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Assessment of Surface and Ground water Quality in Hyderabad

K.V. Pavan Kumar[1], Nangunoori Dinisha[2], Priyanka[3], Dr. R. Premsudha[4], G. Chandana[5], B. Anusha[6]
UG Students, Department of Civil Engineering[1,2,3]
Professor, Department of Civil Engineering[4]
Assistant Professor Department of Civil Engineering[5,6]
TKR College of Engineering and Technology, Hyderabad, India

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. Nowa 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 big lakes 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 Himayath Sagar, Osman Sagar, Peerzadiguda 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, E.Coli, Coliforms, TBC, Alkalinity, Sodium is higher than the permissible limit in Himayath Sagar and Peerzadiguda. The high content of EC, E.Coli, Coliforms, TBC, Alkalinity in water results in formation of chemical scale or precipitate which would clog piping or form a scale on filter, These parameters were higher in few sampling stations of study area 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 Himayath Sagar, Osman Sagar, Peerzadiguda in Hyderabad City of Telangana state for conducting a study on assessing groundwater and Surface water quality Flow chart of methodology adopted for the study is shown in Fig:1.

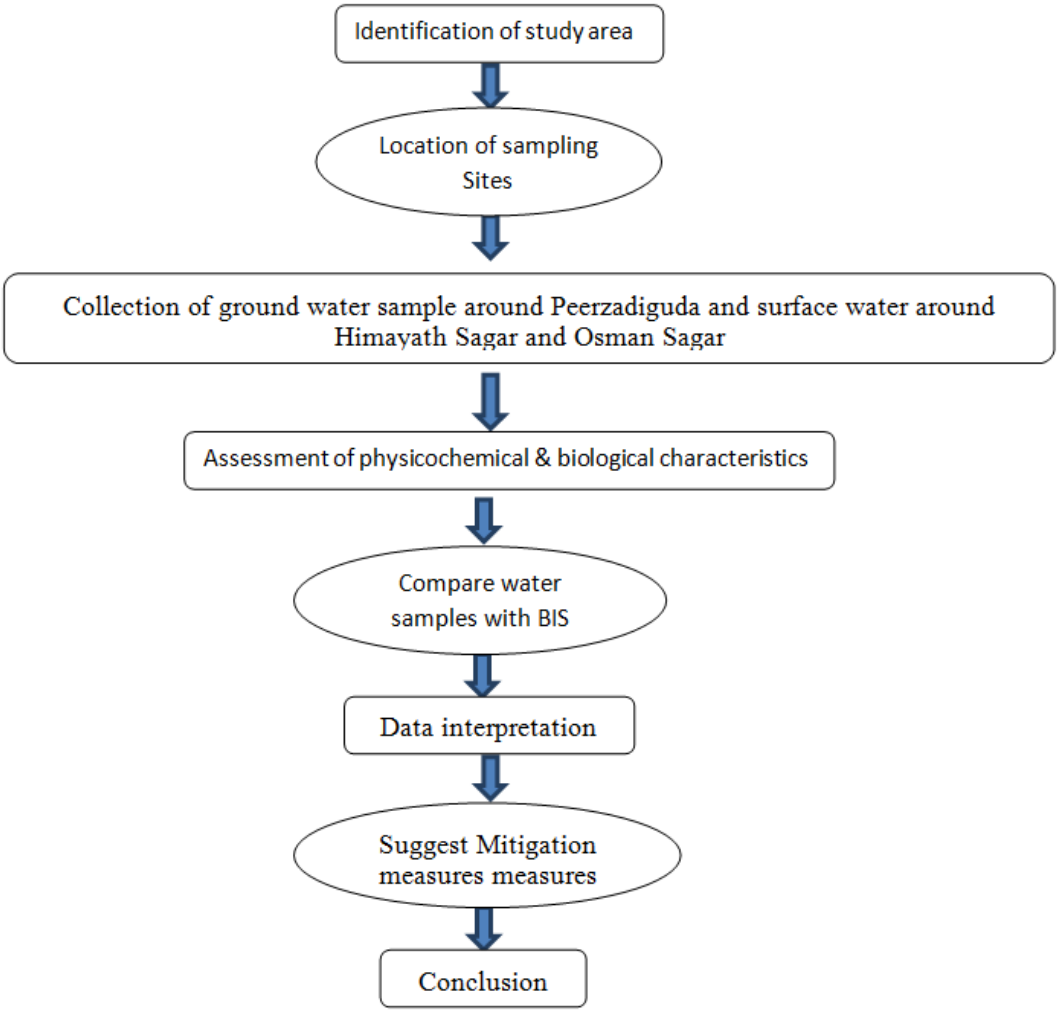

Fig:1. Flow chart of methodology

2.1 Description of Study Area:

Himayath Sagar:

Himayath Sagar is an artificial lake about 20 km from Hyderabad in Telangana. It lies parallel to a larger artificial lake Osman Sagar The Surface water level varies based on season depth 12-18 m during summer , 8-15m during winter and monsoon. The study was carried out to assess the quality and quantity of Surface water around different sampling stations at Himayath Sagar.

Osman Sagar:

Osman Sagar is located at western paet of Hyderabad E.Mir Osman Ali Khan created this water body as part of damming project of the river Musi in the year of 1920. The surface water level varies based on pre cast and pre monsoon seasons which varies the range between 10;24m . The study was carried out to assess the quality and quantity of Surface water around four different sampling stations at Osman Sagar.

Peerzadiguda :

Peerzadiguda is a satellite city of Hyderabad and municipal corporation located in Medchal- Malkajgiri district in Telangana. Peerzadiguda cheruvu is situated nearby to Sankar Nagar. Very polluted lake in which sewage water

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accumulated instead of fresh water. The study was carried out to assess the quality and quantity of Ground water around four different sampling stations at Peerzadiguda.

2.2 Location of sampling stations:

For our study we have selected four sampling sites around the Himayath Sagar, Osman Sagar, Peerzadiguda. Geographical directions of Sampling Sites at Himayath Sagar, Osman Sagar, Peerzadiguda is given in Table 1 to 3, respectively.

Table 1 Geographical directions Sampling Stations at Himayath Sagar

S.N0	Sampling Sites	Station Names	Latitude	Longitude	Distance
1	S1	Himayath Sagar Dam	17.3187° N	78.3586° E	50m
2	S2	Himayath Sagar viewpoint	17.3208° N	78.3712° E	50m
3	S3	Vasundara dairy	17.3221° N	78.3811° E	50m
4	S4	Nursery	17.329° N	78.3843° E	50m

Table 2 Geographical directions Sampling Stations at Osman Sagar

S.N0	Sampling Sites	Station Names	Latitude	Longitude	Distance
1	S1	Osman Sagar viewpoint	17.3775° N	78.3162° E	50m
2	S2	Gandipet Temple	17.3799° N	78.3187° E	50m
3	S3	Park	17.3811° N	78.3192° E	50m
4	S4	Rock Garden	17.3823° N	78.3197° E	50m

Table 3 Geographical directions Sampling Stations at Peerzadiguda

S.N0	Sampling Sites	Station Names	Latitude	Longitude	Distance
1	S1	Resort	18.2416° N	78.5566° E	50m
2	S2	Beside Petrol pump	17.3216° N	80.5672° E	50m
3	S3	Restaurant	17.8317° N	74.4586° E	50m
4	S4	Resedential Building	18.7241° N	78.3764° E	50m

2.3 Collection of water sample:

There are 3 types of sampling methods, they are 1. Grab or catch sampling, 2. Composite sampling and 3.Included sampling. 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. Ground Water Quality at Himayath Sagar, Osman Sagar, Peerzadiguda is given in Table 4 to 6, respectively.

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).

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Table 4. Surface Water Quality at Himayath Sagar

S.No	Parameters	Sampling stations			
		S1	S2	S3	S4
1.	Colour	-	-	-	-
2.	Odour	-	-	-	-
3.	PH	7.6	7.4	7.8	7.7
4.	EC	382	416	379	424
5	TDS	450.5	430.9	454.4	475.3
6.	Turbidity	0.4	0.7	0,5	0.6
7.	Alkalinity	245	251	265	272
8	Chlorine	3.5	3.8	3.6	3.9
9	Sodium	25	28	27	26
10	Potassium	3.6	4.2	3.9	4.5
11	TH	172	142	153	167
12	BOD	1.5	1.7	1.4	1.5
13	COD	290	326	388	420
14	Fluorine	1	1.2	1.4	1.3
15	Sulphate	272	311	351	389
16	E.Coli	1234	1239	1245	1232
17	Coliforms	922	930	934	948
18	TBC	2156	2169	2179	2180

Table 5. Surface Water Quality at Osman Sagar

S.No	Parameters	Sampling stations			
		S1	S2	S3	S4
1.	Colour	-	-	-	-
2.	Odour	-	-	-	-
3.	PH	7.8	8.2	7.9	8.3
4.	EC	567	584	573	611
5	TDS	435.81	450.67	461.91	444.84
6.	Turbidity	0.12	0.17	0.21	0.34
7.	Alkalinity	269	272	278	267
8	Chlorine	2.89	3.2	3.8	3.7
9	Sodium	22	28	27	29
10	Potassium	3.6	4.1	3.8	3.7
11	TH	137	142	148	139
12	BOD	1.8	1.7	1.8	1.5
13	COD	381	398	409	413
14	Fluorine	1.4	1.2	1.1	1.3
15	Sulphate	211	217	219	222
16	E.Coli	1321	1328	1342	1348
17	Coliforms	841	852	847	859
18	TBC	2162	2180	2189	2207

Table 6. Ground Water Quality at Peerzadiguda

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

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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
16	E.Coli	1776	1785	1791	1783
17	Coliforms	1513	1521	1528	1519
18	TBC	3289	3306	3319	3302

III. 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).The Quality of water around the lake at four different stations of sampling sites (Himayath Sagar,Osman Sagar,Peerzadiguda) is represented in the following Table 7.

Table 7 Comparison of Surface and Ground Water Quality with standards

S.No	Parameters	Sampling sites			Permissible limit	Remarks
		Himayath Sagar	Osman Sagar	Peer zadiguda		
1.	Colour	-	-	-	-	-
2.	Odour	-	-	-	-	-
3.	PH	7.8	8	8.2	6.9-8.5	Within the limit
4.	EC	428	436	454	400us/cm	Exceeds the limit
5	TDS	454.2	482.5	495	500mg/l	Below the limit
6.	Turbidity	0.8	0.9	1	1 NTU	Below the limit
7.	Alkalinity	252	275	312	200mg/l	Exceeds the limit
8	Chlorine	3.2	3.6	3.5	4mg/l	Below the limit
9	Sodium	228	235	238	20mg/l	Exceeds the limit
10	Potassium	4	3.6	4.5	0.4-11.1mg/l	Within the limit
11	TH	170	175	186	120-170mg/l	within the limit
12	BOD	23	27	28	1-2ppm	Within the limit
13	COD	280	348	412	250-500ppm	Within the limit
14	Fluorine	1.2	1	1.3	1-1.5ppm	Within the limit
15	Sulphate	364	372	390	400mg/l	Below the limit
16	E.Coli	1237.5	1334.7	1783.73	Absent/100ml	Exceeds the limit
17	coliforms	933.5	849.75	1520.25	Absent/100ml	Exceeds the limit
18	TBC	2171	2184.5	3304	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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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. From 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.

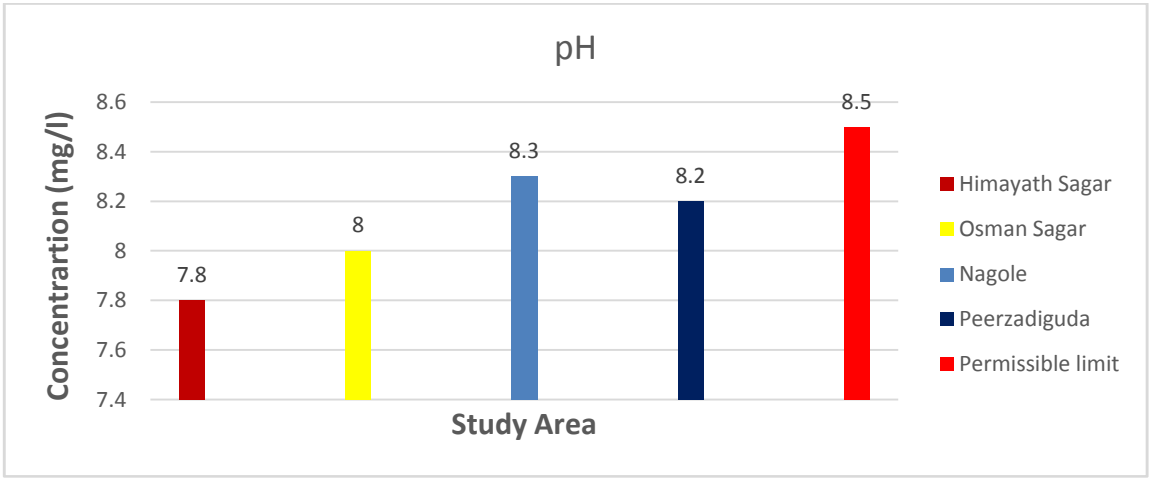

Fig 1 pH of Study Area

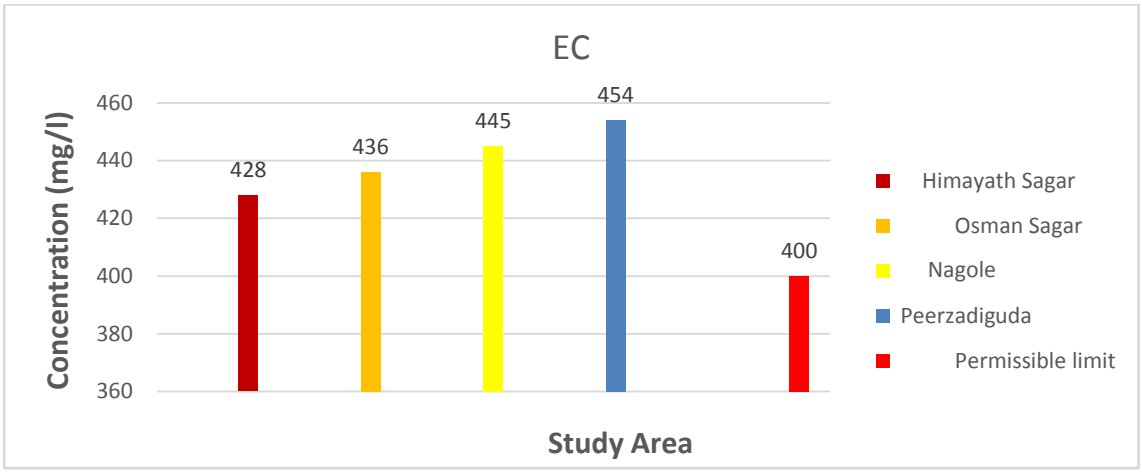

Fig 2 EC of Study Area

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.From 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.

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.From 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.

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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. From 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.

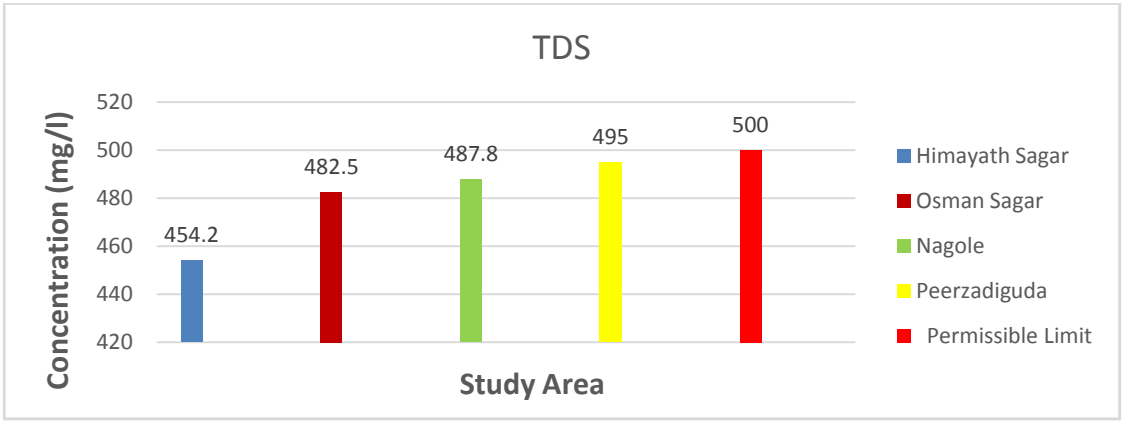

Fig 3 TDS of Study Area

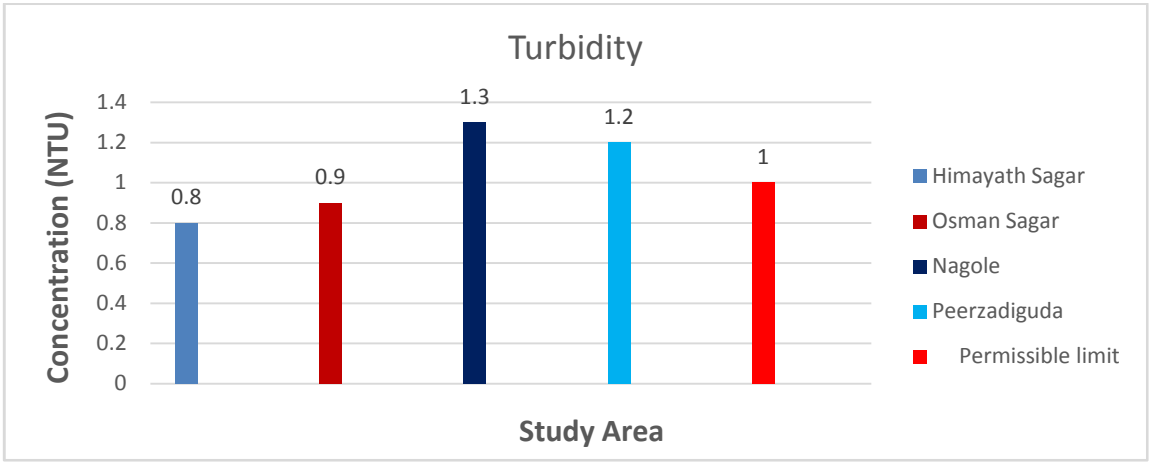

Fig 4 Turbidity of Study Area

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. From 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.

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. From 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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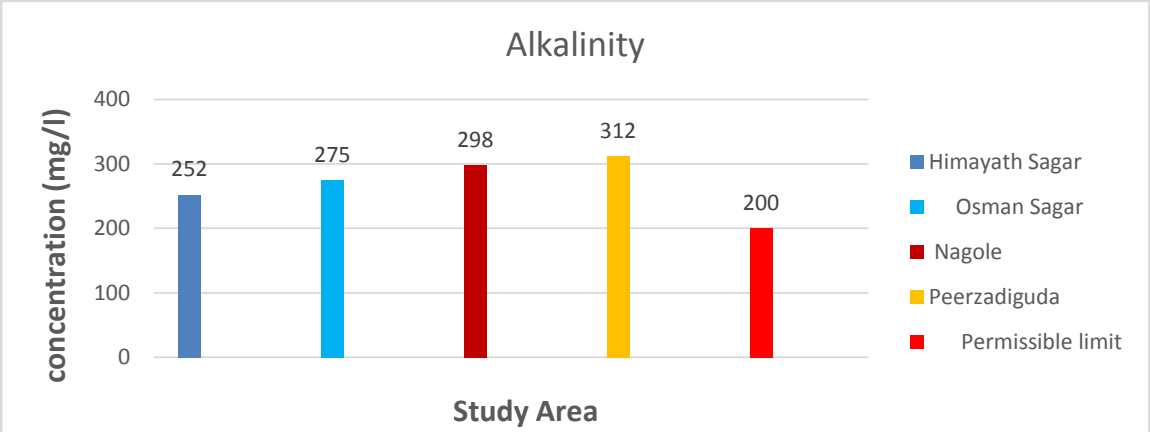

Fig 5 Alkalinity of Study Area

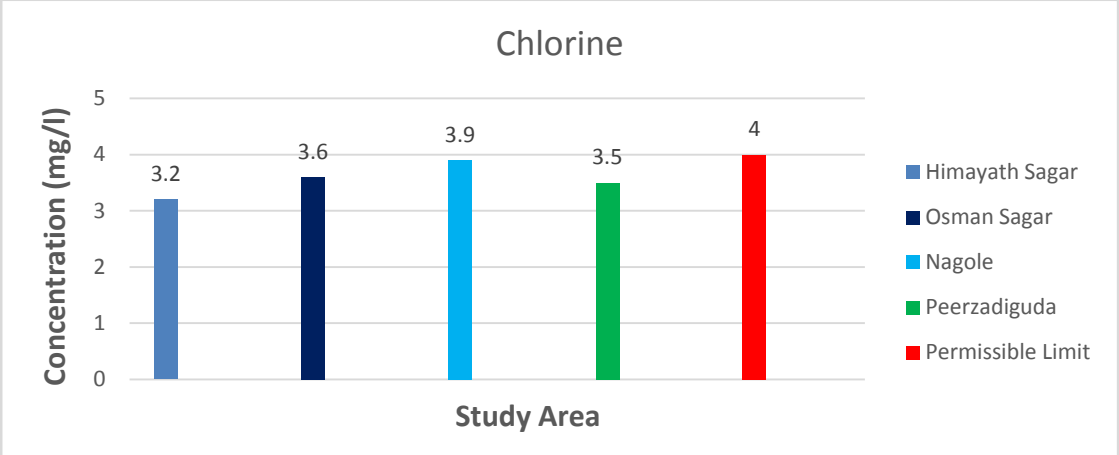

Fig 6 Chlorine of Study Area

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. From the study potassium values ranges from 4 to 5mg/l, which were within the limit. As per BIS the permissible limit for potassium is 5 mg/l shown in table 2 and fig 8.

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. From 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.

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. From 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.

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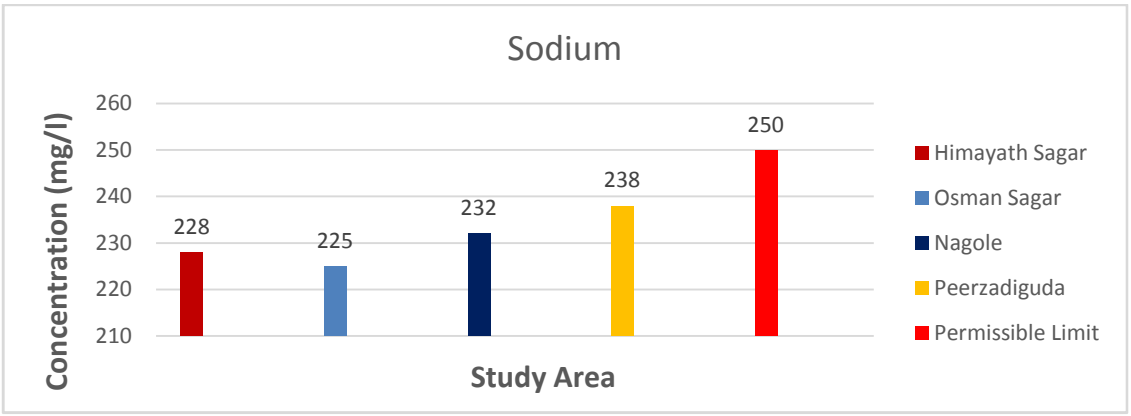

Fig 7 sodium of Study Area

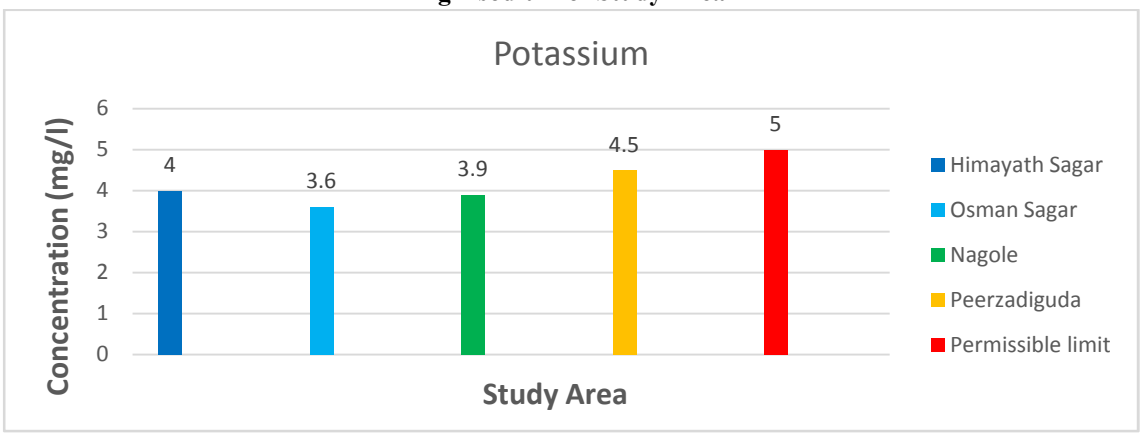

Fig 8 Potassium of Study Area

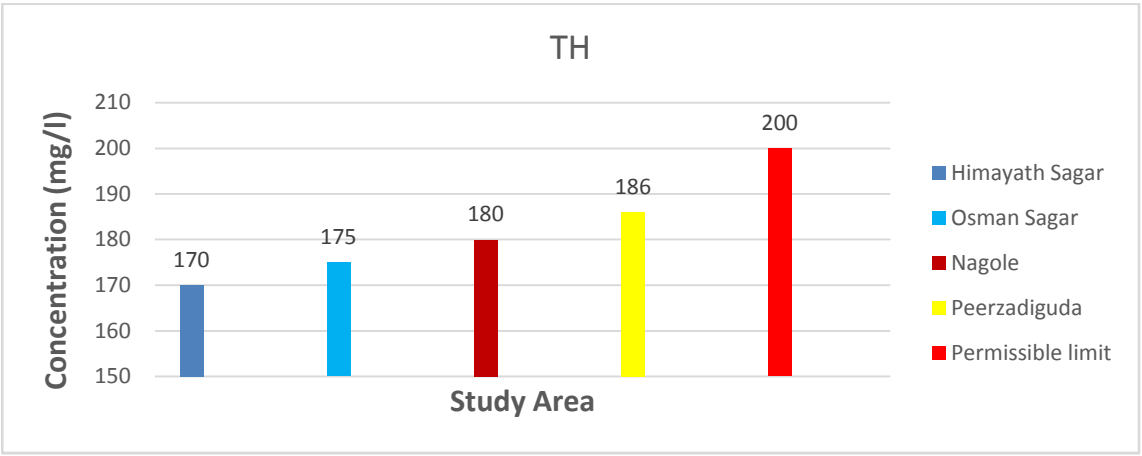

Fig 9 TH of Study Area

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 280 mg/l to 420 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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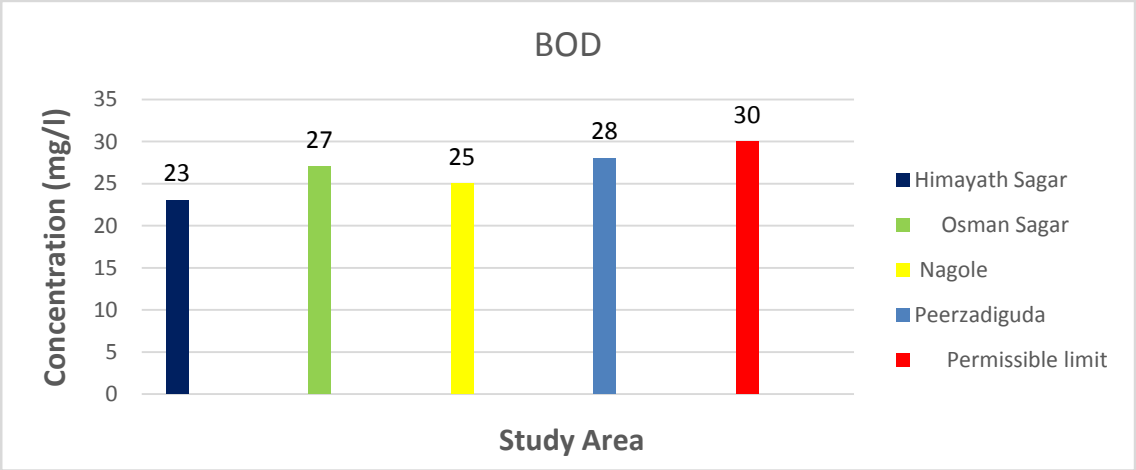

Fig 10 BOD of Study Area

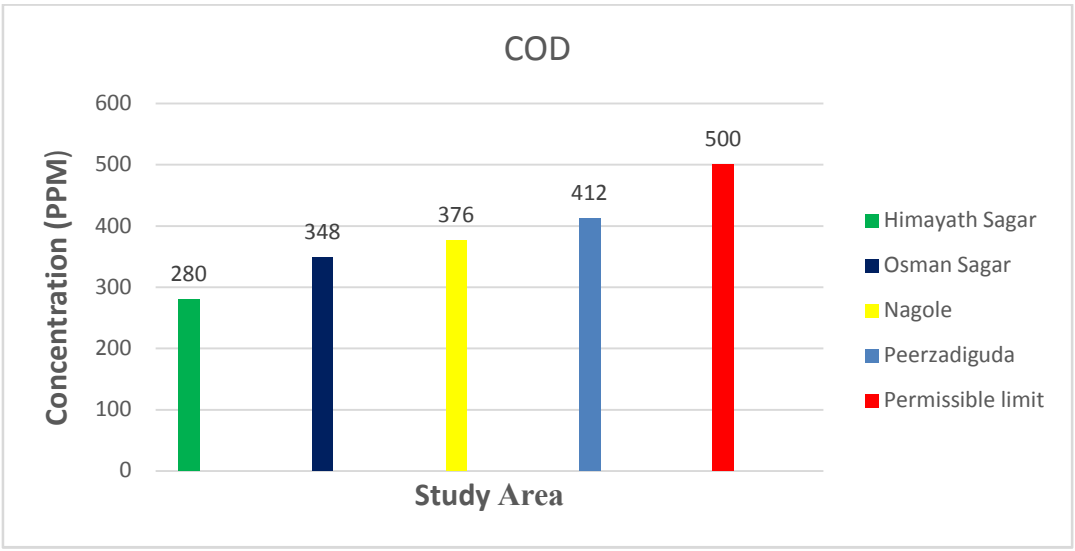

Fig 11 COD of Study Area

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.

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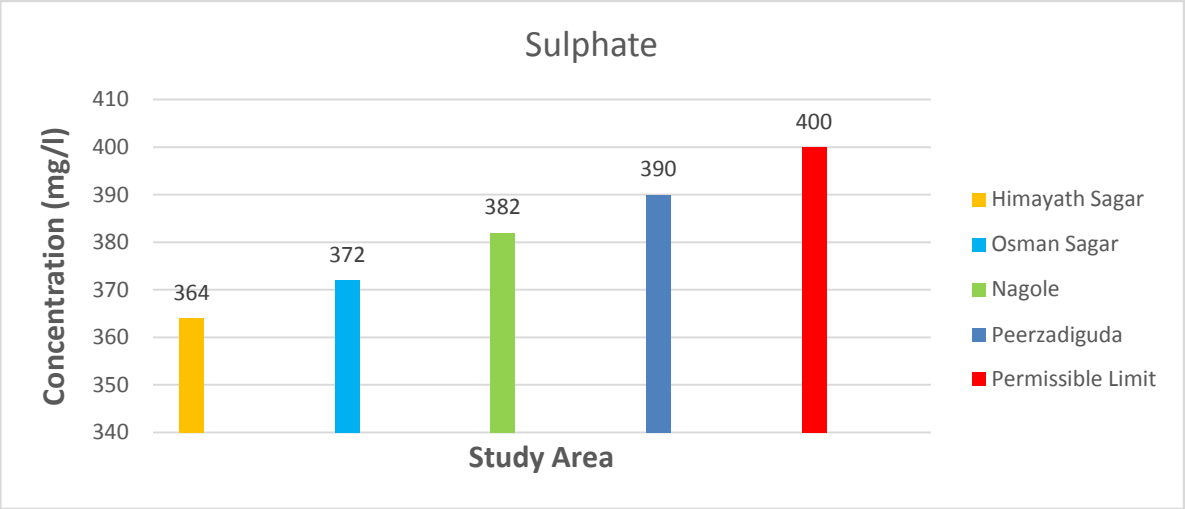

Fig 12 Sulphate of Study Area

IV. CONCLUSION

The water quality analysis gives the detailed pollutional status of Surface Water of Himayath Sagar And Osman Sagar & Ground water around Musi river (in Peerzadiguda) 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 Osman Sagar, which impacts of more ion presence in the samples, alkalinity and E.Coli, Coliforms, TBC which were exceeded the permissible limit at Peerzadiguda. 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 Himayath Sagar, 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 and surface water is used for agriculture 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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