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Pre- and Post-Monsoon Variations in Physico Chemical analysis of Ground Waters of Hapur District

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ABSTRACT: The area of East Godavari district in Andhra Pradesh, India is selected to discuss the impact of seasonal variation of groundwater quality on human health, where agriculture is the main livelihood of rural people. Groundwater is one of the main sources for irrigation and drinking. Groundwater samples collected seasonally, pre- and post-monsoons, during the years 2013-2014 and 2014-2015. Forty samples were collected from five areas from different Ground Water sources. The selected five areas are Area 1, Area 2, Area 3, Area 4 and Area 5 in HapurDistrict for the investigation because these areas are growing vastly with increasing in population as well as many numbers of Industries.
Keywords: - Groundwater quality, Seasonal Variations, Pre-and Post- monsoons, Agricultural area,

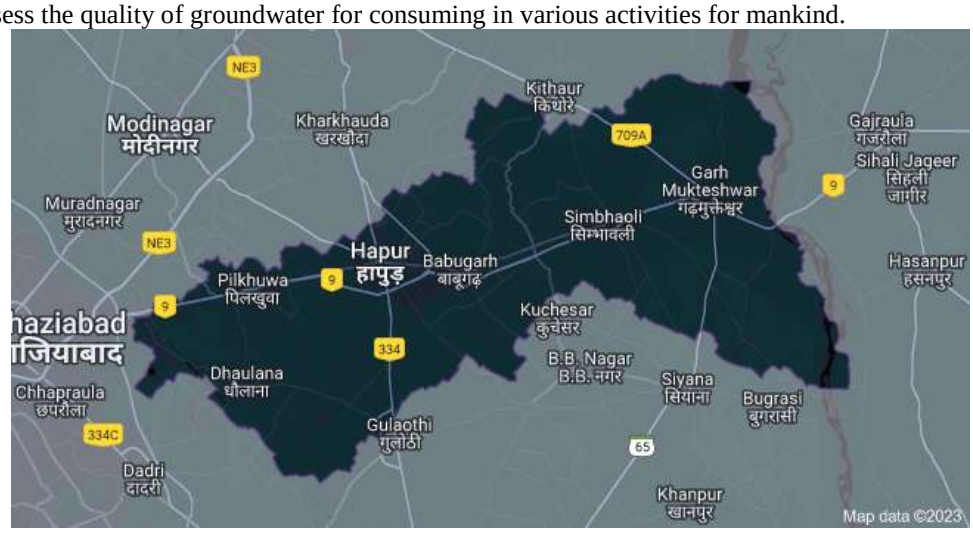
I. INTRODUCTION

Groundwater quality is as important as the quantity. Groundwater is a renewable natural resource, which is replenished annually by precipitation. Groundwater and surface water are both used very well by human beings and animals and are required as one of the major constituents for industries. Groundwater quality plays an important role in groundwater protection and quality conservation. Poor quality of Water adversely affects the lives of humankind and animals. Water intended for human consumption should be "Safe and Wholesome," i.e., free from pathogenic and harmful chemicals, pleasant to taste and usable for domestic purpose1. Water plays an essential role in human life. Although statistics, the WHO reports that approximately 36% of urban and 65% of rural Indians were without access to safe drinking water2. Human alteration of the landscape has an extensive influence on watershed hydrology Gurunathan, 2006.3

II. MATERIAL AND METHODS

Analysis of all the parameters is carried out by APHA recommended procedures with high sensitivity instruments and analytical grade reagents.

Study area: Hapur district is located at 28.72°N77.78°E covering an area of 660 sq. miles. It has anaverage elevation of 213 meters (699 feet). Hapurdistrict comprises four blocks Hapur, Garhmukteshwar, Dhaulanaand Simbhawali. Many small growing Industries are establishedin different blocks of district like sugar mills, bottling plant, crashers, Paperand pulp factoriesetc. The treated and untreated contaminated effluentfrom these Industries is being discharged into theground which is absorbed bythe soil and thusreaches the ground water table and contaminate it. Once it is contaminated, it is difficult to restore the original quality of water so it is our duty to assess the quality of groundwater for consuming in various activities for mankind.



Method of Investigation

About 40 Water samples were collected in pre and post-monsoon seasons from selected areas of Hapur district. The water samples were collected in plastic bottles as possible to avoid unpredictable changes in Physicochemical characteristics from all available groundwater sources, i.e., dug wells and tube wells in the surrounding area of the selected cities. The testing of samples was done according to the procedure prescribed by APHA.

The present study comprises of interpretation and analysis of water samples compare with the APHA recommended measurements. Samples were collected from forty different places in the main five areas of the Hapurdistrict. Our study first identified and marked the five main cities that have been developing by established various industries in and around them.

The water samples were collected and analysed for different chemical, physical parameters and results were carefully studied and analysed. Groundwater samples were taken in polythene bottles having quantity 2 lit. and they were sterilised before collecting the samples. Various water quality parameters such as PH, Total Dissolved Solids, Dissolved Oxygen, Total Alkalinity, Total Hardness, Chloride, Electrical Conductivity, Potassium, Sodium, BOD, COD, Nitrate, Sulphate, Ca-hardness, Mg-hardness, Calcium, Magnesium, Fluoride were determined. Preservation, analysis, and interpretation are carried out in accordance with BIS (1998) procedures.

Hydrogen Ion Concentration (pH):

WHO has recommended the maximum permissible limit of PH from 6.5 to 9.2(De, 2002). As per the BIS standards, all the samples of both the seasons fall within the recommended limit (6.5 to 9.2) for human consumption. The hydrogen ion concentration in the pre-monsoon water samples varies from 7.73 to 8.54 and in the post-monsoon it varies from 6.8 to 8.25. The measured PH values of water samples in bothseasonswere within the permissible range.

Calcium

Calcium occurs in water naturally. Calcium cannot be found alone in nature. The calcium was found in the range of 32 mg/lit to 136 mg/lit in pre-monsoon and 36 mg/lit to 247 mg/lit in post-monsoon. According to BIS permissible range, in post-monsoon, the maximum value beyond the limit.

Magnesium

Magnesium is washed from rocks and subsequently ends up in the water. Magnesium has many purposes and consequently may end up in the water in many different ways. Chemical industries add Magnesium to plastics and other materials as a fire protection measure or as filler. Magnesium content of the groundwater samples ranges from 60mg/lit to 700 mg/lit in pre-monsoon and 24mg/lit to 91.5 mg/lit in post-monsoon. In the present study, the magnesium content in the water samples is high in pre-monsoon when compare to the post-monsoon. Particularly in area 5, water samples have a high content of magnesium.

Sulphate

BIS has prescribed a desirable limit of sulphate is 200 mg/lit and the permissible limit in the absence of an alternate source is 600 mg/lit. The sulphate content in all the groundwater samples is under the limit prescribed by BIS in both the season in pre and post-monsoon. BIS has prescribed limit of sulphate is 200 mg/lit and the permissible limit in the absence of an alternate source is 600 mg/lit. In the present study, the observed values are within the permissible range in both seasons.

Chloride

Chlorides occur in all-natural waters in widely varying concentrations. High chloride concentrations give a salty taste to water and beverages (WHO (World Health Organisation) 2004). The Chloride content normally increases as the mineral content increases (Sawyer and McCarty 1978). In the present study, the Chloride content of the groundwater samples ranges from 100 to 280 mg/lit in pre-monsoon and 64 to 245 mg/lit in post-monsoon. Chloride quantity in all five cities is in the permissible limit prescribed by the BIS.

Total Dissolved Salts

Total dissolved salts content of the groundwater samples ranges from 247mg/lit to 4864mg/lit in pre-monsoon and 208mg/lit to 617.6mg/lit in post- monsoon. The TDS more than 3000mg/lit concentration not only unfit for irrigation but also deteriorate the quality of soil, which intern effect the yield of agriculture production (Davis and De Wiest 1966). High value of water reduces the solubility of gases (like oxygen) and utility water for drinking. In this study observed that in some places, TDS values crossed the permissible limit. In the present

study, high content of TDS observed in area 4 water samples in pre- monsoon and in post-monsoon, the content of TDS within the permissible range.

Total Hardness

Hardness is a very important parameter in decreasing the toxic effect of poisonous elements. The hardness was found to be in the range of 200 mg/lit to 1600 mg/lit in pre-monsoon and 204 mg/lit to 354mg/lit in post-monsoon. BIS has prescribed a desirable limit of total hardness is 300 mg/lit and the permissible limit in the absence of an alternate source is 600 mg/lit (De, 2002). In the present study, area 5 water samples have high values due to maybe Ca and Mg salts.

Alkalinity

Alkalinity was found in the range of 120 mg/lit to 660 mg/lit in pre-monsoon and 198 mg/lit to358 mg/lit in post-monsoon. Alkaline water may decrease the solubility of metals. The alkalinity varies in accordance with the fluctuation in the pollution load (Parashar et al., 2006). According to the BIS, the limits minimum value for total alkalinity is 200mg/lit and the maximum value is 600 mg/lit. In the present study, the values obtained in both seasons are within the range.

Sodium

Sodium is a principal chemical in bodily fluids, and it is not considered harmful at normal levels of intake from combined food and drinking water sources. However, increased intake of sodium in drinking water may be problematic for people with hypertension, heart disease or kidney problems that require them to follow a low sodium diet. Sodium is used in the normal functioning of some processes in the human body and such as an essential element, but high concentration may adversely affect the cardiac, renal and circulatory functions (Srivastava, 2007).

Sodium content is found in the pre- monsoon from 24mg/lit to155mg/lit and in post-monsoon, the range from 21mg/lit to 40m g/lit. According to BIS, the permissible value range of sodium is 60mg/lit to 120mg/lit. In this study, pre- monsoon values are within the permissible limit, but in post-monsoon, these values range below the BIS range.

Potassium

Natural waters normally contain a low concentration of potassium. A high volume of potassium should be looked upon with some suspicious as these may indicate pollution. Neither BIS nor any other organisation lays down any limits for potassium content in drinking water (Srivastava, 2007). The potassium content in groundwater has been found in the range of 20 mg/lit to 35 mg/lit in pre- monsoon and 14 mg/lit to 75 mg/lit in post-monsoon.

Nitrate

Nitrate indicates the pollution in groundwater due to sewage percolation beneath the surface. The nitrate concentration is found to be in the range of 13 mg/lit to 52 mg/lit in pre-monsoon and22 mg/lit to 40 in post-monsoon. It is within the permissible limit. BIS prescribed the desirable limit of nitrate is 45 mg/lit. The presence of nitrate in water indicates the final stage of mineralisation (Nema et al., 1984). Nitrate is particularly dangerous to infants less than six months old, causing child disease (methemoglobinemia) (A.K.De, 7th Edition)

Electrical Conductivity

Electrical Conductivity is the measure of mineral content, which was found varying from 388 m mhos/cm to 7600 m mho/cm in pre-monsoon and 326 m mho/cm to 1200 m mho/cm in post-monsoon.

Chemical Oxygen Demand

COD parameter determining the organic load of a water body. It measures the amount of oxygen required for the oxidation of organic compounds that are present in water by means of chemical reactions. COD values in pre-monsoon from 67ppm to 150ppm and post-monsoon from 67ppm to141ppm.

Biological Oxygen Demand

BOD parameter reveals that the amount of biochemically degradable organic matter is present in the sample. More the oxidizable organic matter presents in water, the greater the amount of oxygen required to degrade it biologically, hence more the BOD. In the present study, these values are in pre-monsoon from 8.03 ppm to 12.86ppm and in post-monsoon from 8.47ppm to 16.45ppm.

Dissolved Oxygen

In natural and wastewaters, DO levels depend on the physical, chemical and biological activities of the water body. Its value also depends on temperature. Good quality water should have the solubility of Oxygen 7.0mg/L at 300C. DO value for all samples in pre-monsoon is from 3.72ppm to 5.7ppm and in post- monsoon from 3.47ppm to 5.95ppm. BIS recommended value range is from 4ppm to 6ppm. In both seasons, the values are within the permissible range.

Phosphate

Phosphates occur in natural and wastewater as inorganic and organically bound phosphate. In the present study the values obtained were in the range of 0.01mg/lit to 0.064mg/lit in pre-monsoon and 0.01mg/lit to 0.25mg/lit in post- monsoon. According to USPH, the maximum permissible limit is 0.1 mg/lit. In the present study, particularly, in post- monsoon, the presence of phosphate content in samples is more than the permissible limit.

Data analysis

The water quality analysis of different groundwater has been carried out for PH, Total Dissolved Solids, Dissolved Oxygen, Total Alkalinity, Total Hardness, Chloride, Electrical Conductivity, Potassium, Sodium, BOD, COD, Nitrate, Sulphate, Ca-hardness, Mg-hardness, Calcium, Magnesium, Fluoride and selected metals analysis. These values were showed in the table.1 about pre- monsoon and table.2 about post-monsoon.

Table.1 Physico-Chemical parameters of Ground Waters of HapurDistrict in Pre-monsoon Season

S.No.	Area	pH	EC(mmhos/cm)	TDS (mg/L)	TH (mg/L)	TlAlkalinityPh	Total (MO)	DO	BOD	COD
Area 1										
1	Sample-1	8.18	2230	1427.2	300	42	250	4.56	10.23	98.6
2	Sample-2	8.02	636	407.04	240	48	260	4.36	11.36	101.2
3	Sample-3	7.88	974	623.36	280	51	210	5.01	10.69	123.3
4	Sample-4	7.73	876	560.64	280	42	350	5.22	14.39	99
5	Sample-5	8.06	1613	1032.32	240	38	211	5.68	16.45	120.3
6	Sample-6	7.8	2500	1600	340	54	240	4.61	14.32	121
7	Sample-7	8.26	817	522.88	240	45	210	3.98	16.25	136
8	Sample-8	7.97	854	546.56	240	50	214	4.01	14.56	102
Area 2										
9	Sample-1	8.2	1252	801.28	300	32	251	5.12	10.06	102
10	Sample-2	7.74	1890	1209.6	900	51	261	4.30	11.09	120
11	Sample-3	8.16	773	494.7	360	26	241	4.13	10.40	131
12	Sample-4	8.12	911	583	260	24	203	5.98	9.80	102
13	Sample-5	8.24	445	284.8	220	45	254	5.21	12.60	132
14	Sample-6	7.91	1125	720	340	39	204	4.22	21.30	126
15	Sample-7	8.37	2540	1625.6	240	54	198	4.98	11.63	141
16	Sample-8	8.06	910	582.4	280	35	213	5.86	10.58	120
Area 3										
17	Sample-1	7.91	1380	832	300	23	358	4.56	11.16	114
18	Sample-2	8.19	2720	1740.8	420	34	314	5.34	12.36	102
19	Sample-3	8.3	1450	928	380	54	251	3.99	10.25	110
20	Sample-4	8.25	3760	2406.4	420	27	321	5.36	9.87	98
21	Sample-5	7.97	3400	2176	520	45	301	4.56	8.96	69
22	Sample-6	8.06	2440	1561.6	400	39	214	4.68	8.47	113
23	Sample-7	8.37	2570	1644.8	360	51	255	4.75	12.32	125
24	Sample-8	8.11	1960	1254.4	400	45	261	4.06	11.25	114
Area 4										
25	Sample-1	8.25	1050	672	360	35	333	4.22	10.23	67
26	Sample-2	8.12	1510	966.4	280	26	341	3.95	11.4	98
27	Sample-3	8.17	1340	857.6	360	57	235	5.01	11.6	130
28	Sample-4	7.88	2450	1568	400	94	241	5.22	12.58	141
29	Sample-5	7.9	1343	859.5	360	26	246	5.04	14.65	85
30	Sample-6	7.91	973	623	340	51	298	3.98	12.36	98.8
31	Sample-7	8.09	388	247	200	45	257	3.95	14	76
32	Sample-8	8.03	584	373	300	35	203	4.56	12.03	95.6
Area 5										
33	Sample-1	8.31	2490	1593.6	240	36	216	5.4	14.36	87.3
34	Sample-2	8.12	1580	1011.2	340	25	255	5.13	11.34	86.9
35	Sample-3	8.08	1110	710.4	300	29	231	5.02	10.25	110
36	Sample-4	8.54	2150	1376	400	34	211	5.03	16.25	120
37	Sample-5	8.03	5160	3302.4	1040	39	243	5.06	9.8	114
38	Sample-6	8.05	981	627.8	320	34	251	4.89	9.47	121

39	Sample-7	7.76	6940	4441.6	1600	25	261	4.78	10.26	98.7
40	Sample-8	8.22	7600	4864	860	39	241	5.02	11.23	96.1

Table:-2 Physico Chemical parameters of Ground Waters of hapur District in Post-monsoon

S.No.	Area	pH	EC(mmhos/cm)	TDS (mg/L)	TH (mg/L)	TlAlkalinityPh	Total (MO)	DO	BOD	COD
Area 1										
1	Sample-1	8.18	2230	1427.2	300	42	250	4.56	10.23	98.6
2	Sample-2	8.02	636	407.04	240	48	260	4.36	11.36	101.2
3	Sample-3	7.88	974	623.36	280	51	210	5.01	10.69	123.3
4	Sample-4	7.73	876	560.64	280	42	350	5.22	14.39	99
5	Sample-5	8.06	1613	1032.32	240	38	211	5.68	16.45	120.3
6	Sample-6	7.8	2500	1600	340	54	240	4.61	14.32	121
7	Sample-7	8.26	817	522.88	240	45	210	3.98	16.25	136
8	Sample-8	7.97	854	546.56	240	50	214	4.01	14.56	102
Area 2										
9	Sample-1	8.2	1252	801.28	300	32	251	5.12	10.06	102
10	Sample-2	7.74	1890	1209.6	900	51	261	4.30	11.09	120
11	Sample-3	8.16	773	494.7	360	26	241	4.13	10.40	131
12	Sample-4	8.12	911	583	260	24	203	5.98	9.80	102
13	Sample-5	8.24	445	284.8	220	45	254	5.21	12.60	132
14	Sample-6	7.91	1125	720	340	39	204	4.22	21.30	126
15	Sample-7	8.37	2540	1625.6	240	54	198	4.98	11.63	141
16	Sample-8	8.06	910	582.4	280	35	213	5.86	10.58	120
Area 3										
17	Sample-1	7.91	1380	832	300	23	358	4.56	11.16	114
18	Sample-2	8.19	2720	1740.8	420	34	314	5.34	12.36	102
19	Sample-3	8.3	1450	928	380	54	251	3.99	10.25	110
20	Sample-4	8.25	3760	2406.4	420	27	321	5.36	9.87	98
21	Sample-5	7.97	3400	2176	520	45	301	4.56	8.96	69
22	Sample-6	8.06	2440	1561.6	400	39	214	4.68	8.47	113
23	Sample-7	8.37	2570	1644.8	360	51	255	4.75	12.32	125
24	Sample-8	8.11	1960	1254.4	400	45	261	4.06	11.25	114
Area 4										
25	Sample-1	8.25	1050	672	360	35	333	4.22	10.23	67
26	Sample-2	8.12	1510	966.4	280	26	341	3.95	11.4	98
27	Sample-3	8.17	1340	857.6	360	57	235	5.01	11.6	130
28	Sample-4	7.88	2450	1568	400	94	241	5.22	12.58	141
29	Sample-5	7.9	1343	859.5	360	26	246	5.04	14.65	85
30	Sample-6	7.91	973	623	340	51	298	3.98	12.36	98.8
31	Sample-7	8.09	388	247	200	45	257	3.95	14	76
32	Sample-8	8.03	584	373	300	35	203	4.56	12.03	95.6
Area 5										
33	Sample-1	8.31	2490	1593.6	240	36	216	5.4	14.36	87.3
34	Sample-2	8.12	1580	1011.2	340	25	255	5.13	11.34	86.9
35	Sample-3	8.08	1110	710.4	300	29	231	5.02	10.25	110
36	Sample-4	8.54	2150	1376	400	34	211	5.03	16.25	120
37	Sample-5	8.03	5160	3302.4	1040	39	243	5.06	9.8	114
38	Sample-6	8.05	981	627.8	320	34	251	4.89	9.47	121
39	Sample-7	7.76	6940	4441.6	1600	25	261	4.78	10.26	98.7
40	Sample-8	8.22	7600	4864	860	39	241	5.02	11.23	96.1

III. CONCLUSION

In conclusion, the concentrations of the investigated major ions like chloride, sodium and potassium in the groundwater samples from the five cities were within the permissible limits except for the Sodium, which is below the permissiblelimits for drinking water recommended by BIS (1991) and WHO (1984). To assess the quality of water, each parameter was compared with the standard desirable limits prescribed by the World health organization (WHO). 4, 5, 6 The above cited results show that the overall water qualityof Hapur district is suitable for drinking purpose as well as domestic purpose. At present, the measured parameters of water samples were within the permissible range, but in future days they may be crossed the BIS range due to increase in population and their regular anthropogenic activities, using of unlimited pesticides and fertilisers to improve the yield of paddy, establishing of a wide variety of chemical industries and croplands converted into aqua-ponds.

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