

STUDIES ON THE PHYSICO-CHEMICAL CHARACTERISTICS OF GROUNDWATER OF GURMITKAL TOWN AND MAPPING BY GIS METHOD

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Abstract - Studies of Physico-chemical parameters of groundwater quality based on Physico-chemical parameters at Gurmitkal town of Karnataka have been taken up to evaluate its suitability for domestic purpose. 17 groundwater samples were collected from different places of Gurmitkal town of Yadgir district. The quality analysis has been made through the pH, Chloride, Total hardness, Dissolved Oxygen, Calcium, Fluoride, Magnesium, Sulphate, and Alkalinity. A systematic calculation of the correlation coefficient has also been carried out between different analysed parameters. The sampling sites Gurmitkal town showed physicochemical parameters within the water quality standards and the quality of water is good and it is fit for drinking purpose. The correlation coefficients were calculated for water quality assessment.

Key Words: Groundwater, Municipal water, Drinking water, Dissolved Oxygen, Total Hardness, Calcium, Magnesium, Sulphate, Chloride, Alkalinity, Ph, Fluoride, Physicochemical characteristics.

1. INTRODUCTION

Water is extremely essential for survival of all living organisms. The quality of water is vital concern for mankind since it is directly linked with human welfare. In India, most of the population is dependent on groundwater as the only source of drinking water supply. The groundwater is believed to be comparatively much clean and free from pollution than surface water. But prolonged discharge of industrial effluents, domestic sewage and solid waste dump causes the groundwater to become polluted and created health problems¹. The problems of groundwater quality are much more acute in the areas which are densely populated, thickly industrialized and have shallow groundwater tables. The rapid growth of urban areas has further affected groundwater quality due to overexploitation of resources and improper waste disposal practices. Hence, there is always a need for and concern over the protection and management of groundwater quality.

Water plays vital role in human life. It is extremely essential for survival of all living organisms. Groundwater is ultimate, most suitable fresh water resource with nearly balanced concentration of the salts for human consumption. Over burden by means of population pressure, unplanned urbanization, unrestricted

exploration policies and dumping of the polluted water at inappropriate place enhance, the infiltration of harmful compounds to the groundwater (Pandey et al., 2008). The quality of water is of vital concern for the mankind since it is directly linked with human welfare. There are several states in India where more than 90% populations are dependent on groundwater for drinking and other purpose. The uncontrolled disposal of industrial and urban wastes and the use of chemical substances in agriculture (fertilizers, herbicides and pesticides) are the primary causes of groundwater contamination

1.1 Objectives

- To find out the Physico-Chemical characteristics of groundwater of Gurmitkal Town, Yadgir district.
- To compare the Physico-Chemical characteristics of groundwater samples with IS standards.
- To find the Water Quality Index (WQI) for obtained data.
- GIS mapping for obtained parameters.

2. MATERIALS AND METHODS

2.1 Study Area

The area of the town is 3.50 square kilometers (1.4 sq mi). As of the 2001 census there were four wards, but by the 2011 census there were 17 wards. As of 2001, the town panchayat had 46 km of roads of which 25 km were surfaced. As of 2011 India census, Gurmitkal has a population of 20,631, up from 16,927 in the 2001 census. Males constitute 50% of the population and females 50%. Gurmitkal has an average literacy rate of 50%, lower than the national average of 59.5% male literacy is 60%, and female literacy is 40%. 15% of the population is under 6 years of age. The location map is shown in Figure 2.1.1 and the ward wise map is shown in Figure 2.1.2.



Fig -2.1.1: Showing the Location of Gurmitkal Town

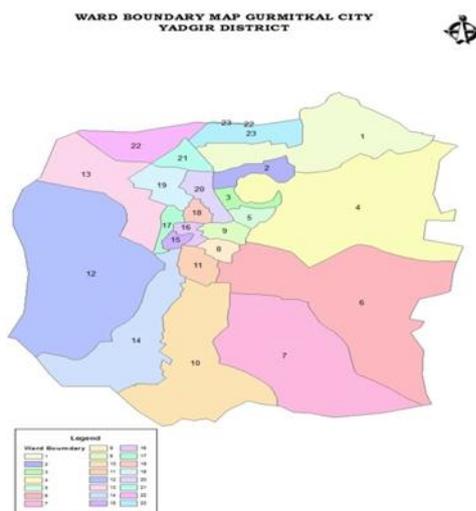


Fig -2.1.2: Ward Map of Gurmitkal Town

2.2 Sampling:

Water Samples were collected in Polythene bottles of 2.5 litres and 2.0 litres. The samples were collected from borewells as well as from deep handpumps at different wards. It was ensured that the concentrations of various water quality parameters do not changes in time that elapses between drawing of samples and the analysis in the laboratory.

3. RESULTS AND DISCUSSION

3.1 Physical and Chemical Examinations of Groundwater of Gurmitkal Town:

The detailed analyses of Physico-Chemical parameters mentioned are carried out as per the standard methods and the results are tabulated in table 1.

Table -1: Results of Physico-Chemical Analysis

WARD	Cl in mg/L	TH in mg/L	Ca in mg/L	Mg in mg/L	TOTAL ALKALINITY	SO4 in mg/L	pH	DO in mg/L	F in mg/L
1	232.16	621.67	455.67	166.00	88.00	44.86	7.49	7.34	0.76
2	274.35	737.87	395.67	342.20	88.00	52.38	7.43	6.45	0.83
3	387.25	728.00	459.00	269.00	89.67	50.86	6.93	7.08	0.80
4	320.23	702.67	461.33	241.33	103.00	46.43	7.21	6.85	0.83
5	215.53	652.20	344.00	308.20	77.33	37.45	7.24	6.36	0.79
6	77.98	488.67	192.00	296.67	93.00	17.76	7.32	6.80	0.79
7	76.98	489.67	203.33	286.33	96.33	17.68	7.33	6.63	0.81
8	104.97	473.33	257.00	216.33	85.67	16.04	7.20	7.26	0.80
9	199.01	520.33	100.00	420.33	101.00	18.73	7.21	6.66	0.79
10	168.78	482.67	115.00	367.67	90.67	31.66	7.24	6.38	0.78
11	419.87	616.67	185.67	431.00	103.67	35.38	7.28	6.73	0.78
12	379.38	493.67	175.33	318.33	118.33	35.31	7.09	6.68	0.70
13	353.72	434.67	150.33	284.33	118.00	29.52	6.77	6.54	0.79
14	270.42	450.33	159.67	290.67	96.00	32.74	6.81	6.72	0.78
15	260.75	455.67	138.00	317.67	97.67	27.59	6.83	6.81	0.80
16	258.59	448.33	118.67	329.67	104.33	19.58	6.91	7.03	0.78
17	191.44	447.00	100.33	346.67	87.33	18.80	6.84	6.38	0.79
MEAN	246.6	543.7	235.9	307.8	96.4	31.3	7.1	6.7	0.8
MAX	419.9	737.9	461.3	431.0	118.3	52.4	7.5	7.3	0.8
MIN	77.0	434.7	100.0	166.0	77.3	16.0	6.8	6.4	0.7
SD	104.83	107.41	133.15	66.44	10.96	12.20	0.23	0.30	0.03
% CV	42.52	19.75	56.43	21.59	11.37	38.94	3.25	4.38	3.65

Cl- Chloride in mg/l, TH – Total Hardness in mg/l, Ca – Calcium Hardness in mg/l, Mg – Magnesium Hardness in mg/l, So4- Sulfate in mg/l, F – fluoride in mg/l, DO – Dissolved Oxygen in mg/l, Max – Maximum, Min – Minimum, SD – Standard deviation, CV – Co-efficient of variation %.

3.2 Comparison of Physico-Chemical Characters with BIS Standards:

The detailed analysis of Physico-Chemical parameters is compared with BIS standards and is shown in below table2.

Table-2: Comparison of Average Physico-Chemical Parameter with BIS Standards

Parameter	Standards	Recommended Agency	Observed Values	Remarks
Cl	250-1000	BIS	246.6	Complying
TH	200-600	BIS	543.7	Complying
Ca	75-200	BIS	235.9	Slightly higher
Mg	30-100	BIS	307.8	higher
T Alk	200-600	BIS	96.4	Complying
SO4	200-400	BIS	31.3	Complying
pH	6.5-8.5	BIS	7.1	Complying
F	1-1.5	BIS	0.8	Complying

3.3 Water Quality Index (WQI):

The water quality index of the samples is found out to be 68.63 which lie in "B" grade, Hence water quality fall under good category.

Table-3: Water Quality Index of Groundwater of Gurmitkal Town

Parameter	IS	Ci	Si	wi	Wi=(wi/∑wi)	Qi=(Ci/Si)*100	SI=Wi*Qi
Cl	250-1000	246.6	1000	3	0.150	24.66	3.70
TH	200-600	543.7	600	2	0.100	90.62	9.06
Ca	75-200	235.9	200	2	0.100	117.95	11.80
Mg	30-100	307.8	100	1	0.050	307.80	15.39
T Alk	200-600	96.4	600	1	0.050	16.07	0.80
SO4	200-400	31.3	400	3	0.150	7.83	1.17
pH	6.5-8.5	7.1	8.5	4	0.200	83.53	16.71
F	1-1.5	0.75	1.5	4	0.200	50.00	10.00
Total		0.8		20			68.63

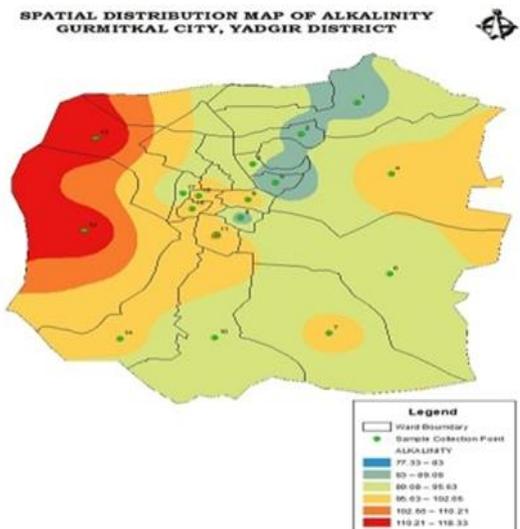


Fig -3.4.2: spatial distribution map of Alkalinity Gurmitkal city

Ca: In the present study it is observed that maximum Calcium is present in (Ward no 4)

3.4 GIS mapping of different parameters for Gurmitkal Town

Cl: In the present study it is observed that maximum chloride is present in (Ward no 11)

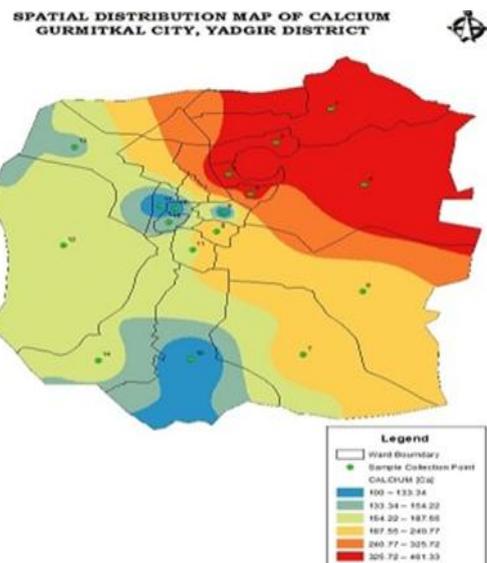


Fig -3.4.3: spatial distribution map of Calcium Gurmitkal city

DO: In the present study it is observed that maximum Dissolved oxygen is present (Ward no 1)

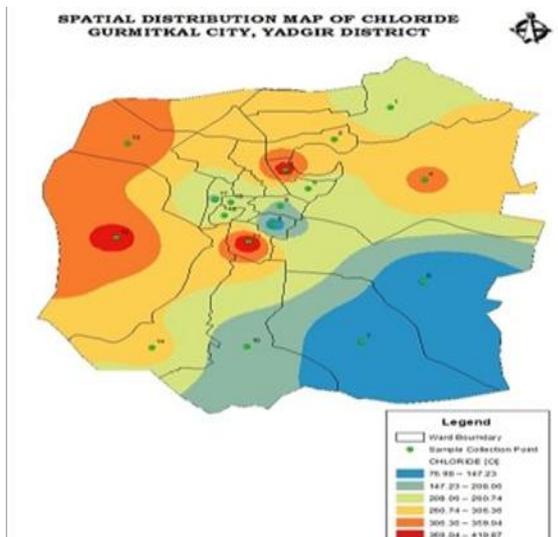


Fig -3.4.1: spatial distribution map of chloride Gurmitkal city

Alk : In the present study it is observed that maximum Alkalinity is present in (Ward no 12)

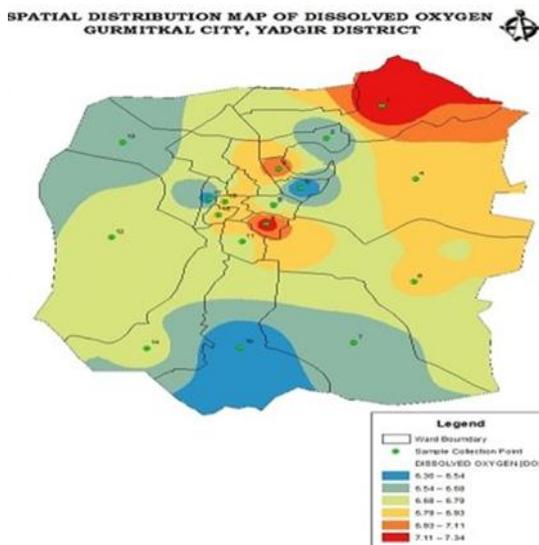


Fig -3.4.4: spatial distribution map of Dissolved oxygen Gurmitkal city

F: In the present study it is observed that maximum Fluoride is present in (Ward no 2&3)

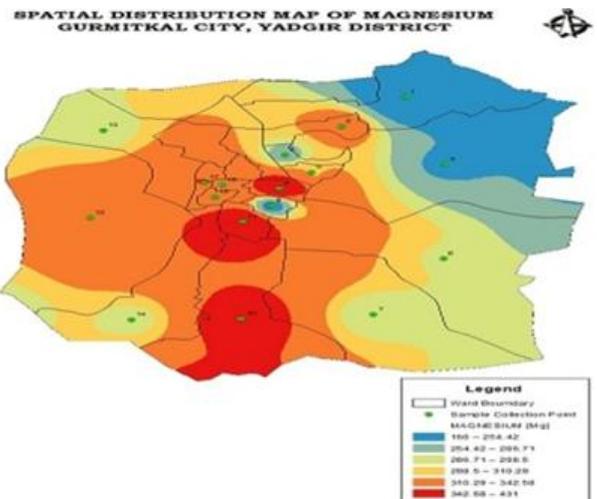


Fig -3.4.6 spatial distribution map of Magnesium Gurmitkal city

pH: In the present study it is observed that maximum pH is present in (Ward no 1)

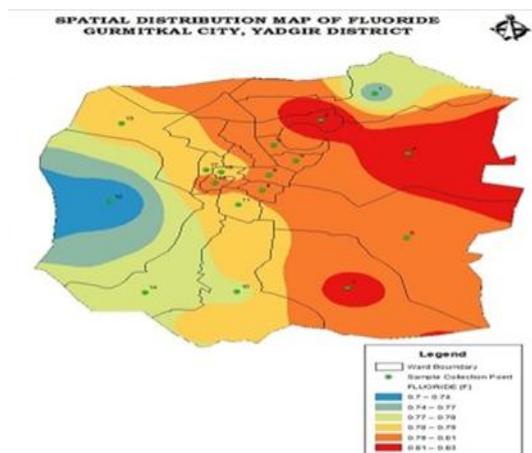


Fig -3.4.5: spatial distribution map of Floride Gurmitkal city

Mg: In the present study it is observed that maximum Magnesium is present in (Ward no 11)

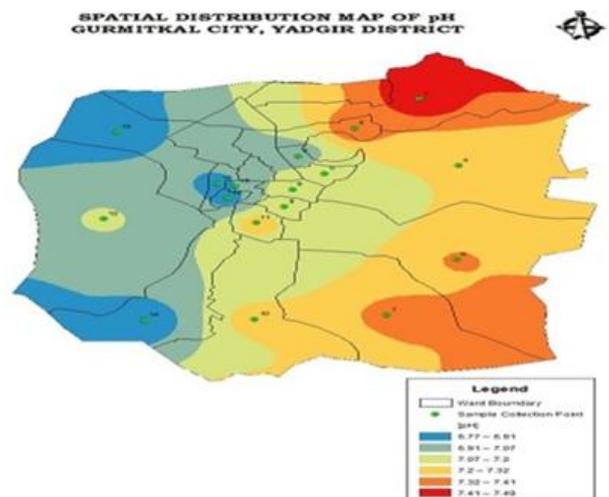


Fig -3.4.7 spatial distribution map of pH Gurmitkal city

TH: In the present study it is observed that maximum Total Hardness is present in (Ward no 2)

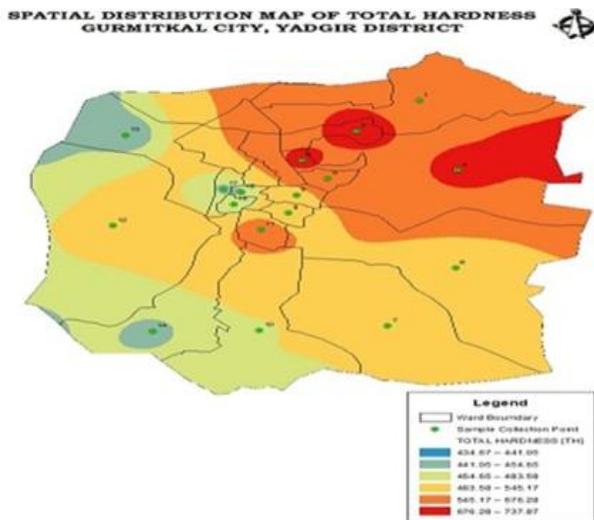


Fig -3.4.8 spatial distribution map of Total Hardness Gurmitkal city

4. CONCLUSIONS

Analysis of water samples collected from various locations of Gurmitkal town revealed that all water samples comply with BIS standards. Groundwater in Gurmitkal region does not require any precautionary measures before drinking because there is no adverse health effects. Deviations were observed in groundwater samples, water quality standards indicating groundwater of Gurmitkal town fall under "B" Grade (Good quality of water). groundwater was found to be fit for drinking purpose. In respect, Calcium Hardness and magnesium Hardness, which are slightly higher side. This may be due to geological rock bed or mineral existing in the area. Carbonate or bicarbonate minerals are also lesser as Alkalinity is less. The Sulphate and Fluoride results found that lesser than Acceptable Limit of BIS standards.

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