HYDRO GEOCHEMICAL STUDIES IN AND AROUND DABEERPURA LAKE SUROUNDING AREA, MEDCHAL MANDAL, RANGA REDDY DISTRICT, TELANGANA

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Abstract—

Assessment of suitability of groundwater for domestic and irrigation purposes was carried out in and around Dabeerpura lake region which is located location at Dabeerpura (vi) Medchal(M) is a northern suburb of Hyderabad, India. The study area covers an area of 20 km. Groundwater is the major source for domestic and agricultural activities in this area. The study emphasized on groundwater for physical and chemical characteristics, to assess the potability of samples collected from one surface and seven Borewells during pre-monsoon period for the year 2012. The analytical parameters of data were compared with the standard guidelines recommended by the (WHO, 1984) and (I.S.I). The hydrochemistry of the groundwater of the study area indicates the calcium and magnesium exceeds the limits

Keywords: Water Quality, Hydrochemistry, Pre-monsoon

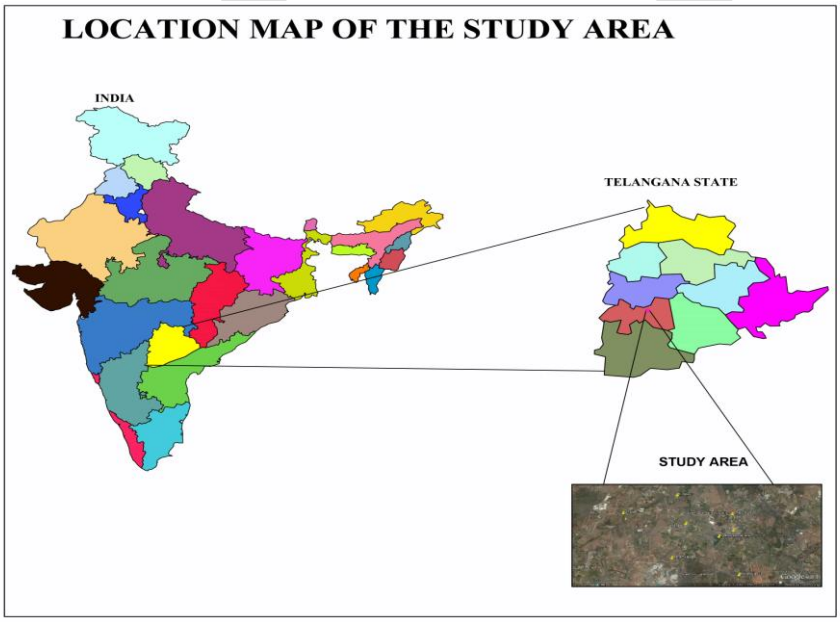
INTRODUCTION

In the past, most researches regarding drinking water distribution systems focused on source water protection and water treatment processes. Nevertheless, more and more emphasis had been placed on distribution systems and storage facilities, which play a critical role in drinking water qualities. However, in general groundwater consists of major ions, minor ions, trace metals, heavy metals, radio nuclides, organic matter etc. It is often used for drinking and domestic purposes apart from agricultural and industrial purposes due to itswide distribution and as it is comparatively less polluted than surface water. The quality of water has been continuously declining globally in general and in developing countries in particular because of natural and anthropogenic processes (Carpenter *et al*, 1998; Chen *et al*, 2002). Living standards and well being of a population is greatly impacted by the quality and quantity of water that is accessible and available, thus global and local efforts are widespread at ensuring adequate provision of clean and safe water. Freshwater plays unique role for society and for economic development through provision (e.g., products, food), support (e.g., wastewater processing, supply of clean water), enrichment (e.g., aesthetic, recreational, cultural) and services (Yang *et al*, 2007). The growing demand for freshwater resources to sustain human activities, coupled with adverse effects of human activities, such as discharge of industrial wastewater and domestic sewage, are likely to cause a crisis in the near future if

water resources are not appropriately managed (Charkhabi and Sakizadeh 2006). The groundwater quality needs to be monitored regularly so as to check that its
composition do not exceed the limits of drinking water quality The quality of water for drinking and domestic purposes depends on the physical as well as socio-economicdevelopment of the area. A number of studies on water quality with respect to potable water have been carried out in different parts of Andhra Pradesh (Brindha *et al,* 2011; Narsimha and Sudhakar 2013; Subba Rao 2003; Narsimha and Sudarshan 2013; Ramamohana *et al,* 1993; Narsimha *et al,* 2012a; 2012b; Narsimha *et al,* 2013). Therefore, there is a great need to ascertain the physicochemical characteristics of the water usedfor drinking and domestic purposes by residents of surrounding of Chandhupatla, Nalgonda district, AndhraPradesh, India. This paper examines the various physicochemical characterizations including pH, EC, TDS,TH, Ca2+, Mg2+ and HCO3.

STUDY AREA

Study area near to medchal(M) location at Dabeerpura (vi) The area lies between north17°35' to 17˚45′ latitudes and east 78˚25′ to 78˚30′ longitude. Medchal is a northern suburb of Hyderabad, India. It used be a suburban village and one of the largest mandals in Rangareddy district of Telangana, India



Fg:1 Location Map of the Study area

GEOLOGY OF THE AREA

The study area comprises crystalline rocks of Archaean age consisting of essentially granites. They are hard and compact and range in texture from fine to coarse, least intergranular porosity.

However alteration of minerals composition and structure tend to modify this condition. Geological map of Ranga Reddy district is given here (Fig no. 1).

The granites are primarily two type's namely pink and gray granites. They owe their color to the presence of characteristic of mineral. It is rather difficult to demarcate between the two granites. The gray granite is conspicuously banded with light bands being rich in quartz and feldspar and dark bands are mainly mica and hornblende. Pink granites consists of quartz microcline or orthoclase and acid plagioclase, some hornblende. Pink granites consists of quartz, microcline or orthoclase and acid plagioclase, some hornblende, mica and epidote. Pink granites grade into porphyritic varieties. The colour of the pink granite is mainly due to the presence of orthoclase feldspar, and gray is mainly due to the presence of orthoclase feldspar, and the grey is mainly due to the presence of typically light colored feldspar.

Gray Granites

These rocks exhibit low relief. These are fine to medium grained. They show all enclaves of mafic minerals are hornblende and Biotite ranging in size 2 to 3 mm. this cluster is arranged in parallel plains and constitute lineation and this is responsible for the pronounced gneissic banding the mafic enclaves are about 5cm long and 2-3 cm wide. The light grey and the blue colour quartz grains are mainly responsible for the rock. The potash feldspar crystals have a light brown colour and the plagioclase grains are white or light gray colour. Hence they are called grey granites. The rock is jointed quartz and epidote veins have traversed the rock. The ramifications of quartz-feldspathic veins are also observed. The grey granites are also occur as even grained and which case these rocks are mostly equi granular in texture expect for a few patches of coarse and find texture here and there. The find grained rocks are relatively dark in colour. The feldspars are white or greyish white in colour and some times light pink collared feldspar also observed. The quartz is gray, smoky or light green in colour. The feldspar occurs as irregular crystals.

Pink granites: The pink granites are common in this area. The pink granites are heterogeneous group of rocks whose common character is the pink colour. It is also shown that there is no difference in texture and mineralogy between these granites and the gray equivalents. The only criteria is pink colour which is due to pink or flesh colour feldspar, which forming dominant constituent. Some of them are brick red to light pink. The grain size varies from fine to coarse. There are generally coarse and porphyritic.

The rock is grades into adjacent county rocks in the fields. It is generally weathered and the feldspar crystals are conspicuous. A

METHODOLOGY

Collection of water samples of about 1 liter each,The chemical analysis viz. pH, Ec, TDS, Ca, Mg, and CO3, HCO3& Interpretation of analysis and its bearing on environment.

Collection of samples and chemical analysis:

The procedures and precautions followed for collecting water samples are as follows:

Collecting ground water samples from Bore wells, Dug wells, Tanks, Lakes and knowing their chemical variations. Plastic bottles used. The volume of bottle should be about 1 liter.

Glass bottles are not preferred because some minerals present in ground water react with glass and alter the chemistry of samples.

Before a well sample is collected the well should be pumped for some time, to ensure that a representative sample is obtained. Ensure that, no solid particles are seen along with the sample of ground water.

The bottle should be closed tightly after the sample is collected. Temperature, pH, Ec, location of well, well inventory data and other physical parameters such as colour of water, turbidity and Odour should be recorded their itself. Shorter the time gap between collection of samples and analysis greater the accuracy. If samples are to be preserved long time, suitable treatment should be given. They are analyzed for pH, Ec and total dissolved solids as per slandered procedures. A total of 8 water samples were collected.

Analysis of ground water:

The aim of the laboratory test is determine the constituents present in ground water. The tests conducted to determine the quality of water are:

Physical tests

Bacteriological tests

Chemical tests.

Physical tests:-

Indicated the aesthetic quality of ground water. It also include measurement of turbidity, colour and odour of the ground water.

Bacteriological tests:-

Bacteria present in ground water are determined by various bacteriological tests such as E.coli tests etc.

Chemical tests:-

The amount of chemical present in ground water and extent of pollution in it can be determined by analysis. Substances commonly determined in chemical analysis are expresses as ions, which comprise that captions and anions. Captions are positively(+ve) charged ions which include Ca, Mg. Anions are negatively charged ions which include carbonate , bicarbonate.

The collected water samples from the bore wells are analyzed to determine the chemical characteristics, such as pH, Ec, TDS and Ca, Mg, and HCO3, CO3.

HYDROGEO CHEMISTRY

Physical properties:

Unlike surface water, ground water is generally clean, colourless and odourless, with little or no suspended matter relatively constant temperature. Because of these characteristics, in most

hydrological situation ground water can be put to direct use without treatment. Exceptions are found, for example, in ground water derived from cavern and other large openings that may permit suspended matter and pollutant's to enter into the aquifer. Some of the physical quality may be critical to restrict the usability of water specific purposes. It is therefore necessary to assess the physical quality of water in addition to chemical quality. Colour, odor, turbidity and temperature are the main physical qualities to be considered for the water for beneficial use.

Colour:-

Colour is one of the main physical qualities to be considered for water beneficial use. Colour in ground water may be due to mineral or organic compounds. The presence of organic matter and iron may impart colour. For drinking water supply colour is not desirable.

Odor:-

Odor and taste of ground water are due to presence of gases, organic compounds and minerals, which impart these qualities.

Turbidity:-

Turbidity is a measure of suspended, colloidal matter and microscopic organism in water. The turbidity measurements are based on of a light path through the water.

REAGENTS:

EDTA 0.02N gms is diluted in 1000ml if double distilled water.

NaOH buffer 160 gms NaOH is dissolved in 1000 m of double distilled water.

Ammonia purpurate and potassium Sulphate 0.05 gms of ammonium purpurate gained with the 100 gms of potassium sulphate.

PROCEDURE:

20 ml of sample is taken in to a conical flask and 2ml of NaOH buffer is added after through shake and add 0.2 gms of ammonia perpetrate indicator. Then titrate against EDTA solution until the color is changed from orange red to lavender or purple noted the volume of EDTA and calculated by the formula.

$$\text{Ca mg/L} = \frac{\text{Volume of EDTA X 1000 X eq. wt. of Ca X normality of EDTA}}{\text{MI. of sample taken}}$$

$$\text{Ca hardness} = \frac{\text{Volume of EDTA X 1000 X eq. wt. of CaCO3 X normality of EDTA}}{\text{Ml. of sample taken}}$$

MEGNESIUM:

The megnesium is also one of the most of abundant elements in igneous rocks. It causes hartdness in water. The common sources of megnesium in the hydrosphere are olivine, biotite, Hornblende, augite in igneous rocks and dolomite in sedimentary rocks.

The concentration Mf in ground water varies from about nil to as much as 100 ppm. In ground water the Ca content normally exceeds than magnesium content in accordance with their relative abundance in rock, but country to the relatively soluble their salts. As in the case of CaCO3 , MgCO3 is more soluble in water containing sodium salts. The ratio of calcium to magnesium is about 1 to 5.

The magnesium is determined by subtracting value of calcium hardened form the total hardness is obtained. Then it is multiplied with equivalent weight of magnesium and also normally of EDTA to get concentration of magnesium ppm.

Mg/ppm = MgH X eq. wt. of Mg X normally of EDTA.

Carbonate & bicarbonate (CO3 & HCO3):

These two anions are the predominant anions in the ground water and contribute. All the alkalinity or acid neutralizing power of water. The primary source of carbonate and bicarbonates in ground water is dissolved carbon dioxide in rain. Which as its enters into the soil dissolve more CO2 , increase in temperature or decrease in pressure caused reduction in the solubility of CO2 in water and the organic matter release CO2 for dissolution. Water changed with CO2 dissolved carbonate minerals as it possible through soil and rocks to give HCO3.

Ground water commonly contains more than 10 ppm but less than 800 ppm of bicarbonate concentration between 50 and 400 ppm is very common.

Determination of CO3 and HCO3:

These two radicals are determined volumetrically by titration method by using different indicators and sulphuric acid as standard solution.

Reagents:

H2SO4 (0.02 N) solution : 0.56 ml H2SO4 in distilled water

Phenolphthalein indicator: 0.5 gms of phenolphthalein diluted in 50 ml ethyl alcohol and 50 ml distilled water.

Methyl orange indicator: 1.05 gms of methyl orange, diluted in 100 ml distilled water

Na2CO3 (0.02 N) solution: 1.06 gms of Na2CO3 diluted in 1000 ml for reference only.

Procedure:

CO3 take 20 ml of water sample in a conical flask and add 2 to 3 drops of phenolphthalein indicator and titrate with 0.02 N H2SO4 drop wise until the pink color just disappear and note the volume of acid required for titration.

$$CO_3\ mg/l = \frac{Ml\ of\ acid \times 1000 \times eq.\ wt.\ of\ CO_3 \times normality\ of\ H_2SO_4}{Ml\ of\ sample\ taken}$$

If the pH value of water sample exceeds 8.3 carbonate determination is required otherwise it is not required.

HCO3 20 ml of sample is taken in a conical flask and 2 to 3 drops of methyl orange indicator is added. Then titration with 0.02 N with H2SO4 drop wise until the orange yellow color turns to just pink and noted the value of acid for required for titration and calculated by the formula.

$$HCO_3\ mg/l = \frac{Ml\ of\ acid \times 1000 \times eq.\ wt.\ of\ HCO_3 \times normality\ of\ H_2SO_4}{Ml\ of\ sample\ taken}$$

Table: 1 showing sample location

Sample No	**Location**	**Collecting sample water**	**surroundings**	**Usage**
1	**Dablipur**	Surface Water	Near Dhobighat	Domestic
2	Dabeerpura lake	Borewell	Dobhighat	Domestic
3	Dabeerpura	Borewell	Near Water Tank	Drinking Wate
4	Baramjiguda	Borewell	neardablipurlake	driking water
5	Baramjiguda	Borewell	Near primarey school	Domestic
6	Lingapur	Borewell	near milk dairey	Agriculture
7	Lingapur	Borewell	near primarey school	Agriculture
8	Lingapur	Borewell	primaryschool	driking water

Table : 2 showing Standards

S.No.	Water quality parameters	W.H.O standards in ppm		I.S.I standards in ppm		Analysis of the area investigated	
		Min. accept limit	Max. acceptable limit	Min. accept limit	Max. acceptable limit	Min	Max
1	pH	6.5	8.5	6.5-8.5	6.5-9.2	6.83	7.52
2	Ec	500	1500	500	1500	450	5196
3	Ca	75	200	75	200	16	208
4	Mg	50	150	30	100	10	336
5	Na	-	-	200	-	36	198
6	K	-	-	-	-	1	13
7	HCO_3	500	1000	-	-	159	525
8	Cl	200	600	250	1000	14	813
9	SO_4	200	400	150	-	1	43

Table : 3 showing Results

No.	Location	pH	Ec	TDS	TH	Ca	Mg	CO_3	HCO_3
1	Dablipur lake	8.7	545	348.80	2000	166.33	1833.67	nill	195.2
2	Dablipur lake near dobighat	8.5	360	230.40	500	74.14	425.86	nill	353.8
3	Near Dablipur lake	8.4	509	325.76	875	100.2	774.8	nill	305
4	Bramajiguda	8.6	399	255.36	360	120.24	239.76	nill	378.2
5	Bramajiguda near primary school	8.13	658	421.12	185	220.44	35.44	nill	488
6	Lingapur near milk dairy	8.10	570	364.80	925	260.52	664.48	nill	475.8
7	Lingapurl	8.18	393	251.52	480	340.68	139.32	nill	292.8
8	Lingapur near primary school	8.52	462	295.68	1150	200.4	949.6	nill	427

RESULTS AND DISCUSSIONS

HYDROGEN ION CONCENTRATION (PH):

The pH of water is very important of its quality and provides important piece of information in geochemical equilibrium or solubility calculations (Hem, 1991). pH of ground water is varying between 6.83 to 7.52. the limit of pH is 6.52 to 8.5 (WHO, 1883). pH values for all the samples are within the permissible limits.

ELECTRICAL CONDUCTIVITY (Ec):

The conductivity measurement provides an indication of ionic concentrations. It depends upon temperature, concentration and types of ions present (Hem,1991). The Ec of the ground water in the study area are varying between 450 to 5196 µ Siemens/cm at 250. The maximum limit of Ec in drinking water is prescribed as 1500 µ Siemens/cm (WHO,1983). 9 samples of the study area (3,4,6,7,8) are exceed the limit.

TOTAL HARDNESS:

Hardness is an important criteria for determining the usability of water for domestic, drinking and many industrial supplies. Total hardness of the ground water in the study area is varying between 90 and 1650 mg/l. The limit of the TH for drinking water is specified as 300 mg/l (ISI, 1983). 4 samples of the study area (6,7,8,) are exceeding the limit.

MAGNESIUM:

Mg concentration is varying between 10 to 336 mg/l. The limit of Mg concentration for drinking water is specified at 30 mg/l. 7 samples of the study area (2,4,6, and 8) are exceeding the limit.

CALCIUM:

Ca concentration of the ground water is varying between 16 and 20 mg/l. The limit of the Ca for drinking water is specified at 75 mg/l. 4 samples of the study area (6,7 and 8) are exceeding the limits.

CONCLUSIONS:

The groundwater of the study area is fresh, hard to very hard. On the basis of above physio-chemical characteristics of sub-surface waters, it is concluded that the natural water of the present area is not fit for drinking. concludes that the collected groundwater samples were suitable for irrigation and Domestic purposes.

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