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GEO-PHYSICO-CHEMICAL STUDY OF WATER OF COLLEGE OF MILITARY ENGINEERING AREA OF PUNE (INDIA)

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ABSTRACT

An extensive geo-physico-chemical study of water was done. Analysis of water samples shows a vast change in water quality of CME area of Pune. A comparative study tells that there is no water pollution in CME area. The parameters are taken electrical conductivity, pH, TDS, bicarbonate, chloride, fluoride and refractive index. All these parameters are in permissible limit of W.H.O. There is no water pollution in CME as per the water quality parameters.

Key words: Geo physico chemical, Water quality, Pune

INTRODUCTION

The College of Military Engineering at Pune is a premier technical training Institute of Corps of Engineers and the Indian Army. Surrounded by green hills and located at the confluence of Mutha & Mula rivers, Pune was developed by the British as an Army town in 19th century.

CME, College of Military Engineering is situated on the Pune Mumbai High way nearly 8 km from the main city. The most beautiful lake of CME is located in the center of CME campus. The location is unique, the surrounding scenic and the ambience out of the world. It was necessary to analyze the water samples of CME area. The water samples were collected from CTW lake area, upper lake, middle lake, tap water samples, bore well water, mulla river, mutha river, mulla river high explosive discharge, Khadakwasla dam near NDA. The water samples were analyzed in the Chemical Laboratory, Department of Applied Sciences. The all water parameters are in permissible limits of W.H.O.

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EXPERIMENTAL

pH was measured by Beckman Zeromatic pH Meter. Conductivity by Surfass Conductivity Bridge, Arthur, H. Thomas Co, Philadelphia. TDS were measured by weight difference method using platinum crucible and vacuum desiccators. Fluoride was measured spectrophotometrically using zirconium oxychloride (SPADNS photometric method) as well as by Orion ion meter.

The fluoride electrode consists of a sensing element bonded into an epoxy body. When the sensing element is in contact with a solution containing fluoride ions, an electrode potential develops across the sensing element. This potential, which depends on the level of free fluoride ion in solution, is measured against a constant reference potential with a potential with a digital pH/mV meter or specific ion meter. The measured potential corresponding to the level of fluoride ion in solution is described by the Nerest equation:

$$E = E_o + S \log (A),$$

Where, E = Measured electrode potential, E_o = Reference potential (a constant), A = Fluoride ions level in solution and S = Electrode slope (about 57 mV per decade).

The level of fluoride ion, A, is the activity or "effective concentration" of free fluoride ions in solution. The fluoride ion activity is related to free fluoride concentration, C_f, by the activity coefficient, γ:

$A = \gamma C_f$, ionic activity coefficients are variable and largely depend on total ionic strength[2]. Ionic strength is defined as:

$$\text{Ionic strength} = \tfrac{1}{2} \sum C_i Z_i^2$$

Where: C_i = Concentration of ion i

Z_i = Charge of ion i, $\sum$ symbolizes the sum of all the types of ions in solution.

Total hardness is measured by EDTA classical titration method and TDS by difference method.

Chloride was measured by Mohr's method as described in APHA. The refractive index was measured by Leica ABBE Mark II refractometer Model 10495 Germany made.

RESULTS AND DISCUSSION

pH: On examination of Table 1, it is clear that pH varies from 7.0 to 8.2 of the samples collected from various sources. The pH 7.0 is of Mula River and Mutha river is adjoining. pH 8.2 of upper lake is probably due to mixing of water from out side water sources. pH range is in accordance with the W.H.O. limits. No excessive alkalinity and acidity have been observed.

Conductivity: The conductivity value varies from 0.22 x 10^3 to 1.29 x $10^3$of the different samples. Conductivity of these samples also within permissible limits of W.H.O. Conductivity of Khadakwasla dam is lowest. This is truly in agreement with the results obtained by analysis, as only rainy water is stored in this dam for the supply to Pune city for drinking purpose only.

Table 1. Analysis result of different water samples collected from CME and near by vicinity

Water samples collected	pH	Sp. Cond. at 25°C (S/cm)	TDS (ppm)	Fluoride (ppm)	Total hardness (ppm)	Refractive index	Chloride (ppm)	Bicarbonate (ppm)
CTW lake	7.2	1.25 x 103	713	0.325	175	1.3327	99.4	40
UPPER lake	8.2	1.05 x 103	470	0.200	195	1.3326	142.0	60
MIDDLE lake	8.2	1.06 x 103	420	0.100	210	1.3324	142.0	40
CME tape water	7.9	0.22 x 103	131	0.100	80	1.3317	99.4	40
CME bore well	7.8	1.05 x 103	273	0.050	160	1.3319	127.8	40
Mulla river	7.6	1.21 x 103	539	0.120	185	1.3322	99.4	10
Mutha river	8.2	1.29 x 103	503	0.100	180	1.3323	85.2	10
Mulla river	7.0	0.44 x 103	192	0.050	95	1.3322	71.0	60
Khadkwasladam	7.6	0.12 x 103	51	0.130	45	1.3326	56.8	10

TDS : Total dissolved solids value ranges between 51 ppm to 713 ppm. Khadakwasla dam TDS value 51 ppm indicates that rain water is collected in the dam and hance, it has less TDS value. CTW lake contains maximum value of 713 TDS.

Fluoride: The value of fluoride varies from 0.05 to 0.325. These values are in permissible limits. These values are also represented graphically.

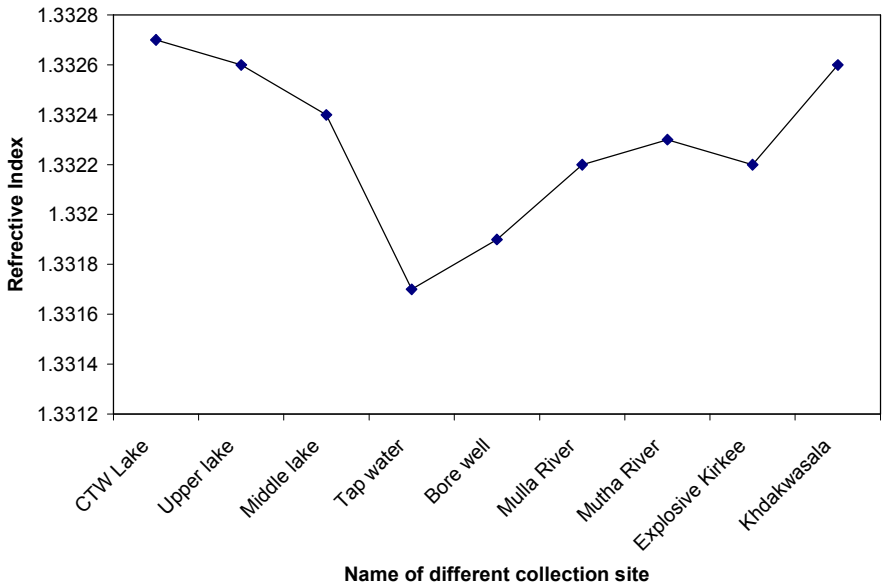

Fig. 1: Refractive index

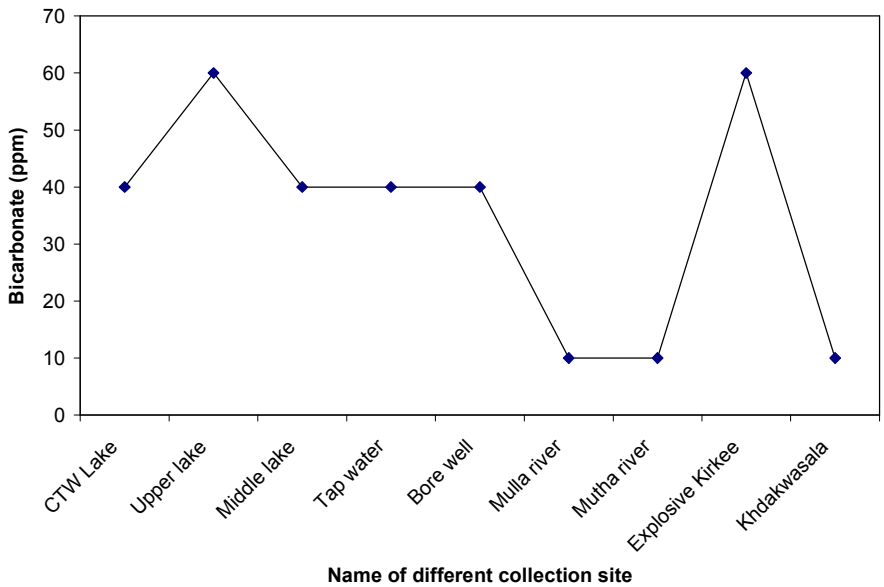

Fig. 2: Bicarbonate concentration

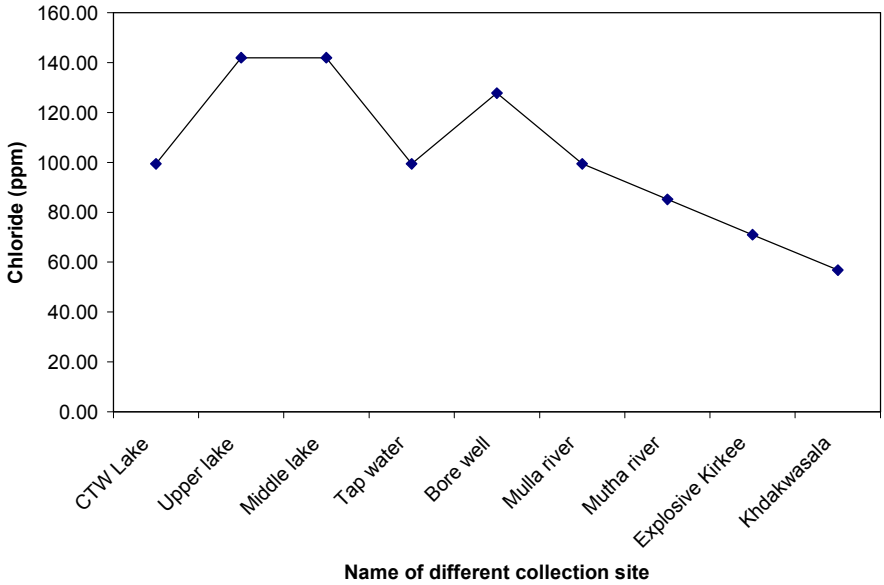

Fig. 3: Chloride concentration

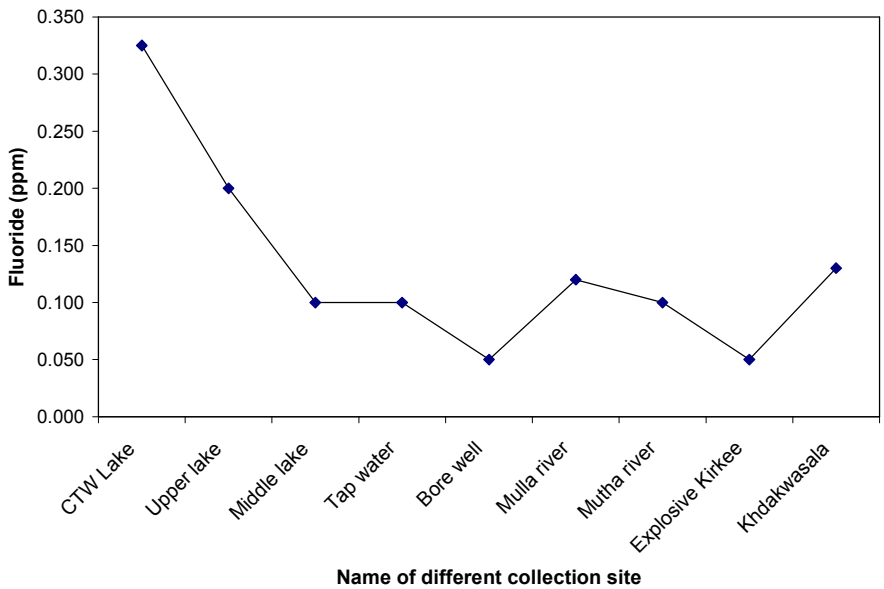

Fig. 4: Fluoride concentration

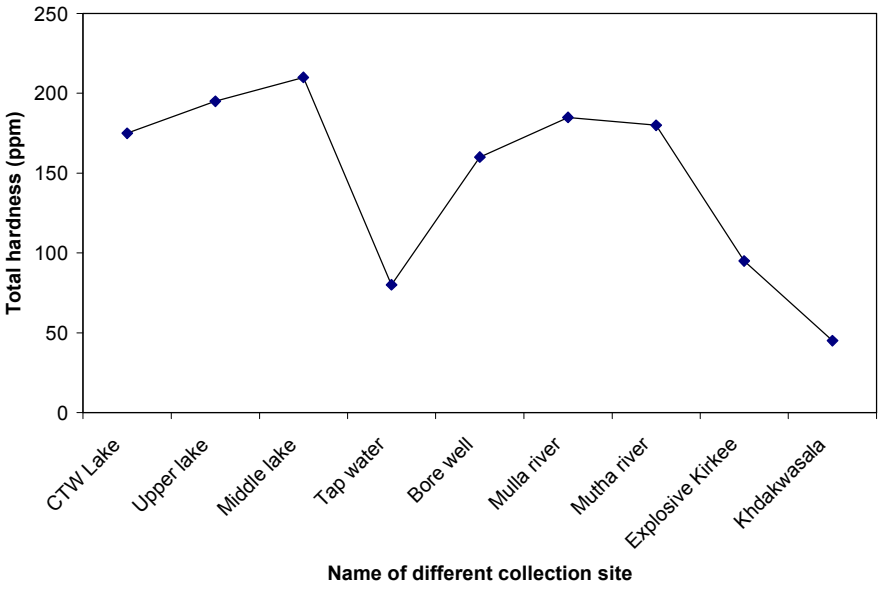

Fig. 5: Total hardness

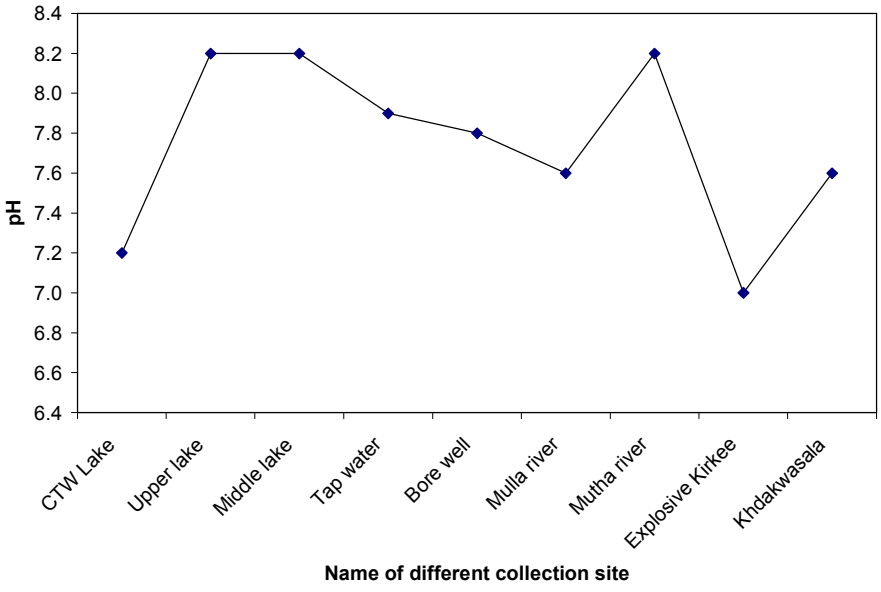

Fig. 6: pH

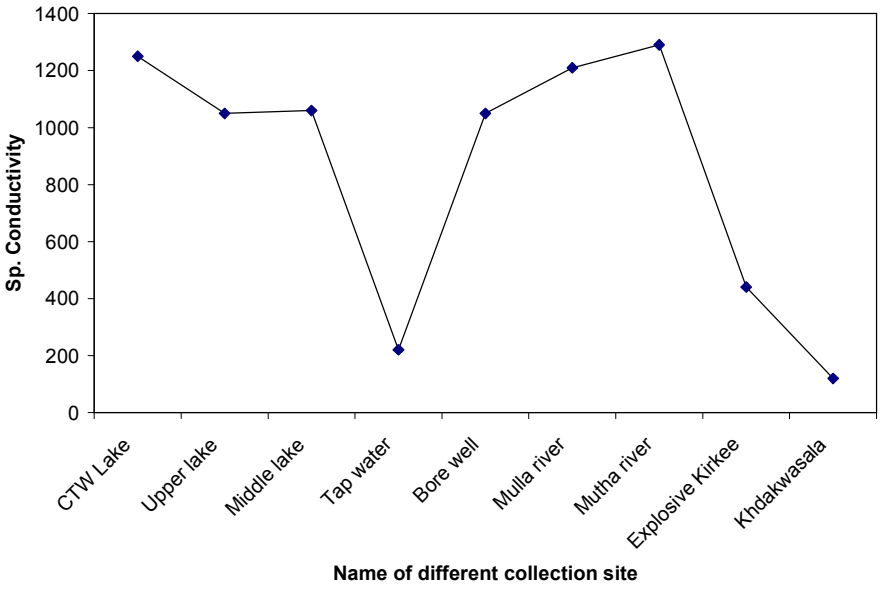

Fig. 7: Specific Conductivity

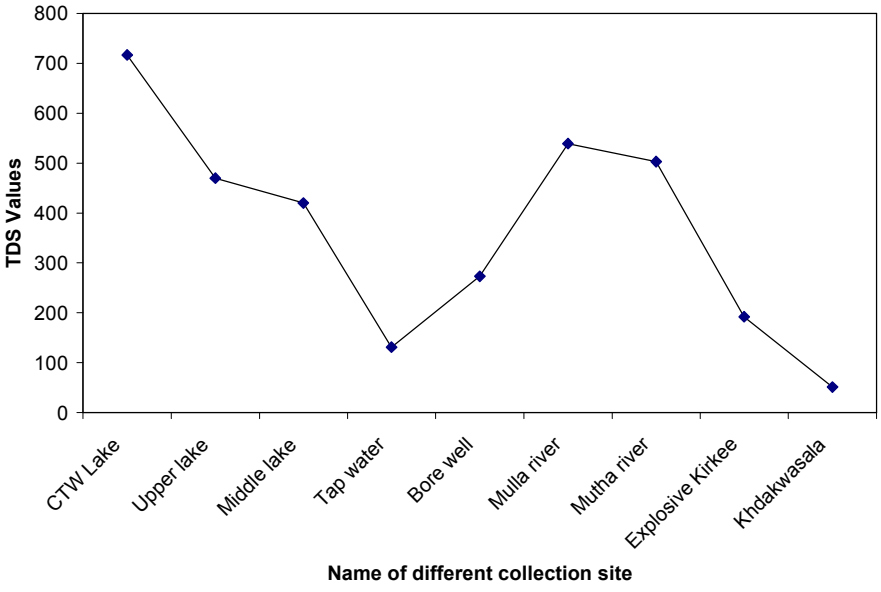

Fig. 8: TDS Values

Total hardness: The value of total hardness varies from 45 ppm to 210 ppm as

shown in Table. The total hardness values are also within permissible limits.

Refractive index: The value of refractive index varies from 1.3317 to 1.3337.Thre is no appreciable change in this physical parameter.

Chloride: The value of chloride varies from 56.8 to 146 ppm in different samples. The lowest concentration is in Khadakwasla dam. The chloride concentration is in permissible limits.

Different fauna present near by lake areas are little Egret, Darter, Coot, Painted Stork, Purple Moor hen, Spoonbill, Open bill Stork, Grey Hepon and different flora like Cassia fistula, Tamariandus indica, Delonix regia, Saraca indica and Bauhinia variegata and others in CME. The water quality in CME and near by area is good and there is no water pollution as per the parameters observed. It is suggested that the water coming towards CTW lake must come by proper recycling methods.

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