

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

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**Abstract** -The present work is aimed at assessing the groundwater quality characteristics of sedam city. The groundwater samples of the 20 wards are collected and analyzed for physico chemical analysis. The following parameters have been analyzed. pH, Total Hardness, Calcium Hardness, Magnesium Hardness, Chloride, Total Alkalinity, Dissolved Oxygen, Sulphate and Fluoride. The Correlation and Regression analysis are done. Water Quality Index studies carried out. The estimated values are compared with Indian standards for drinking water, revealed that the water sample analyzed from the study areas are within the permissible standard limits, but the Calcium Hardness and magnesium Hardness are slightly on higher side. The Geographic Information System (GIS) mapping is done for the considered physico chemical parameters of the study area. The analysis reveals that the groundwater of the study area is good, but it also needs to be protected from the perils of contamination by giving certain degree of treatment.

**Key Words:** Groundwater, Correlation Coefficient, Regression Analysis, Water Quality Index, GIS mapping, Physico-Chemical Characteristics.

## 1. INTRODUCTION

Water is one of the most important and abundant compounds of the ecosystem. All living organisms on the earth need water for their survival and growth. As of now only earth is the planet having about 70 % of water. But due to increased human population, industrialization, use of fertilizers in the agriculture and man-made activity it is highly polluted with different harmful contaminants. Therefore it is necessary that the quality of drinking water should be checked at regular time interval, because due to use of contaminated drinking water, human population suffers from varied of water borne diseases. According to WHO organization, about 80% of all the diseases in human beings are caused by water.

Once a groundwater gets polluted could remains for decades, or even for hundreds of years, because the natural processes of through-flushing are so slow. Secondly, there is a considerable degree of physico-chemical and chemical interdependence between the water and the containing material. Groundwater contains various types of pollutants and several other substances

are dissolved in it. Concentration of which is useful for human body but in a specific limit. The study was conducted to know the physico chemical characteristics of ground water and its impact on human life.

The groundwater quality is degrading in Sedam town due to increasing in human habitation and commercial practice.

### 1.1 Objectives

- To find out the Physico-Chemical characteristics of groundwater of Sedam Town, Gulbrga 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

Sedam is a town in Gulbarga district in the state of Karnataka, India. It is the headquarters of Sedam Taluk. Sedam was formed in 1952 as a Town Municipal Council. It is located 17.183°N 77.283E°. It has an area of 5.5km<sup>2</sup>(2.1 sq mi). Sedam town has a population of 39,341 (2011) and has 23 wards. Sedam Taluk shares borders with three Taluks in the Gulbarga district: Chitapur Taluk to the west, Chincholi Taluk to the north and Yadgir district to the south. It also borders Tandur Taluk of the Rangareddy District of Telangana and Kodangal Taluk of the Mahbubnagar District in Telangana to the east. The Kamalawathi River flows through town. In the summer temperature varies from 36°C to 44°C and in winter, the temperature varies from 20°C to 30°C. The location map is shown in Figure 2.1.1 and the wardwise map is shown in Figure 2.1.2.

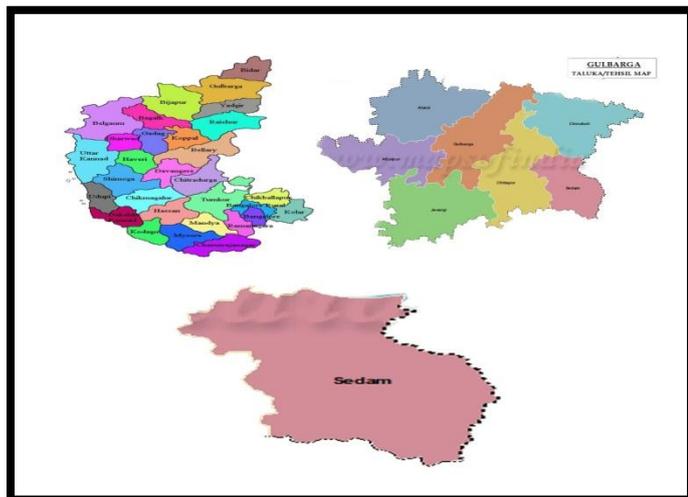


Fig -2.1.1: Showing the Location of sedam Town

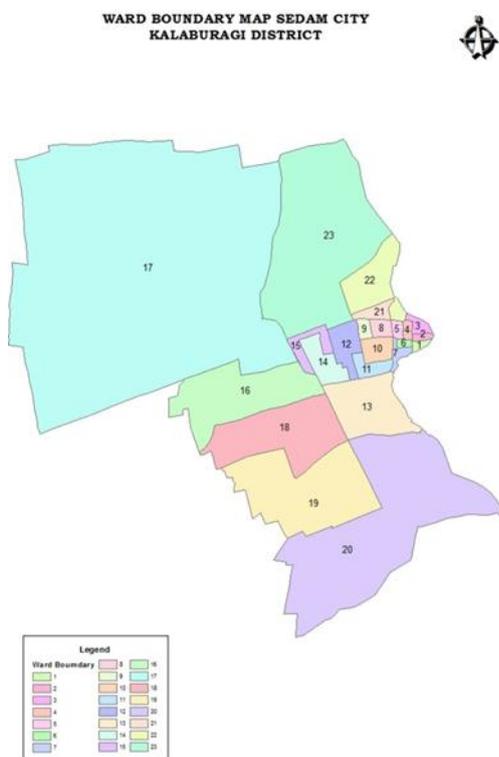


Fig -2.1.2: Ward Map of Sedam Town

## 2.2 Sampling:

The samples were collected from Feb 1 2018 to May 20 2018 covering pre monsoon season. The grab samples are collected covering with a frequency of 12 times with a gap of every 10 days. Two liters of water samples are collected from each sampling point in a white plastic can and immediately transported to the laboratory for analysis.

## 3. RESULTS AND DISCUSSION

### 3.1 Physical and Chemical Examinations of Groundwater of Sedam 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 no	Cl (mg/l)	TH (mg/l)	Ca (mg/l)	Mg (mg/l)	Total Alkalinity (mg/l)	So <sub>4</sub> (mg/l)	pH	DO (mg/l)	F (mg/l)
1	168.45	371.67	241.58	130.08	79	29.04	7.77	6.81	0.78
2	238.09	380	246.13	132.53	100.67	48.18	7.61	6.56	0.81
3	251.42	373	242.45	130.55	85	42.74	7.55	6.52	0.78
4	243.59	363	235.95	127.05	83.33	45.51	7.44	6.49	0.78
5	195.77	341.33	221.87	119.47	86	25.24	7.41	6.43	0.8
6	195.77	309.33	201.07	108.27	77	29.6	7.34	5.42	0.78
7	195.77	309.33	201.07	108.27	77	29.6	7.34	5.42	0.78
8	86.64	316.67	202.58	109.08	72.33	23.82	7.78	7.07	0.76
9	173.78	351	228.15	122.85	63.33	33.15	7.8	6.33	0.81
10	146.29	330	214.5	115.5	77	36.37	7.35	7.25	0.82
11	251.42	394.33	256.32	138.02	68.33	28.42	7.49	5.38	0.8
12	332.73	385	247	133	77	25.28	7.27	5.02	0.82
13	197.22	408	264.98	142.68	75.33	26.51	7.14	7.38	0.78
14	179.45	347.58	224.9	121.1	78.33	22.87	7.39	6.05	0.78
15	126.29	326.67	212.33	114.33	71	17.78	7.36	6.57	0.81
16	157.27	446	289.9	156.1	72.67	50.04	7.28	6.27	0.79
17	181.94	362	232.05	124.95	60.67	28.54	7.51	6.12	0.8
18	197.11	355.33	234.43	126.23	72.67	20.5	7.38	6.05	0.78
19	174.61	398.67	253.28	136.38	75.33	35.25	7.41	5.02	0.78
20	146.12	372.67	242.23	130.43	77.33	16.13	7.29	6.36	0.75
Mean	191.987	362.079	234.639	126.344	76.466	30.729	7.445	6.226	0.790
Max	332.730	446.000	289.900	156.100	100.670	50.040	7.800	7.380	0.820
Min	86.640	309.330	201.070	108.270	60.670	16.130	7.140	5.020	0.750
SD	53.319	35.109	22.638	12.189	8.507	9.696	0.179	0.684	0.019
CV%	16.025	7.872	7.809	7.809	8.451	19.377	2.300	9.268	2.289

Cl- Chloride in mg/l, TH – Total Hardness in mg/l, Ca – Calcium Hardness in mg/l, Mg – Magnesium Hardness in mg/l, So<sub>4</sub>- 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 Characteristics 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

Parameters	Standards	Recommended Agency	Observed Values	Remarks
Cl	250-1000	BIS	191.987	Complying
TH	200-600	BIS	362.079	Complying
Ca	75-200	BIS	243.639	Slightly higher
Mg	30-100	BIS	126.344	Slightly higher
T Alk	200-600	BIS	76.466	Complying
SO <sub>4</sub>	200-400	BIS	30.729	Complying
pH	6.5-8.5	BIS	7.723	Complying
F	1-1.5	BIS	0.790	Complying

### 3.3 Water Quality Index (WQI):

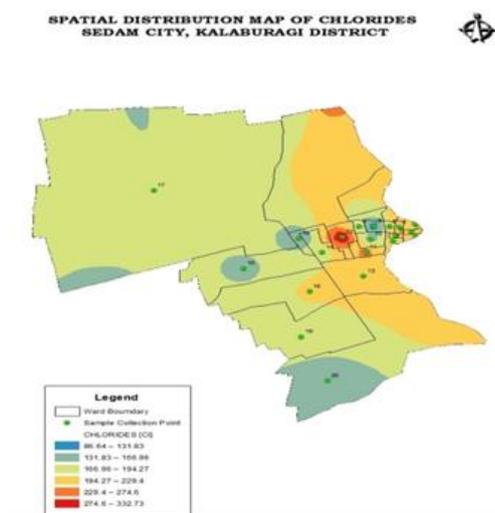
The water quality index of the samples is found out to be 57.19 which lie in “B” grade, Hence water quality fall under good category.

**Table-3:** Water Quality Index of Groundwater of Sedam Town

Parameters	IS	CI	SI	Wi	Wi=(wi/Σwi)	Qi=(Ci/Si)*100	SI=Wi*Qi
Cl	250-1000	191.987	1000	3	0.15	19.1987	2.88
TH	200-600	362.079	600	2	0.1	60.3465	6.03
Ca	75-200	243.639	200	2	0.1	121.82	12.18
Mg	30-100	126.344	100	1	0.05	126.344	6.32
T Alk	200-600	76.466	600	1	0.05	12.7443	0.64
SO4	200-400	30.729	400	3	0.15	7.68225	1.15
pH	6.5-8.5	7.723	8.5	4	0.2	90.8588	18.17
F	1-1.5	0.79	1.5	4	0.2	52.6667	10.53
Total				20			57.91

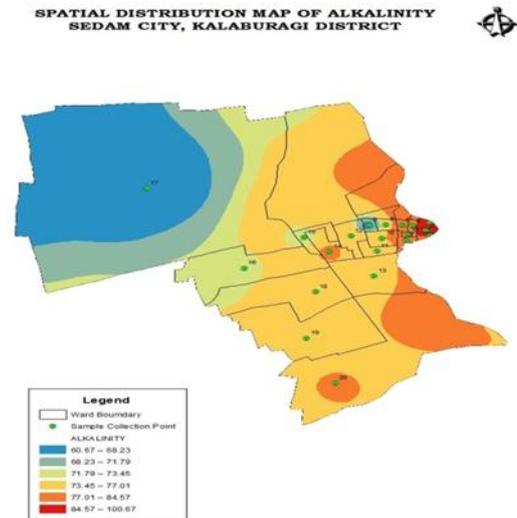
### 3.4 GIS mapping of different parameters for Sedam Town

**Chloride:** The maximum value is 332.730mg/L (ward no.12) and a minimum value is 86.64 mg/L (ward no 8).



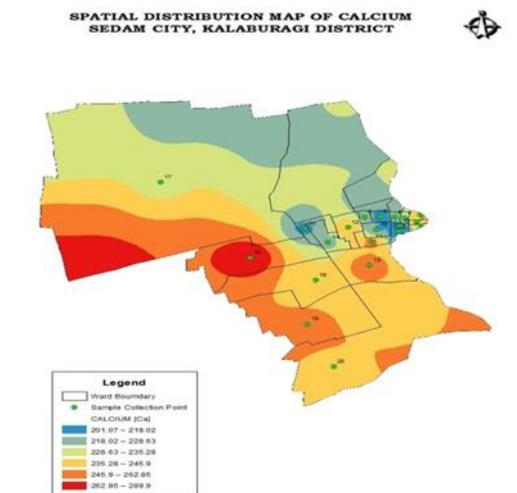
**Fig -3.4.1:** spatial distribution map of chloride Sedam town

**Total Alkalinity :** The maximum value is 100.670 mg/L (ward no.2) and a minimum value is 60.670 mg/L (ward no.17).



**Fig -3.4.2:** spatial distribution map of Total Alkalinity Sedam Town

**Calcium Hardness:** The maximum value is 289.900 mg/L (ward no.16) and a minimum value is 201.070 mg/L (ward no 6 and 7).



**Fig -3.4.3:** spatial distribution map of Calcium Hardness Sedam town

**Dissolved Oxygen:** In The maximum value is 7.380 mg/L (ward no.13) and a minimum value is 5.020 mg/L (ward no.12 and 19).

SPATIAL DISTRIBUTION MAP OF DISSOLVED OXYGEN  
SEDAM CITY, KALABURAGI DISTRICT

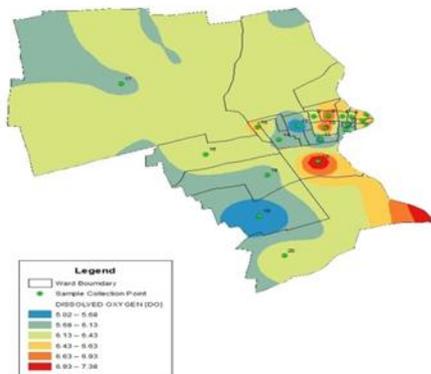


Fig -3.4.4: spatial distribution map of Dissolved oxygen Sedam Town

SPATIAL DISTRIBUTION MAP OF MAGNESIUM  
SEDAM CITY, KALABURAGI DISTRICT

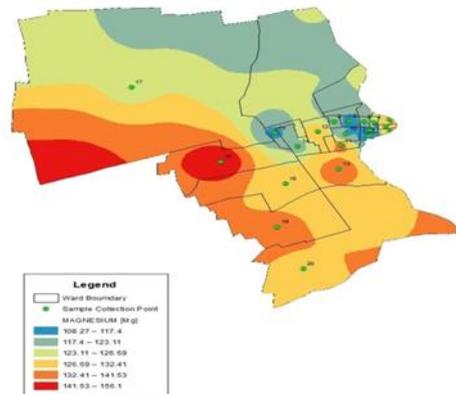


Fig -3.4.6 spatial distribution map of Magnesium Hardness Sedam Town

**Fluoride:** The maximum value is 0.820 mg/L (ward no.10 and 12) and a minimum value is 0.750 mg/L (ward no.20).

**pH:** The maximum value is 7.800 (ward no.9) and a minimum value is 7.140 (ward no.13).

SPATIAL DISTRIBUTION MAP OF FLUORIDE  
SEDAM CITY, KALABURAGI DISTRICT

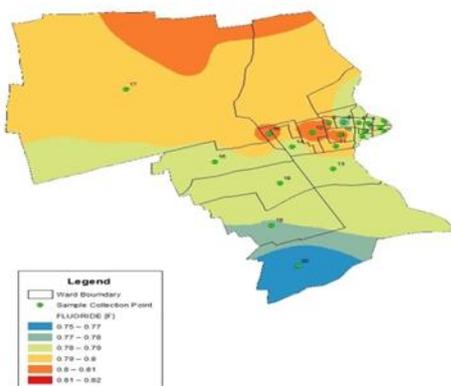


Fig -3.4.5: spatial distribution map of Floride Sedam Town

SPATIAL DISTRIBUTION MAP OF pH  
SEDAM CITY, KALABURAGI DISTRICT

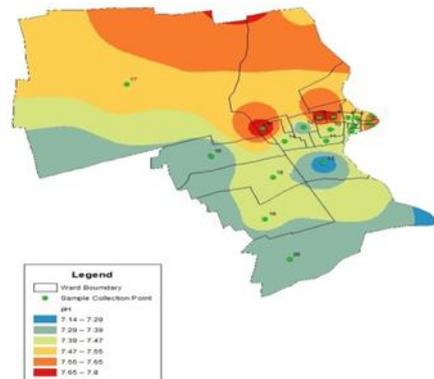


Fig -3.4.7 spatial distribution map of pH Sedam Town

**Magnesium Hardness:** In The maximum value is 156.100 mg/L (ward no.16) and a minimum value is 108.27 mg/L (ward no 6 and 7).

**Total Hardness:** The maximum value is 446.00 mg/L (ward no.16) and a minimum value is 309.330 mg/L (ward no 6 and 7).

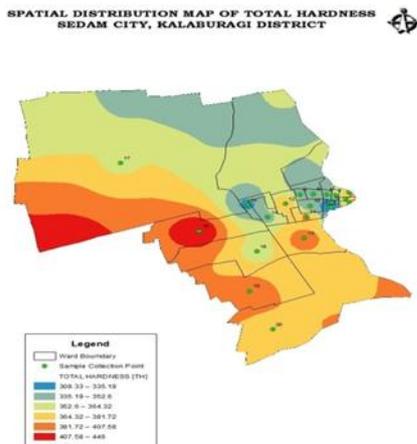


Fig -3.4.8 spatial distribution map of Total Hardness Sedam Town

**Sulphate:** The maximum value is 50.040 mg/L (ward no.16) and a minimum value is 16.130 mg/L (ward no.20).

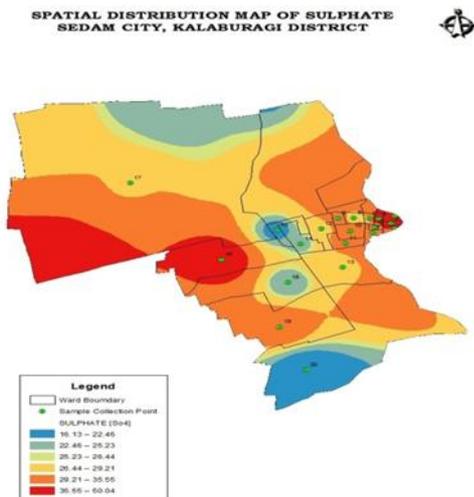


Fig -3.4.9 spatial distribution map of Sulphate Sedam Town

#### 4. CONCLUSIONS

The water quality of Sedam town by overall lookout is good and potable. This is again proved by WQI which fall under “B” grade (Good quality of water). In respect, of Calcium Hardness and Magnesium Hardness, this is 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 obtained lesser than Acceptable Limit of IS standards.

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