

STUDY ON SUBSURFACE WATER QUALITY IN SELECTED PLACES IN COIMBATORE

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ABSTRACT:

Studies were conducted in the year 2009 and 2010, to know the quality of bore well water of few stations of Coimbatore district to assess their suitability for drinking and irrigation purposes. The data was analyzed with reference to WHO standards and it is found that the physico-chemical parameters are within the maximum permissible limits. The study area also reveals that ground water of area is dominated by magnesium and sodium with chloride.

Keywords: Coimbatore district, ground water, Permissible limit, Physico-Chemical parameters, magnesium and sodium with chloride.

INTRODUCTION:

Water is the mother of life. It is a mysterious liquid having physical and chemical properties. Water is not only the most important essential constituent of all animals, plants and other organisms but also it is pivotal for the survival of mankind in the biosphere. Ground water also plays an important role in agriculture. It is estimated that about 45% of the irrigation

water requirement is met from ground water sources (AJA Ranjith Singh et al., 2004).

To safeguard the ground water resources, the quality of water must be monitored periodically. For this purpose, it is very important to know the physico-chemical parameters, water quality index and the classification of water.

The area chosen for the present study belongs to Coimbatore. The study area is situated at 11° 20'N latitude and 77° 05'E longitude.

MATERIALS AND METHODS:

The collection and testing of water samples is very important operation in water quality. In order to find out the water quality and to classify, the water samples were collected from 5 bore wells of Coimbatore in the year 2009 and 2010 and tested for the various physico-chemical parameters, and compared with the permissible limits.

CHEMISTRY OF PHYSIO CHEMICAL

PARAMETERS:

Table 1 Quality data of Coimbatore during the Year 2009

Among all parameters, 12 parameters which are important for drinking water quality were selected for the analysis. Three parameters chloride, electrical conductivity, and sodium were considered for analysis of water for irrigation purposes.

S. No	Village/Locati on Village/ Location	EC	pH	Ca	Mg	Na+ K	HCO ₃	Co ₃	Cl	No ₃	SO ₄	TD S	TH
1	S.S.Kulam	1063	8.1	90	69.6	154	219.6	60	266	44	149	935	215
2	Veerapandi	1760	8.4	92	63.18	190	335.5	66	213	43	179	1030	235
3	K.palayam	540	8	48	22.8	33	100.6	0	92	15.4	62	313	160
4	Nanjunda puram	774	7.56	45	24	48	62	0	128	18	65	540	210
5	Vellamadai	1240	8.5	77	58	103	470	11	88	44	93	664	400
6	Kalapatti	1630	8.3	32	63.1	185	360	18	213	45	120	992	340
7	P.N.Palayam	2060	8.6	108	50.4	280	454	63	220	78	230	1264	460
8	Gudalore	1460	8.4	28	116.6	98	260	24	199	38	160	856	350

Table 2 Quality data of Coimbatore during the Year 2010

RESULTS AND DISCUSSION:

Geo chemical studies provide a complete knowledge of water resources of a hydrological regime. The studies are also of value with respect to water use. They produce a better understanding of possible changes in quality as development progresses, which can in turn provide information about the limits of total development, or can permit planning for appropriate treatment that may be required as the observed that the pH of ground water varied from 7.56 to 8.6. Except one value all other values of pH

result of future changes in the quality of water supply. The results thus obtained in this investigation have been presented and discussed.

The pH is a measure of acidity or alkalinity indicating the logarithm of reciprocal of Hydrogen ion concentration in water. It has no direct adverse effect on health, however, a low value below 4 will produce sour taste and high value above 8.5 shows alkaline taste. For the year 2009, from table 1, it is

S. No	Village/ Location	EC	pH	Ca	Mg	Na +K	HCO ₃	C o ₃	Cl	No ₃	SO ₄	TDS	TH
1	S.S.Kulam	1420	8	110	66	143	232	66	270	40	143	687	350
2	Veerapandi	2570	7.6 8	178	65	192	400	70	300	40	220	1799	470
3	K.palayam	860	8.4	50	26	52	68	0	142	20	72	598.8	215
4	Nanjundapur am	1110	7.7	56	28	146	390.4	0	105	27	61	667	230
5	Vellamadai	1152	8.4	72	50	95	412	10	82	40	87	620	310
6	Kalapatti	960	8.1	60	41.31	78	399	0	67	1	67	516	200
7	P.N.Palaya m	2060	8.6	108	61	194	430	60	128	73	226	989	495
8	Gudalore	1750	8	44	72.9	218	481.9	0	227	0	145	979	235

were within the limits. In the year 2010 from table 2, the pH varied from 7.68 to 8.6, the same location mentioned in the year 2009 exceeded the permissible limit of pH. Higher value of pH reduces the germicidal potentiality of chlorine

and induces the formation of toxic trihalomethanes (*K. Vijiyaram et al., 1989*).

The electrical conductivity is an index to represent the total concentration of soluble salts in water. In the study area, it varied between 540

$\mu\text{mhos/cm}$ to 2060 $\mu\text{mhos/cm}$ in the year 2009 and 860 $\mu\text{mhos/cm}$ to 2570 $\mu\text{mhos/cm}$ in the year 2010.

The total dissolved solids (TDS) is a parameter used to measure salinity of water. The TDS depends upon the variety of dissolved solids or salts as it passes through soil and rocks. These salts include cations such as Sodium, Calcium, Magnesium and Potassium and anions such as Chlorides, Sulphates and Bicarbonates. The concentration of total dissolved solids ranged between 313 mg/l and 1264 mg/l, and 516 mg/l and 1799 mg/l in the year 2009 and 2010 respectively. In many locations the TDS value exceeded the permissible limits. The leachate percolating from the solid waste dumped in these locations could be the reason for this (*M.B. Mehja et al. 2003*).

The alkalinity of water is a measure of its capacity to neutralize acidity in water. The alkalinity ranged between 62 mg/l and 481 mg/l in the year 2009, and 68 mg/l and 481.9 mg/l in the year 2010. In both years of observation, the alkalinity was not within the limits in many locations. This may be due to the presence of carbonate and bicarbonate salts.

Chloride is an important parameter in detecting the contamination of ground water. In the year 2009, it ranged between 92 mg/l and 266 mg/l, and in the year 2010, from 67 mg/l to 300 mg/l. However, in the study area in maximum number of locations the chloride concentrations were within the limits except in one location in 2009 and two locations in 2010. The higher level of Chloride in ground water indicated admixture of mineralized water or pollution (*Narayan et al. 1989*).

Hardness is caused by multivalent metallic cations. The principal hardness causing cations are the divalent Ca, Mg, Fe and Mn ions. Ordinary salts of Ca and Mg cause by far the greatest portion of the hardness occurring in water. Hardness of water is objectionable from the viewpoint of water use for laundry and domestic purposes since it consumes a large quantity of soap. Based on the present investigation, it is clear that the hardness is not

within the limits in some locations. The hardness varied from 160 mg/l to 460 mg/l in the year 2009 and 200 mg/l to 515 mg/l in the year 2010. The higher value of hardness can be attributed to low water level and high pumping rate. In the study area, the concentration of Na + K varies from 33 mg/l to 280 mg/l in 2009 and 52 mg/l to 218 mg/l in 2010.

The sulphate content of natural water is an important parameter in determining the suitability of water for residential use or public use. In the year 2009 it ranged between 62 mg/l and 230 mg/l, and in 2010, between 61 mg/l and 226 mg/l. However in the study area, in the maximum number of locations, the concentration sulphate was within the limits, except in one location in 2009, and two locations in 2010. This may be due to accumulation of soluble salts in soil (*C.K. Jain et al. 2003*).

Calcium and Magnesium are common constituents of natural waters and are important contributors to the hardness of water. These may range from Zero to several hundreds of ppm depending on the source and geology of the study area. Calcium ranged between 28 mg/l and 108 mg/l in the year 2009, and 50 mg/l and 178 mg/l in the year 2010. In the year 2010 the magnesium ranged between 24 mg/l and 116.6 mg/l and between 26 mg/l to 72.9 mg/l. High concentrations of Calcium and Magnesium present no health hazard (*Kotiah et al. 1994*).

Nitrate is regarded as an important natural constituent. The sources of nitrate in ground water may be natural soil nitrogen, fertilizer, and untreated domestic wastes. Ground water contamination by nitrates causes considerable health hazard. High concentration in drinking water has been linked with methaemoglobinemia and gastric cancer (*Prakash et al. 2001*). In the study area, at all locations, the nitrates concentration was within the limits.

STATISTICAL MODELING:

The strong correlation always exists among the water quality parameters, a systematic

Table 2. Inter-correlation Matrix Among Parameters

	pH	TDS	TH	Al	SO4	EC	Cl	Ca	K	Mg	Na	NO3
pH	1											
TDS	-.315	1										
TH	-.167	.952	1									
Al	-.418	-.103	-.033	1								
SO4	-.321	.936	.903	-.083	1							
EC	-.212	.773	.782	-.160	.871	1						
Cl	-.186	.869	.797	-.346	.940	.872	1					
Ca	-.054	.617	.545	-.214	.396	.371	.486	1				
K	-.034	.406	.297	-.397	.498	.407	.525	-.099	1			
Mg	-.040	.393	.369	-.096	.611	.396	.642	-.007	.249	1		
Na	-.360	.940	.932	.003	.965	.920	.879	.460	.393	.421	1	
NO3	-.150	.535	.523	-.076	.412	.026	.312	.240	.140	.351	.297	1

calculation and interpretation of correlation coefficient gives an idea of rapid water quality monitoring methods.

The correlation coefficient greater than 0.7 is taken for discussion.

The high correlation exists between total hardness and total dissolved solids, electrical conductivity and total dissolved solids, electrical conductivity in total hardness, sulphate and electrical conductivity, chloride and total dissolved solids, chloride and sulphate, sodium and electrical conductivity.

A moderate correlation exists between sulphate and TDS, chloride and total hardness.

CONCLUSION:

Analysis of bore well water of five stations in Coimbatore in the year 2009 and 2010, revealed that the parameter TDS is high in all stations and to summarize, the results of present investigation clearly indicates that the ground water in this area is not highly contaminated. So the water is suitable for domestic, industrial and irrigation purposes. The hydro chemistry of water is of magnesium and sodium with chloride.

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