



THE STUDY OF DRINKING WATER QUALITY AND FLUORIDE CONTENT IN EFFECTED AREA OF NALGONDA DISTRICT OF HYDERABAD

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ABSTRACT

Detailed studies have been made for testing the drinking water quality of the Nalgonda district area in Hyderabad. In this study, twenty spots were selected and samples of water were collected from open wells and public wells and tube-wells in the area. The various parameters such as pH, total dissolved solids, total hardness and magnesium hardness, calcium hardness, alkalinity, chlorides, fluorides, nitrates, sulphates, carbonates and bicarbonates etc. were determined. Fluorides contents are high in Nalgonda district causing fluorosis present in villages of Kamaguda, Yedavalli and Yellareddyguda. The hygienic conditions are very poor and were monitored and compared with different standard parameters. The analysis revealed that the water is not suitable for domestic and drinking purpose. Water of almost all the sampling area were highly contaminated with total dissolved solids (TDS) and nitrate. Total dissolved solids may cause gastro intestinal irritations and high concentration of nitrate in drinking water gives an immediate health concern for infants and pregnant women because nitrate in drinking water has been linked to methemoglobinemia or blue baby syndrome, in which the oxygen carrying capacity of an infant blood is greatly reduced, sometimes leading to death. Fluoride also causes fluorosis, irregular patches of black pigmentation on teeth, exostoses of skull. The findings have been discussed here.

Key words: Fluoride, Nalgonda, Hyderabad, Hardness, TDS.

INTRODUCTION

Ground water comes into contact with various minerals, which are soluble in water to varying degrees. The dissolved solutes determine the usefulness of water for various purpose. Ground and surface water attains their chemical characteristics by chemical

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reactions with solids i.e. soil sediment and sedimentary rocks¹. The ground water contains high degree of minerals which varies according to their quality of soil and rocks. Variations in ground water quality due to ecological factors and industrialization was studied by Gupta². Water is a very good solvent which dissolves all kinds of impurities (solids, liquids and gases)³⁻⁵. Suspended or colloidal organic impurities are obtained from decomposition of plants and animals, particles suspended in water such as clay, slit, sand, other solid particles that absorbs or reflects light turbidity⁶. Excess of these impurities causes pollution of water and make it unsafe for drinking purpose including heavy metals like iron, manganese, as well as fluorides nitrates and chlorides. Their excess in water causes many diseases in plants and animals. The present study has been carried out to find out the water pollutants and to check the suitability of water for drinking and irrigation purpose area of the nalgonda district and surrounding areas in Hyderabad.

EXPERIMENTAL

Material and methods

Water samples were collected in porcelain bottles as per standard procedures from 20 sources distributed in different villages and close to the Nalgonda district of Andhra Pradesh marked for the study of ground water suitability for drinking and other domestic purpose. Sample bottles were well washed with distilled water dried and were stored in refrigeration at 4°C until the analysis were completed.

Physical and chemical parameters like pH, dissolved oxygen, total dissolved solids and alkalinity were analysed by using potability at the sampling sites and rest of the parameters were determined by following for standard methods. Distilled water and AR grade chemicals were used, when ever required. Parameters and methods employed in the test samples are given in Tables 1, 2, 3 and 4.

Table 1

Parameters	Method	Standard values	Units
Colour	By sight	-	-
Odour	Smelling	-	-
Temperature	Thermometric	6.6-8.5	°C
pH	pH meter	100	mg/L
Nitrate	Ion meter	1.5	mg/L

Cont...

Parameters	Method	Standard values	Units
Fluoride	Iron selective electrode	600	mg/L
Total alkalinity	Titrimetric	7.0 to 9.0 mg/L at 20°C-30°C	mg/L
DO	Azide modification	600	mg/L
Total hardness	Titrimetric	600	mg/L
Carbonate hardness	Titrimetric	600	mg/L
Non-carbonate hardness	Titrimetric	200	mg/L
Calcium hardness	Titrimetric	100	mg/L
Magnesium hardness	Titrimetric	-	mg/L
Calcium	Titrimetric	-	mg/L
Magnesium	Titrimetric	2000	mg/L
Total dissolved solids	Conductivity bridge	1000	mg/L
Chloride	Argentometric	400	mg/L
Sulphate	Gravimetric	-	-

The significant increase in calcium magnesium concentration might be due to the fact of high evaporating rate or due to the increased rate of decomposition. Total hardness varied from 200 mg/L to 2110 mg/L. Hardness is caused due to the presence of calcium and magnesium carbonate and bicarbonates. Calcium hardness was observed in the range from 50 mg/L to 850 mg/L and value of magnesium ranged from 280 mg/L to 1950 mg/L, while the carbonate and non-carbonate hardness ranges from 160 mg/L to 680 mg/L and 40 mg/L to 2080 mg/L, respectively.

There is no adverse effect on the health due this hardness. Total dissolved solids varies from 1750 mg/L to 9000 mg/L, which shows that the value of solid in water is very high. It may be due to particles suspended in water such as slit, soil erosion and waste discharge. During the period of study, the value chloride ranged from 360 mg/L to 3750 mg/L, high chloride content in the samples may be due to high evaporation rate. The value of sulphate varied from 43 mg/L to 180 mg/L. nitrate in the sample varied from 30 mg/L to 600 mg/L. The permissible value of nitrate is 100 mg/L and above this concentration, water is harmful and causes a disease like methamoglobinemia in the infants. The concentration of nitrate ions increases with the increase in the depth of ground water because the upper level of nitrate is consumed by the plants.

Fluoride concentration varied in all the water samples from 0.5 mg/L to 12.2 mg/L. the permissible limit of fluoride is 1.5 mg/L.

Table 2

Parameters	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6	Site 7
	Colourless Odourless	Colourless Odourless	Colourless Odourless	Colourless Odourless	Colourless Odourless	Colourless Odourless	Colourless Odourless
Temperature	30.2	30.4	30.4	30.2	30.4	30.3	30.3
pH	8.7	8.3	8.0	7.3	7.2	8.2	8.5
DO	5.7	5.4	5.8	6	5.3	5.4	5.4
Total dissolved solids	4620	5880	5340	7300	7500	4800	4880
Total hardness	750	2110	1820	1030	1000	720	520
Ca hardness as CaCO₃	190	850	330	230	160	150	240
Mg hardness as MgCO₃	560	1260	1690	800	840	570	280
Total alkalinity as CaCO₃	680	260	160	200	250	680	830
Chloride (Cl⁻)	1250	1725	2360	1360	1300	1210	1360
Fluoride (F⁻)	5	12.2	0.7	0.8	0.7	1.3	1.7
Nitrate (NO₃⁻)	80	80	50	150	600	50	25
Sulphate (SO₄²⁻)	92	118	107	146	150	96	98
Carbonate as CaCO₃	590	260	160	200	250	680	790
Bicarbonate as CaCO₃	70	-	-	-	-	-	40
Carbonate hardness	650	260	160	200	250	680	520
Non carbonate hardness	70	1850	1660	830	750	40	520
Ca Hardness	76	340	132	92	64	60	96
Mg Hardness	134.4	302.4	405.6	192	201.6	136.8	67.2

Table 3

Parameters	Site 8		Site 9		Site 10		Site 11		Site 12		Site 13		Site 14	
	Colourless	Odourless	Colourless	Odourless	Colourless	Odourless	Colourless	Odourless	Colourless	Odourless	Colourless	Odourless	Colourless	Odourless
Temperature	30.3		30.2		30.2		30.2		30.3		30.4		30.4	
pH	8.8		8.4		7.6		7.8		8.4		8.1		8.4	
Total dissolved solids	2270		3920		6370		2170		2260		4480		1750	
Total hardness	580		650		1200		470		530		1230		200	
Carbonate as CaCO ₃	230		130		710		110		110		160		50	
MgCO ₃	350		520		490		360		420		1070		150	
Total alkalinity	1110		550		380		240		470		350		540	
Chloride (Cl ⁻)	1200		1340		3020		450		540		1770		360	
Fluoride (F ⁻)	3.5		2.2		4.5		1.6		1.2		0.5		2.7	
Nitrate (NO ₃)	115		140		60		300		115		55		90	
Sulphate (SO ₄ ²⁻)	85		78		127		43		45		90		35	
Carbonate as CaCO ₃	980		530		380		240		450		350		520	
Bicarbonate as CaCO ₃	130		20		-		-		20		-		20	
Carbonate hardness	580		550		350		240		470		350		200	
Non-carbonate hardness	580		100		820		230		60		880		200	
Calcium hardness	92		52		284		44		44		64		20	
Magnesium hardness	84		124.8		117.6		86.4		100.4		256.8		36	

Table 4

Parameters	Site 15		Site 16		Site 17		Site 18		Site 19		Site 20	
	Colourless	Odourless	Colourless	Odourless	Colourless	Odourless	Colourless	Odourless	Colourless	Odourless	Colourless	Odourless
Colour												
Odour												
pH	30.4	8.0	30.2	8.0	8.6	8.0	8.0	8.0	8.0	8.0	8.0	8.3
Total dissolved solids	6720	2050	7280	1730	6930	2040	7790	1580	9000	1480	9000	7920
Total hardness	290	340	410	1320	2490	1950	3750	170	3750	180	3750	3600
Ca hardness as CaCO₃	290	340	410	1320	2490	1950	3750	170	3750	180	3750	3600
Mg hardness as MgCO₃	290	340	410	1320	2490	1950	3750	170	3750	180	3750	3600
Total alkalinity	290	340	410	1320	2490	1950	3750	170	3750	180	3750	3600
Chloride (Cl⁻)	290	340	410	1320	2490	1950	3750	170	3750	180	3750	3600
Fluoride (F⁻)	2740	2740	2170	2170	1.4	1.4	1.5	1.5	2.4	2.4	2.4	1.8
Nitrate (NO₃⁻)	1.4	1.4	1.0	1.0	85	85	30	30	140	140	140	90
Sulphate (SO₄²⁻)	325	325	360	360	139	139	155	155	180	180	180	158
Carbonate as CaCO₃	134	134	146	146	30	30	-	-	-	-	-	-
Bicarbonate as CaCO₃	290	290	410	410	170	170	310	310	180	180	180	240
Carbonate hardness	290	290	410	410	200	200	310	310	180	180	180	240
Non-carbonate hardness	1760	1760	1320	1320	1840	1840	1270	1270	1300	1300	1300	2080
Calcium hardness	136	136	164	164	36	36	68	68	100	100	100	232
Magnesium hardness	410.4	410.4	316.8	316.8	468	468	338.4	338.4	290.2	290.2	290.2	417.6

The concentration of fluoride present in the water and in the mud sample obtained from these wells. 20 samples were collected and tested.

Place of sampling	Temperature at time of sampling	Fluoride content of water (ppm)	
		Well No. 1	Well No. 2
Kamaguda	90F-32.2°C	9.2	11.8
	115F-46.1°C	9.6	12.2
Yadavalli	108F- 42.2°C	5.5	6.8
	115F-46.1°C	8.8	6.9
Yellareddyguda	115F-46.1°C	5.2	6.8

Place of sampling	Fluoride content in mud sample
Kamaguda	0.15%
Yadavalli	0.11%
Yellareddyguda	0.09%

RESULTS AND DISCUSSION

The results of physical and chemical characteristics are depicted in given tables all the samples were colourless and odourless. The decrease and increase in the temperature of the sample analyzed might be due to the low water level, low velocity and atmospheric conditions etc. The pH values of the samples analyzed were recorded in the range from 7.3 to 7.9, which shows that the samples are alkaline in nature. The dissolved oxygen concentration of the samples varied from 5.3 to 6.5 mg/L. The value of alkalinity in water content varied from a minimum of 160 mg/L to maximum of 1110 mg/L. Calcium concentration in the samples ranging from 20 mg/L to 340 mg/L and magnesium concentration from 36 mg/L to 468 mg/L.

CONCLUSION

The conclusion drawn is that the concentration of nitrate, fluoride, chloride, total dissolved solids, total hardness are higher than the permissible limit¹². It has also been found that the water of Nalgonda district area is hard and it is contaminated with calcium and magnesium hardness¹³. Hence, water is not potable and may cause serious problems to health. Therefore, there is a need to improve the water quality, especially with respect to fluoride, nitrate and total dissolved solids due to which many people of this area are suffering from dental enamel, methemoglobinemia, fluorosis and gastro intestinal troubles.

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