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ANALYSIS OF GROUND WATER COLLECTED FROM IN AND AROUND MADALAVARIGUDEM, KRISHNA DIST, ANDHRA PRADESH, INDIA

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Abstract - Water is an essential natural resource for sustaining life and environment but over the last few decades the water quality is deteriorating due to it's over exploitation. Water quality is essential parameter to be studied when the overall focus is sustainable development keeping mankind at focal point. Groundwater is the major source of drinking water in rural as well as in urban areas and over 94% of the drinking water demand is met by groundwater. The study was carried out to assess the ground water quality and its suitability for drinking purpose in most rural habitations of ground water in Madalavarigudem, Andhra Pradesh, India. For this purpose, 3 water samples collected from hand pumps and bore wells of village of study area were analyzed for different physico-chemical parameters such as pH, total alkalinity, acidity and total dissolved solids. The pH value in the study area found from 7.2 to 8.3. Total alkalinity will be 730 to 980 mg/L. Total acidity will be 21 to 35 while value of TDS ranges from 150 to 250mg/L. The study reveals that almost all parameters were exceeding the permissible limits. As per the desirable and maximum permissible limit for total dissolved solids, acidity and alkalinity, determined by WHO BIS and ICMR standards, the groundwater sources are unfit for drinking purposes respectively. Due to the higher in drinking water several cases of dentaland skeletal fluorosis have appeared in this region. After evaluating the data of this study, it is concluded that drinking water of Madalavarigudem is not potable and there is an instant need to take ameliorative steps in this region to prevent the population from adverse health effects.

Key Words: Water Analysis, pH, Total Dissolved solids, Total Alkalinity, Total Acidity.

1. INTRODUCTION

Ground water is the major source for drinking and domestic purposes in both ruraland urban areas. Besides, it is an important source for both agriculture and industrial sectors. It has been considered as a dependable source of uncontaminated water. The above situationis changing very rapidly and at a very alarming rate due to pollutants from various sources. Although water can be polluted naturally, due to higher degree of minerals present in the soilsand rocks, the quality of ground water may vary from place to place. In addition to above, rapid population growth, increasing living standards, untreated municipal and industrial waste waters, fertilizers, application of pesticides, sewers and landfill areas are the potential sources of groundwater pollution.

Water pollution is considered with great concern, since the quality of water is of vital importance for mankind and it is associated with human welfare. With this view, the present investigation was carried out to assess the groundwater quality, as groundwater is the only source for drinking, domestic and as well as other purposes in the study area.

Water Quality can be defined as the chemical, physical and biological characteristics of water, usually in respect to its suitability for a designated use. Water can be used for recreation, drinking, fisheries, agriculture or industry. Each of these designated uses has different defined chemical, physical and biological standards necessary to support that use. For example, there are stringent standards for water to be used for drinking or swimming compared to that used in agriculture or industry.

2.LITERATURE SURVEY

Recently various authors carried out extensive studies on ground water quality and its suitability for various purposes. Application of agricultural chemicals, dumping industrial and domestic wastes at the land surface or within the unsaturated zone may have considerable impact on the groundwater quality. Rajamohan et.al. (1999) [16] carried out the groundwater quality study of Kancheepuram district, Tamil Nadu and results shows that, the correlation among the chemical parameters, silicate weathering and source for the nutrients is mainly by agricultural activities. Tatawat et al. (2008) [17] investigated the quality of ground water for Jaipur city, Rajasthan and its suitability for domestic and irrigation purposes. B Vijaya Lalitha et al. (2017) [8] investigated the quality the groundwater for Vuyyuru, Krishna district, Andhra Pradesh was some areas in the study area are having good water quality standards, some areas are having poor and very poor quality, the groundwater can be used for drinking purposes and though the study area previously used for agriculture.

N. Varadarajan, B. K. Purandara. (2011) [14] groundwater in the study area for Belgaum, Karnataka, India and its suitable for irrigation purposes. Er. Lakshmi Priya A. R, (2016) [12] groundwater in the study area for Alappuzha district of Kerala was found that most the test parameters were beyond the permissible limit and were not fit for drinking purposes. Varadarajan (2000) [7] carried out study of groundwater quality

of both open and bore wells in the Malaprabha sub basin in Belgaum District of Karnataka and applied one dimensional solute transport model SWIMv2.1 to predict the movement of contaminants through the unsaturated zone. Laluraj et al. (2005) [18] studied the ground water quality and sea water intrusion of shallow aquifers of coastal zones of Cochin, India.

2.1 Drinking Water Quality Standards

CHARACTERISTICS	UNIT	DESIRABLE LIMITS
pH	-	6.5-8.5
Total Hardness as CaCo3	Mg/l	200
Turbidity	NTU	1
Alkalinity	Mg/l	200
Acidity	Mg/l	-
Chloride	Mg/l	250
Iron	Mg/l	0.3

Table 2.1: Desirable Limits as per IS 10500:2012

3. MATERIALS AND METHODS

3.1 Chemical Reagents

This section describes different techniques and methods followed in the present project work. All chemicals and reagents used in this study were of analytical grade and supplied by Hi-Media Pvt. Ltd., India, LOBA Chemie Pvt. Ltd., India, SRL Chemicals Pvt. Ltd., India, Merck India Ltd., and CDH Pvt. Ltd., India.

3.2 Study area

Water samples were collected from three locations, from hand pump (16.6124872° N, 80.7221431° E), lingayas college bore well (16.6147099° N, 80.7351502° E) and lingayas hostel bore well (16.6136117° N, 80.7355213° E) of Madalavarigudem, Andhra Pradesh, India.

3.3 Methods

Collected Samples were analyzed for pH, total dissolved solids (TDS), alkalinity, acidity according to methods described in American Public Health Association (APHA) (APHA, 2005). Water quality was evaluated based on the water quality standards recommended by Bureau of Indian Standards (BIS). The pH in the samples was determined by using a pH paper. The TDS in the samples was quantified using a Generic Digital LCD TDS Meter (Generic, TDS-3, India). Alkalinity, acidity in the samples was determined via titration. Iron and nitrate in the samples were determined using spectro photometric method.

pH: The pH is a figure that represents potential hydrogen, and is the measure of acidity or alkalinity in any water-soluble substance. The pH values are represented on a logarithmic scale with numbers 1-14 with 7 being a neutral point. Values below 7 indicate acidity with lower numbers indicating greater acidity. The values above 7 indicate alkalinity with higher numbers indicating greater alkalinity. As pH can be affected by chemicals in the water, pH is an important indicator of water that is changing chemically. The pH is really a measure of therelative amount of free hydrogen and hydroxyl ions in the water.

Total dissolved solids: Total dissolved solids is a measure of the dissolved combined content of all inorganic and organic substances present in a liquid in molecular, ionized, or micro-granular suspended form. TDS concentrations are often reported in parts per million. Water TDS concentrations can be determined using a digital meter. Total dissolved solids are composed mainly of carbonates, bicarbonates, chlorides, phosphates and nitrates of Calcium, Magnesium, Sodium, Potassium, Manganese, organic matter salt and other particles. Total dissolved solids (TDS) is a measure of the dissolved combined content of all inorganic and organic substances present in a liquid in molecular, ionized, or micro-granular (colloidal sol) suspended form.

Alkalinity: Alkalinity is a measure of ability to neutralize acids. Excess alkalinity gives bittertaste to the water and reacts with cautions forming precipitates, which can damage pipes, valves etc. However, some alkalinity is required for drinking water to neutralize acids such as lactic acid and citric acid produced in the body. The main sources for natural alkalinity are rocks which contain carbonate, bicarbonate, and hydroxide compounds. Borates, silicates, and phosphates also may contribute to alkalinity. Limestone is rich in carbonates, so waters flowing through limestone regions or bedrock containing carbonates generally have high alkalinity, hence good buffering capacity.

Acidity: Acidity of water is its quantitative capacity to neutralize a strong base to a designated pH. Acidity contributes corrosiveness to water influences certain chemical and biological processes. Acidity due to carbon dioxide is practically important in the field of public water supplies. It can be measured by titrating the sample with standard solution of alkalinereagents. Carbon dioxide is the most common cause of acidic water, however, anthropogenic (human-induced) pollution which causes acid rain, can also make the water acidic. Carbon dioxide (CO2) is the most common cause of acidic water. Carbon dioxide decreases the pH of water during precipitation, photosynthesis, respiration, and decomposition. Acidity due to carbon dioxide is practically important in the field of public water supplies. It can be measured by titrating the sample with standard solution of alkalinereagents. Results are reported in terms of phenolphthalein acidity and methyl orange acidity.

4. RESULT AND DISCUSSION

The key highlights of the present study as outlined in the objectives were to update information on ground water quality of Madalavarigudem, Andhra Pradesh, India (for chosen water quality parameters), maintain a record on technical continuity and uniformity in the collection of the data and, assess the importance of the ground water quality of the Madalavarigudem, Andhra Pradesh, India. In the present study, the water quality analysis was performed on the samples collected from three different locations, from Madalavarigudem Bus stand (SMB), Lingayas college bore well (SLC) and Lingayas Hostel (SLH) of Madalavarigudem, Krishna district, Andhra Pradesh, India. The following parameters that include pH, total dissolved solids (TDS), alkalinity, acidity and, the results obtained are discussed below.

pH

The pH is measure of intensity of acidity or alkalinity of water. All chemical and biological reactions are directly dependent upon the pH of water system (Rao, 2006). In our findings pH varied between 7.2-8.3. Maximum pH was recorded at all samples. In sample were determined which are have an alkaline nature. As per permissible limit prescribed by Bureau of Indian standards (BIS) and World Health organization (WHO). The Figure 4.1 shows the range of pH pertaining to the samples collected from three different locations. During the period of investigation for 30 days, pH was in the range of 7.2-8.3 in SMB, SLC and SLH samples, which is within the permissible limit as per the standards presented in Table 2.1. ThepH of water is very important indication of its quality and provides information in many types of geochemical equilibrium or solubility calculations (Mitharwal et al., 2009)

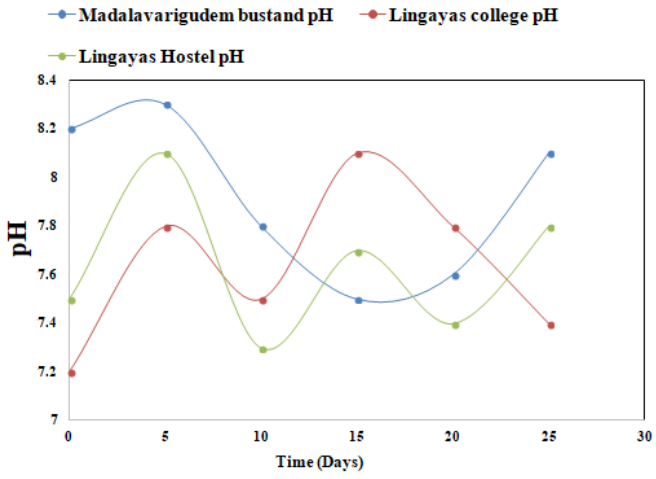

Figure 4.1: pH pattern of the samples collected from three different locations.

TDS

Total dissolved solid is an important parameter for drinking water and water to be used for other purposes beyond the prescribed limit, it imparts a peculiar taste to water and reduce its potability (Sandeep Mitharwal et al., 2009). The TDS refers to the amount of dissolved material present in the water body and serves as a parameter for pollution indicator. In the present finding TDS value varied from 170 to 300 mg/L, which is also notwithin the prescribed permissible limits. The range of TDS pertaining to the samples collected from three different locations is shown in Figure 4.2.

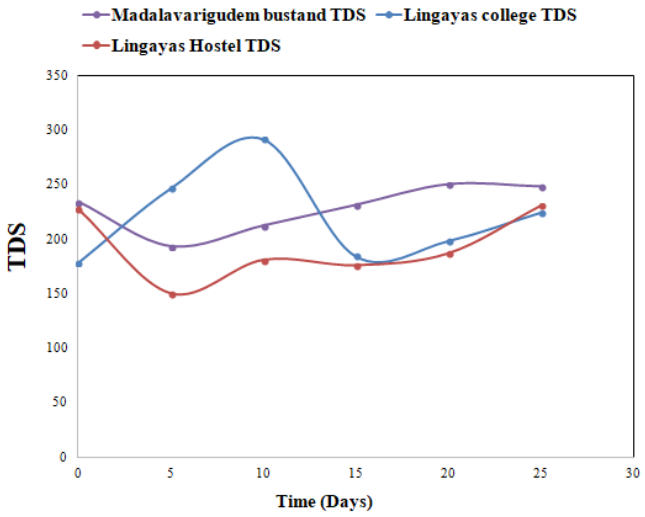

Figure 4.2: TDS pattern of the samples collected from three different locations.

Alkalinity

Alkalinity is reported as the equivalent amount of calcium carbonate in mg/L. The variation of alkalinity in the samples collected from three different locations is shown in Figure 4.3. Alkalinity was in the range of 670-980 mg/L in three samples. The alkalinity values in all the three locations are above the permissible limit as per the BIS standards, which need to be treated if it is meant for drinking purpose. The alkalinity in the ground water is suitable for the irrigation purpose.

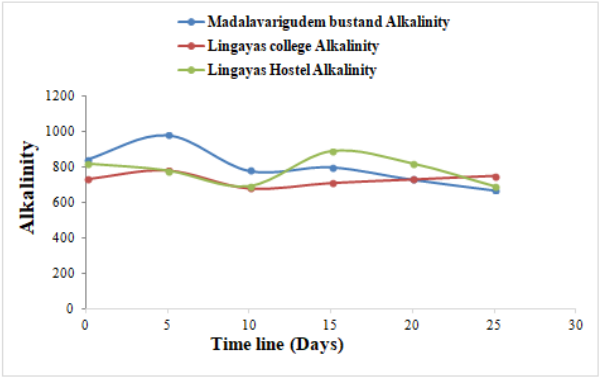

Figure 4.3: Alkalinity pattern of the samples collected from three different locations.

Acidity

In the absence of coal or iron sulfide minerals, the pH of groundwater typically ranges from about 6.0 to 8.5, depending

on the type of soil and rock contacted. In ground water, most of the Acidity is caused due to carbon dioxide. The variation of acidity in the samples collected from three different locations is shown in Figure 4.4. Acidity was in the range of 24-35 mg/L in three samples. The acidity values in all the three locations are above the permissible limit as per the BIS standards, which need to be treated if it is meant for drinking purpose. The acidity in the ground water is suitable for the irrigation purpose.

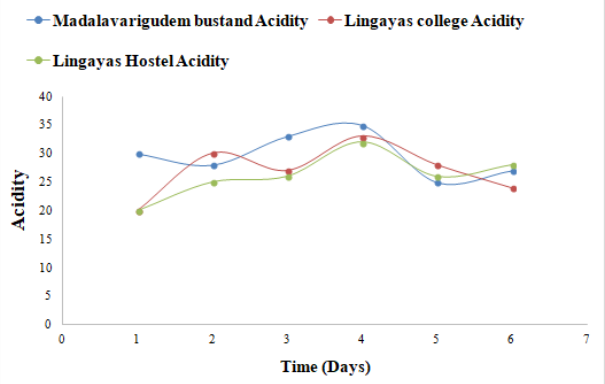

Figure 4.4: Acidity pattern of the samples collected from three different locations.

5. CONCLUSION

The present study was aimed at analyzing the variation in the physicochemical parameters of water quality at selected locations of Madalavarigudem, Krishna district, Andhra Pradesh, India. The key findings of the study are discussed in this section. Water samples were collected from three locations (Madalavarigudem bus stand, Lingayas college, Lingayas hostel, of Madalavarigudem, Krishna district, Andhra Pradesh, India based on the time frame and limited resources available. The water samples collected were analyzed for pH, total dissolved solids (TDS), alkalinity and acidity according to standard methods. As apparent from the water quality parameter analysis, all the tested parameters were within the standards prescribed by Bureau of Indian Standards (BIS) and World Health Organization (WHO). Water quality monitoring and the analysis showed significant variation and indicated unsatisfactory ranges.

All samples contain the TDS concentration below 500 mg/L and samples contain the high acidity levels up to 20mg/L. the permissible limit of acidity in drinking water was in between 6 to 7 mg/L. The results of current study indicate that the water has analyzed is not suitable for drinking, but it was useful for washing and irrigation purpose. Based on these results and analysis of water samples, it is also recommended to use water only after boiling and filtering or by Reverse Osmosis treatment for drinking purpose by the individuals to prevent adverse health effects.

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