and post monsoon of the years from 2013 to 2016. The constituents such as pH, electrical conductivity, total dissolved solids, total hardness, ions of Ca, Mg, F⁻, Cl⁻, nitrite and dissolved oxygen, total alkalinity and computed Water Quality Index (WQI). The results are revealed that in this area the water quality is good for drinking.

Santhosh kumar et al. [32] investigated the ground water quality in the selected villages of Veeraghattam mandal of Srikakulam district of Andhra Pradesh and analyzed various constituents and are calculated the WQI and they concluded that in this study region the quality of water was good.

Jayaraj and Suresh [33] are collected the groundwater samples from different locations in Srikakulam district of Andhra Pradesh and analyzed the physico chemical parameters such as Temperature, Turbidity, TD, pH, DO, Free CO₂, Hardness as total, ions of Cl⁻, NO₃⁻, Phosphate and Alkalinity in the pre and post monsoon from 2019 to 2020. As per the experimental results they concluded that in the study region the ground water was suitable to drinking purpose.

Venkata rao and Kalpana [34] are determined the ground water quality for suitability of domestic and irrigation aspects in Pydibhimavaram industrial area of Srikakulam district of Andhra Pradesh and for this they chosen 30 water samples from four different locations in this study area. Physico chemical parameters of pH, total hardness, ions of Cl⁻, SO₄²⁻, NO₃⁻, electric conductivity, metals of Cd, Pb, Ni and Zn were analyzed. As per the experimental results are expressed that in this study region the water quality parameters are exceeded than the standards as per WHO/BIS and also identified that in this study area the ground water was contaminated due to industrial effluents.'

Srinivasulu [35] and along with other authors are examined the water quality in Kotturu and Hiramandalam Mandals of Srikakulam Dist, Andhra Pradesh. They were taken very few sample locations i.e. eight samples and are assessed the water quality of some physico chemical parameters and are observed that TDS, Hardness and Alkalinity values are not within the drinking water standards. The other constituents like PH, conductivity, fluoride, dissolved

oxygen and sulphate ion are within the drinking water standards. But they are not given any valid conclusions in this article for contaminations.

Based on the review of various papers on ground water quality in the districts Andhra Pradesh, an observation is noticed that all mot all researchers does the work on the physico chemical parameters such as pH,electrical conductivity, total dissolved solids, total hardness, total alkalinity, ions of calcium, magnesium, sodium, carbonate, bicarbonate, chloride, sulphate, nitrate, fluoride. It is also noticed that determination of heavy metals in the ground water was not carried out by the almost all authors. In addition to that majority of the authors are chosen limited selection sites on selectivity of water samples, it was also not much given good results. From cluster or selective location, if more samples are collected from different sampling sites better results has been come. As per the observations in this review study are remarkable notice is that a wide scope of research work is possibility is do the determine heavy metals in ground water and after that a full clarity will be executed in the drinking water quality in the selected areas in the districts of Andhra Pradesh.

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