Analysis & Assessment of Water Quality Index of Surface and Subsurface Water Near Devarabelakere

Kiran Kumar M S[1], Yuvaraj V[2], Varshini T[3], Srinivasa H[4], Suraj Kumar S Anajer[5]
Department of Civil Engineering, Jain institute of technology, Davangere, India.

***Abstract*— For drinking and agriculture, rural India relies heavily on surface and underground water. Unsustainable groundwater withdrawal has contributed to the problem of water scarcity. Not only are hazardous pathogenic microorganisms and anthropogenic pollutants contaminating accessible water quality, but geogenic substances are also wreaking havoc on many places' water supplies. The current study examines the surface's quality and subsurface (ground) water in Devarabelakere village, Harihara taluk, Davangere District, Karnataka State.**

Variations in the physico-chemical parameters in the water samples were observed. Analyzed parameters of selected samples of water were contrasted with BIS standard & WQI valuesSome of the water quality measures uncovered to be above the allowable limit, while others were not. This research assists many regions in better understanding the potential hazards to their ground water resources. In the current study, the WQI of the surface Water was discovered to be safe., but the WQI of subsurface & Water was discovered to be of poor quality. in the Devarabelakere village watershed.

Keywords*— Surface Water, Ground Water, Physico-Chemical Parameters, water quality index, Devarabelakere Village, Harihara taluk, Davangere.*

I. INTRODUCTION

"Water first-class" refers to the physical channel and water column needed to maintain aquatic existence. Water is a crucial natural resource for preserving life and the environment. Significant growth has occurred when using groundwater for drinking, irrigation, business, and many industrial purposes over the last couple of decades. To "guard and preserve the chemical, physical, and organic integrity of the nation's waters," as stated in the federal Clean Water Act. highlights the need of evaluating each water body's quality in addition to the habitat needed to preserve various aquatic creatures. The quality of groundwater may also have an impact on the local geology, water table intensity, and seasonal variations. It is also controlled by the quantity and make-up of dissolved salts, which are determined by the salt supply and soil-floor environment. The quality of groundwater may also be influenced by the local geology, water table intensity, and seasonal variations. It is also controlled by the quantity and make-up of dissolved salts, which are determined by the salt supply and soil-floor environment.

Despite the widespread belief that bore well water (groundwater) is much purer and less likely to be contaminated than surface water, due to the massive anthropocentric sports interference, floor water is now incredibly abundant with heavy steel infection Strong waste dumping sites, aquifer fabric mineralogy combined with a semiarid environment, many anthropogenic activities, and increased human interventions have all had a negative impact on groundwater greatly. The level of water contaminants has gotten really bad. The goal of the investigation is to assess the quality of both surface and groundwater that have accumulated from several outcrops near Devarabelakere Village in the Harihar Taluk in the Davangere District of Karnataka State.

Therefore, it is crucial that water quality testing be done to determine whether the available water from the so-called reliable resources is safe for consumption and other applications.

II. METHODOLOGY

A. *Study Area*

In the Harihar taluka of Karnataka's Davangere district is the village of Devarabelakere. It is situated 14 kilometres from the district headquarters Davangere and 18 kilometres from the sub-district headquarters Harihar. According to 2009 statistics, Devarabelakere village also functions as a grame panchayat. The total land area of the settlement is 670.56 hectares. There are 2,984 people living in Devarabelakere, 1,524 of whom are men and 1,460 of whom are women. The literacy rate in Devarabelakere village is 68.20%, with 73.75% of men and 62.40% of women being literate. Around 557 dwellings make up the community of Devarabelakere.

Fig 1. Devarabelakere village Map

B. Methodology

Five distinct bore wells were used to collect ground water samples, and three surface samples were also collected. Using the standard grab sample procedure and standard methods, In sterile bottles, the samples were gathered. With important prewarning, samples were gathered in one-liter, pre-wiped, clean, and rinsed bottles before being sent to the laboratory for physicochemical parameter evaluation.

Fig 2. Collection of Surface and Subsurface water

The samples of water were examined in our college lab's environmental technology laboratory utilizing standard analysis procedures. In order to create certain chemical solutions used for water sample analysis, distilled water was used, and the chemicals were purchased from SD fine. Standard procedures were employed to evaluate the samples. pH, TDS (Total Dissolved Solids), TH (Total Hardness), (TA) Total Alkalinity, (calcium), Mg (magnesium), & Cl (chloride) are the seven physicochemical parameters measured.

Table 3. Parameters and Methods used in the analysis

Sl. No	Parameters	Method of Estimation
1	pH	pH Meter
2	Alkalinity	Conductivity
3	Total Dissolved Solids	TDS meter
4	Total Hardness	EDTA Titration
5	calcium	EDTA Titration
6	Magnesium	EDTA Titration
7	chloride	Silver nitrate tight ration

Table 4 source of collected surface water

Sl. No	Source	section	Source code		
			start	Mid	End
1	Devar abela kere	1	S-11	S-12	S-13
		2	S-21	S-22	S-23
		3	S-31	S-32	S-33

Table 5. Sources of Sub-Surface water Collected

Sl. No	Source	Source Code
1	Borewell	SS-1
2	Irrigation bore well	SS-2
3	Mini water tank	SS-3
4	Direct bore well	SS-4
5	Irrigation bore well	SS-5

III. RESULT AND DISCUSSION

In Devarabelakere Village, Harihar Taluk, Davangere District, Karnataka State, India, surface and subsurface quality physicochemical parameters were examined. The chemical properties of the surface water are listed in Physico-Table 6. The physicochemical characteristics of the subsurface water in Devarabelakere Village are displayed in Table 7.

Table 6: Physico-chemical properties of surface water

Parameter	S-11	S-12	S-13	S-21	S-22	S-23	S-31	S-32	S-33
pH (6.5-8)	8.3	8.4	8.3	8.2	8.5	8.5	8.2	8.1	8
Alkalinity (200 mg/l)	265	146	204	245	280	277	290	247	289
Total dissolved solids (ppm)	515	513	513	516	516	513	510	466	510
Total Hardness (300 mg/l)	128	132	108	104	108	112	120	100	128
Calcium (75 mg/l)	26	26.4	22	20	22	22	26	19.2	26
Magnesium (30 mg/l)	24.4	25.3	20.64	20.1	20.6	21.6	22.5	19.3	24.4
Chlorides (250 mg/l)	67.51	59.57	55.6	51.62	59.57	59.57	47.65	59.57	59.57

Table 7: Physico chemical properties of subsurface water

Parameter	SS-1	SS-2	SS-3	SS-4	SS-5
pH (6.5-8)	7.5	7.6	8	8.4	7.6
Alkalinity (200 mg/l)	578.4	372	446.4	432	372
Total dissolved solids (ppm)	1266	1220	920	950	1220
Total Hardness (100 mg/l)	294	300	230	208	300
Calcium (75 mg/l)	56	60	44	36	60
Magnesium (30 ppm)	57.12	57.6	44.64	41.28	57.6
Chlorides (250 mg/l)	119.14	158.86	99.28	103.25	158.86

Table 8: Calculation of the Surface Source WQI

K	1.667				
Parameter	Test Values (Tn)	Standard Values (Sn)	Wn= K/Sn	Qn = Tn/Sn *100	Wn*Qn
pH	7.8	8.5	0.196	19.6	3.842
Alkalinity	280	200	0.008	140	1.167
Total dissolved solids	516	500	0.003	103.3	0.345
Total Hardness	108	300	0.006	36	0.2
calcium	22	60	0.028	36.67	1.01
Magnesium	20.64	30	0.056	68.80	3.823
Chlorides	59.57	250	0.007	23.82	0.159
			ΣWn=0.237		ΣWn*Qn=8.402
WQI	34.803				

Table 9: Calculation of the sub-Surface Source WQI

K	1.667				
Parameter	Test Values(Tn)	Standard Values (Sn)	Wn= K/Sn	Qn = Tn/Sn *100	Wn*Qn
pH	8.4	8.5	0.196	19.61	3.846
Alkalinity	432	200	0.008	216	1.8
Total dissolved solids	950	500	0.003	190	0.633
Total Hardness	208	300	0.006	69.33	0.385
calcium	36	60	0.028	60	1.66
Magnesium	41.28	30	0.056	137.6	7.646
Chlorides	103.25	250	0.007	41.3	0.275
			ΣWn=0.303		ΣWn*Qn=16.254
WQI	53.579				

pH

Testing was done on the sample from Devarabelakere Village. Surface and groundwater samples are analyzed to ascertain the convergence of the parameters under investigation. Drinking water should have a pH between 6.5 and 8. In the research location, water samples were taken. have a pH range of 6.5 to8. The pH of all samples was, on average, within the desired level set by WHO and IS. As a result, because the surrounding water has no effect on the pH, there is no need to be concerned with pH.

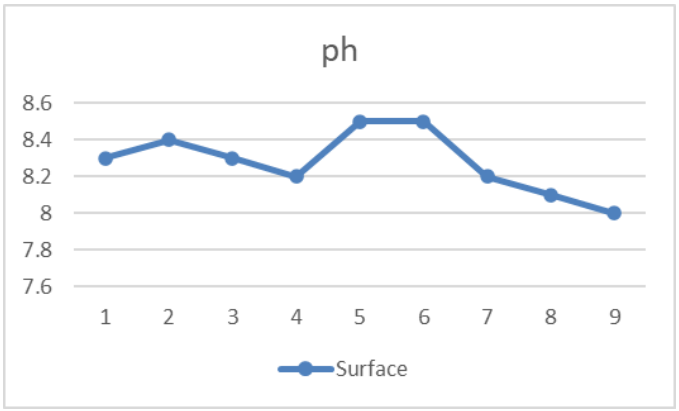

Fig 10. Variation of pH (surface water)

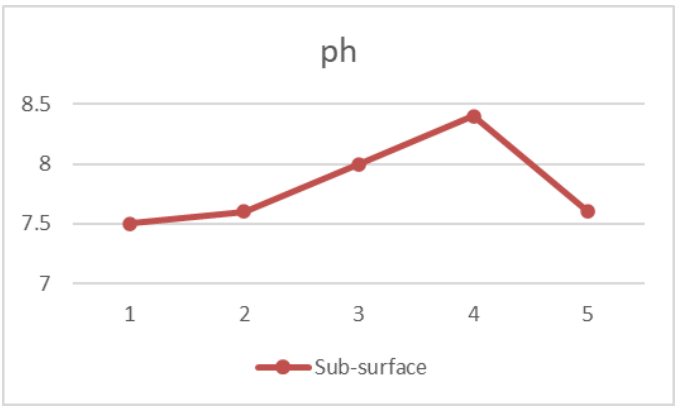

Fig 11. Variation of pH (subsurface water)

Total Alkalinity

Both the overall surface alkalinity and the subsurface alkalinity were modest. For domestic use, water with an alkalinity of less than 200 mg/l is safe. The current investigation's data, which range from 0 to 200 mg/l, show that alkalinity treatment is necessary.

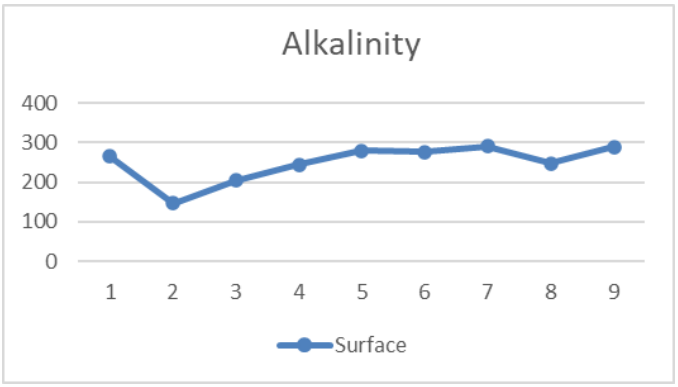

Fig 12. Variation of alkalinity (surface water)

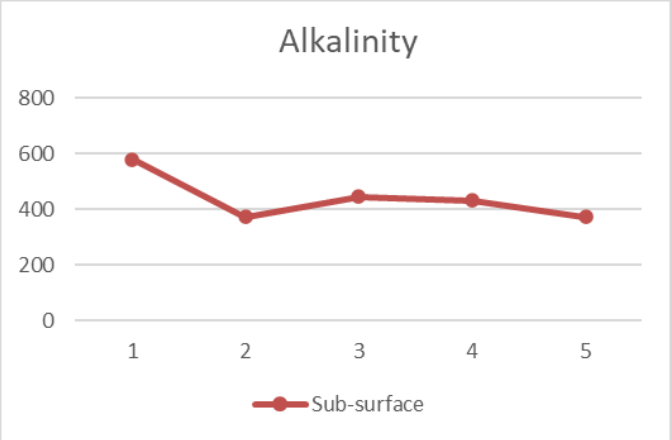

Fig 13. Variation of alkalinity (subsurface water)

Total Hardness

Surface samples had total hardness readings between 0-300 mg/l., but exceeds 0-300 mg/l in subsurface samples, indicating that the water required temporary treatment. There are no known negative health risks associated with hardness. However, the agreed limit value for drinking water is 300 mg/l. According to the findings, all surface samples were relatively soft, and beneath water needed treatment. As a result, The total hardness is not greatly impacted by the local water.

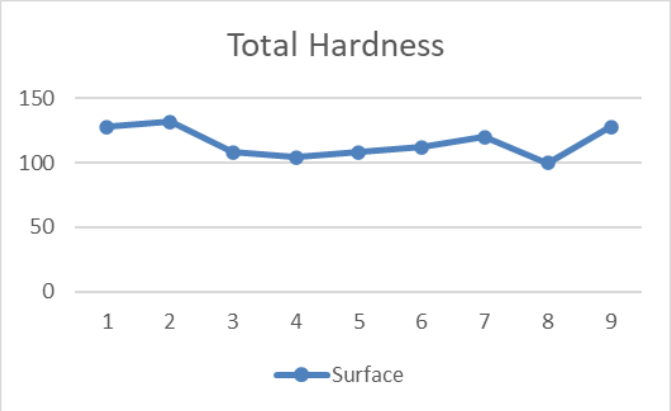

Fig 14. Variation Of total hardness (surface water)

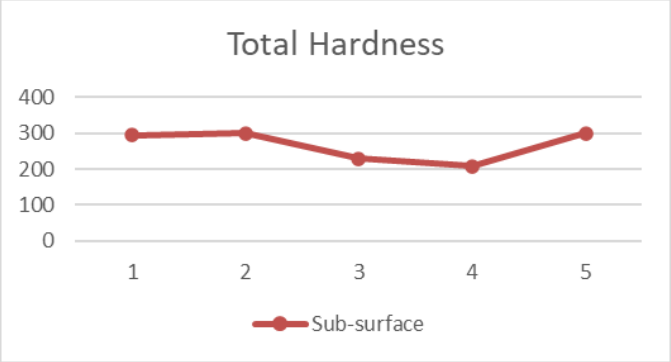

Fig 15. Variation Of total hardness (subsurface water)

Total dissolved solids

In surface samples, the dissolved solids are within limits, but they are greater in subterranean samples. Total dissolved solids range with in 500-900ppm. However the dissolved solids do not have any effect, but to sub-surface less amount of treatment is required.

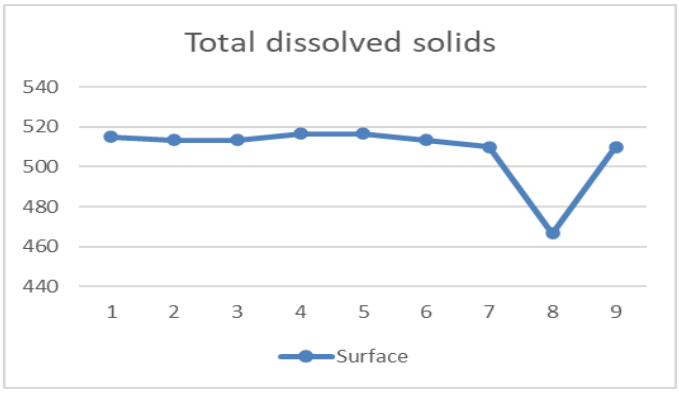

Fig 16. Variation of Total Dissolved Solids (Surface Water)

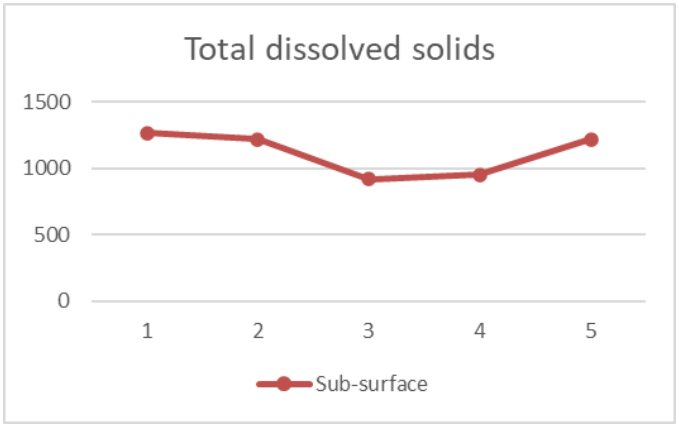

Fig 17. Variation Of Total Dissolved Solids (Subsurface Water)

Calcium

The calcium in surface and sub-surface are within the limit. Calcium ranges within 60 to120 mg/l. so there is no treatment is required.

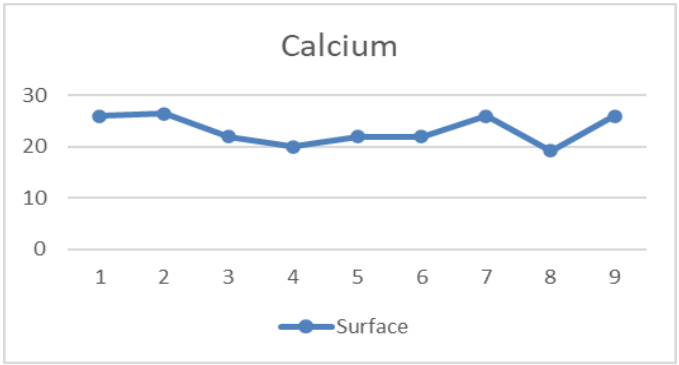

Fig 18. Variation of calcium (surface water)

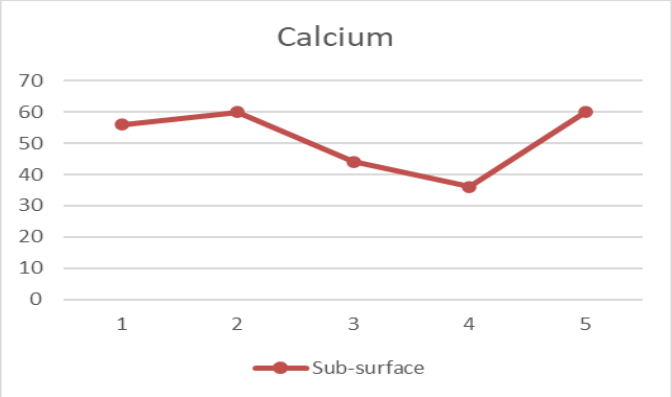

Fig 19. Variation of calcium (subsurface water)

Magnesium

The both surface and subsurface samples some are within the desired limit and some samples are not within the desired limit. Magnesium ranges from 25-50ppm. Small amount of magnesium does not cause any harmful effect.

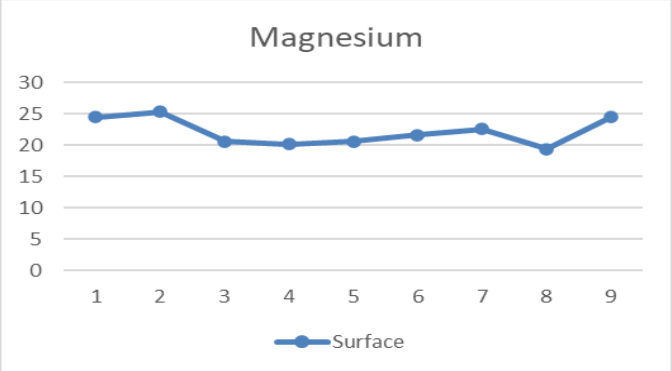

Fig 20. Variation Of magnesium (Surface Water)

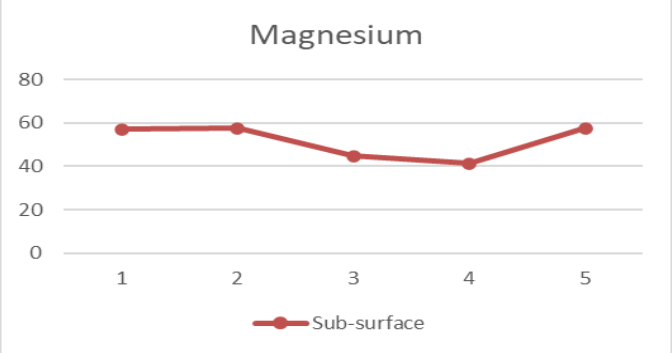

Fig 21. Variation of magnesium (subsurface water)

Chlorides

Both surface and surface samples are within the chloride limit. Chloride should be within 250mg/l.

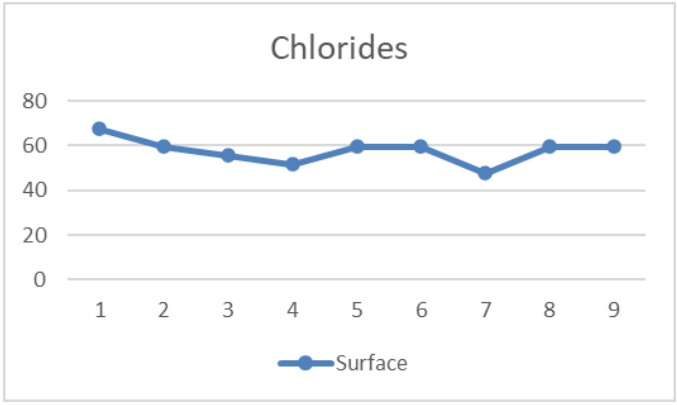

Fig 22. Variation Of chlorides (Surface Water)

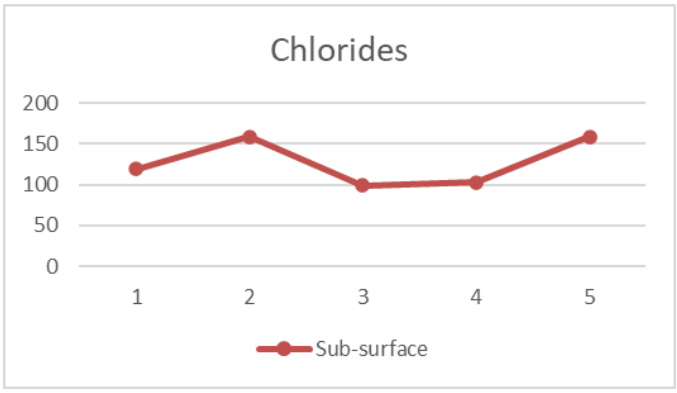

Fig 23. Variation of chlorides (subsurface water)

Water Quality Index

The WQI values for subsurface water (between 51 and 75) and surface water (between 26 and 50).

Table 24. Range of the Water Quality Index, its condition, and potential applications of the water sample.

The WQI Range	condition of the water	Prospective uses
0-25	Excellent	Drinking water, irrigation and industrial purpose
26-50	Good	Drinking water, irrigation and industrial
51-75	Bad	irrigation purpose and industrial purpose
76-100	Very Bad	Irrigation purpose
100 & above	Unfit for consumption	Before use, proper treatment is essential.

IV. CONCLUSION

In the settlement of Devarabelakere, water samples were taken from a number of surface and subsurface samples that were used for drinking and irrigation and examined and analyzed for various parameters. Based on the results obtained, the following conclusion can be drawn:

- The physio-chemical Surface water is determined to have favorable qualities, as compared with standard values.
- Some physio-chemical parameters of subsurface water find themselves to be above the standard limit.
- The WQI shows that the obtained surface WQI value has good water quality. The surface water is therefore suitable for agriculture and drinking.
- The WQI shows that the obtained subsurface WQI value has low water quality. Subsurface water must therefore be treated before being disposed of.

Overall, according to the laboratory results, the surface water in Devarabelakere village is adequate for drinking, irrigation, and industrial purposes without treatment, however the subsurface water test results indicate that treatment is required before discharge.

REFERENCES

[1] Ambiga Kannapiran, E. Balaji (2017)," Groundwater quality assessment using correlation and regression Model in Tirupati", IJCRGG, Volume 10 NO.7, PP 218-227.

[2] Shiv Kumar Jaiswal , Soraya Bouslah, Lakhdar Djemili, Larbi Houichi (2017) "study on River Ganges, to determine the Water Quality Index (WQI) of the monsoon season water sample the main objective is to analyse the differences in River Ganges at different Ghats in Patna city", IJETST-Vol.04, Issue 08, Pages 5549-5555

[3] Putaka Ramesh, E. Balaji (2016) "Analysis of Physico-Chemical Characteristics of Industrial Effluents in Tirupati", Journal of Research in Environmental and Earth Science, Volume 2~ Issue 9 (2016) pp: 01-06.

[4] Adimasu Woldesenbet Worako, Colonel Daniel Riviere (2015), "study on physicochemical and biological water quality suitability for multiple purposes of Lake Hawassa and to find out the tropic state index of the lake", Journal of Research in Environmental and Earth Science. vol. 9, n 2, p. 146-157.

[5] Ansari and Hemke, S.v. dorairaju (2013), "to determine the suitability of ground water of different zones in Chandrapur city by analyzing the Water Quality Index (WQI)", International Journal of Recent Trends in Science and Technology, ISSN 2277-2812 E-ISSN 2249-8109, Volume 4, Issue 3, 2012 pp 120-124.

[6] R. Usha, A. Vasavi, Spoorthi (2011), "The Physico-Chemical and Bacteriological Analysis of Ground Water in Around Tirupati", Journal of Research in Environmental and Earth Science.