Assessment of ground water quality of LB Nagar, Hyderabad and Impacts of Industries closure

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Abstract— Impacts on ground water quality were carried out in the L B Nagar, Hyderabad by many of the researchers previously. As Environmental Act has forced to close sum of the Industries in the LB Nagar area, would like to observe the present status on the natural system in the area.
The principal objective of the present study is to understand the hydrochemistry of ground waters in the study area and the Post Industrialization impact on ground water quality of the investigated area. The study area is situated on thickly populated area of Hyderabad district, Telangana State. About 30 water representative ground water samples will be collected from different stations to monitor the water chemistry of various Physical, Chemical and Trace Metals status.Collected ground water samples different locations in study area will be studied for various Physical & Chemical parameters such as pH, Electrical Conductivity, Turbidity, Total Dissolved Solids, Alkalinity, Total Hardness, Calcium, Magnesium, Chlorides, Sulphates, Fluorides, Sodium, Potassium, Nitrate, Iron, Manganese, Zinc, Total Chromium, Copper, etc….

The study was carried out by collecting some ground water samples during Aug 2014 to Sep 2014.The results were compared with standards prescribed by IS 10500:2012.

Index Terms— BIOLOGICAL METOHDS, GROUND WATER ANALYSIS, PHYSICAL and CHEMICAL METHODS, HYDERABAD.

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1 INTRODUCTION

Impact on ground water quality was carried out in the L B Nagar, Hyderabad by many of the researchers previously. As Environmental Act has forced to close sum of the Industries in the LB Nagar area, would like to observe the present status on the natural system in that area. About 30 water representative ground water samples will be collected from different stations to monitor the water chemistry of various Physiochemical and Trace Metals status. The study was carried out by collecting ground water samples during Aug 2014 to Sep 2014.The results were compared with standards prescribed by IS 10500:2012.

Hyderabad The metropolitan city Hyderabad is the capital of Telangana and is located at 17°12' N latitude and 78°18' E longitude. Hyderabad district surrounded by nine municipalities falling in Ranga Reddy district forms the Hyderabad Urban Agglomeration with an areal extent of about 1000 km2 and spreads on the North and South bank of the river Musi, a tributary of Krishna. The beautiful Hussain Sagar Lake is centrally located in the city and connecting the Hyderabad and Secunderabad twin cities. Hyderabad is a landmark

of spiritual and cultural activities of Hindus and Muslims. It has beautifully planned architecture, aesthetically designed monuments, splendidly carved temples and shrines. It is 6th largest town in India (population wise), and the first in the state of Andhra Pradesh. As per census, 2011, the population of Hyderabad metropolitan city is 67,31, 790.

2. METHODOLOGY

It includes field work and laboratory analysis. The field work consists of collection of water samples from 30 wells for August to September 2014 in the study area. The ground water samples collected from the study area bore wells/Dug wells and analyzed for various Physical and chemical parameters described by the standard methods. These parameters include pH, Electrical Conductivity, Total Dissolved Solids, Alkalinity, Total Hardness, Calcium, Magnesium, Chlorides, Sulphates, Fluorides, Sodium, Potassium and Nitrates etc.

2.1 GIS MODEL FOR WATER QUALITY:

GIS can be a powerful tool for developing solutions for water resources problems for assessing water quality, determining water availability, preventing flooding, understanding the natural environment, and managing water resources on a local or regional scale. Though there are a number of spatial modeling techniques available with respect to application in GIS, spatial interpolation techniques through Inverse Distance Weighted (IDW) approach has been used in the present study to delineate constituents. This method uses a defined or selected set of sample points and controls the significance of known points upon the interpolated values based upon their distance from the output point thereby generating a surface grid as well as thematic isoclines. Important water quality indicating parameters and their distribution patterns were studied in the one District, Telangana, India.

Geo-statistical Analyst provides a cost-effective, logical solution for analyzing a variety of data sets that would otherwise cost an enormous amount of time and money to accomplish. There are two main groups of interpolation techniques, deterministic and geo-statistical. In this study one of

the deterministic interpolation techniques called Inverse Distance Weighted the geo-statistical interpolation techniques are based on statistics and are used for more advanced prediction surface modeling. The GIS is gaining importance and widespread acceptance as a tool for decision making or support in the infrastructure, water resources, environmental management, spatial analysis and urban regional development planning. With the development of GIS, environmental and natural resources management has found information systems in which data are more readily accessible, more easily combined and more flexibly modified to meet the needs of environmental and natural resources decision making. In this study, GIS was extensively used to identify the zones of suitable water quality in the Rangareddy district on the sampled data by Mapping.

2.2. WATER QUALITY PARAMETERS:

Water as it travels in the atmosphere, through ground or over the land, dissolves a large variety of substances or salts. These substances in solution exist in their ionic form. The major cations (positively charged ions) comprise Calcium (Ca^{++}), Magnesium (Mg^{++}), Sodium (Na^{+}) and Potassium (K^{+}) and the associated anions typically include Sulphate (SO_4^{2-}), bicarbonate (HCO_3^{-}) and Chloride (Cl^{-}). The divalent cations (those having two positive charges) are responsible for the hardness of water mostly. Other ions, which may be present in smaller concentrations but can nevertheless, be of environmental significance are Fluoride (F^{-}), and Nitrate (NO_3).

MAJOR IONS IN GROUND WATER:

All waters in the environment contain dissolved salts. However, some special occur more frequently and at greater concentration than others. (Table 1)

With regards to ions, (table 3) shows the cations and anions, which normally constitute the major ions (table 2) in water.

3. RESULT AND DISCUSSION:

QUALITY OF GROUND WATER:

The quality of water different sources varies widely. Precipitation absorbs gases from atmosphere and removes particulates from the air. As precipitation striking the ground the surface water flows from smaller to larger channels, ponds, lakes and rivers. In this course, surface water picks up organic material including bacteria, as well as minerals, salts and other soluble substances.

Ground water derives its composition from a variety of processes, including dissolution, hydrogeological and precipitation, absorption and ion exchange reactions, oxidation and reduction, gas exchanges between ground water and atmosphere and biological processes. The composition of ground water and mostly depends on the lithological composition of various rock types through which the ground water pass through. However, artificial pollution shows the sewerage, organic and other waste dumps. Chemical dumps too cause considerable ground water pollution, particularly in urban agglomerations.

In the basin, the area is occupied by granitic rock and is mostly calcium and sodium rich delivered from the dissolution of plagioclase, which is a major constituent mineral found in the rock type.

Chemical analysis details are given in Table 4,5,6:

pH: The ground water is mostly alkaline in nature. The pH of ground water occurring in the area ranges from 6.65 to 8.25. All the samples are within the permissible range as per IS Standards. (Fig – 5)

Electrical Conductivity: The EC Values of ground water in the area ranges from 700-11,435µS/cm at 25°C. The highest value of 11,345 EC was recorded in a bore well near to SIRIS factory. 9 samples recorded higher values of EC more than the permissible limits i.e. 3000 µS/cm at 25°C.

Total Hardness: It is reported in terms of calcium carbonate. In the sub basin surveyed, it ranges from 700 to 3423mg/L 19 samples recorded higher values of hardness > 600, which is the permissible limit. The highest value recorded is 3,423mg/L. which is adjacent to SIRIS factory.

Calcium: The minimum and maximum values of Calcium in the area are 32 and 445 mg/L. 5samples recorded higher values of calcium >200mg/L, which is the permissible limits of BIS range. The highest value of calcium noticed adjacent to SIRIS factory, which is around 445mg/L and also at Bhagatsingnagar borehole around 497mg/L.

Magnesium: Magnesium occurs generally lower than calcium in accordance with the relative abundance in rocks. In the surveyed area, it is observed that in Magnesium is determinant over calcium by 44%, which may be due to weathering process of magnesium. The general range varies from 24 to 561mg/L, which is the permissible limit of BIS. Highest value of 561mg/L is noticed nearby SIRIS factory.

Sodium: In the study area, sodium concentration ranges from 25 to 124mg/L. 11 samples have recorded highest values of Sodium > 350mg/L, which is the permissible limit as per BIS standards. Highest values of sodium are observed adjacent to SIRIS factory, which is 240mg/L.

Potassium: The concentration of potassium in the study area ranges from traces to 2.8mg/L. The highest value noticed is 2.8 mg/L at Saroornagar, Venkateswara colony.

Carbonates and Bicarbonates: The primary source of Carbonate and Bicarbonate is the dissolved co_2 in rain. In the submerged area, Carbonates are not noticed. The Bicarbonate in ground water ranges from 146 to 1122mg/L. Highest values of Bicarbonate noticed is 1122, which is adjacent to SIRIS facto-

ry.

Chloride: Chloride values range from 39 to 2659mg/L and the general range is 250 to 1000mg/L. In 5 samples, chloride is less than 250mg/L, which is nearby SIRIS factory. Remaining samples are within the permissible limit. (Fig – 6)

Nitrate: It is the major constituent of atmosphere. It is converted by soil bacterial into Nitrite to Nitrate. Part of the Nitrate is fixed by the plants before the rain water percolates below root zone. Natural ground water contains less than 5mg/L of Nitrates. But the polluted water contains high concentrations of Nitrate. The concentration of nitrate in the study area ranges from 40 to 269 mg/L. In majority of the samples (16), Nitrates are higher than the permissible limit, which is 100mg/L Higher values of Nitrate are noticed around Gowthaminagar, RTC colony, L.B. Nagar, Jilllaguda, Saroornagar Venkateswara colony. Highest values may due to pollution of ground water by SIRIS factory and also from soils and sewerage water, which is located near the collection point. (Fig – 7)

Sulphates: In the study area, sulphate ranges from 17 to 1622mg/L. In all 16 samples recorded values of less than 150mg/L. 5 samples have recorded higher values >400mg/L which is permissible limit of IS. Highest values of Sulphates are noticed around Gowthaminagar (1294mg/L), Bharatsinghnagar (1622mg/L). (Fig – 8)

Fluoride: The fluoride in the area generally ranges from 0.108 to 1.194mg/L. As per IS standard, maximum of 1.5mg/L is the permissible limit. All the samples in the surveyed are within the permissible limit. (Fig – 8)

CONCLUSION & RECOMMENDATIONS:

CONCLUSION:

- The study area of the Saroornagar sub-basin is 40.5sq.cm out of which an area of 4.06sq km was affected by SIRIS factory. The study area falls in L.B.Nagar municipality and is drained by Musi river. The main factory SIRIS located at L.B.Nagar and established in the year 1965 and mainly manufactures the drugs for preparation of pharmaceuticals.
- The area is underlain by the oldest rocks of Archaean group and recent alluvium. The pink granites are considered tobe the younger than grey granites. The elevation of water table ranges from 460m amsl to 540m amsl and flow direction is towards Musi River, which forms the discharge area.
- Approximately 30 samples were collected for chemical analysis, which includes 11 dug wells, 10 hand pumps and 9 bore wells. The depth of the dug wells ranges from 8.5 to 20.12m. The depth to water level (pre monsoon) range from 4.4 to 15.65m and post monsoon period from 1.7 to 11.8m.
- The phreatic aquifer in the dug wells and bore wells is almost damaged in an area of roughly 5sq.km. The range of weathered thickness ranges from 5 to 10m. The long term water level records at Saroornagar basin shows rising trend. Due to urbanization, the area available for ground water recharge from rainfall has been considerably reduced. The annual normal rainfall in the area is around 760mm.
- The results of the chemical analysis of samples, shows that all the samples are beyond tolerable limits as per BIS Standards. The pH values ranges from 6.36 to 7.82 and the EC Values ranges from 1150 to 10160µS/cm at 25^0 C.
- Out of the 30 samples collected, 85% of the samples are unfit for drinking. 59% of the samples are dominated by Nitrate in area, which may be due to open drainage/sewerage system. The colour and EC of ground water in the area nearby the factory are beyond limits, which is mainly due to urbanization and industrialization.
- From the year 1992, the SIRIS factory is releasing the effluents through underground pipeline into the Musi river. The factory is not functioning since 2001 and people nearby areas are reported that the colour of water is slowly improving as the factory has stopped his productivity. However, it may take long time for dilution of chemical constituents/ purification of the entire aquifer.

RECOMMENDATIONS:

Ground water region in 5sq.km out of 40.5 sq.km in the sub basin is severely damaged due to pollution from SIRIS factory. The following suggestions are recommended to improve the quality of the ground water.

- Citizens should be advised to make use of garbage bins provided in their colonies, instead of disposing garbage on roads.
- Desalting of tanks and purification of the existing tank water by recycling process will improve the quality of ground water in the nearby area.
- Sewerage should not be allowed to enter into nearby tank area. Restriction on release of industrial effluents into open areas and use of concealed pipelines should be ensured.
- Rainfall run off should be arrested and ground level storage cum tanks may be constructed to collect rain water from rooftops either to use directly or to artificially recharge the ground water.
- It is necessary to evaluate the consequences of various cases of water on the environment, which will help to take measures in controlling water related diseases and to protect and improve the quality of water resource. Construction of recharge shafts, pits, contour trenches in the open areas such as public parks, play grounds and institutions will augment the ground water resource.

- Public awareness through conducting mass awareness campaigns is very much essential for the construction of roof top/rain water harvesting structures in individual houses and it should be made mandatory which will not only improve the water levels in the existing dug wells/bore wells and also improve the quality.
- Reclamation and recycling of waste water may be taken up to reduce the pressure on existing water resources and to meet the growing needs.
- The analysis water samples revealed that Nitrate concentration in ground water is above permissible limits. It is due to the inadequate sewerage system, indiscriminate solid/liquid waste disposal and industrial waste.
- The open sewerage, solid waste dumps both by local people and municipal Administration is required to be shifted to a safe disposal place for improving the chemical quality of ground water, especially reduction of Nitrate percentage.

4 HELPFUL HINTS

4.1 Tables

Table 1 : Major Constituents in Water

Major Constituents (1.0 to 1000mg/L)	Secondary Constituents (0.001 to 10.0 mg/L)
Sodium	Iron
Calcium	Strontium
Magnesium	Potassium
Bicarbonate	Carbonate
Sulphate	Nitrate
Chloride	Fluoride
Silica	Boron

Table 2: Source of Major ions Contribution

Major Ions	Some Primary Sources Minerals
Calcium	Amphiboles, feldspars, gypsum, pyroxenes, aragonite, calcite, dolomite, clay minerals
Magnesium	Amphiboles, olivine, pyroxenes, dolomite, magnetite, clay minerals
Sodium	Feldspars, clay minerals, halite, mirabilite, industrial wastes
Potassium	Feldspars, feldspathoids, some micas, clay minerals
Bicarbonate/Carbonate	Limestone, dolomite
Sulphate	Oxidation of sulphide ores, gypsum, anhydrite
Chloride	Sedimentary rock, igneous rock

Table 3 :

CATIONS	ANIONS
Calcium (Ca^{+2})	Bicarbonate (Hco_3)/Carbonate (Co_3^{-2})
Magnesium (Mg^{+2})	Chloride (Cl^-)
Sodium (Na^+)	Sulphate (So_4^{-2})
Potassium (K^+)	Nitrate (NO_3)
	Fluoride (F^-)

Table 4: Dug wells (Phreatic aquifer)

S.No	Location	pH	EC
1	Gowmathinagar Behind Siris	7.18	2470
2	Lingojiguda (Salaijay Nagar)	7.05	4520
3	Sirinagar (Sivalayam)	7.12	3990
4	Saroornagar (tank)	8.20	1490
5	Venkateswara colony (Saroornagar)	6.76	2440
6	Chaitanyapuri (South of Musi)	7.18	1915
7	Kamalanagar	7.38	2730
8	Victoria Memorial Hall (Nursery)	6.74	1380

Table 5: Hand Pumps (Shallow Aquifer)

S.No	Location	pH	EC
1	Gowthaminagar Near Siris	6.73	11345
2	Bairamalguda Adj. Siris)	6.86	1680
3	Bairamalguda	6.87	2180

	Overhead Tank)		
4	L.B. Nagar (Near Tailor Shop)	7.25	3360
5	Saroornagar 'X' Road (Bus Depot)	7.57	2770
6	Jillelaguda	7.33	3280
7	Venkateswara Colony (Saroornagar) Adj. to K.S. Rao	6.56	1990
8	Chaitanyapuri (Ramalayam)	6.81	1446

Table 6: Bore Wells (Deep Aquifer)

S.No	Location	pH Post Moon Soon	EC Post Moon Soon
1	Lingojiguda (Satya Sai seva sadan)	6.70	2600
2	Chaitanyapuri (Advocate)	7.30	1808

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4 Conclusion

Although a conclusion may review the main points of the paper, do not replicate the abstract as the conclusion. A conclusion might elaborate on the importance of the work or suggest applications and extensions. Authors are strongly encouraged not to call out multiple figures or tables in the conclusion—these should be referenced in the body of the paper.

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