

Study on Groundwater Quality around Saroornagar Mandal in Hyderabad, Telangana

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Abstract

Indian subcontinent has blessed with abundant water resources in the form perennial rivers and subsurface water. Every citizen of this country has the responsibility and duty towards protecting these most precious resources. Yet there is a scenario in India that thousands of people from different region are deprived of this due to over exploitation, poor management system. In this line, we have selected Saroor Nagar Mandal in Hyderabad City of Telangana state for conducting a model study on assessing groundwater quality. The study has been carried out in 6 locations of Saroornagar Mandal during pre-monsoon and post monsoon seasons by collecting 12 nos of bore water samples. Nine parameters were chosen for the analysis such as Temperature, pH, EC, Total dissolved solids, Total hardness, Calcium hardness, Turbidity, Chlorides and Bicarbonates. Finally, results of the analysis were compared with water quality standards such as BIS 10500 (1991) and CPHEEO manual of water sample and treatment. From this study, it was observed that calcium content was higher in few locations while other parameters were within the permissible limits.

Keywords: Calcium hardness; Parameters; Ground water; Chloride; Analysis

Introduction

Hyderabad is the sixth largest city in India and has the population of 67,31,790 [1] that demands huge quantity of water to fulfill the various activities. It is a well-known fact that ground water recharge has always been linked with surface water. The city has two major water bodies, such as Hussain Sagar lake and Mir Alam Tank that are situated within the corporation limits. Also, there are some smaller lakes located at Nallakunta, Jubilee Hills, Ramanthapur and other places. In addition, Musi river is the other source of water flows through an area subjected to occasional torrential rains. There are two dams built on the Musi river that are Osman Sagar and Himayat Sagar. Both of the reservoirs constitute the major drinking water sources for Hyderabad. The major sources of surface water to Hyderabad are given in detail in Table 1 with capacity of water drawl and type of treatment [2] (Figure 1).

Methodology

Description of study area

Hyderabad has a tropical wet and dry climate bordering on a hot semi-arid climate. The annual mean temperature is 26.6°C (79.9°F); monthly mean temperatures is 21–33°C (70–91°F). The ground water level of the city shows considerable variations during the year with a depth of around 10 to 15m in the summer months and depth of around 2 m to 8 m during the monsoon months. Among 37 mandals of Rangareddy district in Hyderabad, saroor nagar mandal serves as the second largest one that consists of many towns and villages [3]. Hence saroor nagar has been chosen as the study area. Six sampling locations in this mandal were selected based upon the population and the nature of living, which are given in Tables 2 and 3. The present scenario of ground water levels in the study area is shown in the following Figure 2.

Lal Bahadur Nagar is called as L. B. Nagar, it is a commercial and residential hub in Hyderabad, Telangana, India. This is located at main entrance for Hyderabad when approaching the city from eastern direction through Vijayawada highway NH 65. Bhupesh Guptha Nagar is located in Jillelaguda of Hyderabad City. TKR College is located in medbowli area of Meerpet municipality, Hyderabad. The college campus is spread over an area of 15 acres of land and having a strength of more than 9000 students and faculties. The other area, Nandhi hills is

located at a distance of 2 km from TKR College and spread over an area of 15 sq.km within the Meerpet municipality, Hyderabad. Badangpet is a Nagar Panchayath located in Saroornagar mandal of Rangareddy district of Telangana. India. Last location, Balapur is a suburb in Ranga Reddy district of the Indian state of Telangana, which is located in Balapur mandal of Kandukur revenue division. Also, Table 2 explains in detail about towns and villages of Saroornagar Mandal [4-7].

Location of sampling stations

Ground water samples were directly collected from hand pump - bore well having a depth of 150 -250ft. Totally, 12 water samples were collected during both monsoon (6 samples in pre-monsoon and 6 samples in post monsoon). The grab sampling techniques was used to collect samples, preservations and analysis were carried out as per the standard methods [8-10].

Polyethylene bottle where used to collect samples, after the sample collection, it was transported to Teegala Krishna Reddy College of Engineering and Technology for preservation and analysis. Nine Physico-chemical parameters were analysed to check the quality of ground water such as Temperature, pH, EC, Total dissolved solids, Total hardness, Calcium hardness, Turbidity, Chlorides and Bicarbonate (Table 3).

Results and Discussion

Drinking water quality standard- BIS 10500 (1991) is given in Table 4. The water quality data of 12 samples at six locations is presented in Tables 5 and 6. Ground water quality analysis report mentioned in Tables 4 and 5 reveals that pH value of ground water were occurring in

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Sources	Normal Draws (in MGD)	Present Draws (in MGD)	System Mode	Water Treatment Plant
Osmansagar	25	0.00	Gravity	Asif agar filter beds
Himayathsagar	15	0.00	Gravity	Miralem filter beds
Singanoor	75	75.00	Gravity/Pumping	Peddapur pH-3,4
Manjra	45	30.00	Gravity/Pumping	Rajampet,Kalabgoor
Akkampally (Krishna pH-1,2,3)	270	226	3 StagePumping	Kodandlapur filter beds
Sripada Yellampally (Godavari)	86.00	56.00		Godavari
Total	516	387		

Table 1: Sources of surface water in Hyderabad.

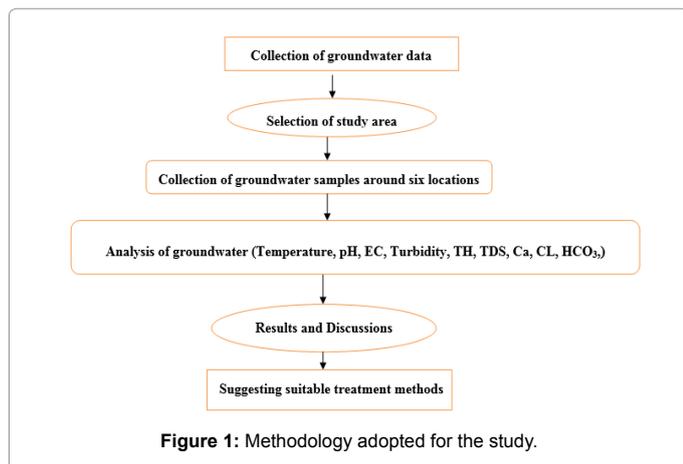


Figure 1: Methodology adopted for the study.

Town	Population
LB nagar	261987
Bhupesh nagar	27,461
TKR College	9000
Nandhi hills	15,913
Badangpet	12,740
Balapur	20,700

Table 2: Towns and villages in Saroornagar Mandal of Rangareddy district.

Sampling Stations	Code
LB nagar	L1
Bhupesh nagar	L2
TKR college	L3
Nandhi hills	L4
Badangpet	L5
Balapur	L6

Table 3: Description of sampling stations.

WATER WOES

GROUNDWATER LEVELS HAVE DIPPED REMARKABLY IN HYDERABAD AND RANGA REDDY

HYDERABAD
6.9 metre in December 2013. In 2014, it dipped to 9.46 metre

RANGA REDDY
8.62 metre in December 2013. In 2014, it dipped to 12.7 metre

Figure 2: Present scenario of ground water levels.

S. No	Characteristic	Requirement (desirable)	Permissible limit
1	Temperature(°C)		
2	pH value	6.5 to 8.5	6.5 to 8.5
3	EC (µm/cm)	0.25-1	
4	Turbidity,NTU,Max	-	10
5	Total Hardness as CaCO ₃ , max mg/l	300	600
6	Calcium as Ca, mg/l,max	75	200
7	Dissolved Solids, mg/l, max	500	2000
8	Chlorides as Cl,max mg/l	250	1000
9	Bicarbonate	200-600	

Table 4: BIS 10500 (1991) standard of drinking water.

S. No	Parameters	L1	L2	L3	L4	L5	L6
1.	Temperature (°C)	24.1	22	23	25.2	21.9	24.7
2.	pH	6.8	6.3	6.4	6.6	6.8	6.2
3.	EC (µm/cm)	1580	1970	620	430	1185	595
4.	Turbidity (NTU)	1.3	0.5	1.1	1.3	2.2	1.5
5.	Total hardness (mg/l)	318	325	309	312	303	306
6.	Total dissolved solids (mg/l)	256	268	292	218	214	259
7.	Calcium (mg/l)	65	153	182	169	224	253
8.	Chlorides (mg/l)	188	220.4	185.9	246.6	185.4	175.9
9.	Bicarbonate	187.5	273	172.3	190.2	199	180.2

Table 5: Ground water quality-pre-monsoon.

S. No.	Parameters	L1	L2	L3	L4	L5	L6
1.	Temperature (°C)	26	25	27	25.06	26.27	25
2.	pH	6.5	6.2	6.30	6.9	6.9	6
3.	EC (µm/cm)	1625	2255	697	479	1258	645
4.	Turbidity (NTU)	1.2	0.4	0.9	1.0	1.8	0.8
5.	Total hardness (mg/l)	328	336	328	320	396	316
6.	Total dissolved solids (mg/l)	256	268	292	218	214	308
7.	Calcium (mg/l)	75	166	198	179	249	271
8.	Chlorides (mg/l)	196.4	226.42	194.93	239.92	173.44	194.93
9.	Bicarbonate	197.5	280	162.5	185	201	176

Table 6: Ground water quality-post monsoon.

the ranges of 6.2 to 6.9 for all samples, which are within the permissible range as per water quality Standards. The Electrical Conductivity (EC) Values of ground water were in the ranges of 479-2255 µS/cm. The highest value of 2255 EC was recorded in sampling location at Bhupeshpur during post monsoon. The other 11 samples showed lower EC values within the permissible limits. Total Hardness is reported in terms of calcium carbonate, it ranges from 300 to 390 mg/L for all 12 samples and are within the permissible limit. Total dissolved solids are in the ranges of 214 to 308 mg/L for all samples and are within the permissible limit. The minimum and maximum values of Calcium in the six locations are 75 and 271 mg/L, respectively. Out of which, 4

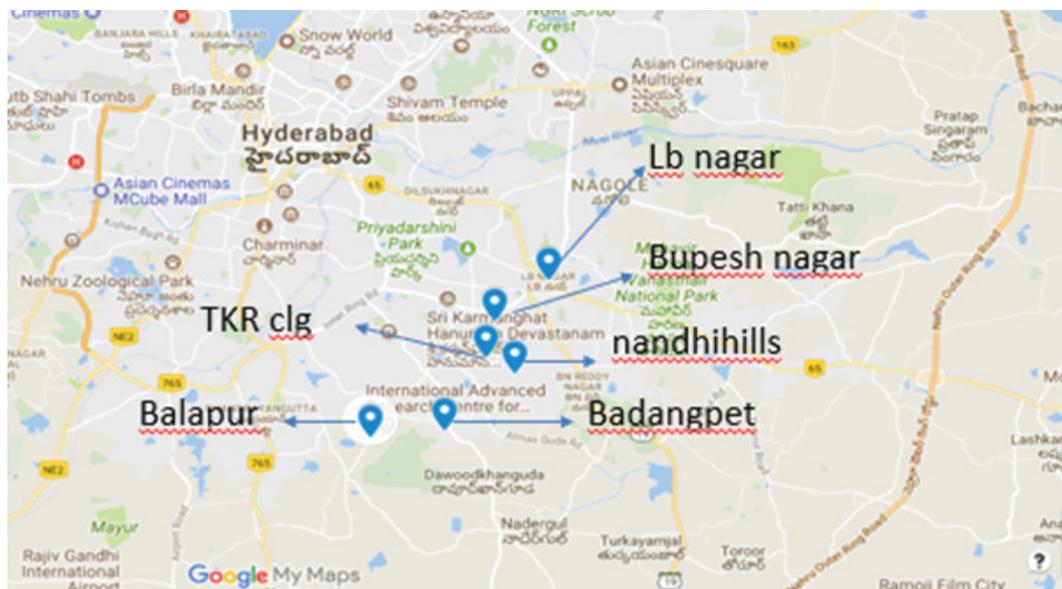


Figure 3: Location of sampling stations.

samples are recorded higher values of calcium that is more than 200 mg/L and higher than the permissible limits of BIS standard. The values of Chloride for all the samples were in the range of 173 to 239 mg/L, which are within the permissible limit. Bicarbonates are the primary source of Carbonate and the dissolved form of carbon dioxide (CO₂) in rain. The values of bicarbonates in all the samples were in the ranges of 170 to 280 mg/L, which are within the desirable limit [11-14].

Effects of Calcium

Calcium and magnesium the two most common minerals that dissolve in water and make water as "Hard." The degree of hardness becomes greater as the calcium and magnesium content increases and is related to the concentration of multivalent cations dissolved in the water. Hard water interferes with almost every cleaning task from laundering and dishwashing to bathing and personal grooming. Clothes laundered in hard water may look dingy and feel harsh and scratchy. Dishes and glasses may be spotted when dry. Hard water may cause a film on glass shower doors, shower walls, bathtubs, sinks, faucets, etc. Hair washed in hard water may feel sticky and look dull. Water flow may be reduced by deposits in pipes. Water hardness causes cardiovascular disease in human beings [15] (Figure 3).

Conclusion

The extent of study area of Saroornagar sub-basin is 40.5 sq.km, out of which an area of 4.06 sq.km has covered in this study and distributed into 6 different locations. It was found that the ground water quality at badangpet (L5) and Balapur (L6) loacations have been deteriorated by higher concentration of calcium. In other four study areas L1 to L4, the groundwater quality is well within standard limit. Similarly, Ground water quality at Bhubesh nagar (L2) location has been deteriorated with higher solid content, which was reflected in EC values. The Greater Hyderabad Municipal Corporation (GHMC) must take appropriate measure to treat the groundwater before its supply to public by reducing calcium level.

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