

**STUDIES ON WATER QUALITY INDEX OF GROUND WATER OF ALAND  
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**ABSTRACT:** Water Quality Index is one of the most effective tools to communicate information on the quality of ground water to the concerned citizens and policy makers. The objective of the present work is to assess the suitability of ground water for human consumption based on the computed water quality index values, ground water characteristics and quality assessment. Ten villages of Aland taluka are selected and at each village water samples at three places were collected using standard procedural methods and analyzed for pH, TH, Ca, Mg, Cl, TDS, Fe, F, NO<sub>3</sub>, SO<sub>4</sub>.

**Key words:** Ground water, Aland, Gulbarga, Water Quality Index. Chemical characteristics.

**INTRODUCTION**

We watched that the world facing the challenges of purification of water and air resources. In spite of many uses the organic compounds are toxic in nature and cause environmental contamination. These toxic chemicals are emerging as a serious global problem. Organic compounds containing industrial effluents from textile, dyeing, chemical and other industries may cause skin cancer due to photo sensitization and photodynamic damage<sup>1,2</sup>.

Ground water quality has become an important water resource issue due to rapid increase in population, rapid industrial development, increasing mining and petroleum operations and too much use of fertilizers and pesticides in agriculture. Most of the population in India use ground water as its primary source of drinking water<sup>3</sup>.

The present study deals with the ground water quality index of Aland taluka of Gulbarga district of Karnataka India. In this context, to create environmental awareness among the students and public. Study of water quality index of Aland taluka has been undertaken.

**EXPERIMENTAL.**

Water samples were collected in 10 villages of Aland taluka and in each village, at three different points, samples were collected. The samples were collected as per the standard procedural method<sup>4</sup> for the chemical analysis of various constituents. All reagents were of Analytical grade and solutions were made of distilled water. Various water quality parameters such as pH, TH, Ca, Mg, TDS, Fe, F, NO<sub>3</sub>, SO<sub>4</sub> were determined using standard analytical methods<sup>5</sup>. The instruments used were calibrated before use for observing readings. The repeated measurements were to ensure precision and accuracy of results.

**STUDY AREA.**

Aland taluka is located towards north western part of Gulbarga district, Karnataka. Major water bearing formation in this area is Deccan Trap Basalt<sup>6</sup>. This taluka falls under one of the hottest regions. The climate is usually warm during most of the year

The minimum temperature in summer is 46°C during March and May and minimum temperature is 10°C during December. Average temperature is 36°C. The winds are generally light and moderate with little intense during the latter part of summer and monsoon. The rainy season occurs between June and October following by winter season between November and January. The average annual rainfall is 691.7mm

## RESULTS AND DISCUSSIONS

The physico-chemical tests were conducted employing standard scientific methods, so as to minimize the determinate errors. Following are the some of the observations revealed from the study of the various water quality parameters.(table 1-3)

Table-1 Chemical characteristics of ground water in Aland taluka

Village	Sample point	pH	TH	Ca	Mg	Cl	TDS	Fe	F	NO <sub>3</sub>	SO <sub>4</sub>
Savalgi	1	7.00	171	92	79	235	1500	0.32	3.5	30	28
	2	7.20	176	102	74	258	1650	0.38	3.2	32	26
	3	7.4	180	108	72	282	1560	0.34	2.8	34	29
Kadagandi	1	8.00	400	303	97	280	1500	0.42	2.5	25	32
	2	7.80	392	284	108	286	1520	0.39	2.8	26	31
	3	7.60	408	302	106	292	780	0.38	3.0	29	29
Savalgi (K)	1	7.00	300	180	120	192	628	0.34	3.5	30	28
	2	7.00	320	182	128	189	526	0.32	3.2	28	23
	3	7.20	380	196	184	210	592	0.33	3.0	29	26
Srichand	1	7.20	408	182	216	202	619	0.39	3.5	46	32
	2	7.40	398	162	236	199	599	0.32	2.9	48	29
	3	7.20	426	198	228	210	638	0.42	3.2	42	26
Suntnoor	1	8.00	620	282	238	209	822	0.29	2.0	38	29
	2	8.20	642	292	350	242	864	0.28	2.4	39	27
	3	8.10	669	228	381	232	832	0.24	2.3	42	26
Keroor	1	9.05	722	581	141	428	1126	0.32	2.6	46	32
	2	8.90	742	592	150	432	1142	0.38	2.8	42	34
	3	8.80	756	599	157	438	1149	0.34	2.4	45	35
Hirolli	1	9.84	632	482	160	396	929	0.42	2.5	48	28
	2	9.41	646	491	154	402	982	0.39	2.9	46	32
	3	9.20	658	498	160	395	996	0.38	2.6	43	29
Allapur	1	8.4	532	398	134	342	876	0.29	2.2	38	32
	2	8.20	548	402	150	348	896	0.26	2.0	40	26
	3	8.1	556	411	145	349	894	0.24	2.0	35	27
Tugaon	1	7.8	498	396	102	342	842	0.32	2.1	52	44.2
	2	7.60	526	402	128	348	856	0.28	2.6	49	42.8
	3	7.90	522	399	123	356	874	0.29	2.3	56	45
Kinnisultan	1	8.20	752	562	210	432	1156	0.32	2.9	41	29
	2	8.40	748	592	156	442	1188	0.31	2.8	43	30
	3	8.10	742	581	162	448	1196	0.32	2.82	44	32
Sum	-	240.2	15470	104.79	4849	9416	29732	10.02	81.32	1186	919
Mean	-	8.06	515.66	349	161.63	313.87	991.06	0.334	2.71	39.53	30.63
Max	-	9.84	756	599	381	448	1650	0.42	3.5	56	45
Min	-	7.0	171	32	72	189	526	0.24	2	25	23

TH – Total hardness in mg/l Ca – Calcium Hardness in mg/l Mg – Magnesium hardness in mg/l Cl – Chloride in mg/l TDS – Total dissolved solids in mg/l Fe – Iron in mg/l F – Fluoride in mg/l No<sub>3</sub> – Nitrate in mg/l SO<sub>4</sub> – Sulphate in mg/l S.D – Standard deviation C.V – Co-efficient of variation %. Min – Minimum Max – Maximum

**Table-2:** Water quality classification based on WQI value

WQI Value	Water quality
<50	Excellent
50-100	Good water
100-200	Poor water
200-300	Very poor water
>300	Water unsuitable for drinking

$Q_i = c_i/s_i * 100$  Where  
 $Q_i$ = quality rating

**Table- 3:****Water Quality Index for Aland Taluka**

SI No	Chemical parameters	Indian Standards	Weightage (wi)	Relative weight (Wi)	Quality rating (Qi)	Sub index (SI <sub>i</sub> )
1	pH	6.5-8.5	4	0.114	94.82	10.80
2	Total hardness(TH)	300-600	3	0.086	85.94	7.39
3	Ca	75-200	2	0.057	174.5	9.94
4	Mg	30-100	2	0.057	161.63	9.21
5	Chloride	250-1000	3	0.0896	31.38	2.69
6	Total dissolved solids (T.D.S)	500-2000	4	0.114	49.55	5.64
7	Fluoride	1-1.5	4	0.114	180.66	20.52
8	Nitrate	45-100	5	0.143	39.53	5.65
9	Iron	0.3-1.0	4	0.114	33.40	3.80
10	Sulphate	200-400	4	0.114	7.65	0.87
11		<b>Total</b>	<b>35</b>	<b>1.00</b>	<b>859.06</b>	<b>76.51</b>

**WATER QUALITY INDEX**

For computing water quality index three steps are followed. In the first step, each of the 12 parameters has been assigned a weight (wi) according to its relative importance in the overall quality of water for drinking purposes (table-3). The maximum weight of 5 has been assigned to the parameter nitrate due to its major importance in water quality assessment. Weight of 4 has been given to fluoride. Alkalinity and Acidity has been given weight of 2 as they are not harmful.

Second step, relative weight (Wi) is computed from the following equation:

$$W_i = \frac{w_i}{\sum_{i=1}^n w_i}$$

Where (Wi) is the relative weight, (wi) is the weight of each parameter and 'n' is the number of parameters calculated relatively weight (wi) values of each parameter are also given in table-3.

In the third step, a quality rating scale (qi) for each parameter is assigned by dividing its connections in each water sample by its respective standard according to the guidelines laid down in the BIS and the results is multiplied by 100:

$$q_i = C_i / S_i \times 100$$

Where (qi) is the quality rating, (Ci) is the concentration of each parameter in each water sample in mg/l, except pH, and (Si) is the BIS (Bureau of Indian standards) water standard for each chemical parameter in mg/l according to the guidelines of the BIS-10500-1991.

For computing the WQI, the SI is first determined for each chemical parameter, which is then used to determine the WQI as per the following equation:

$$SI_i = W_i \times q_i$$

$$WQI = \frac{\sum SI_i}{n}$$

SI<sub>i</sub> is the sub index of the I<sup>th</sup> parameter, q<sub>i</sub> is the rating based on concentration of i<sup>th</sup> parameter and n is the number of parameter. The computed WQI values are classified into five types “excellent water”, “good water”, “poor water”, “very poor water”, “water unsuitable for drinking”. As shown in table 5.3.

### WQI steps

#### Step-1

W<sub>i</sub>=according to relative importance overall quality of water for drinking purpose.

∴ The maximum weight =5 has been assigned to the parameter nitrate and fluoride  
The minimum weight=2 has been assigned to the parameter alkalinity and acidity

#### Step-2

Relative weight (w<sub>i</sub>)

$$W_i = \frac{w_i}{\sum_{i=1}^n w_i}$$

$$S_i = w_i \times Q_i$$

Where

Q<sub>i</sub>=quality rating

C<sub>i</sub>=concentration of each chemical parameter in each water sample in mg/l

S<sub>i</sub>=Indian drinking water standard for each chemical parameter in mg/l according to (BIS 10500:1991)

### CONCLUSIONS.

After the careful study of analysis interpretation and discussions of the numerical data following are the conclusions have been drawn for the Aland Taluka.

1. The ground water is crystal clear, odorless, and palatable. And at few samples points are of salty taste.
2. Few of the bore wells yield saline water with high mineral or dissolved salts.
3. Water is moderately hard in almost all the sampling points.
4. At few places there is considerable increase in chloride. This shows that there is possibility of contamination of groundwater due to percolation of polluted surface water.
5. The concentration of fluoride in the few villages is beyond the permissible limits. Hence treating the water becomes mandatory.
6. The concentration of nitrate was also high in few villages which may be due to percolation of polluted surface water.

7. Higher values of iron, nitrate, TDS, hardness, fluorides and chloride in the ground water, were observed at few sampling points. The reason may be due to contamination by sewage and drainage water.
8. The analysis reveals that the groundwater of the area needs certain degree of treatment before consumption, and it also needs to be protected from the perils of contamination.
9. From water quality index the water of Aland taluka is considered as GOOD WATER.

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