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STUDY ON SUBSURFACE WATER QUALITY IN METTUPALAYAM TALUK OF COIMBATORE DISTRICT, TAMIL NADU

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ABSTRACT

Studies were conducted in the year 2002 and 2003, to know the quality of Borewell waters of five stations of Mettupalayam Taluk, Coimbatore district to assess their suitability for drinking and irrigation. The data were analysed with reference to WHO standards, and it was found that the physico-chemical parameters are within the maximum permissible limits. The study area also reveals that ground water of the area is dominated by magnesium and sodium with chloride.

INTRODUCTION

Water is not only the most important essential constituents of all animals, plants and other organisms but it is also pivotal for the survival of mankind in the biosphere. Ground water plays an important role in agriculture. It is estimated that about 45% of the irrigation water requirement is met from ground water sources (Ranjith Singh & Ajithkumar 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 is Mettupalayam taluk belonging to Coimbatore district of Tamilnadu. The study area was 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 borewells of Mettupalayam taluk in the year 2002 and 2003 and tested for various physico-chemical parameters (APHA 1989), and compared with the permissible limits and classified using HYCH programme.

Based on the programme, the hydrochemical data have been interpreted using the following methods.

1. Classification of water with reference to its hardness, salinity and sodium hazard.
2. Identification of water types based on Schoeller's method (1967).
3. Determination of hydrochemical facies using Piper's Diagram (Piper 1944).

In addition, corrosivity ratio and residual sodium carbonate were also determined.

RESULTS AND DISCUSSION

The results of the physico-chemical analysis of water are given in Tables 1 and 2. The pH of the water samples ranged from 7.3 to 8.6 in the year 2003. The pH is in alkaline range and within WHO

permissible limit. Total dissolved solids (TDS) indicate the general nature of salinity of water. Water containing more than 500mg/L of TDS is not considered desirable for drinking water supplies. But in unavoidable cases 1500mg/L is allowed. In the present study, TDS ranged from 668mg/L to 1092 mg/L in the year 2002, and 436mg/L to 1677 mg/L in the year 2003. In all the locations, except one location in the year 2003, it was beyond the desirable limit, but within the excessive limits. The cause of the high concentration of TDS may be the combined effect of lithologic variation, industrial effluents and chemical fertilizer contaminations (Mohapatra et al. 2001). According to the classification, the ground water of this area belongs to slightly saline (1000-3000 ppm) followed by non-saline (<1000ppm) in nature.

In natural freshwaters high concentration of chlorides is regarded as an indicator of pollution. Chlorides content above 250mg/L makes water salty in taste, however, a level up to 100mg/L has been safe for human consumption. In the study area it ranged between 135mg/L and 284 mg/L in the year 2002 and 78 mg/L and 425 mg/L in the year 2003. In almost all the locations, except one location in each year it was beyond the permissible limit.

Table 1: Water quality data of Mettupalayam taluk, years 2002-2003.

Village/Location	EC	pH	Ca	Mg	Na+K	HCO_3	CO_3	Cl	NO_3	SO_4	TDS
					(Year-2002)						
Irunbarai	1840	8.4	90	60	151	271.2	48	284	6	82	1107
Dayanur	1500	8.3	20	61	156	201.3	24	199	41	120	931
Therampalayam	1610	8.5	52	56	224	230	96	241	40	96	973
Tholampalayam	1880	8.5	28	60	282	376.8	72	195	7	206	1092
B.K.Koil	1200	7.3	60	56	59	241	0	135	14	106	668
					(Year-2003)						
Irunbarai	1610	7.8	40	50.4	121	244	0	174	42	85	1047
Dayanur	870	8.6	20	78.97	34	298.62	11.17	110	11	20	436
Therampalayam	2950	8.4	92	218.7	168	176.9	90	425	11	576	1677
Tholampalayam	960	8.1	62	38.88	79	359.9	0	78	0.05	74	511
B.K.Koil	1690	8.3	44	60.75	157	237.9	48	213	47	106	1035

Table 2: Output results of HYCH for water samples of Mettupalayam Taluk, Years 2002-2003.

SAR	CR	$CaCO_3$ Saturation Indices		Handa's	Schoeller's	Stuyfzand's	USSL classification	
		CA method	pH method	Classification	water Type	Classification	Salinity	Na Hazard
				(Year-2002)				
3.02	1.521	0.9734	1.5	A2C3S1	IV	Fresh Brackish	C3	S1
3.92	1.799	0.8521	0.6175	A3C3S1	IV	Fresh Brackish	C3	S1
5.14	1.348	0.9451	1.2903	A3C3S2	IV	Fresh Brackish	C3	S2
6.89	1.09	0.9356	1.2358	B3C3S2	IV	Fresh Brackish	C3	S2
1.32	1.247	0.6084	0.1727	A2C3S1	III	Fresh Brackish	C3	S1
				(Year-2003)				
3.00	1.367	0.4165	0.502	A2C3S1	IV	Fresh Brackish	C3	S1
0.76	0.567	0.9095	1.0888	A1C3S1	III	Fresh Brackish	C3	S1
2.17	4.491	0.9446	1.324	A2C5S2	II	Brackish	C5	S2
1.91	0.519	0.9755	1.1611	A1C3S1	IV	Fresh Brackish	C3	S1
3.6	1.436	0.9406	1.0324	A2C3S1	IV	Fresh Brackish	C3	S1

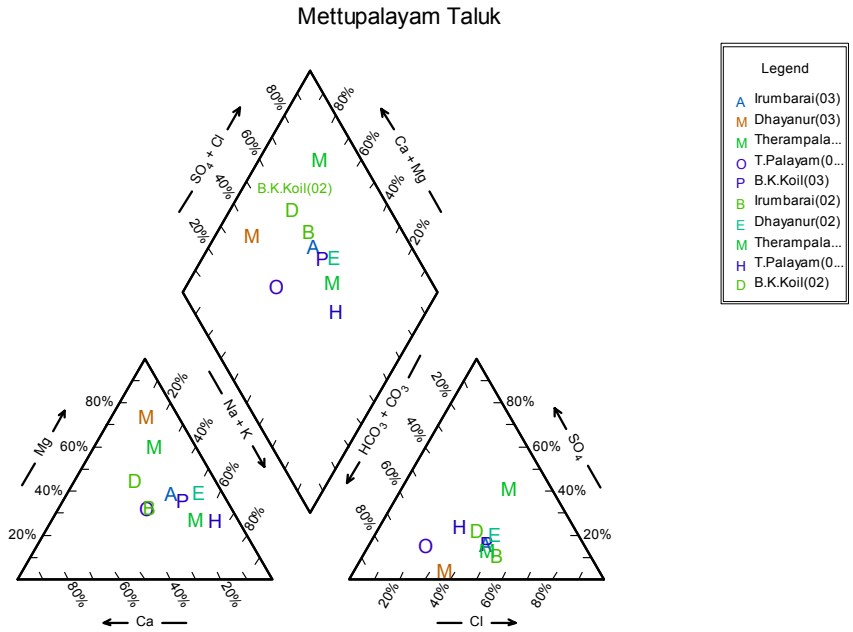

Fig. 1: Piper diagram of Mettupalayam taluk.

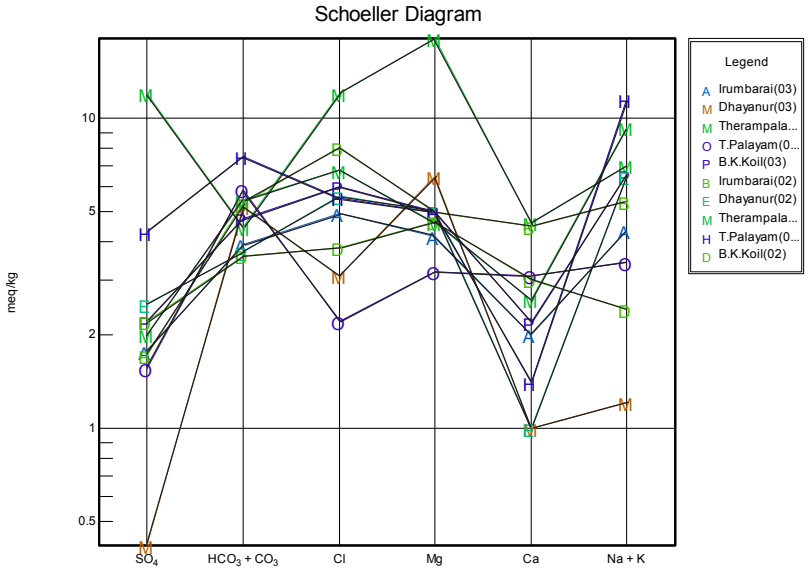

Fig. 2: Schoeller diagram of Mettupalayam taluk..

Sulphate content in the study area ranged from 82mg/L to 206 mg/L in 2002, and 20 mg/L to 506 mg/L in 2003. However, all the samples comply with the limits set by the WHO except one location in 2003. This may due to the discharge of sewage. Excess sulphate content induces cathartic effect on human health.

The calcium content varied from 20 mg/L to 90 mg/L in 2002 and 20 mg/L to 92 mg/L in 2003. Except one location in each year all are with in the permissible limits. High concentration of calcium is due to its presence in rocks from where it has leached out to ground water. Calcium as such has no hazardous effect on human health. The collection and testing of water samples is very important operation in water quality.

Magnesium also occurs in all kinds of natural waters with calcium. Magnesium contents in the study area were beyond the permissible limits.

Nitrate is one of the several inorganic pollutants contributed by the nitrogenous fertilizers, organic manures, human and animal wastes. In the study areas nitrate contents were within the permissible limits.

CLASSIFICATION

Piper diagram (Fig. 1) is a useful tool for characterizing the water types. According to this diagram, in the study area predominant water type was magnesium and sodium with chlorides. Based on the Handa's classification the study area falls in to permanent hardness type.

According to Schoeller, the ground water type in the study area classified as type III followed by Type IV (Fig. 2) . Based on corrosivity ratio, all the samples in the entire study area have CR<1, hence, it is safe with respect to corrosion.

The sodium absorption ratio (SAR) in the study area falls under 10, indicating that water in all locations was suitable for irrigation. According to USSL classification, the dominant water type in the study area was C_3S_1.

CONCLUSION

Analysis of Borewell water of five stations in Mettupalayam taluk in the year 2002 and 2003, revealed that the parameter TDS is high in all the stations. The results of the present investigation clearly indicate that the ground water in this area is not highly contaminated. So the water is suitable for domestic, industrial and irrigation purposes. The hydrochemistry of water is of magnesium and sodium with chloride.

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