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DETERMINATION OF WATER QUALITY INDEX OF SOME AREAS IN GUNTUR DISTRICT ANDHRA PRADESH

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Abstract: Physico – Chemical analysis of well and bore well water samples was carried out from eight sampling sites of Guntur rural area for the month of February 2010. The analysis of different parameters namely- pH, turbidity, colour, total alkalinity, total hardness, chloride, sulphate, nitrate, TDS, DO, BOD, COD were carried out as per standard methods . The present study aimed to calculate water quality index (WQI) in order to assess the suitability of water for drinking purposes. The results obtained on WQI from different sampling stations were found to be varied from 38.3. to 42.6.

INTRODUCTION

Water is essential for the survival of any form of life. The three percent of global fresh water is large enough to meet the requirements of man for million of years etc., Water pollution is a phenomenon that is characterized by the deterioration of its quality as a result of various human activities. In India only 12% of people get good drinking water (Kudesia, 1980). Inadequate management of water resources as directly or indirectly resulted in the degradation of hydrological environment (Karanth, 1989). Therefore, a continuous periodical monitoring of water quality is necessary so that appropriate steps may be taken for water resource management practices. The present investigations was carried out to calculate the Water Quality Index (WQI) in order to assess the suitability of water collected from different areas in Guntur Dt.

MATERIALS AND METHODS

Water samples collected from eight sampling stations selected for the analysis were given bellow: S_1–-Durgi (Bore Well), S2 –Rayavaram (Bore Well), S3 –Adigoppula (Bore Well), S4 –Terla (Bore Well), S5 – Karempudi (Bore well & open well), S6 –Macherla (Bore Well & open well) S7 –Ganapavaram (Bore well) and S8-Chirumamilla (Bore Well).

Samples for analysis were collected in sterilized bottles using the standard procedure for grab (or) catch samples in accordance with standard methods of APHA (1995). The analysis of various Physico – Chemical parameters namely PH, Temperature, Total hardness, Alkalinity, Calcium hardness, Magnesium hardness, Chloride, Sulphate, Nitrate, DO, BOD, COD, TDS etc., were carried out – as per the methods described in APHA (1992). All the chemicals and reagents used were of analytical grade. D.D water was used for the preparation of solutions.

RESULTS AND DISCUSSION

The Physico – Chemical parameters of the water samples are presented in Table – 1

TEMPERATURE

Temperature of water is basically important because it effects bio-chemical reactions in aquatic organisms. A rise in temperature of water leads to the speeding up of chemical reactions in water, reduces the solubility of gases and amplifies the tastes and odours. The average temperature of the present study ranged from 26.93 - 28.21^0C.

pH

The pH value of natural water changes due to the biological activity and industrial contamination. Higher pH includes the formation of trihalomethanes which are toxic (Trivedi 1986). The pH values of the present investigation were within the ICMR standards (7.0 – 8.5).

Electrical conductivity

Conductivity is a measure of current carrying capacity. Thus, as concentration of dissolved salts increases conductivity also increases. Many dissolved substances may produce aesthetically displeasing colour, taste and odour. The values obtained are in the range   0.9 to 1.8 mmhos.

Total Dissolve Solids

TDS values ranged within 420 to 709mg/lt. The TDS values for ground water range from 19 to 1280mg/lt as per standards and in this respect this water is suitable for drinking purposes.

Dissolved Oxygen (DO)

It is an important parameter which is essential to the metabolism of all aquatic organisms that posses aerobic respiration (Wetzel, 1975). Presence of DO in water may be due to direct diffusion from air and photosynthetic activity of autotrophs (Shanti et al., 2002). Oxygen can be rapidly removed from the waters by discharge of oxygen demanding wastes. The DO values obtained in the present study are within ICMR standards.

Alkanity

Alkalinity value less than 100mg/lt is desirable for domestic use. However, in large quantities it imparts bitter taste to water.. In the present investigation the total alkalinity of the water samples is found in the range 106.4 to 162.2 mg/lt.

Hardness

Hardness is a measure of the ability of water to cause precipitation of insoluble calcium and magnesium salts of higher fatty acids from soap solutions. The principal hardness causing ions are Calcium, Magnesium Bicarbonate, Carbonate, Chloride and Sulphates. The hardness values of the present study were found to range between 220.4 to 532 mg/lit. The quantities of Calcium in natural water depend up on the type of rocks. Small concentration of calcium is beneficial in reducing the corrosion in water pipes. Magnesium hardness particularly associated with sulphate ion has laxative effect on persons un accustomed to it (Khursid,1998). In the present study Calcium and Magnesium contents are found in the range of 85.4 – 169.5 and 26.8- 78.2 mg/lt respectively.

Chloride

Chloride occurs in all types of natural waters. The high concentration of chloride is considered to be an indication of pollution due to high organic waste of animal origin (Singh, 1995). Chloride values obtained in the study are found in the range between 74.2-134.0 mg / lt.

BOD & COD
BOD & COD are the parameters used to asses the pollution of surface water and ground waters. Both of the parameters (BOD & COD) values obtained in the present study are within permissible levels.

Sulphate

Sulphate ion does not effect the taste of water, if present in low concentrations. The sulphate ion concentration in the present investigation varied from 87.5 - 185.0 mg/lt.

Nitrate

Nitrate is the most important   nutrients in an ecosystem. Generally water bodies polluted by organic matter exhibit higher values of nitrate. In the present study water samples from the stations   (S_1 to S_8) showed low concentrations of nitrate (1.34 to 2.15 mg/lt) well below permissible levels as per the standards.

Table – 1

Physico – Chemical Parameters of Water Samples Collected on 11-02-2010

Parameter	S_1	S_2	S_3	S_4	S_5	S_6	S_7	S_8
Temperature^0 C	27.08	28.10	28.21	27.82	27.08	28.11	27.49	26.93
pH	7.30	7.60	7.42	7.42	7.79	7.8	7.55	7.72
Electrical Conductivity	1.5.	1.9	0.9	1.8	1.2	1.0	1.5	1.3
TDS	562	709	420	532	628.	468	525	576
TSS	49.7	58.5	63.9	46.1	58.0	33.9	52.3	42.8
Hardness	532	.314.5	220.4	345.1	232.4	382.6	420.2	352.6
Calcium	127.0	106.2	85.4	169.5	91.3	139.2	175.2	112.6
Magnesium	78.2	56.0	27.2	72.5	26.8	58.5	62.4	74.8
Chloride	74.2	87.5	123.2	116.3	94.0	115.7	134.0	163.5
DO	4.8	4.5	5.0	4.0	4.7	4.2	4.6	4.3
BOD	1.3	0.5	1.2	0.8	0.7	0.8	1.4	1.2
Sulphate	132.0	96.5	125.2	185.0	87.5	108.5	175.2	162.0
Alkalinity	128.5	156.0	106.4	132.0	162.2	122.4	150..6	115.1
Nitrate	1.38	1.92	2.13	1.80	1.34	1.65	1.85	2.15
COD	5.2	4.8	5.2	5.3	6.0	4.9	6.2	5.8
Iron	0.002	0.003	0.004	0.002	0.003	0.003	0.004	Nil

 All the parameters expressed in mg/lit. except pH and EC (mmhos)
   All the values are the average of 3 determinations.

Water Quality Index (WQI)
WQI indicates the quality of water in terms of index number which represents overall quality of water for any intended use. It is defined as a rating reflecting the composite influence of different water quality parameters were taken into consideration for the calculation of water Quality index (WQI) .The indices are among the most effective ways to communicate the information on water quality trends to the general public or to the policy makers and in water quality management. In formulation of water quality index the relative importance of various parameters depends on intended use of water. Mostly it is done from the point of view of its suitability for human consumption.
The calculation of WQI was made using weighed Arithmetic index method (Brown et al,1972) in the following steps:

Let there be water quality parameters and quality rating (q_n) corresponding to nth parameter is a number reflecting relative value of this parameter in the polluted water with respect to its standard permissible value. q_n values are given by the relationship. $q_n = 100 (v_n-v_i) / (v_s-v_i)$

v_s = Standard value, v_n = observed value v_i = ideal value

In most cases $v_i = 0$ except in certain parameters like pH, dissolved oxygen etc.,

Calculation of quality rating for pH & DO ($v_i \neq 0$)

$q_{pH} = 100 (v_{pH} - 7.0) / (8.5 - 1.0)$ and $q_{DO} = 100 (V_{DO} - 14.6) / (5.0-14.6)$.

Calculation of unit weight

The Unit weight (w_n) to various water Quality parameters are inversely proportional to the recommended   standards for the corresponding parameters.

$W_n = k/s_n$.

Where w_n = unit weight for nth parameter

s_n = standard permissible value for nth parameter

k = proportionality constant.

The unit weight (w_n) values in the present study are taken from Krishnan et al., 1995
WQI is calculated by the following equation.

$$WQI = \sum_{n=1}^{n} q_n w_n / \sum_{n=1}^{n} w_n .$$

The suitability of WQI values for human consumption according to Mishra & Patel, 2001 are rated as follows. 0-25- Excellent;   26-50- Good; 51-75- Bad; 76-100- Very Bad; 100 & above- Unfit.

Assessment of water quality based on WQI

Application of WQI is a useful method in assessing the suitability of water for various beneficial uses. The WQI values of the present investigation from different sampling stations are given in Table – 2.

Conclusions

Some of the samples have total dissolved solids, hardness and calcium values exceeding the permissible limits as prescribed by Indian standards. However the WQI values in the present investigation were reported to be less than 50 (38.3 – 42.6) for different samples indicating that the water is safe for human consumption.

Table – 2

Water Quality Index of Well & Bore Well Waters of Guntur rural

parameter	ICMR Standard	Unit weight (w_n)	S_1	S_2	S_3	S_4	S_5	S_6	S_7	S8
pH	7.74	0.07164	6.7567	7.034	6.8678	7.21016	7.2195	7.2195	6.988	7.1455
TDS	500	0.00100	0.1124	0.1418	0.084	0.1256	0.0936	0.097	0.105	0.1152
TH	200	0.00167	0.4442	0.2626	0.1840	0.2881	0.1941	0.3195	0.3508	0.2944
DO	5	0.10030	9.629	9.027	10.03	8.024	9.428	.8.425	9.227	8.626
BOD	5	0.10030	2.608	1.003	2.4072	1.6048	1.4042	1.6048	2.8084	2.4072
Chloride	250	0.00200	0.05936	0.07	0.0986	0.09304	0.0752	0.0925	0.1072	0.1308
Total Alkalinity	120	0.00417	0.0447	0.05421	0.037	0.04587	0.0563	0.0425	0.0523	0.0399
NO_3	45	0.01111	0.03471	0.0474	0.05258	0.0555	0.0443	0.0407	0.0456	0.0530
COD	20	0.02507	0.65182	0.60163	0.65182	0.664	0.7521	0.6142	0.7772	0.7270
Sulphate	200	0.007418	0.04896	0.03579	0.04637	0.06862	0.0324	0.0402	0.0649	0.0600
Iron	0.3	1.6666	1.11066	1.666	2.22132	1.11066	1.666	1.666	2.2213	nd
w_n	----	----	1.98487	----	----	----	----	----	----	----
q_n	----	----	21.50051	19.94345	22.6807	19.2903	20.965	20.162	22.7479	19.599
WQI	----	----	42.6757	39.587	45..0182	38.2889	41.614	40.019	45.151	38.902

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REFERENCES

APHA1995 Standard methods for the estimation of water and waste water 19th edn, AWWA. WPCP, New York USA.

Brown,R.M, N.J.Mc cleiland, R.A.Deiniger, and M.F.A. O' Connor (1972). Water quality index – crossing the physical barrier (Jenkis, S H ed) Proc. Intl. Conf. on water poll. Res. Jerusalem **6**, 787 – 797

Karnath.K.R (1989). Hydrogoology. Tata Mc. Graw Hill publishing company Ltd., NewDelhi.

Khursid.S, Zaheeruddin and A. Basheer (1998). Ind.J.Env. Prot. 18 (4) 246-249.

Krishnan,J.S.R K.Rambabu & C. Rambabu (1995). Studies on water quality parameters of bore waters of Reddigudum Mandal. Ind J. Env. Prot. **16 (2)** ,91-98

Kudesia.V.P (1980). Water pollution, Pragathi Prakashan, Meerut, India pp 1-12.

Mishra.P.C and R.K. Patel (2001). Quality of Drinking water in Rourkela, out side the steel town ship. J. Env. Poll. **8 (2),** 165 – 169.

Shanthi.K, P. Ramasamy, and Lashmanperumalsamy (2002). Hydrological study of Singanallur lake at Coimbatore, Nature Environment& Pollution Technology, **1(2),** 97-101..

Trivedi R.K. and P.K. Goel (1986). Chemical and Biological methods for water pollution studies. Environment Publications pp .215.

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