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Assessment of Ground Water Quality and Its Suitability for Drinking Purposes in the Koduru Mandal

Dr. K. Chandrasekhar Reddy

Professor of Civil Engineering, Siddharth Institute of Engineering & Technology, Puttur- 517583, Andhra Pradesh, India.

Abstract - *Groundwater is important natural resources of fresh water available for domestic, industrial and agricultural purposes. It has better quality compared to surface water but the potability is not guaranteed. Hence, it is necessary to assess the quality of water and give appropriate treatment if needed, before supplying to the public. In this study ground water samples were collected from bore wells located at Settigunta, Koduru, Mysoorivaripalli, and Bayanapalli in the study area. All these samples were assessed for drinking purpose based on the various water quality parameters like colour, taste, pH, turbidity, TDS, chlorides, sulphates, DO, total hardness, acidity, alkalinity and MPN as per Bureau of Indian Standards (BIS) specifications pertain to IS: 10500-2012. It is found that all the physiochemical parameters are within the permissible limits except turbidity. Turbidity values are high in all the study villages except at Settigunta village. High turbidity values may be due to agricultural activities nearby bore wells. It is recommended to treat water for turbidity before consumption in order to prevent health hazards.*

Key words: *Groundwater quality, drinking water standards, Physiochemical analysis, Water quality parameters, health hazards.*

I. INTRODUCTION

Groundwater is the main natural resource of acceptable water for drinking in many parts of India especially in rural areas. India is one of the largest users of groundwater mostly in drinking and irrigation purposes in the world (Shah 2009). Demand on groundwater is increasing day-by-day in India due to rapid population growth and significant economic advancement. Groundwater quality in a region is largely determined by both natural processes like dissolution and precipitation of minerals, groundwater velocity, quality of recharge water, and interaction with other types of water aquifer and anthropogenic activities (Andrade et al. 2008). Groundwater has better quality compared to surface water but the potability is not guaranteed. Hence, it is necessary to assess the quality of water and give appropriate treatment if needed, before supplying to the public.

Y.S.R. Kadapa (Kadapa) district is said to be the heart of the Rayalaseema as it is centrally located and well connected with the 4 districts (Kadapa, Kurnool, Ananthapuramu and Chittoor) of Rayalaseema. Kadapa district is one of the persistently drought affected Rayalaseema districts of Andhra Pradesh. Most of the villages of Kadapa district are absolutely dependant on groundwater for domestic and agriculture purposes especially mandals like Koduru since there are no canals or rivers passing through Koduru mandal. Due to rapid population growth and diverse human activities like discharge of agricultural, domestic and industrial wastes, land use practices, and geological formation of aquifer, rainfall patterns and infiltration rate of the soil the fresh water availability is becoming inadequate. Consuming poor quality of water adversely affects human health and leads to socio-economical problems. It is therefore becomes essential to determine the current status of groundwater on the basis of its quality and suitability for drinking purposes. So far, there is no reliable study on the groundwater quality in the chosen study area of Koduru mandal. Therefore, the present study has been undertaken for assessment of groundwater quality and its suitability for drinking by comparing the results against drinking water quality standards laid down by Bureau of Indian Standards (BIS) pertain to IS: 10500-2012.

II. LITERATURE REVIEW

M. Ackah et al. (2011) investigated the suitability of groundwater quality for drinking and agricultural purposes in a predominantly farming and sprawling settlement in the Ga East Municipality (Ghana). Various water quality parameters were determined to assess groundwater quality of 16 wells in Teiman-Oyarifa community. Standard methods for physicochemical determinations were employed. Most of the groundwater samples fell in the US Salinity Laboratory Classification of C2-S1 (medium salinity-low SAR). This research may serve as a preliminary study to provide baseline information that may direct future water quality assessment studies in the study area.

Deshpande S.M. and Aher K.R.(2012) they Evaluated Groundwater Quality and its Suitability for Drinking and Agriculture use in Parts of Vaijapur, Aurangabad District, Maharashtra State, India. Fifteen groundwater samples have been collected from Vaijapur taluka of Aurangabad district for analysis. The analytical results shows higher

concentration of total dissolved solids (26.66%), electrical conductivity (26.66%), chloride (33.33%) total hardness (60%) and magnesium (86.66%) which indicates signs of deterioration as per WHO and BIS standards. The study revealed that application of fertilizer for agricultural contributing the higher concentration of ions in aquifer of Vaijapur.

Narsimha. A et al (2013) the suitability of groundwater quality for drinking purpose was assessed in the rural areas of Gunthakal area, Ananthapur District, Andhra Pradesh, India based on the various water quality parameters. Fifteen groundwater samples were collected and analyzed. They found that Fluoride concentrations ranged up to 2 mg/l, and average concentrations varied from 1.07 mg/L. Nitrate concentrations ranged up to 68.40 mg/l, and average 22.21 mg/l in the study area.

Anthony Ewusi et al. (2013) they studied on Groundwater Quality Assessment for Drinking and Irrigation Purposes in Obuasi Municipality of Ghana. Water samples were collected during the raining season and dry season. They were analyzed for major cations and anions. Parameters like sodium adsorption ratio, % sodium, electrical conductivity, total hardness, total dissolve solutes and stoechiometric relations were calculated on the basis of chemical data. They concluded that, the concentrations of major ions in groundwater are within the permissible limits for drinking. Irrigation waters classified based on SAR has indicated that both seasons have excellent groundwater.

Cristina ROSU et al. (2014) hydro-chemical investigation was conducted in a rural area from Cluj County, Romania, in order to determine the chemical composition of groundwater and investigated water sources for drinking or agriculture purposes. Some groundwater samples were collected from fifteen wells in order to analyze the major dissolved ions. They concluded that the
pollution with nitrate, nitrite, phosphate, fluoride and potassium of the drinking water in the area may pose high potential health risks to local residents. But, it can be safely used in agricultural purposes as irrigation water.

Shubhra Singh et al. (2015) they focused on the hydrochemistry of groundwater in parts of Chandauli-Varanasi region to assess the quality of groundwater for determining its suitability for drinking and agricultural purposes. A total of 70 ground water samples were collected randomly from different sources viz. hand pump, dug wells and bore wells, and analyzed for major cations and anions. Out of 70 groundwater samples, 7% and10% samples exhibit water unsuitable for drinking purposes in pre- and post-monsoon, respectively.

Lilly Florence P et al. (2016) evaluated the status of physico-chemical contaminants and their sources in groundwater of Kunnam Taluk. 25 groundwater samples were collected from open wells at the different locations of Kunnam Taluk for the analysis. The results were compared with water quality standards prescribed by WHO and an attempt has been made to find the suitability of groundwater quality for drinking purpose through Water Quality Index (WQI). The correlation coefficients were calculated for water quality assessment.

Fathi M. Elmabrok (2017) this study was carried out to assess the suitability of ground water for the human consumption in the rural and urban areas of Alagilat area, Libya. Sixty fife ground water samples were collected from 26 villages. The hydro- chemical parameters such as pH, EC, TDS, TH, Ca, Mg, Na, K, Cl, SO_4, HCO_3, F, NO_3 and Fe were analyzed using standard procedures. The results were compared with WHO and Libyan water standards. They concluded that most of the parameters of the water samples were beyond the permissible limits and unsuitable for drinking purposes.

III. MATERIALS AND METHODS

Study area

Settigunta, Koduru, Mysoorivaripalli, and Bayanapalli villages of Koduru mandal, YSR Kadapa district, Andhra Pradesh, India has chosen as the study area. YSR Kadapa district is one of the chronically drought affected Rayalaseema districts of Andhra Pradesh. YSR Kadapa district is absolutely dependant on ground water for its irrigation and domestic needs.

Water sampling procedure

Polythene bottles of 1.5 litre capacity with stopper were used for collecting samples. Each bottle washed with 2% Nitric acid and then rinsed three times with the groundwater. The bore wells which have been installed with hand pumps, the water samples were collected after pumping for sometime as part of the quality control measures to remove casing storage water and obtain representative groundwater samples. The bottles were filled leaving no air space and then the bottles were sealed to prevent any leakage. Each bottle was clearly marked with the name and date of sampling. Then they brought to the laboratory for analysis.

Sampling points

The water samples collected from hand bore wells of villages Settigunta, Koduru, Mysoorivaripalli, and Bayanapalli.

Water quality analysis

Colour, Taste, pH, Turbidity, Total Dissolved Solids(TDS), Chlorides, Sulphates, Dissolved Oxygen(DO), Total hardiness, Acidity, Alkalinity and MPN parameters were measured using standard procedures and compared with IS:10500 (BUREAU OF INDAIAN STANDARDS second revision published in 2012).

IV. RESULTS AND DISCUSSIONS

The various parameters such as Colour, Taste, pH, Turbidity, Total Dissolved Solids(TDS), Chlorides, Sulphates, Dissolved Oxygen(DO), Total hardiness, Alkalinity and MPN were measured in the laboratory using standard procedures and compared with IS:10500 as shown in Table 1.

Parameter	**Settigunta**	**Koduru**	**Mysoorivaripalli**	**Bayanapalli**	**As per IS:10500**
pH	7.1	7.5	7.6	7.5	6.5-8.5
Turbidity	0	**45**	**44**	**44**	1-5 NTU
Total Dissolved Solids(TDS)	540	512	600	526	500-2000 mg/l
Chlorides (as Cl)	310	295	300	300	250-1000 mg/l
Sulphates (as SO_4)	210	226	234	350	200-400 mg/l
Dissolved Oxygen(DO)	1.8	2.1	1.9	1.3	4-6
Total hardiness (as $CaCO_3$)	210	224	265	357	200-600 mg/l
Alkalinity (as calcium carbonate)	230	214	260	290	200-600 mg/l
Most Probable Number (MPN)	0.65	0.78	0.85	0.91	<1/100 ml

From table 1, it is found that all the parameters are within the permissible limits except Turbidity. Turbidity values are high in the study villages except Settigunta. It may be due to the agricultural activities nearby bore wells can lead to high sediment levels entering water bodies. the higher the turbidity level, the higher the risk that people may develop gastrointestinal diseases (refer to diseases involving the gastrointestinal tract, namely the esophagus, stomach, small intestine, large intestine and rectum, and the accessory organs of digestion, the liver, gallbladder, and pancreas). This is especially problematic for immune compromised people, because contaminants like viruses or bacteria can become attached to the suspended solids. Turbidity is commonly treated using either a settling or filtration process.

V. CONCLUSIONS

The physical, chemical and biological characteristics of water quality were tested and compared with IS: 10500(2012). It is found that all the parameters are within the permissible limits except Turbidity. Turbidity values are high in the study villages except Settigunta. It may be due to the agricultural activities nearby bore wells. Excess Turbidity causes gastrointestinal diseases refer to diseases involving the gastrointestinal tract. It is recommended to treat water for turbidity before consumption. However, continuous assessment and monitoring is required to verify the temporal as well as special variability of the groundwater resources in the study area for water security and public health.

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