ISSN: 2633-4828 Vol. 3 No.1, June, 2021

International Journal of Applied Engineering & Technology

SPATIAL ANALYSIS OF FLUORIDE QUALITY IN PARTS OF THE RAICHUR TALUKA, RAICHUR DISTRICT, KARNATAKA STATE, USING GIS TECHNIQUES

Devendra Hanche[1], Siddangowda[2] and Sridhara MK[3]

[1,2]Assistant Proffesor, Department of Civil Engineering Government Engineering College Raichur India

[3]Assistant Professor, Government SKSJTI Bangalore

ABSTRACT

The major objective of the present study was to find out the vulnerable bore well water in terms of fluoride contamination. A total of 60 groundwater samples were collected from major drinking water sources in Raichur Taluk Raichur District and studied with reference to the distribution and hydro- geochemistry of fluoride. Fluoride ion exhibits single properties compared to other physico-chemical parameters as its concentration in optimum dose in drinking water is advantageous to health and if the concentration exceeds the limit, affects the health. Ground water is the major natural source of water in drought prone areas. In this present study area, the 60 bore well samples collected in villages of Raichur Taluka, Raichur District where fluorosis is reported heavily. Physic- chemical analysis of Thirteen parameters were analyzed, Fluoride quality ranging between 0.51-2.26mg/ltr were obtained in the study area. Thematic maps were generated using ARC GIS software techniques. The ground water present in these bore wells require treatment before the usage for drinking, agriculture or other purposes.

Keywords: - Ground Water, Physico-Chemical Characteristics, Water Quality, GIS, Thematic Maps.

I.INTRODUCTION

Ground water is the important source for potable purpose in rural areas. But obtaining in potable state is very unlikely due to the fact that different materials can dissolve in water easily. Hence there is a need to watch over the extent of pollution in ground water. Excess fluoride intake causes various physiological disorders in humans (Sahoo.et.Al.2003; Maiti.et.Al.2004) whereas permissible limit of fluoride in water kills bacteria. Hence there is an important need to monitor the status of fluoride. Therefore, it is necessary to maintain the quality of groundwater at regular intervals to observe the suitability of ground water for consumption or other purpose. This study aims to reduce the fluoride concentration in Raichur taluka.

A. Experimental Work

Present study comprises of interpretation and analysis of ground water samples collected from sixty different locations at all over Raichur taluk (Table 1). In our study, first we mark the sampling locations, then stations were established and groundwater samples were collected. The samples were analyzed for fluoride concentration and results were carefully studied and analyzed. The present study provides a detailed description of the fluoride level in groundwater. sixty representative ground water samples were collected.

B. Collection and Analytical procedure for Samples:

Ground water samples were collected in plastic bottles, which were previously thoroughly washed with tap water and rinsed with double distilled water. Groundwater level in the wells is documented and pH of groundwater samples is measured in the field using a handy pH meter. In the present study bore well water samples are collected after pumping the water for 10 min. Samples collected are transported to the laboratory and filtered using 0.45- µm Millipore filter paper. The fluoride concentration of groundwater samples is determined using Specific Ion Electrode method (APHA, 1998).

II.DESCRIPTION OF STUDY AREA

Raichur district is covering five talukas i.e., Devadurga, Lingasugur, Manvi, Raichur and Sindhanur Figure 1), Raichur headquarter Population 1,924,773 (As per 2011 census) Population 228 per sq. km density Literacy rate 60.46% Major Industrial 4 Industrial Estates & 4 Industrial Areas Infrastructure. The district on the whole has a dry climate, the period from November to May being the driest part of the year. Even during the southwest

monsoon period, the humidity is not very high. Rainfall: Generally, Rain is observed between June to December. The rainfall in the district occurs from South- West monsoon extends from June to September and ranges from 998.2 to 594.30 mm. An average of 59 rainy days registered during1901 to 1970, with the rainfall contribution of about 64.9% from South-West monsoon and by North-East monsoon 35.1%. The yearly normal rainfall of 772 mm recorded during 1971- 2000 and is about 600 mm in the NE region of the district Temperature 45˚C (Max.) 18˚C (Min.) Geographical 16˚34'North latitude location 77˚35 ' East longitude.

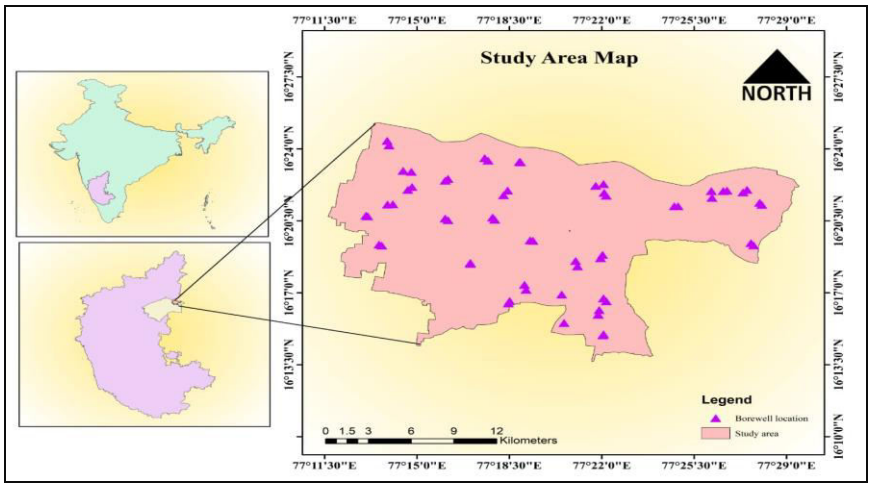

Figure 1. Study Area

Sample Locations

Table 1. Groundwater sampling locations of Raichur taluk

Sl. No.	Sample Stations	Sl. No	Sample Stations	Sl. No.	Sample Stations	Sl. No	Sample Stations
1	Timarpur	16	IbhraimDoddi	31	Kuknoor	46	Hegasanahalli
2	H.Timmapur	17	Sagamgunta	32	Kuknoor	47	Bevin Benchi
3	Karekal	18	Sagamgunta	33	Yegnoor	48	Bevin Benchi
4	Karekal	19	Yargunta	34	Yegnoor	49	Hanumapur
5	Rangapur	20	Yargunta	35	Dand	50	Hanumapur
6	Rangapur	21	Ramagaddi	36	Dand	51	Deosugur
7	Mirapur	22	Ramagaddi	37	Marched	52	Hegasanahalli
8	Mirapur	23	IbhraimDoddi	38	Marched	53	Deosugur
9	Kadlur	24	Sagamgunta	39	Wadloor	54	Koratkonda
10	Kadlur	25	Sagamgunta	40	Wadloor	55	Koratkonda
11	Hembral	26	Yargunta	41	Naglapoor	56	Kurvihal
12	Hembral	27	Yargunta	42	Naglapoor	57	Kurvihal
13	Shrinivaspur	28	Ramagaddi	43	Yadlapoor	58	Mamadadoddi
14	Shrinivaspur	29	Ramagaddi	44	Yadlapoor	59	Mamadadoddi
15	Arshanagi	30	Potgal	45	Hegasanahalli	60	Ganjalli

III. RESULTS AND DISCUSSIONS

In the Raichur Taluka as per the Zilla Panchayat Water Supply Department Water Quality reports, a survey was conducted on fluoride affected villages. Finally, 30 fluoride affected villages are selected, in each village 2 Bore well samples are collected. Total thirteen Physico-chemical parameters (Table 2) along with fluoride analysed(Figure 2).

Table 2. Physico-chemical variables of different sites of study area

Sample no	Atm Temp	pH	Ca	TH	TA	F^-	Cl^-	NO^-_3	Fe^{2+}	Sulphate	Phosphate	Zn	Chromium
1	35.23	7.5	323.22	525	450	1.92	320.83	45.12	0.211	99.56	0.41	0.54	0.052
2	34.23	8	286.36	475	490	1.71	290.79	40.12	0.265	100.23	0.45	1.11	0.023
3	33.23	6.5	286.53	640	480	0.7	890.82	50.23	0.294	122.23	0.65	0.13	0.021
4	31.23	6.5	278.56	720	360	0.82	294.86	43.12	0.214	130.23	0.45	1.26	0.011
5	32.23	7	196.36	700	300	0.81	590.64	51.23	0.245	145.23	0.78	1.56	0.041
6	31.23	6.5	175.23	510	380	2.26	580.94	36.12	0.263	148.23	0.62	1.26	0.021
7	30.23	7	196.56	420	340	1.81	610.67	42.15	0.245	112.23	0.75	0.25	BDL
8	32.23	6.5	184.52	750	480	1.6	1250.67	51.1	0.312	118.23	0.46	1.26	0.041
9	31.02	7	389.63	320	580	1.48	180.46	52.32	0.213	125.36	0.52	0.25	0.026
10	31.23	8	269.53	380	570	1.51	230.97	51.42	0.501	114.25	0.62	0.87	0.021
11	33.56	8	301.23	220	430	1.83	384.32	53.12	0.321	145.63	0.75	1.27	0.045
12	32.52	8.5	286.95	180	570	1.35	282.67	53.45	0.365	151.23	0.54	0.23	0.041
13	30.23	6.5	289.56	400	450	0.8	290.48	51.23	0.245	125.23	0.56	1.89	0.012
14	31.23	6.5	278.56	450	440	0.82	380.42	41.23	0.326	129.23	0.65	1.49	0.032
15	30.21	6.5	196.56	480	310	0.91	580.68	33.23	0.421	142.23	0.71	1.25	0
16	30.52	8	185.23	208	680	1.25	280.78	22.15	0.415	148.25	0.45	0.24	0
17	32.12	8.5	298.65	160	620	1.4	69.82	51.32	0.521	110.23	0.35	1.29	0
18	32.14	8.5	245.23	148	655	1.38	75.88	41.23	0.326	98.56	0.62	1.42	0.032
19	30.63	8	269.56	480	800	0.92	474.69	53.12	0.321	91.23	0.51	1.22	0.014
20	30.41	7	265.53	362	610	0.65	386.72	41.26	0.289	98.62	0.42	1.03	0.015
21	32.12	7.5	256.89	162	410	1.58	598.63	51.23	0.245	84.56	0.44	1.62	0.032
22	31.23	7.5	289.89	242	520	1.34	492.86	56.12	0.265	85.26	0.43	0.64	0.041
23	30.29	7.5	287.56	380	600	0.96	310.64	53.12	0.214	124.56	0.49	0.45	0.014
24	30.12	7	296.56	480	650	0.72	482.16	51.23	0.236	120.23	0.39	0.25	0.041
25	32.33	7.5	301.23	600	410	0.84	690.86	53.12	0.284	119.52	0.61	0.52	0.025
26	31.86	7.5	295.56	550	550	0.68	510.12	50.62	0.245	117.23	0.51	0.66	0.045
27	31.11	7.5	205.23	180	510	0.64	78.17	45.12	0.236	162.23	0.53	0.33	0.062
28	31.52	7	225.56	570	770	0.73	340.18	51.23	0.245	158.12	0.51	0.78	0.012
29	30.26	7.5	158.86	600	555	0.79	342.27	50.21	0.215	145.26	0.58	0.23	0.042
30	30.33	7	165.23	580	490	0.65	735.19	51.02	0.236	142.23	0.52	0.13	0.013
31	31.23	7.5	178.56	500	475	0.85	583.61	41.32	0.289	123.25	0.49	0.23	0.114
32	33.23	7	205.45	380	300	0.71	152.92	51.85	0.245	124.53	0.48	0.63	0.032
33	32.52	7	296.56	420	310	0.75	381.16	51.65	0.321	114.23	0.47	0.85	0.036
34	31.02	7.5	301.23	350	320	0.71	478.12	53.65	0.261	116.23	0.71	0.27	0.024
35	31.44	7	341.23	800	380	2.12	894.18	50.62	0.412	178.25	0.46	0.24	0.026
36	30.23	7	378.56	210	245	0.69	180.18	32.25	0.521	181.23	0.52	0.45	0.021
37	30.45	6.5	265.36	425	270	0.94	674.93	58.45	0.369	174.25	0.51	0.41	0.036
38	31.25	7	389.1	1250	380	0.78	1210.73	46.65	0.412	170.96	0.5	1.24	0.052
39	32.01	7.5	278.45	535	220	0.54	183.42	59.12	0.364	145.56	0.39	1.89	0.058
40	33.23	6.5	265.53	450	980	1.51	1249.78	51.37	0.321	149.21	0.61	0.26	0.021
41	32.52	7	265.41	200	230	0.86	58.13	52.68	0.258	152.23	0.64	0.53	0.036
42	30.12	6.5	301.23	450	170	0.82	188.83	32.41	0.265	148.23	0.52	0.46	0.012
43	31.52	7	326.54	450	200	0.93	187.68	34.12	0.241	112.36	0.54	0.58	0.011
44	31.25	7	296.45	350	250	1.3	267.83	43.65	0.295	112.56	0.53	0.75	0.055
45	31.24	7	305.26	625	210	0.69	592.18	35.42	0.278	147.52	0.54	0.85	0.012
46	30.14	7.5	296.56	410	320	0.74	482.29	51.62	0.236	138.52	0.74	0.96	0.011
47	30.52	7.5	295.48	125	510	1.78	98.78	51.68	0.312	123.23	0.48	0.26	0.023
48	32.32	8	245.56	80	400	0.72	89.61	41.62	0.325	131.2	0.49	0.86	0.051
49	31.56	7.5	186.56	215	410	0.78	168.72	31.86	0.254	114.25	0.43	1.03	0.061
50	31.25	7.5	189.56	225	490	0.82	525.16	35.67	0.264	115.25	0.37	1.22	0.012
51	31.26	7.5	178.56	250	310	1.59	184.78	45.65	0.145	185.52	0.64	0.86	0.013
52	30.42	7	184.56	180	290	1.42	0	58.12	0.125	179.25	0.35	0.95	0.026
53	31.52	7.5	124.56	350	320	1.38	169.73	45.62	0.325	174.21	0.52	0.65	0.038

54	30.12	8	121.23	430	315	1.36	0	51.68	0.256	172.23	0.53	0.46	0.014
55	30.12	8.5	115.56	175	410	1.28	74.81	35.26	0.265	156.23	0.35	0.37	0.016
56	31.23	7	138.56	210	315	1.32	197.83	42.12	0.248	85.56	0.45	1.24	0.012
57	31.45	8	124.56	270	415	0.71	26.73	22.32	0	84.25	0.62	1.63	0.013
58	31.51	7.5	105.56	70	295	0.93	280.82	58.12	0	84.71	0.45	0.56	0.052
59	30.12	6.5	389.56	1200	285	0.62	780.72	51.63	0.1	86.23	0.52	0.44	0.051
60	31.23	8	394.56	675	350	0.72	380.83	26.45	0.3	75.56	0.41	0.22	0.021

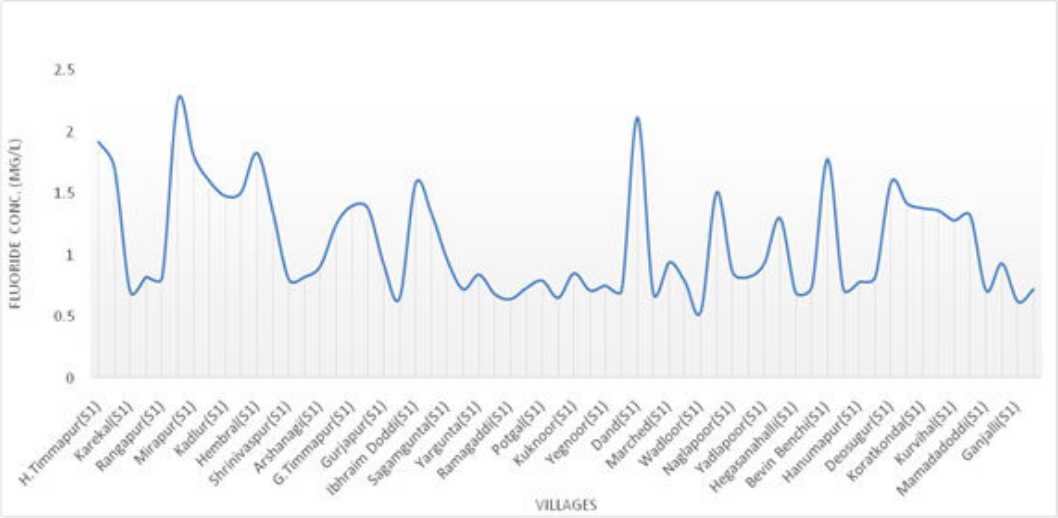

Figure2. Fluoride concentration

Analysis of Variance (ANOVA).

Table 3. ANOVA Results for Physico-Chemical Variables of Ground Water ofDifferent Sites of Study Area

		Sum of Squares	df	Mean Square	F	Sig.
pH	Between Groups	10.235	34	.301	.808	.722
	Within Groups	9.310	25	.372		
	Total	19.546	59			
Calcium	Between Groups	142389.819	34	4187.936	.587	.926
	Within Groups	178286.393	25	7131.456		
	Total	320676.212	59			
TH	Between Groups	1664426.892	34	48953.732	.774	.759
	Within Groups	1580186.042	25	63207.442		
	Total	3244612.933	59			
TA	Between Groups	703313.750	34	20685.699	.634	.892
	Within Groups	815390.833	25	32615.633		
	Total	1518704.583	59			
F	Between Groups	6.158	34	.181	.923	.591
	Within Groups	4.903	25	.196		
	Total	11.061	59			
Cl	Between Groups	2878487.512	34	84661.397	.935	.579
	Within Groups	2264561.267	25	90582.451		
	Total	5143048.779	59			
NO_3	Between Groups	2899.933	34	85.292	1.196	.324
	Within Groups	1782.299	25	71.292		

	Total	4682.232	59			
Fe_2	Between Groups	.357	34	.011	1.335	.229
	Within Groups	.197	25	.008		
	Total	.554	59			
Sulphate	Between Groups	29109.119	34	856.151	1.141	.371
	Within Groups	18764.152	25	750.566		
	Total	47873.271	59			
Phosphate	Between Groups	.412	34	.012	1.233	.297
	Within Groups	.246	25	.010		
	Total	.658	59			
Zn	Between Groups	9.715	34	.286	1.814	.063
	Within Groups	3.937	25	.157		
	Total	13.652	59			
chromium	Between Groups	.011	34	.000	.706	.830
	Within Groups	.012	25	.000		
	Total	.023	59			

The above-mentioned data in Table 3 explains about significance relation of the different variables of water quality of different sampling stations of the study area. Among the 12 variables of the study, all variablesexhibit a significant value among the other parameters of the groundwater (level 0.05)

Correlation Analysis

Table 4. Pearson Correlation among Physico-chemical variables of different sites of study area

		Temp	pH	Calcium	Total hardness	Total Alkalinity	F	Cl	NO_3	Fe^{2+}	Sulphate	Phosphate	Zn	chromium
Temperature	PC	1												
	Sig													
	N	60												
pH	PC	0.159	1											
	Sig	0.224												
	N	60	60											
Calcium	PC	0.128	-0.156	1										
	Sig	0.328	0.235											
	N	60	60	60										
Total Hardness	PC	-0.026	-.457**	.373**	1									
	Sig	0.842	0	0.003										
	N	60	60	60	60									
Total Alkalinity	PC	0.112	.257*	-0.001	-0.091	1								
	Sig	0.396	0.047	0.996	0.489									
	N	60	60	60	60	60								

F	PC	.265*	0.154	-0.088	-0.186	0.141	1							
	Sig	0.041	0.239	0.504	0.154	0.283								
	N	60	60	60	60	60	60							
Cl	PC	0.098	-.474**	0.225	.666**	0.189	0.04	1						
	Sig	0.457	0	0.084	0	0.147	0.759							
	N	60	60	60	60	60	60	60						
NO_3	PC	0.135	-0.093	0.119	0.076	0.117	0.072	0.184	1					
	Sig	0.304	0.477	0.365	0.561	0.375	0.587	0.158						
	N	60	60	60	60	60	60	60	60					
Fe_2	PC	0.045	0.114	.333**	0.021	0.158	0.131	0.146	-0.058	1				
	Sig	0.732	0.386	0.009	0.872	0.227	0.318	0.264	0.658					
	N	60	60	60	60	60	60	60	60	60				
Sulphate	PC	-0.191	-0.172	-0.12	0.055	-0.164	0.072	0.008	0.098	.280*	1			
	Sig	0.144	0.188	0.361	0.679	0.211	0.583	0.95	0.457	0.03				
	N	60	60	60	60	60	60	60	60	60	60			
Phosphate	PC	0.022	-0.174	-0.012	0.096	-0.11	0.017	0.181	0.034	-0.015	0.155	1		
	Sig	0.869	0.183	0.93	0.464	0.404	0.896	0.166	0.796	0.907	0.238			
	N	60	60	60	60	60	60	60	60	60	60	60		
Zn	PC	0.147	-0.011	-0.106	-0.019	-0.101	-0.013	-0.08	-0.053	0.014	-0.183	0.048	1	
	Sig	0.262	0.936	0.419	0.883	0.444	0.919	0.544	0.685	0.918	0.162	0.716		
	N	60	60	60	60	60	60	60	60	60	60	60	60	
Chromium	PC	.273*	0.046	0.023	0.104	-0.084	-0.122	0.089	0.24	-0.094	-0.037	-0.129	-0.076	1
	Sig	0.035	0.728	0.862	0.43	0.521	0.355	0.497	0.065	0.477	0.776	0.325	0.561	
	N	60	60	60	60	60	60	60	60	60	60	60	60	
*. Correlation is significant at the 0.05 level (2-tailed).														
**. Correlation is significant at the 0.01 level (2-tailed).														

To examine the relationship of Fluoride content with other chemical variables of ground water samples, correlation matrix was conducted for ground water sample (Table 4). The study results indicate that, excellent correlation was noticed between total hardness and calcium, Fe, phosphate and sulphate. While fluoride was exhibited with negative correlation with pH, total alkalinity and total hardness and other variables of ground water. This could be due to the concentration of dissolved solids and similar observation was made by several authors from different study areas.

Principal Component Analysis

Principal component analysis was done with defence to the different chemical variables of the ground water samples of the study area and the results are presented in graph (Figure 3)

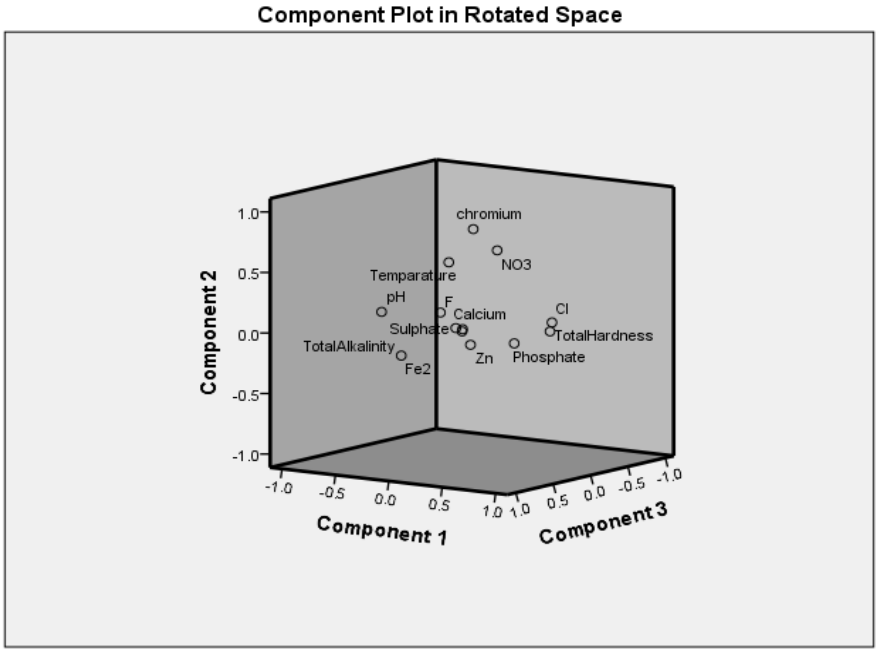

Figure 3. Principal component analysis of different water parameters

The above results indicate to emphasise the concentration of different chemical variables of the water samples of the study area and the distribution of different variables with reference to the variation in their concentration with special reference to the fluoride content. The above graph explains the correlation and significant among the different variables like pH, Total Hardness and Calcium. These parameters are exhibited significant relation with other chemical substances of water samples of the study area.

Spatial distribution of chemical parameters and ground water quality of ground water samples of the study area

The spatial distribution of fluoride concentration among the sampling stations of the study area is presented in the Figure4. The satellite map explains that there is distinct NE-SE and SW running linear trend in the southern part and northern part of the study area. These liner trends match with a lineament observed in the map with an alignment of sampling site. This would be following the anti-clinical axis as younger geological formations. The southern part of study area has high level of fluoride concentration and the high concentration of fluoride content in the ground water may be connected with acidic to alkaline water influenced by pH distribution. The depletion of ground water and depth of the water also influence on concentration of fluoride content in the water samples. The water quality index (Table 5) indicates that, water quality is good in northeast and southwest region as shown in Figure5. While west region of the study area has more index values which clearly state that, quality of water is not good for drinking purpose.

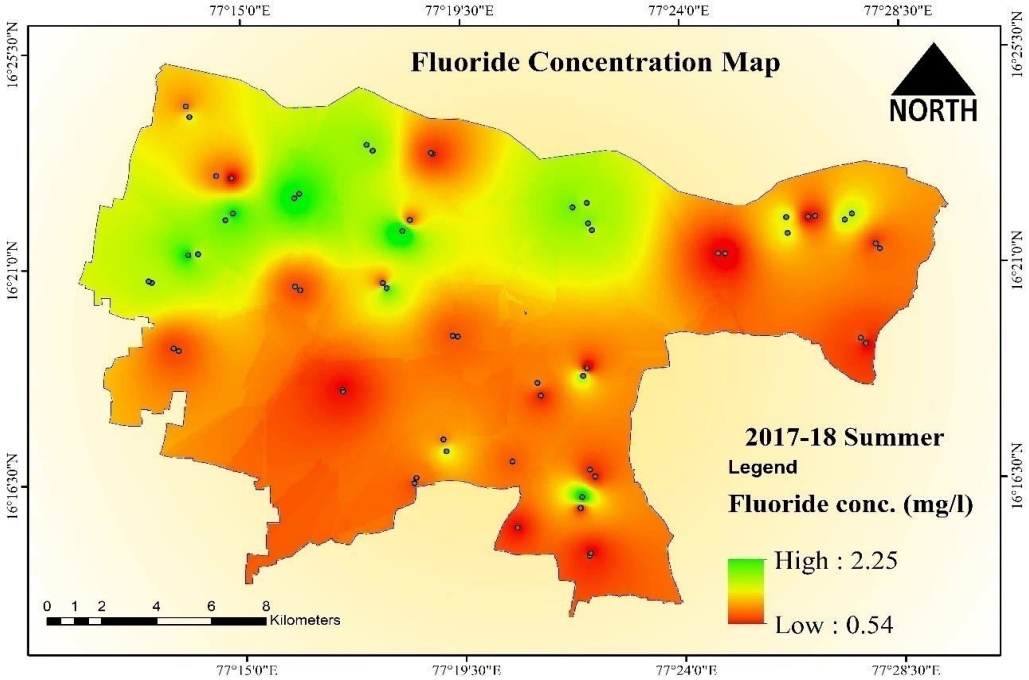

Figure 4. Fluoride concentration

Water Quality Index.

Table 5. Water Quality Index of different Stations

Sample No	Lat	Long	WQI	Sample no	Lat	Long	WQI
S1	16.3743	77.2679	64.25289478	S31	16.282	77.3414	75.29811772
S2	16.3758	77.2696	89.64465641	S32	16.259	77.3429	73.33083282
S3	16.3892	77.3154	74.95212855	S33	16.2789	77.3678	96.50253076
S4	16.3896	77.3148	80.69317903	S34	16.2765	77.3696	69.97952541
S5	16.3663	77.3073	94.10509002	S35	16.2694	77.3651	105.0851097
S6	16.3625	77.3047	91.76859831	S36	16.2656	77.3645	134.6876445
S7	16.3692	77.2469	65.0161624	S37	16.2767	77.3085	98.50641692
S8	16.3669	77.2443	103.8832412	S38	16.2748	77.3078	127.5937362
S9	16.3905	77.2949	58.25382687	S39	16.3142	77.3672	129.837732
S10	16.3926	77.2928	139.9330931	S40	16.3115	77.3659	84.40301793
S11	16.3549	77.2314	106.4293357	S41	16.3256	77.3232	74.27210893
S12	16.3552	77.2348	94.17963048	S42	16.3259	77.3215	74.77652298
S13	16.3423	77.2696	101.8669305	S43	16.2899	77.3179	71.54801102
S14	16.3436	77.2678	112.0262746	S44	16.2858	77.3189	87.98854703
S15	16.4066	77.2312	128.7265332	S45	16.3076	77.2837	86.39048067
S16	16.4029	77.2324	105.1942161	S46	16.3069	77.2838	79.30155009
S17	16.3454	77.2189	154.1869919	S47	16.3427	77.2991	81.57614466
S18	16.3459	77.2178	110.8599472	S48	16.3445	77.2978	97.81170354

S19	16.3823	77.2413	105.5440925
S20	16.3815	77.2465	92.83284215
S21	16.3645	77.3682	95.73198625
S22	16.3621	77.3695	79.09177997
S23	16.3092	77.3502	62.93822154
S24	16.3048	77.3514	63.52620009
S25	16.3237	77.4609	81.14781812
S26	16.3218	77.4626	74.99104393
S27	16.3659	77.4434	64.86631576
S28	16.3662	77.4458	77.1350352
S29	16.2489	77.3674	57.92665177
S30	16.2498	77.3678	60.45172546

S49	16.3225	77.2261	84.28410627
S50	16.3216	77.2278	91.04303332
S51	16.3701	77.3629	55.00970058
S52	16.3716	77.3678	51.99145316
S53	16.3669	77.4584	92.58919911
S54	16.3648	77.4559	72.53043461
S55	16.3604	77.4363	72.73838342
S56	16.3659	77.4359	87.03292349
S57	16.3564	77.4664	37.69151045
S58	16.3547	77.4678	14.00782897
S59	16.3535	77.4149	36.66364586
S60	16.3536	77.4125	78.59026714

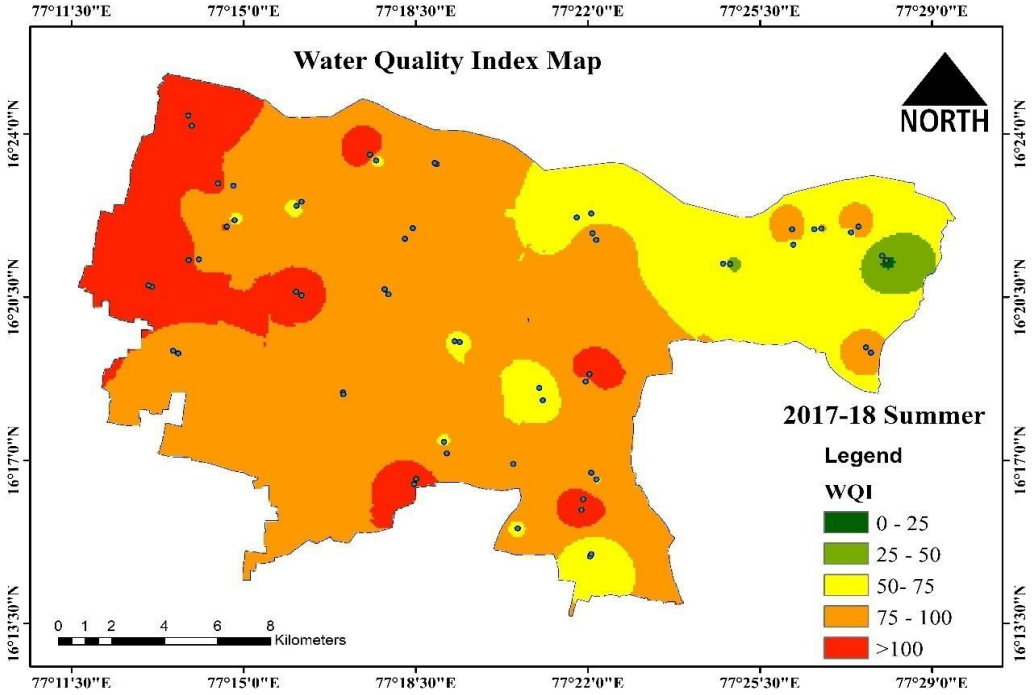

Figure 5. Water quality index

Spatial Autocorrelation (Global Moran's I)

Table 6. Spatial Auto correlation (Global Moran's I)

Parameters	Value
Moran's Index (MI)	0.346984
Expected Index (EI)	-0.016949
Variance	0.030307
z-score	2.090491
p-value	0.036574

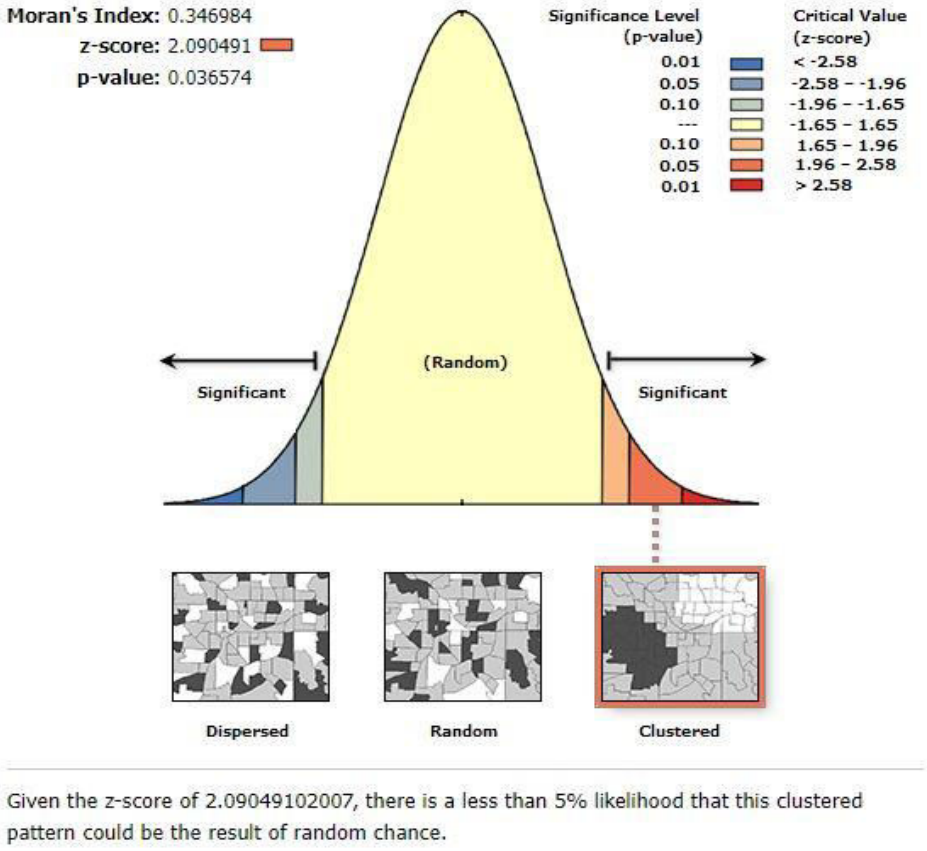

Figure 6. Spatial Autocorrelation (Global Moran's I)

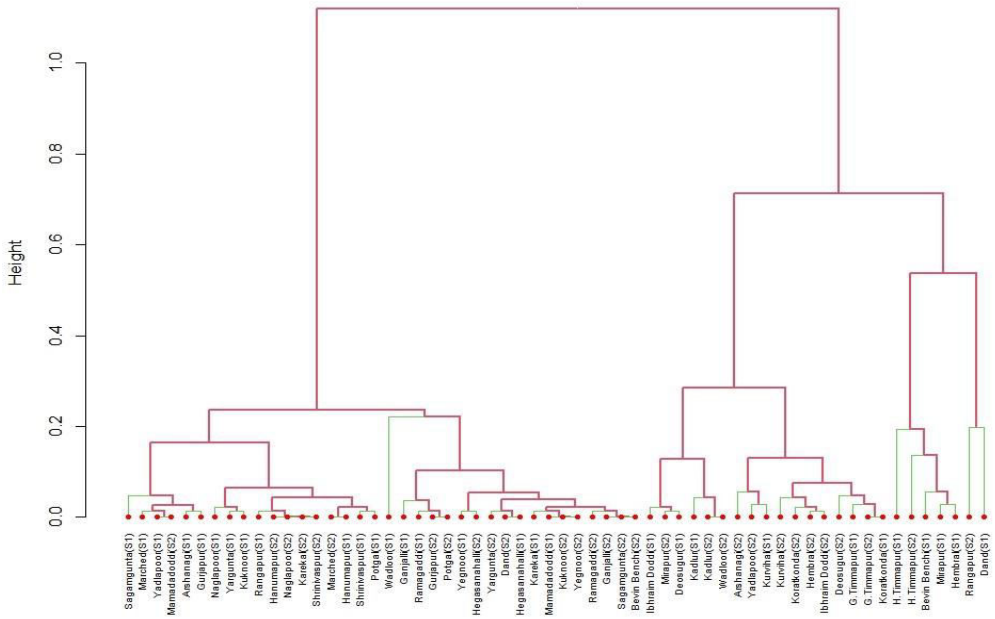

Figure 7. Dendrogram of different sampling stations of the study area

The above-mentioned Figure 7 explains about similarity and variation among the different sites of the study area. Among 60 sites of the study area majority of them are similar in their ground water chemistry and showing linkage relation between sampling stations.

The study conducted during the summer season in the study area revealed substantial variations in groundwater chemistry parameters across different sampling stations. The temperature ranged from 30.12°C to 31.30°C, pH values were between 6.50 and 8.50, and calcium concentrations varied from 105.56 mg/l to 394.56 mg/l. Total hardness ranged from 70.00 mg/l to 1250.00 mg/l, indicating hard water quality. Total alkalinity levels exceeded permissible limits, while fluoride concentrations were notably high compared to recommended standards. Chloride levels remained within acceptable limits, but the lowering of the water table during the summer season raised concerns. Nitrate concentrations fluctuated but generally remained within permissible limits. Iron (Fe+2) concentrations were acceptable, and sulphate levels met standards. Phosphate content adhered to recommended levels, and heavy metals (Zinc and Chromium) generally stayed within acceptable limits.

Correlation analysis uncovered intriguing relationships among these parameters. Spatially, fluoride concentration exhibited distinct trends, notably in the southern part of the study area.

IV. CONCLUSIONS

The main objective of the present study was to understand and analyse the quality of groundwater in and around Raichur Taluka, Raichur District, Karnataka. The study reveals that most of the samples are Alkaline and very hard in nature. From the studied available data, groundwater concentration is shown to be highly variable and variations are seen between different villages. The fluoride concentration in the groundwater was found to vary between 0.54 to 2.26 mg/L. Moreover, Majority of the samples do not comply with Indian as well as WHO standards for most of the water quality parameter. Overall water quality was found as unsatisfactory for drinking purpose without any prior treatment.

V.REFERENCES

[1]. APHA, AWWA, WEF. (1995) Standard methods for analysis of water and wastewater.20th Ed. American Public Health Association, Inc., Washington D C.

[2]. Bureau Indian Standards. (2012) Drinking Water Specification (Second Revision of IS 10500) [online]

[3]. Chaudhary, P., Dagaonkar, A. and Praveen, S. 2007. Physicochemical analysis of ground waters .

[4]. Hussain I, Hussain J, Sharma KC, Ojha KG. Fluoride in drinking water and health hazards: Some observations on fluoride distribution Rajasthan In Environmental Scenario of 21st Century. New Delhi 2002:355-74.'

[5]. World Health Organisation (WHO) Fluorides, World Health Organization (Environmental Health Criteria 227). 2002.

[6]. World Health Organization, 2011. Guidelines for Drinking-water Quality. fourth ed. (ISBN: 978 92 4 154815).