ASSESSMENT OF INDUSTRIAL EFFLUENTS AND ITS IMPACT ON GROUND WATER QUALITY IN AND AROUND BALANAGAR, HYDERABAD,A.P, INDIA

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ABSTRACT:

Due to rapid industrialization and overexploitation of the groundwater resources, there is a drastic change taking place in the Hyderabad urban environment. The present study area is Jeedimetla of Hyderabad, AP, India. The possible quality of the heavy metals major and trace elements in the hydrological system have been identified and quantified in the present study.

Depending on the environmental parameters, the trace metals and associated elements may form complexes and precipitate or become concentrated at several places. In the present study is an attempt made to evaluate the changes in the water quality of the Jeedimetla area.All trace elements, which include As, Se, B, V, Fe, Co, Pb, Cu, Zn, Cd, Mn, Ni, Mo, Ba, and Na, Mg, Si, Ca, Al, were analyzed using the highly sensitive inductively coupled plasma-mass spectrometer (ICP-MS). For most of the elements, the detection limits are around 1ppb.

Analytical data were processed with various computer programs for statistical evaluation. The impacts of natural and anthropogenic sources on the elemental concentration and the total area affected by each element have been deciphered using these graphs. The range and average concentrations of some of the trace elements of environmental concern in the Ground water.

The average concentrations are listed, and the world health organization (WHO) and minimum.National Standards (MINAS), Central pollution control board (CPCB) for water quality are also listed for comparison. Most of the trace elements show high concentrations (several orders of magnitude) in the groundwater of Jeedimetla in comparison to global average standards. Especially salts like Na, Ca, Mg, Se, are at peak levels and add turbidity to water and make it worst.

Key Words: environmental pollution, anthropogenic, irrigation practices, hydrogeochemistry

1.INTRODUCTION

Water is very vital for nature and can be limiting resource to men and other living beings. Without a well functioning water supply, it is difficult to imagine productive human activity be it agriculture or livestock. Water quality is influenced by natural and artificial effects including local industrial waste pollutants, geology and irrigation practices the hydrogeochemistry of water is important to quality in water supply planning for living areas. The geochemical character of any groundwater determines its quality and utilization. The quality is function of the physical, chemical and biological parameters and it should be subjective, since which depends on a particular intended use.

The various on hydrogeochemistry of water quality have been carried out by various members. Laluraj et al.(2005) have been studied ground water chemistry of shallow aquifers in the costal zones of Cochin and concluded the ground water present in the shallow aquifers of some of the stations were poor in quality and beyond the potable limit as per the standard by World Health Organization (2004). Rapid increase of urbanization and industrialization leads to deterioration in hydrogeochemistry of ground water quality. Srinivas et al. (2000) and Jha and Verma (2000) have reported the degradation of the water quality in Hyderabad and Bihar, Respectively, Patnaik et al (2002) have studied water pollution generated from major industries similarly, waste pollutants or effluents. Discharged into streams may enter the aquifer body downstream. This also affects the ground water geochemistry. The studies on trace metals have been carried out (Jangir et al. 1990; Sharma et al.)Sharma et al (2004) Singh and Chandel (2003, 2006) pollution problems in ground water and industrial waste water have been studied. The specific objectives of the present study area 1) the investigations and interpretation of hydrogeochemistry of Jeedimetla and adjoining areas. 2) Find out the suitability of groundwater for irrigation and drinking purpose and 3) establish significant correlation among ton parameters of ground water samples.

Method

Balanagar area is located at Hyderabad city, in the NE of Andhra Pradesh state, is undergoing rapid urbanization and industrialization.

Groundwater samples collected from different hand pump, tube wells and ponds at 5 sampling points were analyzed. Samples were collected in good quality polythene bottles of 1-1 capacity. Sampling was carried out with out adding any preservatives in rinsed bottles for avoiding any contamination and brought to the laboratory. Only high pure (anal R Grade) chemicals double distilled water was used for preparing solutions for chemical analysis. Physical parameters like Ph, total dissolved solids, and electrical conductivity were determined at site with the help of digital portable analyzer kit. The samples collected and as per procedure (APHA 1995).

The total hardness (TH) in mg/l was determined by following equation (Todd 1980)

$$TH = 2.497\ Ca^{2+} + 4.115\ Mg^{2+}$$

Sample 1	Sample 2	Sample 3	Sample 4	Sample 5
48.68	42.75	67.88	87.91	95.73

All the results compared with standard limits recommended by world health organization (WHO 2004).

2. AIMS AND OBJECTIVES:

- The present study area was undertaken with an objective to assess the quality of ground water collected from Balanagar,Hyderabad,AP.
- To assess the quality of drinking water in the Balanagar .
- To determine various physic-chemical parameters in the water samples.
- To assess heavy metal concentrations in ground water and to locate the possible source of contamination.
- To study the impact of heavy metal pollutants on ground water and to know the health effects on the people living and using the water for different purpose.

3. MATERIALS AND METHODS:

METHODOLOGY

Sample collection

The total number of 5 sites were sampled during post-monsoon season (Feb 2013). Most of the water samples were collected from bore wells and acidified immediately to bring the pH of the solution to < 2.0. Clean polythene bottles of litre capacity soaked with 1:1 HNO_3 and washed using detergent was used for groundwater sampling. These bottles were allowed to stand for several hours in double distilled water before taking to the field. The sample bottles were rinsed two to three times using the representative groundwater samples. Water samples were collected 30 cm below the water level in open wells using water sampler. Bore well water samples were collected directly from the pump sets. Since industrial pollutants contaminate the upper layer of soil, the samples were collected from wells that are being constantly used.

3. Sample preparation

All the samples were filtered in Whattman 42 filter paper and were diluted to 20 times for further analysis by ICP-MS. Care was taken to avoid contaminants to enter into the sample solution.

4. Sample analysis

Physical parameters of groundwater such as, pH and EC were determined in the field using digital meters immediately after sampling. Collected groundwater samples were transported to the laboratory on the same day. They were filtered using 0.45 microns Millipore filter paper and acidified wit[Abstract]h nitric acid (Ultrapore, Merck) for cations. For All trace elements (Li, Be, B, Si, V, Cr, Mn, Fe, Co, Cu, Zn, As, Se, Rb, Sr, Mo, Ag, Cd, Sb, Ba and Pb) were determined quantitatively by ICP-MS following Balaram (2003).

5. Instrumentation

A Perkin Elmer SCIEX, Model ELAN DRC II ICP-Mass Spectrometer (Concord, Ontario, Can-ada) was used throughout. The sample introduction system consisted of a standard Meinhard equalizer with a cyclonic spray chamber. All quantitative measurements were performed using instrument software. The software uses knowledge-driven routines in combination with nu-merical calculations to perform an automated interpretation of the whole spectrum. Several well-known isobaric interferences are programmed, and the corrections are automatically ap-plied. Instrumental and data acquisition parameters are listed elsewhere (Balaram and Rao, 2003).

6. Calibration Strategies

In order to overcome matrix effects that are generally observed during the analysis of water samples, several methods can be used. Dilutions of the sample to bring down the total dissolved solids content to < 200 mg/L, use of internal standard for calibration etc., are effective for this purpose. By using alternative isotopes interferences can often be avoided, except for the mono-isotopic elements. NIST 1640 (certified reference material trace elements in natural water ob-tained from National Institute for Science and Technology, USA) was used to calibrate the sys-tem. The isotopes of measured elements in this work are free from potential polyatomic, iso-baric, and doubly charged ion interferences.

7. Sampling Area

The ground water samples from pumps were collected from the Balanagar, Hyderabad, Ap.

A total of 5 water samples were collected in presterilized bottles (schott duran et al. Germany)

And were stored at 2 to 4 degrees. The physicochemical properties such as hydrogen ion

Concentration (pH), total dissolved solids (TDS) in water sample were analysed on pH Bench top

Meter (Thermo electron corp. orion 5 star), using standard procedures. ICP-MS (perkin-Elmer

Sciex Elan drc II). ICP-MS is a type of producing ions (ionizations) with a mass spectrometer as a

Method of separating and detecting ions.ICP-MS is highly sensitive and capable of determination

Of a range of metals and several non-metals at concentrations

SAMPLING AREAS-TABLE 1.

S.NO	SAMPLE CODE	LOCATION AREA
1	SAMPLE 1	CITD, BALANAGAR
2	SAMPLE 2	NRSC, BALANAGAR
3	SAMPLE 3	IDS SCHOOL OF AUDITORIUM, BALANAGAR
4	SAMPLE 4	HAL AUDITORIUM, BALANAGAR
5	SAMPLE 5	BALAJI STEEL, BALANAGAR

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1. Tables and graphs

Table 1: Analytical data of major, minor and trace elements in groundwater samples collected from Balanagar, Ranga Reddy District, Andhra Pradesh.

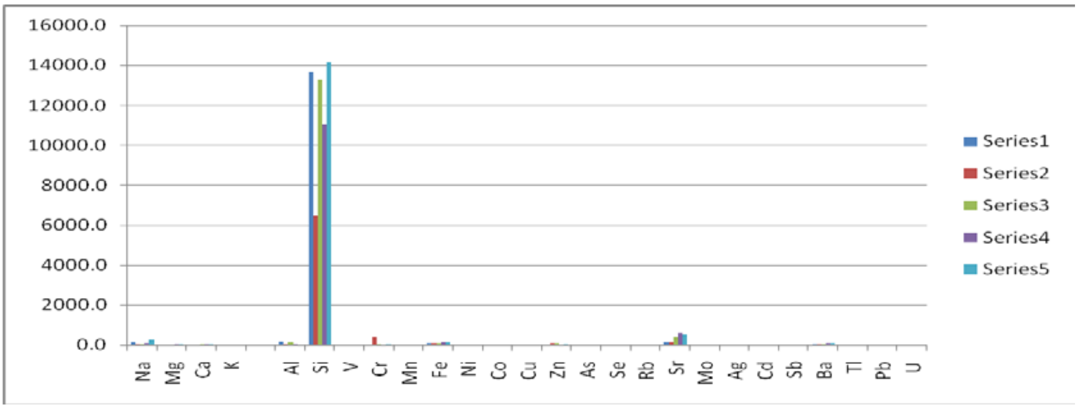
ELEMENTS	unit	VA1	VB2	VC3	VD4	VE5
Na	ppm	111.3	52.69	41.85	83.82	257.6
Mg	ppm	6.241	5.766	15.66	25.51	24.06
Ca	ppm	10.35	11.11	24.88	33.09	35.71
K	ppm	1.625	1.341	1.400	1.286	1.591
Al	ppb	159.1	24.30	109.8	39.69	12.76
Si	ppb	13684	6454	13275	11044	14113
V	ppb	12.70	8.090	6.630	5.015	9.730
Cr	ppb	11.58	396.1	44.15	15.83	43.78
Mn	ppb	4.860	3.160	4.100	18.48	8.795
Fe	ppb	69.16	74.20	102.9	119.6	112.9
Ni	ppb	1.310	1.220	2.800	3.345	3.255
Co	ppb	0.175	0.095	0.265	0.425	0.775
Cu	ppb	6.770	19.51	12.75	7.745	19.92
Zn	ppb	11.63	65.77	104.5	17.76	25.28
As	ppb	1.420	1.255	0.710	1.150	2.695
Se	ppb	8.005	6.980	6.490	8.895	9.900
Rb	ppb	2.005	1.290	0.815	0.605	1.630
Sr	ppb	124.1	118.0	371.5	606.8	525.0
Mo	ppb	6.325	3.180	1.435	1.930	8.615
Ag	ppb	0.055	0.020	0.020	0.030	0.020
Cd	ppb	0.020	0.075	0.140	0.020	0.050
Sb	ppb	0.035	0.040	0.025	0.020	0.035
Ba	ppb	30.27	21.45	43.18	64.42	88.26
Tl	ppb	0.025	0.015	0.015	0.015	0.015
Pb	ppb	0.045	2.330	2.750	0.130	0.100
U	ppb	5.420	1.650	3.320	2.420	6.490

Table 2: Summary of the analytical data of major, minor and trace elements in groundwater samples collected from Balanagar, Ranga Reddy District, Andhra Pradesh

ELEMENTS	unit	min	max	mean	std	WHO	BIS
Na	ppm	41.85	257.6	109.4	87.17	<200	
Mg	ppm	5.766	25.51	15.45	9.407	<30	30
Ca	ppm	10.35	35.71	23.03	11.92	75	75

K	ppm	1.286	1.625	1.449	0.152		
Al	ppb	12.76	159.1	69.12	62.84	200	30
Si	ppb	6454	14113	11714	3170		
V	ppb	5.015	12.70	8.433	2.956		
Cr	ppb	11.58	396.1	102.3	164.9	50	50
Mn	ppb	3.160	18.48	7.879	6.302	500	100
Fe	ppb	69.16	119.6	95.74	22.82		300
Ni	ppb	1.220	3.345	2.386	1.044	20	
Co	ppb	0.095	0.775	0.347	0.269		
Cu	ppb	6.770	19.92	13.34	6.247	2000	50
Zn	ppb	11.63	104.5	44.98	39.41	3000	5000
As	ppb	0.710	2.695	1.446	0.746	10	50
Se	ppb	6.490	9.900	8.054	1.389		
Rb	ppb	0.605	2.005	1.269	0.574		
Sr	ppb	118.0	606.8	349.1	224.6		
Mo	ppb	1.435	8.615	4.297	3.074	70	
Ag	ppb	0.020	0.055	0.029	0.015		
Cd	ppb	0.020	0.140	0.061	0.050	3	10
Sb	ppb	0.020	0.040	0.031	0.008	50	
Ba	ppb	21.45	88.26	49.51	27.02	700	
Tl	ppb	0.015	0.025	0.017	0.004		
Pb	ppb	0.045	2.750	1.071	1.350	10	50
U	ppb	1.650	6.490	3.860	2.037	2	

GRAPH:



5. RESULTS AND DISCUSSION

Al:

ALLUMINIUM.In study area varys from 12.76 to 159.9with an average of 69.12.The permissible limit of Al WHO 200 OR BIS 30. All the samples are exceeding the permissible limit except 2&5.

Si:

SILICON.In study area varys from 6454 to 14113 with an average Of 11714.The

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permissible limit of

Si WHO 0.05 .All the samples are exceeding the permissible limit. High Si in water Silicosis disease.

V:

VENEDIUM.In study area varys from 5.01 to 12.7with an average of8.43.The permissible limit

of V WHO 10. All the samples are below the permissible limit except sample1.

Cr:

CHROMIUM.In study area varys from 11.58 to 396.1 with an average of102.3.The permissible limit

of Cr WHO 50 OR BIS 50. All the samples are below the permissible limit except sample2.

Mn:

MANGANESE.In study area varys from 3.16 to 18.48with an average of 7.87.The permissible

limit of Mn WHO 500 OR BIS 100. All the samples are below the permissible limit.

Fe:

FERROUS.In study area varys from 69.16 to119.6 with an average of 95.74.The permissible limit of

Fe WHO 1-3 OR BIS 300. All the samples are below the permissible limit. High Fe in water cause siderosis.

Ni:

NIKEL.In study area varys from1.22 to 3.34 with an average of 2.38.The permissible limit of Ni

WHO 20. All the samples are below the permissible limit.

Co:

COBALT:In study area varys from0.09to 0.77 with an average of 0.34.The permissible limit of

Co WHO 0.2. All the samples are below the permissible limit except sample 4. . High Co in water

cause lazyness, headache, death.

Cu:

CUPPER:In study area varys from 6.77. to 19.92. with an average of 13.34.The permissible limit of

Cu WHO 1.5. All the samples are exceeding the permissible limit.

Zn:

ZINC:In study area varys from 11.63. to 104.5 with an average of 44.98.The permissible limit of Zn

WHO 500 OR BIS. All the samples are below the permissible limit.

As:

ARSENIC:In study area varys from0.71 to 2.69 with an average of 1.44.The permissible limit of

As WHO 10 OR BIS 50. All the samples are below the permissible limit. High As in water causes

cancer.

Se:

SELENIUM:In study area varys from 6.49. to 9.90 with an average of 8.05.The permissible limit

of Se WHO OR BIS.

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Rb:

RUBIDIUM:In study area varys from0.60 to 2.005 with an average of 1.26.The permissible limit of

Rb WHO OR BIS.

Sr:

STRANICIUM:In study area varys from 118.0to 606.8 with an average of 349.1The permissible

limit of Sr WHO OR BIS.

Mo:

MOLYBDENUM:In study area varys from 1.43to 8.61 with an average of 4.29.The permissible

limit of Mo WHO OR BIS.

Ag:

SILVER:In study area varys from 0.02 to 0.055 with an average of 0.02.The permissible limit of

Ag WHO OR BIS 0.2. All the samples are below the permissible limit except sample 1&4 .

Cd:

CADMIUM:In study area varys from 0.02to 0.01 with an average of 0.06.The permissible limit of

Cd WHO 3 OR BIS 10. All the samples are below the permissible limit. High Cd in water Itai Itai

,anaemia diseases.

Sb:

ANTIMONY:In study area varys from 0.02 to 0.04 with an average of 0.03The permissible limit

of Sb WHO 50 OR BIS -.All the samples are below the permissible limit.

Ba:

BARIUM:In study area varys from 21.45 to 88.26 with an average of 49.51.The permissible limit of

Ba WHO 700 OR BIS-. All the samples are below the permissible limit.

Pb:

LEAD:In study area varys from0.45to 2.75 with an average of 1.07.The permissible limit of Pb

WHO 10 OR BIS 50. All the samples are below the permissible limit.

Tl:

TALIUM:In study area varys from 0.01to 0.02 with an average of 0.01.The permissible limit of

Tl WHO OR BIS.

U:

URENIUM:In study area varys from 1.65 to 6.49 with an average of 3.86.The permissible limit of

U WHO 2 OR BIS 5. All the samples are below the permissible limit except sample1&5

5. CONCLUSIONS

The groundwater in the area is generally alkaline in nature and the pH varies from 7.2 to 8.61. Based on the concentration of TDS, 11 samles are with in the “permissible limits” both for drinking and irrigation while the remaining 3 samples useful only for “irrigation”. Based on Wilcox’s (1948, 1955) classification 4 samples fall in the fields of excellent to good, 9 samples that in good to permissible and one sample falls out side of the figure indicates that it is not useful for irrigation. Classification based on SAR alone for irrigation suitability indicates that all samples are suitable for irrigation purpose.

According to USSL classification, most of the samples belong to C2S1 and C3S1 category suggesting that the Rangapur water is suitable for agriculture. The Gibbs diagram indicates that majority of the groundwater fall in the rock dominant field.

The quality of groundwater is controlled by lithology apart from other factors like land use pattern. Based on the above observations it is noticed that the groundwater in the present study area except few samples are suitable for both drinking and agriculture. But it is observed that the people are suffering with endemic diseases and agricultural crop production is declined drastically. Detailed study of trace elements is expected to unravel the suitability of the water of various purposes.

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