IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.301
Volume 3, Issue 6, April 2023

Assessment of Groundwater Quality around Nagole in Hyderabad

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Abstract: *Water is one of the most essential elements for survival of living organism. Water consumption of a person is 135l/c/day. In current scenario, due to increase in population leads to occupy the rivers space. Now a days due to deteriorating natural water bodies, human depends upon sub surface water and ground water to meet their daily needs. In future these subsurface water source also become deteriorate due to over exploitation. In future it leads to subsurface and surface water scarcity so, many researchers finding alternate sources, sustainable water management techniques for proper monitoring the present sources to reduce water demand. There are 400 small and biglakes available in Hyderabad City. Out of which 169 lakes were notified by Hyderabad Metropolitan Development Authority (HMDA) for protection and conservation of water spread area. We have selected Nagole in Hyderabad City of Telangana state for conducting a study on assessing groundwater quality. Thirteen parameters were chosen for the analysis such as pH, EC, Total dissolved solids, Turbidity, Alkanlinity, Chlorine, Sodium, Potassium, Total hardness, BOD, COD, Fluorine, Sulphate. Finally, results of the analysis were compared with water quality standards such as BIS 10500 (1991) of water sample. From this study, it was observed that EC exceeded the Permissible limit which impacts of more ion presence in the samples, alkalinity also higher than the permissible limit. The high content of alkalinity in water results in formation of chemical scale or precipitate which would clog piping or form a scale on filter, sodium exceeds the permissible limit. These parameters were higher in few sampling station while other parameters were within the permissible limits.*

Keywords: Deteriotation, Scarcity, Management techniques

I. INTRODUCTION

Water is a most important compound for existence of human beings and other living organism and absence of water cannot consider any things about life. Human body contains two third percentage of water. Hyderabad is fifth largest city in India and capital of Telangana state with a population of 12 million that demands huge quantity of water to fulfill the various activities. Greater Hyderabad covers 250 sq.km, making it one of the largest metropolitan areas in India with an average altitude of 542m. There are 33 districts in Telangana, earlier there are 18 rivers flows in the state but now it was observed that 13 major and 9 minor rivers flows in and around 10 major districts in Telangana state. Due to globalization and industrialization increase pollution of surface water and ground water. An approximately all water bodies are get polluted including Ground Water. Polluted water is easily mixed in water and destroys the original quality of water. Ground water resource plays a very vital role drinking water by hand pump or piped water supply system. Ground water resource widely consumed by Urban and Rural areas by use of different type of water supply system. Disposal of industrial effluents and domestic sewage waste in river causes a reduction in water quality is due to disposal of effluents in river gradually deteriorate ground water. Due to water demand increased day by day in and around the greater Hyderabad, now drinking water inflows from Krishna, Manjeera and Godavari through the water pipelines to Hyderabad city and waste water release the city is disposed into the Musi river. Due to these reasons water smells unobjectable odour and people afraid to touch the river water. It became 6th most polluted river in India declared by the CPCB India

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II. METHODOLOGY

The study has been carried out at four sampling stations of Nagole We have selected Nagole in Hyderabad City of Telangana state for conducting a study on assessing groundwater quality Flow chart of methodology adopted for the study is shown in Fig:1.

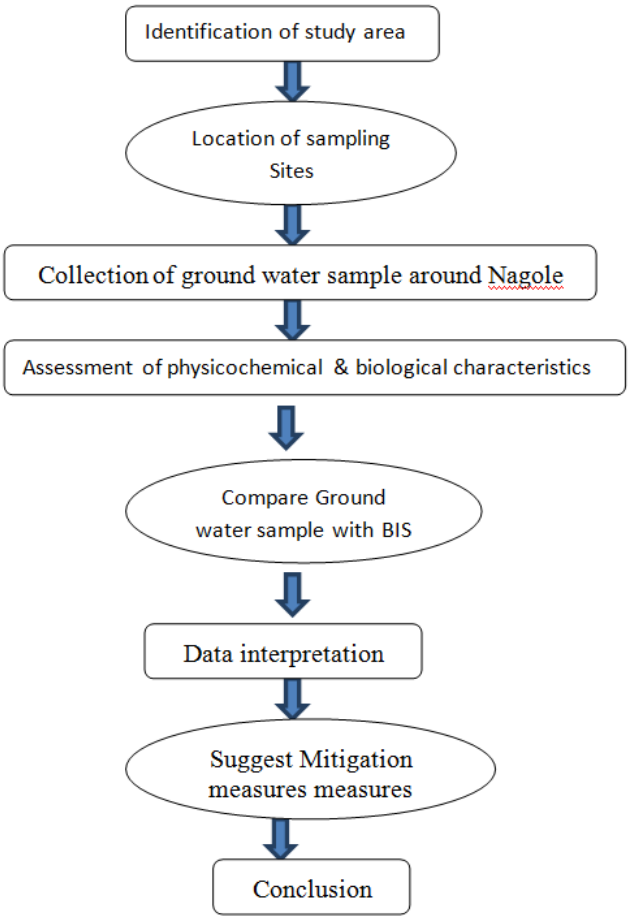

Fig:1. Flow chart of methodology

III. DESCRIPTION OF STUDY AREA

3.1 Nagole

Nagole is a residential and commercial locality is situated in Uppal mandal of eastern part of Hyderabad, Telangana, The ground water level varies based on season depth 10-15 m during summer , 2-8m during winter and monsoon. The study was carried out to assess the quality and quantity of groundwater around different sites at Nagole

3.2 Location of Sampling Stations

For our study we have selected four sampling sites around the Nagole Geographical directions of Sampling Sites at Nagole is given in Table 1

Table 1: Geographical directions Sampling Stations at Nagole

S.N0	Sampling Sites	Station Names	Latitude	Longitude	Distance
1	S1	Minishilparamam	17.3832° N	78.5566° E	50m
2	S2	GHMC mini park	18.7287° N	87.78428° E	50m
3	S3	marble shop	17.4832° N	76.3121° E	50m
4	S4	residential	18.3210° N	79.23108° E	50m

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3.4 Collection of Water Sample

There are 3 types of sampling methods, they are 1. Grab or catch sampling, 2. Composite sampling and 3.Includedsampling. In which we had selected the grab sampling techniques to collect ground water samples. Polyethylene bottles were used to collect samples. Before collecting the samples, the containers were rinsed thoroughly with the water being sampled, after collection of the samples, the containers were closed with air tight. The preservations and analysis were carried out as per the standard methods (APHA 1998 and US EPASW-846). Collection of ground water samples is shown in Fig 2 &3.Water Quality Analysis Methods is given in Table 2. Ground Water Quality at Nagole is given in Table 3


Fig 2 &3 Collection of ground water samples

3.5 Water Quality Analysis Methods

PH is determined using pH analyzer, electrical conductivity is determined using EC analyzer, TDS is estimated using TDS analyzer, turbidity is determined using nephelometric turbidity meter, alkalinity is determined using digital titrator, chlorine is estimated using digital colorimeters, sodium and potassium are determined using flame photometer, total hardness is estimated using complexometric titration, BOD is determined using polarographic method, COD is estimated using dichromatete ion, sulphate is determined using Spectrophotometer, E.Coli and coliforms are determined using membrane filtration, TBC is determined using colony forming units(CFU).

Table 3: Ground Water Quality at Nagole

S.No	Parameters	Sampling stations			
		S1	S2	S3	S4
1.	Colour	-	-	-	-
2.	Odour	-	-	-	-
3.	PH	7.2	7.4	7.8	8
4.	EC	457	481	468	472
5	TDS	406.6	411.6	431	436.8
6.	Turbidity	0.6	0.5	0,8	0.7
7.	Alkalinity	228	235	242	238
8	Chlorine	3.6	3.8	3.7	3.9
9	Sodium	25	28	26	27
10	Potassium	1.2	0.9	4.2	5.1
11	TH	147	142	153	161
12	BOD	1.6	1.8	1.5	1.7
13	COD	285	296	378	421
14	Fluorine	1.2	1.4	1.3	1.1
15	Sulphate	362	370	381	388

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16	E.Coli	1663	1671	1678	1667
17	coliforms	1218	1228	1251	1248
18	TBC	2881	2899	2929	2915

IV. RESULTS AND DISCUSSIONS

It is very essential and important to test the water before it is used for drinking, domestic, agricultural or industrial purpose, because water does contain different types of floating, dissolved, suspended and microbiological as well as bacteriological impurities. Standard river water quality analysis are performed with various physico-chemical parameters, such as colour, odour, electrical conductivity, pH, Total solids, Total dissolved solids, Alkalinity, turbidity, chlorine, sodium, potassium, Total hardness, fluorine, sulphate, Biological oxygen demand(BOD) and Chemical oxygen demand(COD). Quality of wateraround the lake at four different stations is presented in the following Table 4.

Table 4: Comparison of Ground Water Quality with standards

S.No	Parameters	Sampling stations				Permissible limit	Remarks
		S1	S2	S3	S4		
1.	Colour	-	-	-	-	-	-
2.	Odour	-	-	-	-	-	-
3.	PH	7.2	7.4	7.8	8	6.9-8.5	Within the limit
4.	EC	457	481	468	472	400us/cm	Exceeds the limit
5	TDS	406.6	411.6	431	436.8	500mg/l	Below the limit
6.	Turbidity	0.6	0.5	0,8	0.7	1 NTU	Below the limit
7.	Alkalinity	228	235	242	238	200mg/l	Exceeds the limit
8	Chlorine	3.6	3.8	3.7	3.9	4mg/l	Below the limit
9	Sodium	25	28	26	27	20mg/l	Exceeds the limit
10	Potassium	1.2	0.9	4.2	5.1	0.4-11.1mg/l	Within the limit
11	TH	147	142	153	161	120-170mg/l	within the limit
12	BOD	1.6	1.8	1.5	1.7	1-2ppm	Within the limit
13	COD	285	296	378	421	250-500ppm	Within the limit
14	Fluorine	1.2	1.4	1.3	1.1	1-1.5ppm	Within the limit
15	Sulphate	362	370	381	388	400mg/l	Below the limit
16	E.Coli	1663	1671	1678	1667	Absent/100ml	Exceeds the limit
17	coliforms	1218	1228	1251	1248	Absent/100ml	Exceeds the limit
18	TBC	2881	2899	2929	2915	Absent/100ml	Exceeds the limit

pH:

The pH value of water is very important indicator of its quality. The pH values of water are coded by the amount of dissolved carbondioxide, carbonate and bicarbonates. From the study, it reveals that pH values are within the permissible limit as given in Table 2 and Fig 1.

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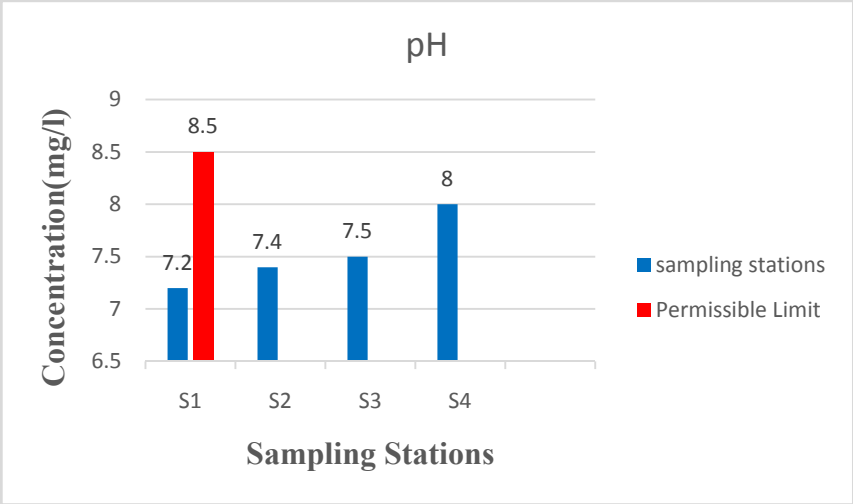

Fig 1 pH in Ground water (Nagole)

EC:

Electrical conductivity is the conductivity of water is a measure of the capability of water to pass electrical flow. This ability directly depends on the concentration of conductive ions in water. As per BIS the permissible limit for electrical conductivity is 400 us/cm from table 2 and figure 2. During the study we observed that the EC values ranges from 457 to 481us/cm. It is observed that the 100% samples were exceeded the Permissible limit which impacts of more ion presence in the samples.

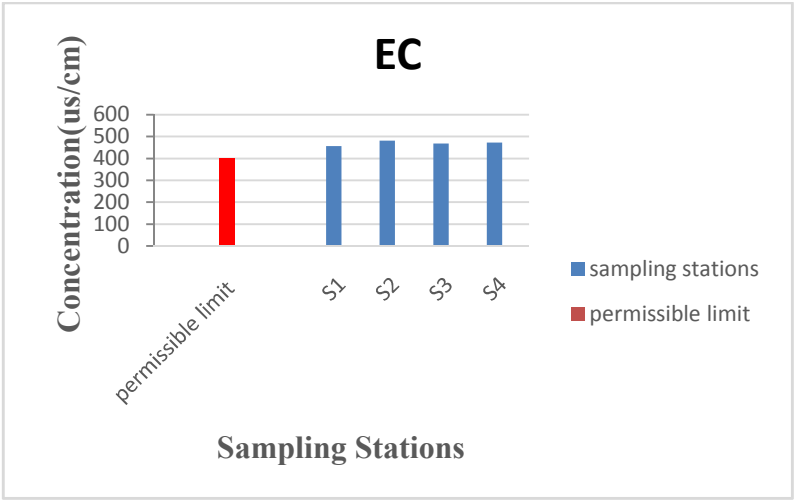

Fig 2 EC in Ground Water (Nagole)

Total Dissolved Solids :

Total dissolved solids (TDS) are a measure of total inorganic substances dissolved in water. TDS indicates the general nature of water quality or salinity. During the study TDS values were found in the ranges of 406.6 mg/l to 436.8 mg/l, which were below than the permissible limit as given in Table 3 and Fig 3. A low TDS level indicates high quality of water, but it may have a flat taste, has it is devoid of many minerals.

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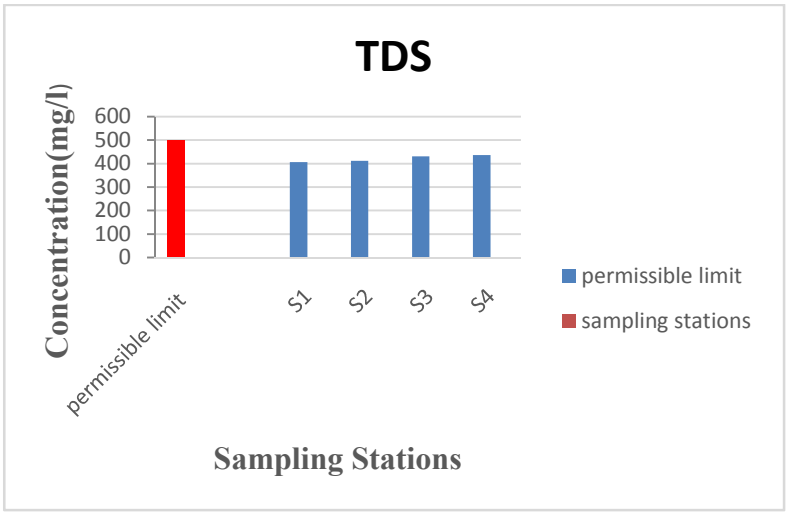

Fig 3 TDS in Ground water (Nagole)

Turbidity:

Turbidity is the measure of relative clarity of a liquid. Turbidity is the state or quality of being clouded or opaque, usually because of suspended matter in the water. As per BIS the permissible limit recommended for turbidity is 1NTU in the table 2 and figure 4. During the study turbidity values ranges from 0.6 to 0.8 NTU, which were below the permissible limit. Low turbidity value indicates high water clarity.

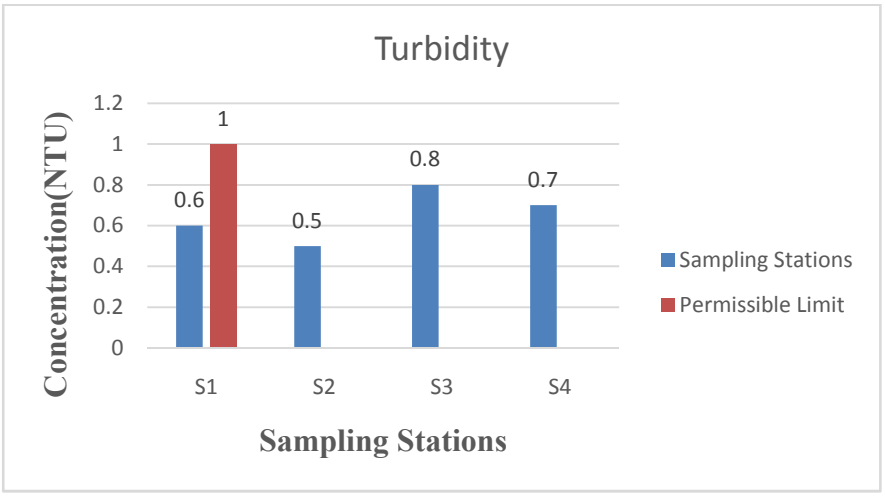

Fig 4 Turbidity in Ground Water (Nagole)

Alkalinity:

Alkalinity is the result of water's ability to neutralize acids or resist changes that cause acidity, maintaining a stable PH. Titration is used to measure the alkalinity of a water sample. As per BIS the permissible limit for alkalinity is 200 mg/l from the table 2 and fig 5. During the study alkalinity values ranges from 228 to 242 mg/l, which were higher than the permissible limit. The high content of alkalinity in water results in formation of chemical scale or precipitate which would clog piping or form a scale on filter.

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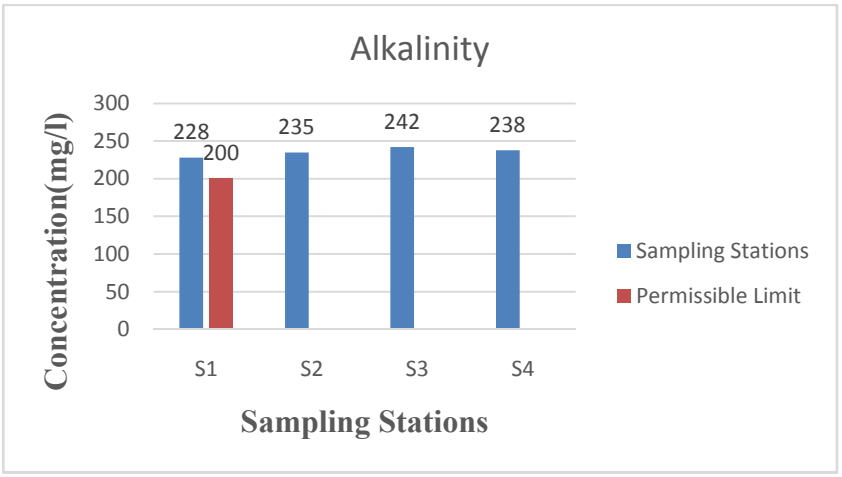

Fig 5 Alkalinity in Ground Water (Nagole)

Chlorine:

Chlorine test is generally given to determine the presence and amount of chlorine in water. 4mg/l is the permissible limit recommended by the BIS. During the study chlorine values 3.6 to 3.9, which were below the permissible limit of 4 mg/l as given in Table 2 and Fig 6. High presence of chlorine is Dangerous and poisonous chemical if at high levels here it is the samples values were below the limits.

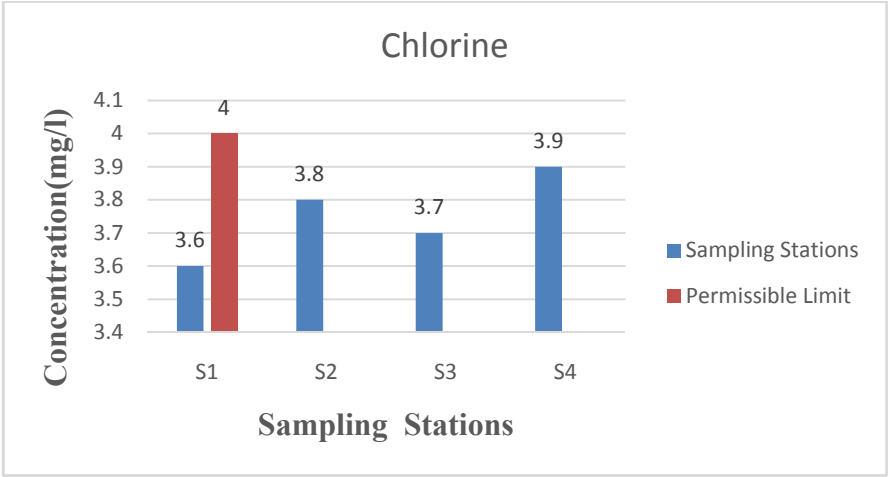

Fig 6 Chlorine in Ground Water (Nagole)

Sodium:

Sodium is the result of salinity in water, which preserve more dehydrated, which form the mineral sodium chloride, commonly referred to as salt. As per BIS 10500-2012 the permissible limit recommended for sodium is 20mg/l. During the study sodium values were found in the ranges of 25 mg/l to 28 mg/l, which were higher than the permissible limit as given in Table 2 and Fig 7. Excessive salt intake seriously aggravates phronic congestive heart failure and ill effects due to high levels of sodium in drinking water.

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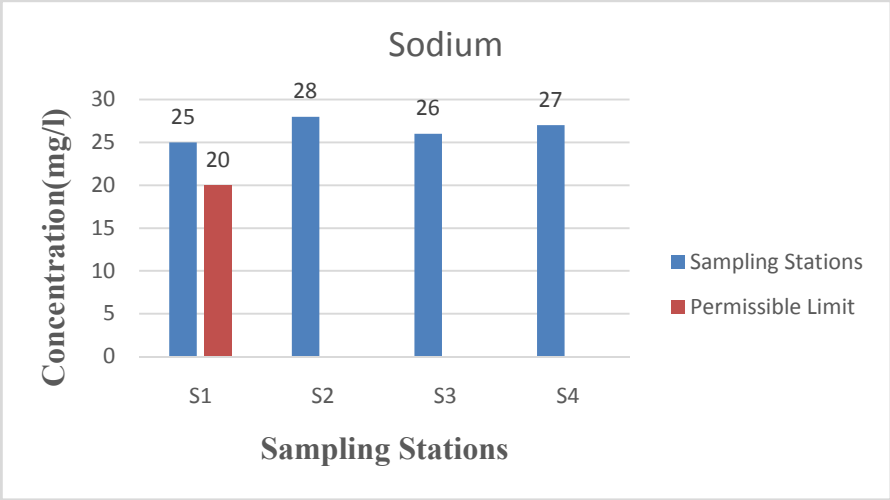

Fig 7 sodium in Ground Water (Nagole)

Potassium:

Potassium ranks seventh among the element in order of abundance, behaves similar to sodium and remains low. Though found in small quantities(<20 mg/l) it plays a vital role in the metabolism. During the study potassium values ranges from 0.9 to 5.1, which were within the limit. As per BIS the permissible limit for potassium is in between 0.4-11 mg/l shown in table 2 and fig 8.

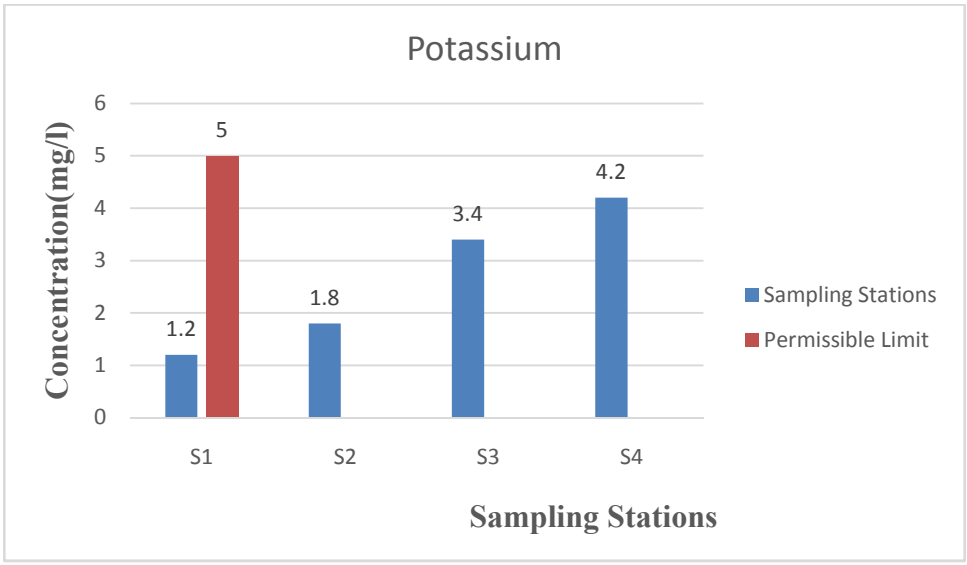

Fig 8 Potassium in Ground Water (Nagole)

Total Hardness:

Hardness is an important parameter of water for its use in domestic purpose. Calcium and magnesium are important parameter for total hardness in groundwater. During the study Total hardness values were ranged from 147 mg/l to 161 mg/l, which were much higher than permissible limit of 75 mg/l as given in Table 2 and Fig 9. Excess hardness is undesirable mostly for economic reasons.

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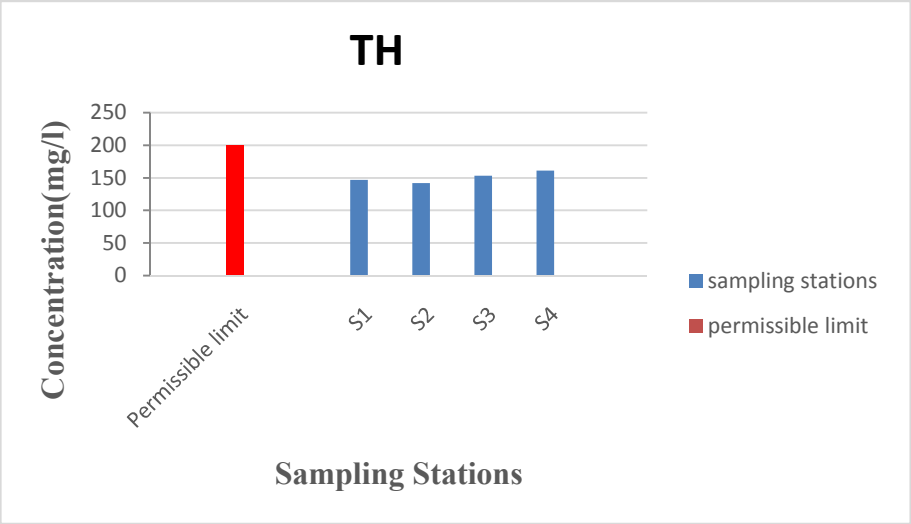

Fig 9 TH in Ground Water (Nagole)

BOD:

BOD stands for Biochemical Oxygen Demand. BOD is the amount of oxygen consumed in one litre of water by microorganisms while they oxidise the entire organic matter present in it at a specified temperature. BOD is a measure of the amount of oxygen required to remove waste organic matter from water in the process of decomposition by aerobic bacteria. As per BIS the permissible limit recommended for BOD is 2 mg/l in the table 2 and figure 10. During the study BOD values ranges from 1.5 to 1.8 ppm, which were below the limit. we observed that 100% of sample values were below the permissible limit during the month of december to march.

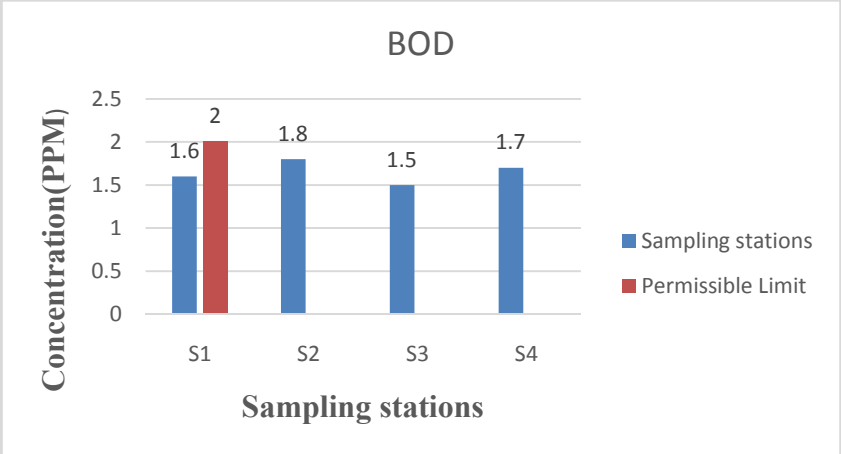

Fig 10 BOD in Ground Water (Nagole)

COD:

COD is a measure of the oxygen equivalent of the organic matter in a water sample that is fusceptible to oxidation by a strong chemical oxidant. COD values were in the ranges between 285 mg/l to 421 mg/l, which were within the permissible limit of 500 mg/l as given in Table 2 and Fig 11. COD values reveals that river water had not been much polluted with non biodegradable organic matter. A reduction in COD can lead to anaerobic conditions, which is deleterious to higher aquatic life forms.

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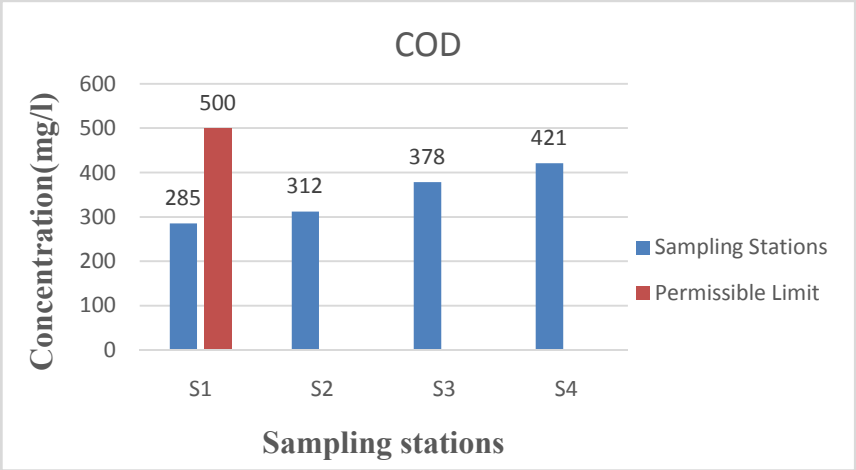

Fig 11 COD in Ground Water (Nagole)

Sulphate:

Sulfate is second to bicarbonate as the major anion in hard water reservoirs. 400mg/l is the value recommended by the BIS 10500-2012 for sulfate. During the study TDS values were found in the ranges of 362 mg/l to 388 mg/l, which were below than the permissible limit as given in Table 2 and Fig 12. The low level of sulphate in water, causes diarrhea and dehydration by drinking the water.

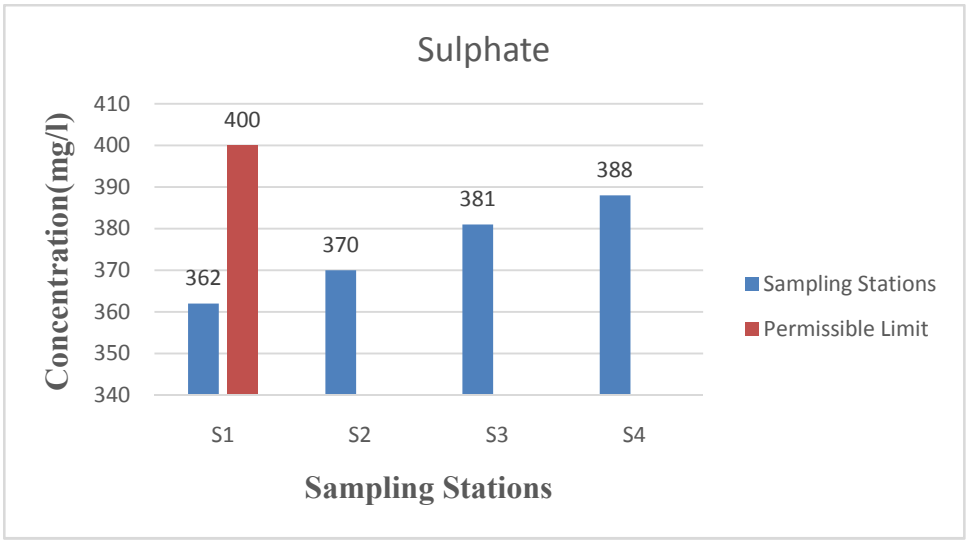

Fig 12 Sulphate in Ground Water (Nagole)

V. CONCLUSION

The water quality analysis gives the detailed pollutional status of ground water around Musi river (in Nagole) and confirmed the higher degree of pollution. These was due to discharge of untreated domestic sewage and industrial effluents washing of clothes and cleaning of vehicles important parameters such as EC exceeded the Permissible limit at S2, which impacts of more ion presence in the samples, alkalinity which were higher than the permissible limit at S3. The high content of alkalinity in water results in formation of chemical scale or precipitate which would clog piping or form a scale on filter, sodium exceeds the permissible limit at S2, where as TDS, turbidity, chlorine and sulphate values are below the permissible limit. And other parameters are within the limits. Above results show that the ground water could be used for domestic, agriculture, industrial and other activities but not for drinking purpose. The Greater Hyderabad Municipal Corporation (GHMC) must take appropriate measure to treat the groundwater before its supply to public by reducing sodium level.

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