

Total Alkalinity and Total Hardness in the Ground Water of Ramachandrapuram and Serilingampally, Telangana, India.

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Abstract

Groundwater is found in vast quantities filling the spaces between grains of soil or rock. Water from rain and rivers migrates through the ground and is stored in soil and rocks. The present study was on the groundwaters of Ramachandrapuram S I and Serilingampally S II. In this paper, Total Alkalinity and Total Hardness were focussed.

Alkalinity is an index of the buffering capacity of water. In the present work, Total Alkalinity average was 286 mg/l and 283mg/l at Station I, Ramachandrapuram and Station II, Serilingampally respectively. According to BIS (1983) and WHO (1984), the standard limit given is 0.6 – 1.2 mg/l and 1.5 mg/l respectively. At Station I, Total Alkalinity is 23.83 times more than BIS and 19.06 times more than WHO at Station I. Similarly at Station II, Total Alkalinity was 23.58 times more than BIS and 18.86 times more than WHO . Hence the groundwaters cannot be used for drinking purpose.

Total Hardness is expressed in terms of lather produced while using soap. Soft water produces lather when we use soap whereas hard water precipitates. The Total Hardness average at Station I was 354 mg/l and 308 mg/l at Station II respectively.

According to Glohmann and Wassers (1976), if the average Total Hardness value is 180 mg/l and above, they are classified as **VERY HARD**. Hence the groundwaters at Station I and Station II are **VERY HARD**. They cannot be used for drinking purpose.

The study clearly indicated that the two groundwaters cannot be used for drinking purpose based on Total Alkalinity and Total Hardness.

Key Words

Total Alkalinity, Total Hardness, Groundwaters, Telangana

Introduction

Groundwater constitutes 98% of the freshwater on the planet earth. In areas beyond the municipal water limits, groundwater is used for drinking, irrigation and industrial purposes. The present study was on the groundwater of Ramachandrapuram which falls into Medak district and Serilingampally of Rangareddy district.

Material and Methods :

Two groundwater stations were identified :

Station I : Ramachandrapuram [located in Medak district]

Station II : Serilingampally [located in Rangareddy district]

Groundwater samples were collected from two sampling stations at monthly intervals for the duration of one year and analysed.

- (1) Total Alkalinity Trivedi et.al., 1987
- (2) Total Hardness Trivedi et.al., 1987

Results and Discussion :

Total Alkalinity

In groundwaters and natural waters, anions like hydroxides, bicarbonates and carbonates and also borates, phosphates, silicates and organic acids contribute to Alkalinity. Total Alkalinity is expressed in terms of calcium carbonate. In the present investigation, Total Alkalinity ranged from 208 mg/l to 520 mg/l and averaged to 286 mg/l in the groundwater of Ramachandrapuram while it ranged from 144 mg/l to 520 mg/l and averaged to 283 mg/l in the groundwater of Serilingampally. According to BIS (1983) and WHO (1984), the permissible limits are 0.6 --- 1.2 mg/l and 1.5 mg/l respectively.

At Station I, Ramachandrapuram , Total Alkalinity is 23.83 times more than the standard limit given by BIS (1983) and 19.06 times more than WHO (1984). At Station II, Serilingampally , Total Alkalinity is 23.58 times more than the standard limit given by BIS (1983) and 18.86 times more than WHO (1984) . Hence the present groundwater cannot be used for drinking purpose.

Total Hardness

Total Hardness is the sum of the Calcium and Magnesium concentrations expressed as Calcium carbonate in milligrams per litre.

The Total Hardness of the two groundwater samples during the period of investigation ranged from 300 mg/l to 424 mg/l at Station I, Ramachandrapuram and 180 mg/l to 532 mg/l at Station II, Serilingampally with the average value of 354 mg/l for Station I and 308 mg/l for the Station II respectively.

Table I: Range and Average of Total Alkalinity and Total Hardness in Groundwater at Station I and Station II

STATION			TOTAL ALKALINITY mg/l	TOTAL HARDNESS mg/l
STATION I RAMACHANDRAPURAM	RANGE	MINIMUM	208	300
		MAXIMUM	520	424
	AVERAGE		286	354
STATION II SERILINGAMPALLY	RANGE	MINIMUM	144	180
		MAXIMUM	520	532
	AVERAGE		283	308

According to Glohmann and Wassers (1976), based on Total Hardness, four categories of water were recognised. When the concentration was 0 – 60 mg/l ----- SOFT; 60 – 120 mg/l --- MEDIUM HARD; 120 – 180 mg/l --- HARD and 180 mg/l and above --- VERY HARD. In the present study, both the groundwaters were **VERY HARD**. They cannot be used for drinking purpose.

Seasonal Variations of Total Alkalinity and Total Hardness in Groundwater at Station I and Station II

Total Alkalinity

The seasonal averages of Total Alkalinity were 361 mg/l pre monsoon, 244 mg/l monsoon, and 252 mg/l post monsoon in groundwater of Ramachandrapuram and 400 mg/l pre monsoon, 228 mg/l monsoon and 221 mg/l post monsoon in Serilingampally. According to BIS and WHO (1983 – 1984), the permissible limits are 0.6 --- 1.2 and 1.5 mg/l respectively.

Total Hardness

The seasonal averages of Total Hardness were 339 mg/l pre monsoon, 338 mg/l monsoon, and 384 mg/l post monsoon in groundwater of Ramachandrapuram and 357 mg/l pre monsoon, 243 mg/l monsoon and 324 mg/l post monsoon in groundwater of Serilingampally.

At Station I Ramachandrapuram and Station II Serilingampally, Total Hardness was minimum in Monsoon season. This indicated that percolation of rain water diluted the Total Hardness.

Table 2: Seasonal Variations of Total Alkalinity and Total Hardness in Groundwater at Station I and Station II

STATION		Pre monsoon	Monsoon	Post monsoon
STATION I RAMACHANDRAPURAM	Total Alkalinity mg/l	361	244	252
	Total Hardness mg/l	339	338	384
STATION II SERILINGAMPALLY	Total Alkalinity mg/l	400	228	221
	Total Hardness mg/l	357	243	324

Gowd and Kotaiah 2000 reported the Calcium and Magnesium causing high Hardness in groundwater. Manoranjini 2001 reported 110.61 mg/l at Station I, Ramachandrapuram and 117.37 mg/l at Station II, Patancheru. Ruth and Johnson (2015) reported that the range of Total Hardness was 122 mg/l --- 826 mg/l and averaged to 508.25 mg/l in the groundwaters of Bogole Mandal, Nellore District.

Table 3: Total Hardness in Various Groundwaters

Serial No.	Author	Place	Year	Total Hardness mg/l
1	Self	Ramachandrapuram	2019	354
2	Self	Serilingampally	2019	308
3	Manoranjini	Ramachandrapuram	2001	110.61
4	Manoranjini	Patancheru	2001	117.37
5	Ruth & Johnson	Bogole Mandal, Nellore Dist. Andhra Pradesh	2015	508.25
6	BIS	Indian Standards	1983	300
7	WHO	International Standards	1984	500

At Station I, Total Alkalinity is 23.83 times more than BIS and 19.06 times more than WHO at Station I. Similarly at Station II, Total Alkalinity was 23.58 times more than BIS and 18.86 times more than WHO. Hence the groundwaters cannot be used for drinking purpose.

From the present study, Total Hardness at Station I and Station II are more than 180 mg/l and above. According to Glohmann & Wassers (1976), they are classified as **VERY HARD** waters.

Conclusion

In the present work, Total Alkalinity average was 286 mg/l and 283mg/l at Station I, Ramachandrapuram and Station II, Serilingampally respectively. At Station I, Ramachandrapuram, Total Alkalinity is 23.83 times more than the standard limit given by BIS (1983) and 19.06 times more than WHO (1984). At Station II, Serilingampally, Total Alkalinity is 23.58 times more than the standard limit given by BIS (1983) and 18.86 times more than WHO (1984). Hence the present groundwater cannot be used for drinking purpose.

The average value of Total Hardness is 354 mg/l for Station I and 308 mg/l for the Station II respectively. According to Glohmann and Wassers (1976), if the average Total Hardness value is 180 mg/l and above, they are classified as VERY HARD. Hence the groundwaters at Station I and Station II are **VERY HARD**. They cannot be used for drinking purpose.

The study clearly indicated that the two groundwaters cannot be used for drinking purpose based on Total Alkalinity and Total Hardness.

Remedial Measures

1. Purification of water when used for drinking.
2. To educate the people to boil groundwater, filter and then use so that Total Alkalinity and Total Hardness can be removed to some extent.

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