

Seasonal Variation Of Ground Water Quality And Its Suitability For Drinking In And Around Tiptur Town, Tumkur District, Karnataka, India: A WQI Approach.

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Abstract

A water quality index provides a single number that expresses over all water quality at certain location and time based on several water quality parameters. The objective of an index is to turn complex quality data in to information that is understandable and useable by the public. Seven most important physico- chemical parameters such as PH, Total dissolved solids Total hardness, Calcium, Magnesium, Chloride and Nitrate were taken for the calculation of WQI of ground water to assess the impact of pollutants due over exploitation, Domestic sewage, mining operation, agriculture ,human activities on ground water quality. The water quality index values for the ground water ranged between 83.9-138.5 during pre monsoon and 67.91 -130.5 during Post monsoon season. In the present investigation the quality of water was found to be good in all the sampling locations in tiptur town and surrounding areas.

Key words: Water quality index, physicochemical parameters, Human activities, complex quality data, Public.

1. Introduction

Water is indispensable and one the precious natural resource of our planet. Ground water is an important natural source of water supply all over the world. Its use in irrigation ,industries and domestic usage continues to increase where perennial surface water source are absent (Mariappan et al 2005). The modern civilization, over exploitation, rapid industrialization and increased population have lead to fast degradation of our environment(K .Murali; 2011). To meet the rising demand it is imperative to recognize the fresh water resources and also to find out remedial methods for improvement of water quality (Ch Maruthi Devi et al ;2011).The quality of water may depend on geology of particular area and also vary with depth of water table and seasonal changes and is governed by the extent and composition of the dissolved salts depending upon source of the salt and soil , subsurface environment.

The development of growing regions in developing countries is allied several social, economical ,environmental and technical aspect of concern area along

with the study of available, sustainable resources for civilization. Among all; Ground water is the one of the vital resources confined everlasting. In the context of quality and quantity ; ground water fluctuates in variably in its own which reflects the time to time status of ground water as a whole for the region (Neeraj D et al ;2010).

A number of indices have been developed to summarize water quality data in an easily expressed under the stood format .The WQI which was first developed by Horton in the early 1970s is basically a mathematical; Means Of Calculating a Single value from multiple test results .The Index results represents the levels of water quality in a given water aquifers and lakes, river or stream. After Horton a number of workers all over the world developed WQI based on rating of different water quality parameters. Basically a WQI attempt to provide a mechanism for presenting water accumulatively derived. Numerical expression defining a certain level of water quality (Miller et al ;1986). The different analyzing water data based on rank of observations and factor analysis (Shoji et al ;1966,Harkin;1974).For the evaluation of water quality; WQI was applied to river water as well as coastal (Dojlido et al ,1994, Gupta et al 2003 and Avvannavar and shrihari,2007)

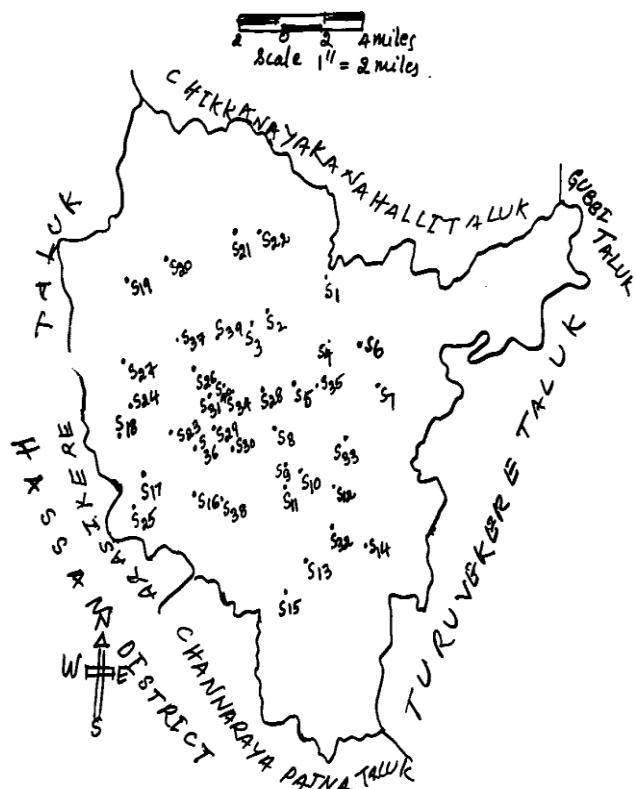
A water quality index is a means to summarize large amounts of water quality data into simple terms (eg good, excellent, moderate,, poor) for reporting to management and public in a consistent manner (Aswani Kumar et al ;2009).The objective of the present study is to investigate the water quality of ground water in and surrounding areas of tiptur town ,tumkur district ,Karnataka,India. The index produces a number between 0 for worst water quality and 100 for best water quality (saffron et al ,2001).

2. Study Area

Karnataka state is situated in the southern peninsular India. Tiptur town is about 75km from Tumkur district. It covers an area of 785 sq km having 13°, 16' north latitude 76°, 29' east longitude and an altitude of 850.30 meter above

the sea level. The average temperature ranges from 11° in winter and 38° during summer. The average rain fall of Tiptur town is 503 mm.

TIPTUR TALUK



3. Material and Methods

Water samples were collected once every month from 50 locations in and around tiptur town during Pre monsoon and post monsoon. A WQI was calculated for Average values of the parameter in both seasons.

3.1. Analytical Methods

The parameters like Temperature, PH, total dissolved solids, were noted immediately at the spot using water analyzer kit (Global make). In the laboratory, the other parameters like, Total hardness, chloride, calcium, Magnesium and Nitrate ion was done by volumetric analysis using standard methods given in APHA (1998), Eaton et al (1998) and Trivedy and Goel 1986).

Water quality index was calculated for average values of parameters for pre monsoon and post monsoon. It was done considering important physico-chemical properties using central public Health Environmental engineering organization (CPHEEO) 1991 and Indian council of medical research (ICMR,1975), BIS and IS10500 standards

WQI was obtained by weight arithmetic index method as given below.

$$\text{Water quality index (QWI)} = \sum q_i w_i$$

Where q_i is water quality rating .

$$q_i = (V_a - V_i) / (V_s - V_i) * 100$$

V_a - Actual value of the parameter present in water sample.

V_i -ideal value.

V_s -Standard value

$W_i = K/S_n$ where W_i = unit weight.

$$K(\text{constant}) = 1 / (1/V_{s1} + 1/V_{s2} + 1/V_{s3} + \dots + (1/V_{sn}))$$

Where S_n -standard value.

4. Result and discussion

The results of study are given in the table (1) and (2) . PH of water is influenced by geology of the area, buffering capacity of water (Achutha Nair et al ; 2005). If the water has PH less < 7 may cause tuberculation and corrosion ,while higher the values may produce in crustation, sediment deposit and difficulties in chlorination for disinfection of water .(Ch .Marthi Devi et al 2011). In the present study PH in all the sampling locations varied between 6.63 to 7.73 during pre monsoon and 7.02 to 8 during post monsoon. The permissible limit of PH value of drinking water specified as 6.5 to 8.5 as per IS 10500 standards and the values were acceptable.

TDS is an important parameter for drinking water and other uses. Water with high solid content is of inferior palatability and may produce unfavorable physiological reaction in the transient consumer (Abudul Jameel; 2002). In the study TDS was found in range of 213 to 1427 mg/L during pre monsoon and 310 to 1670 mg/ L (Tadasur, S16)during post monsoon. The permissible level of TDS is specified as 500 to 1500 mg/L as per WHO /ICMR standard.

Total hardness varied between 100 mg/L to 1180mg/L in pre monsoon and 280 mg/L to 720 mg/L in post monsoon .Total hardness of water is characterized by content of calcium and magnesium salts. Calcium was 8 mg/L to 153 mg/L in pre monsoon season compared to post monsoon 24 mg/L and 128mg/L specially (S23) other wise in the most of the sampling locations calcium and Magnesium concentration are well with in the ICMR /BIS standard.

Chloride concentration in all the sampling locations ranged between 52mg/l 330 mg/L and except for sampling locations S23 ,340mg/L and S25 , 400mg/L in pre monsoon and 50mg/L to 250 mg/L in the post monsoon ,were with in the WHO limits. Chloride concentration imparts salty taste and higher value produces laxative effect on consumers

Nitrate varied between 4mg/L to 56mg/during pre monsoon season and 10 mg/L 72 mg/L. Nitrate was found more than 45mg/L in 20% of sampling locations. But as per BIS standards. Regular consumption of nitrate >45mg/L may cause Blue baby disease or Methaemoglobinaemia in infants.(K. Murali et al ; 2011).

Water quality index (WQI) is one of meaningful approach for ground water and all other type of water like river, lake and surface water quality analysis (Eaton A.D ,Clescer and Green beg A E , 1998). The value of WQI in all sampling locations was reported to approach 100 and some

samples > 100, indicating that the water suitable for human use.

On the basis of the WQI the quality of water is categorized from very Bad to Excellent (Tiwari and Mishra, 1985) table-3. According to water quality index (WQI). The

water in all sampling locations range between good and excellent category in tiptur town and surrounding areas. Hence the ground water in and around tiptur town is suitable for pot ability as well as irrigation purpose.

Physico –chemical Parameters Pre monsoon season in and around tiptur town.Table-1

	Smampling Stations	PH	TDS	TH	Ca+2	Mg+2	Cl-	No3	WQI
S1	Eralagre	7.48	622	240	39	34.6	160	10	89.42
S2	Chikkmrppanahalli	7.14	720	175	74	2.37	220	20	85.74
S3	Doddamarppanahalli	6.98	213	310	8	70.4	52	10	87.25
S4	Ramenahalli	6.96	780	315	83	26.1	305	29	92.54
S5	Huchgondnahalli	7.35	620	285	51	38.2	165	4	88.55
S6	Karadi	7.12	680	205	68	8.54	270	26	88.03
S7	Kuppalu	6.24	640	195	57	12.79	180	49	83.91
S8	Gorgondanahalli	6.88	1387	222	92	1.87	440	48	94.42
S9	Hedagarahalli	6.8	914	100	69	17.5	187	21	85.09
S10	Bedagarahalli	6.89	994	502	90	67.3	305	56	107.69
S11	Aldahalli	7.12	534	530	53	96.5	156	5	98.24
S12	Kannugatta	7.02	447	400	27	80.7	125	55	103.2
S13	Sugur	7.01	400	390	23	80.7	94	24	95.03
S14	Kodihalli	6.98	1020	270	91	10.3	240	31	90.72
S15	Machegatta	7.12	340	570	13	130.5	76	10	101.66
S16	Tadasur	6.8	1367	660	108	94.7	330	27	107.95
S17	Gurgadahalli	7.06	600	350	49	55.2	174	15	91.60
S18	Siddapura	7.1	260	310	11	68.6	78	10	88.64
S19	Honnnavalli	6.63	960	510	99	63.8	260	25	97.39
S20	Potarihalli	6.82	594	260	50	32.8	100	15	84.20
S21	Byrapura	7.05	600	500	24	106.8	125	37	104.53
S22	Halenahalli	6.92	894	770	32	167.5	225	16	112.56
S23	Madenoor	6.8	1367	1180	131	207.1	340	51	138.54
S24	Bidaregudi	7.12	480	480	19	105	115	19	99.79
S25	Shivara	6.98	1427	750	153	89.3	400	46	117.95
S26	Manakikere	7.06	847	335	44	54.6	185	47	99.25
S27	Nagatihalli	6.99	813	670	56	128.7	195	50	115.35
S28	Idenahalli	6.99	574	415	35	79.5	183	34	99.11
S29	Marangere	6.9	633	390	56	60.7	171	27	94.68
S30	Anagondanahalli	7.1	527	560	29	118.4	114	24	104.4
S31	Madihalli	7.68	528	630	22	139.6	99	24	113.76
S32	Nagaragatta	7.11	600	625	27	135.4	170	3	103.38
S33	Echoor	6.9	867	600	64	106.8	205	47	110.23
S34	Kanchegatta	7.45	586	400	47	68.6	127	25	99.98
S35	Kotanayakanahalli	7.28	567	485	42	92.3	172	14	100.31
S36	Lingadahalli	7.3	687	510	45	96.5	152	30	105.54
S37	Gudigondanahalli	7.12	467	490	24	104.4	155	46	106.87
S38	Rangapura	7	673	750	43	156	100	15	110.39
S39	Sarathavalli	7.35	360	305	18	63.1	85	25	94.48
S40	Kobredoddayyanna Palya	7.46	586	550	33	113.5	110	10	104.16
S41	Gandhi Nagar	7.73	380	260	13	55.25	75	12	93.050
S42	Chamundeshwari	6.93	740	600	39	122	151	28	106.10

	Badavane								
S43	Sharada Nagar	7.28	514	610	30	129.9	110	15	106.47
S44	Vidya Nagar	7.32	567	370	15	80.7	115	24	97.86
S45	H.B.Colony	6.9	620	495	36	98.4	120	28	100.29
S46	Govina Pura	7.3	1173	1000	32	223.4	151	10	126.14
S47	Shankarappa Layout	7.14	994	970	20	223.4	273	12	124.54
S48	Manjunatha Nagar	7.66	414	400	18	86.2	73	5	97.43
S49	Vinayaka Nagar	6.86	1014	920	30	205.2	265	10	118.50
S50	Kote	7	893	460	32	92.3	235	14	97.75

Physico -chemical Parameters post monsoon season in and around tiptur town. Table 2

	Smampling Stations	PH	TDS	TH	Ca+2	Mg+2	Cl	No3	WQI
S1	Eralagre	7.67	770	290	32	51	110	20	96.27
S2	Chikkmarppanahalli	7.24	950	300	24	58	100	50	100.15
S3	Doddamarppanahalli	7.82	690	300	26	57	130	20	98.42
S4	Ramenahalli	7.28	1250	310	32	56	170	48	101.52
S5	Huchgondnahalli	7.72	470	400	34	51	60	10	93.78
S6	Karadi	7.84	350	300	35	60	100	20	67.9
S7	Kuppalu	7.06	1090	310	24	76	200	58	77.6
S8	Gorgondanahalli	7.42	1410	600	64	107	240	20	104.85
S9	Hedagarahalli	7.26	900	350	48	56	90	25	110.2
S10	Bedagarahalli	7.39	1190	350	32	65	230	60	95.97
S11	Aldahalli	8	280	400	32	77.7	60	20	107.65
S12	Kannugatta	7.71	240	340	30	64	70	10	103.59
S13	Sugur	7.85	550	590	40	119	110	50	95.37
S14	Kodihalli	7.3	950	400	57	62	50	20	119.27
S15	Machegatta	7.14	310	490	56	85	70	10	96.99
S16	Tadasur	7.3	1670	700	80	121	290	52	96.48
S17	Gurgadahalli	7.39	650	500	80	73	160	20	121.9
S18	Siddapura	7.7	500	280	56	34	100	42	102.4
S19	Honnnavalli	7.02	1000	520	88	73	200	35	99.98
S20	Potarihalli	7.2	720	360	32	68	95	15	102.37
S21	Byrapura	7.2	510	600	40	121	110	45	93.64
S22	Halenahalli	7.25	970	580	51	110	200	15	111.9
S23	Madenoor	7.08	1320	500	96	63	220	52	105.63
S24	Bidaregudi	7.61	490	700	29	152	80	25	108.26
S25	Shivara	7.18	1390	400	56	63	110	52	116.22
S26	Manakikere	7.3	1260	500	64	57	90	42	104.89
S27	Nagatihalli	7.29	490	560	32	116	120	45	103
S28	Idenahalli	7.3	770	400	66	57	180	20	111.16
S29	Marangere	7.3	1050	500	32	102	100	25	97.46

S30	Anagondanahalli	7.49	590	560	32	116	80	15	104.57
S31	Madihalli	7.87	520	540	40	107	70	10	105.84
S32	Nagaragatta	7.4	240	620	8	146	100	35	107.09
S33	Echoor	7.49	500	610	40	124	140	42	113.08
S34	Kanchegatta	7.6	710	500	88	68	160	20	114.93
S35	Kotanayakanahalli	7.51	1000	490	80	70	170	45	104.38
S36	Lingadahalli	7.54	710	500	35.2	100	95	25	109.79
S37	Gudigondanahalli	7.3	600	460	40	87	120	40	106.13
S38	Rangapura	7.14	910	630	40	129	70	10	105.14
S39	Sarathavalli	7.55	500	450	56	75	90	20	105.07
S40	Kobredoddayyan na Palya	7.37	670	650	44	131	80	20	101.43
S41	Gandhi Nagar	7.87	1440	600	32	126	150	45	110.12
S42	Chamundeshwari Badavane	7.39	1340	600	34	125	200	58	120.99
S43	Sharada Nagar	7.5	640	500	32	102	90	45	119.53
S44	Vidya Nagar	7.32	720	460	128	34	140	60	110.46
S45	H.B.Colony	7.11	430	480	40	92	100	40	107.8
S46	Govina Pura	7.37	1110	680	90	110	220	62	103.7
S47	Shankarappa Layout	7.56	1060	610	48	119	250	72	122.07
S48	Manjunatha Nagar	8	410	700	32	150	70	70	124.47
S49	Vinayaka Nagar	7.4	1080	720	96	116	240	62	130.50
S50	Kote	7.09	900	480	56	83	180	48	124.23

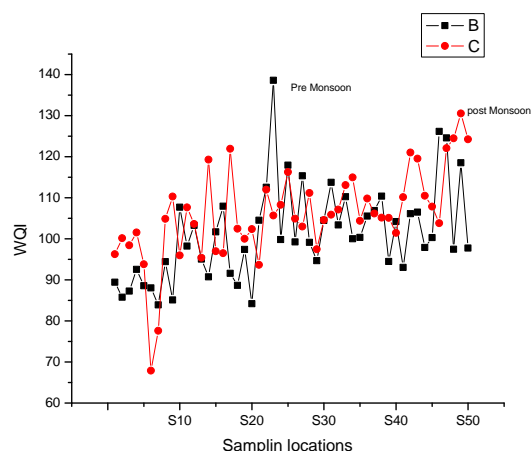
Water quality range based on WQI Table-3

WQI	Quality of water
90-100	Excellent
70-90	Good
50-70	Moderate
25-50	Bad
0-25	Very Bad

Drinking water standards

Parameters mg/L	IS -10500,1991	BIS	ICMR
PH	6.5-8.5	6.5-8.5	7-8.5
TDS	500	500-1500	500-1500
Hardness	300-600	500	300-600
Calcium	75—200	75	75-200
Magnesium	30-100	50	50
Chloride	250-1000	250-600	250-1`000
Nitrate	45	45	20-100

Graph



Conclusion

In the present study WQI was the main tool for analyzing the over all quality of different parameters assessing water quality by index number between $0 \geq 100$. The investigated parameters were with the ICMR/BIS standards, except at few sampling locations. The WQI calculated ranged between 70 to > 100 in both the seasons. But out of the 50 samples 75% were indexed > 100 . The investigation under the present study revealed that the ground water quality in tiptur town and its surrounding areas is good in its quality for drinking ,Domestic use and agriculture.

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