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Preliminary Investigations of Ground Waters in and Around Musheerabad Area, Hyderabad, Telangana.

Alaa Sameer Ibrahim* and Praveen Raj Saxena

Department of Environmental Sciences,Osmania University, University College of Sciences, Hyderabad, Telangana, India.

****Corresponding Author's E-mail: Najeeb.alwais@gmail.com***

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A B S T R A C T

To assess the suitability in relation to drinking water purpose fifteen ground water samples have been collected in and around Musheerabad area. The physico chemical parameters like pH, Conductivity, total dissolved solids (TDS), calcium (Ca^{2+}),magnesium (Mg^{2+}), sodium (Na^{+}), potassium (K^{+}), bicarbonate (HCO_3^{2-}) chloride (Cl^{-}), fluoride(F^{-}) sulphate (SO_4^{2-}) and nitrate (NO_3^{-}) were analyzed using standard methods to know the groundwater quality. Except for fluoride and nitrates, values of most of these parameters fall within prescribed limits for drinking purpose (BIS:2012).

Introduction:

Quality of water is of major concern because of its scarcity. Water resource is essential for maintaining human health and ecosystem. Adequate quantity and quality is essential for sustainable development. Water is one of the most precious sources on earth. All plants and animals must have water to survive. If there was no water there would be no life on earth. Water is our lifeline that bathes us and feeds us (www.health.gov.au). In ancient cultures water represented the very essence of life. Actually, only 1% of the world's water is usable to us. About 97% is salty sea water, and 2% is frozen in glaciers and polar ice caps. Thus that 1% of the world's water supply is a precious commodity necessary for our survival (www.cotf.edu). Contrary to the past, our recent developed technological society has become indifferent to this miracle of life. Our natural heritage (rivers, seas and oceans) has been exploited, mistreated and contaminated.

In India, where groundwater is used intensively for drinking, irrigation and industrial purposes, a variety of land and water-based human activities are causing pollution of this precious resource. Rapid urbanization, especially in developing countries like India, has affected the availability and quality of groundwater due to its overexploitation and improper waste disposal (Vekateshwarlu, Rasheed.et.al.,2014). According to some estimates, ground water accounts for nearly 80per cent of the rural domestic water needs, and 50 per cent of the urban water needs in India. Groundwater is generally less susceptible to contamination and pollution when compared to surface water bodies. Also, the natural impurities in rainwater, which replenishes groundwater systems, get removed while infiltrating through soil strata. Hence ground waters are extensively used in many countries.

In Hyderabad, which is a rapidly growing city in Asia, ground water forms the ultimate source of drinking water in many areas. The current study is emphasized on deriving the qualitative analysis of ground waters in and around Musheerabad area.

Study Area:

The present area of investigation is in and around Musheerabad area, Hyderabad, Telangana District. The Hyderabad area has undulating topography with elevation ranging from 460 to 560 m amsl. It forms part of the Pre-Cambrian peninsular shield and is underlain by the Archaean crystalline complex, comprising of granites intruded by dolerite dykes. (www.waterandmegacities.org) The study area falls between 17.24.40 N and 78.29.20 E and fall in the survey of India Toposheet No. 56K/7(Fig:1).

Hyderabad has a tropical wet and dry climate bordering on a hot semi-arid climate. The annual mean temperature is 26 °C (78.8 °F). Summers (March–June) are hot and humid. Maximum temperatures often exceed 40 °C (104 °F) between April and June. Winter lasts for only about 2 1⁄2 months, during which the lowest temperature occasionally dips to 10 °C (50 °F) in December and January. May, the hottest has temperatures ranging from 26 to 38.8 °C. January, the coldest, has temperatures varying from 14.7 to 28.6 °C.

Heavy rain from the south-west summer monsoon falls between June and September,] supplying Hyderabad with most of its annual rainfall of 812.5 mm (32 in).

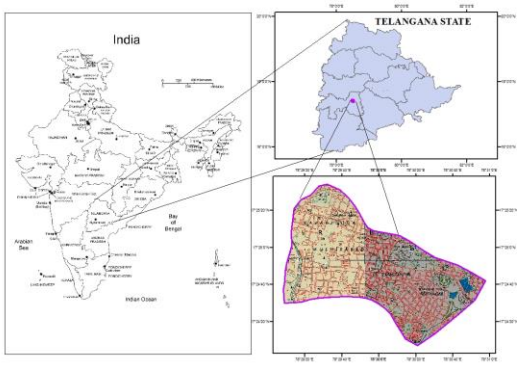

Fig: 1. Location map of the study area

In most parts of Musheerabad, problems pertaining to drinking water, drainage and government educational institutions have become a regular part of the people's lives. Inaction by authorities concerned is leaving the citizens of this area to grapple with the problem on their own.(The New Indian Express, Hyderabad,2014). Thus this paper is aimed to investigate the quality of ground waters to test the potablility.

Materials and Methods:

Fifteen ground water samples have been collected in Pre cleaned high density polyethylene bottles (HDPE) with dil HNO_3 in and around Musheerabad area and numbered.(Table:1). The bottles were rinsed with the same water which is to be taken as the sample so as to avoid cross contamination. The water samples were then analyzed for major ion chemistry using standards methods (APHA, 1995). The results were evaluated in accordance to the drinking water standards (BIS: 2012).(Table:2)

Table:1 Results of Hydro-chemical analysis of ground water samples of study area(Musheerabad) (Values are in PPM except TDS and EC)

Sample Id	Longitude	Latitude	pH	EC	TDS	$N0_3$	SO_4	F	Na	K	Cl	CO_3	HCO_3	Ca	TH	Mg
1	78.30.27.107	17.24.17.561	7.2	700	287	25	35	1.3	46	2	75	9	256	40	180	19
2	78.30.25.120	17.24.44.302	7.3	800	328	62	31	1.7	66	3	114	12	171	26	125	14
3	78.30.14.027	17.24.50.169	7.3	900	369	60	56	1.7	76	2	128	9	177	32	110	7
4	78.29.56.052	17.24.53.419	7.2	1000	410	59	30	1.3	73	2	114	6	293	34	160	18
5	78.29.53.248	17.25.05.876	7.2	1300	532	57	43	2.3	104	2	146	18	445	68	225	13
6	78.29.36.082	17.25.20.245	7.8	1300	532	141	50	0.9	83	8	142	12	372	60	240	22
7	78.29.32.208	17.25.28.311	7.9	1100	451	39	33	1.3	96	2	114	9	421	60	235	21
8	78.29.36.082	17.25.20.245	7.9	900	369	52	33	0.7	87	5	128	9	238	8	130	27
9	78.29.26.764	17.24.55.115	8.2	1300	532	51	48	1.4	136	2	174	15	519	38	205	27
10	78.29.14.516	17.24.45.708	8.1	1200	492	25	41	1.5	132	4	142	21	415	30	95	5
11	78.29.23.099	17.24.36.711	8.1	700	287	18	29	0.4	57	1	89	24	287	42	130	6
12	78.29.33.473	17.24.37.876	8.1	800	328	27	37	2.2	81	3	103	15	214	24	120	14
13	78.29.39.523	17.24.40.610	8	800	328	8	40	0.9	70	3	121	15	348	38	120	6
14	78.30.05.632	17.24.37.342	8.1	800	328	32	34	0.9	55	4	99	9	238	50	130	1
15	78.30.07.630	17.24.37.344	8	800	328	53	35	0.8	64	2	89	12	299	56	240	24

Table: 2 Comparison of Physico-Chemical Parameters of Ground Water Samples with (BIS: 2012) Standards

Parameter	Concentration in study area	BIS(2012) Acceptable Limits(Requirements)	BIS(2012) Permissible (In absence of alternative source)
pH	7.2-8.2	6.2-8.5	No Relaxation
Conductivity(µS/cm)	700-1300	500	200
Sodium(mg/l)	46-136	-	-
Potassium(mg/l)	1-8	-	-
Calcium(mg/l)	8-60	75	200
Magnesium(mg/l)	1-26	30	100
Chloride(mg/l)	74-173	250	1000
Fluoride(mg/l)	0.4-2.3	1	1.5
Sulphate(mg/l)	29-56	200	400
Bicarbonate(mg/l)	170-518	-	-
Nitrate(mg/l)	8-140	45	No Relaxation
TDS(mg/l)	286-532	500	2000
Total Hardness(mg/l)	95-240	300	600

(Except pH & EC all parameters are expressed in mg/l)

The pH was measured with Digital pH meter (Model 802 Systronics) and EC was measured with Conductivity meter(Model 304 Systronics). Total hardness as $CaCO_3$ and (Ca^{+2}) were analyzed titrimetrically using standard EDTA. (Mg^{+2}) was computed taking the reference between TH and (Ca^{+2}) values. Carbonate ($CaCO_3^{-2}$) and Bicarbonate (HCO^{3-}) were estimated by titrating with standard H2SO4. Chloride (Cl^-) was estimated by standard $AgNO_3$. Sodium (Na^+) and Potassium (K^+) were measured by Flame Photometer (Model Systronics 130). Sulphates (SO_4^{-2}) and nitrates were measured with Spectronics 21(Model BAUSCH AND LOMB), and Fluoride (F^-) was analyzed by Orion ion analyzer with Ion-Selective Electrode. Total Dissolved Solids (TDS) were calculated from Electrical Conductivity (EC). All the

parameters are expressed in mg/l except for pH and EC. EC is expressed in micro Siemens /cm.

Results and Discussion:

Suitability for drinking purpose:

In the present study a detailed investigation has been carried out with an objective of identifying the water quality for drinking water suitability. The major ion chemistry of the area showing various statistical parameters are given below(Table:3) The pH of the ground waters ranges from 7.2 to 8.2 which are within permissible limits according to BIS(2012). It is slightly alkaline in nature. Electrical conductivity ranges between 700 to 1300 (µS/cm). EC in the study area was found to exceed the permissible limits (BIS: 2012). Higher EC of water samples is mainly attributed to presence of high amounts of dissolved inorganic substances in ionized form. TDS in ground waters ranges from 286 to 532mg/l. TDS values are within permissible limits (BIS:2012). It also complies with ref(Catrol, freeze, cherry, fetter, Dawis and Dewiest). Water type classification (Table:4). Fluorides in ground waters range from 0.4 to 2.3. All samples fall within permissible limits except for samples numbering (5 & 12). Which are beyond the permissible level.(BIS:2012). The high concentrations of fluorides are may be due to anthropogenic sources. Nitrates ranges from 8 to 140mg/l. nitrate values are beyond permissible limits except for samples numbering (2,3,4,5,6,8,9,15). High nitrates are mainly due to poor sewerage systems in the study area (News Indian Express/Andhra Pradesh: article2185843). TH of ground waters in study area range between 95 to 240mg/l which are within the permissible limits (BIS: 2012). According to Hardness classification of water (Sawyer et al.,) ground waters of study area fall under hard category (Table:5). Hardness is mainly caused due to the presence of divalent metallic ions dissolved in waters principally calcium and magnesium.

Table:3 Summary of Statistical data of Physico-Chemical Parameters of Ground Waters(mg/l)

Parameter	Range	Mean	Standard Deviation
pH	7.2-8.2	7.7	0.394
Conductivity(µS/cm)	700-1300	960	222.9
Sodium(mg/l)	46-136	81.7	26.203
Potassium(mg/l)	1-8	3	1.732
Calcium(mg/l)	8-60	40	16.124
Magnesium(mg/l)	1-26	15	8.328
Chloride(mg/l)	74-173	118	26.006
Fluoride(mg/l)	0.4-2.3	1.2	0.528
Sulphate(mg/l)	29-56	38	7.943
Bicarbonate(mg/l)	170-518	312	103.81
Carbonates(mg/l)	6-24	12.5	5.02
Nitrate(mg/l)	8-140	47	31.12
TDS(mg/l)	286-532	393	91.32
Total Hardness(mg/l)	95-240	163	52.63

(Except pH & EC all parameters are expressed in mg/l)

Table:4 Classification of water by salinity after Dawis and Dewiest

Name	Concentration of TDS(mg/l)	% of samples
Fresh	0-1000	All 15 samples
Brackish	1001-10000	-
Salty	100001-100000	-
Brine	>100000	-

Table:5 Classification of water by Hardness after Sawyer et al.

Hardness(mg/L)	Water class	Sample numbers
0-75	Soft	Nil
75-150	Moderately Hard	Nil
150-300	Hard	Nil
Over 300	Very Hard	All 15 samples

Conclusion:

The results indicate that waters are hard and slightly alkaline in nature. Except for few samples concentration of fluorides and nitrates are within the permissible limits prescribed for drinking water standards (BIS: 2012). It is attributed to anthropogenic activities like poor sewerage systems around the study area. Therefore, it is advisable that constant monitoring and proper treatment of groundwater is essential as prerequisite for use of these waters for drinking purpose.

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