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Physico-Chemical Analysis of the Groundwater – A Case Study

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Abstract: *Groundwater samples collected from 12 different sampling stations were examined for various water quality variables namely, pH, TDS (Total Dissolved Solids), Temperature, EC (Electrical Conductivity), Chloride, Bicarbonate, Total Hardness (TH), Sodium, Potassium, Sulphate and Fluoride employing the standard methods of APHA (1998). The final experimental results were compared with the WHO variable standards (1993) and BIS variable standards (1998). The EC values of all the samples were above the permissible limits, 58% of samples exhibited TDS and TH values above the permissible limits. 16% of samples displayed calcium values above the permissible limit, 41% of the samples had Magnesium values above the permissible limit of WHO (1993). 25% of samples had Chloride values above the permissible limit of WHO (1993). Only a single sample displayed sulphate value above the permissible limit of WHO (1993). All the values are tabulated in table-1.*

Key Words: Water Quality variables; APHA; Talk; Hobli

I. INTRODUCTION

Water pollution is a rising serious concern in todays' scenario. Throughout the country with the swift upsurge in population, the demand for fresh water has also shown a linear increase. The groundwater today is witnessing two faced water crisis. On one hand, the existing aquifers are fast depleting due to its over exploitation through massive digging of bore wells (especially in metropolitan cities), encroaching of small aquifer recharge zones by expanding concrete colonies, secondly the existing groundwater is polluted by anthropogenic activities. An alarming situation of Bengaluru metropolis is mentioned by [1] wherein the groundwater table has largely depleted, many aquifer recharge zones have dried up, some have been encroached as a consequence of rapid urbanization. A few have them have been polluted with domestic wastes. Similar situations were observed by[2], [3] and [4].

Anthropogenic activities like excessive industrialization and irrigation pollutes the groundwater [5]. The dumping of industrial wastes and effluents deep in the ground may come in contact with the groundwater thereby polluting it. Increased use of chemical fertilizers, pesticides in agricultural fields may seep into the water table over a period of time may be along with rain water thereby causing groundwater pollution[6]. The current study area consists of both small scale industries and agricultural fields. Hence the current investigation deals with the assessment of groundwater quality for few water quality variables keeping in view the possible pollution by the above mentioned industrial and agricultural sectors.

II. METHODOLOGY

Groundwater were sampled from twelve stations in Hutridurga Hobli, Kunigal taluk, Tumkur district for various physicochemical parameters mentioned above. Variables namely pH, EC and TDS were estimated on the field, using portable water analyzer. Remaining variables such as Chloride, and Total Hardness were estimated using titrimetric analysis. Sulphate was estimated by Turbidimetry using spectrophotometer Elico in the laboratory of Atria Institute of Technology, Bengaluru. AR-grade

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chemicals and double distilled water were employed for the laboratory analysis.

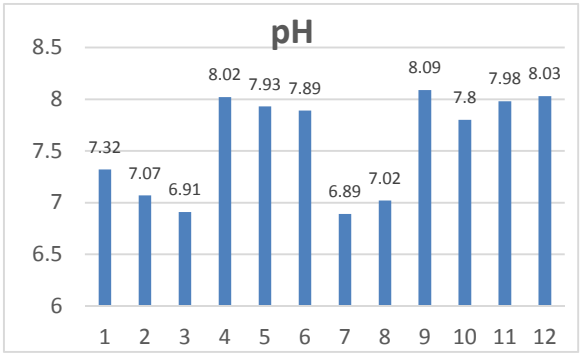
III. STUDY AREA.

Hutridurga Hobli is a part of Kunigal taluk, Tumkur district, Karnataka, India. It is surrounded by Tiptur, Turvekere, Magdi Taluk and Tumkur taluk .This particular Hobli is a blend of Industrial sectors and cultivable lands. The temperature of this region is moderate, considerably less rainfall is witnessed in this region. Groundwater is the main source of fresh water for the people of this Hobli. Groundwater samples were collected from this Hobli keeping in view both the industrial and the agriculturalpollution.

RESULTS AND DISCUSSION:

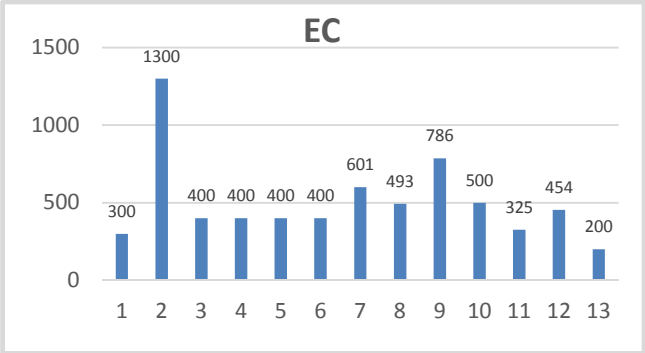
SAMPLE NO	pH	EC	TDS (ppm)	TH (ppm)	Ca^{2+} (ppm)	Mg^{2+} (ppm)	Cl^- (ppm)	Sulphate (ppm)
1	7.32	300	840	356.4	47.64	28.58	137.72	252
2	7.07	1300	464	238	90.53	54.31	73.2	148
3	6.91	400	405	297.8	42.88	25.72	135.95	130
4	8.02	400	467	262	61.94	37.16	106.87	135
5	7.93	400	459	273.9	52.41	31.4	128	86
6	7.89	400	394	309.7	57.17	57.17	180.92	129
7	6.89	601	805	480.1	55.5	58.5	210	72
8	7.02	493	675	440	67.8	68.5	206	132
9	8.09	786	815	335.6	71.02	40.7	152	150
10	7.8	500	858	298.05	61.2	51.8	210	94
11	7.98	325	780	351.2	41.2	42.6	122	190
12	8.03	454	689	408.2	69.02	33.3	108	56
WHO (1993)	**7-8.5**	**200**	**500**		**75**	**50**	**200**	**200**
BIS (1998)			**500**	**300**	**75**	**30**	**250**	**200**

pH: pH measures the acidity or alkalinity of water [7]. The pH values of the water samples ranged between 6.91 and 8.03, with an average value of 7.52.The pH values of all the samples are found to be within the permissible limits of WHO (1993) water standards.



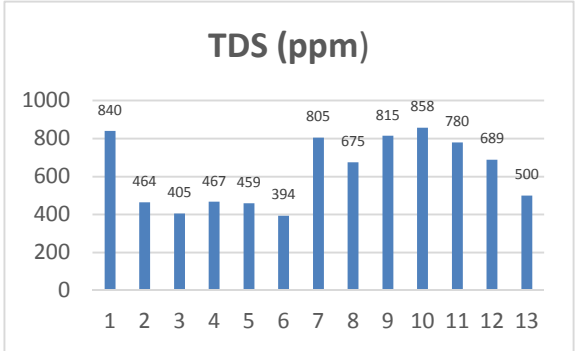
.Graph -1: showing the pH values of different study sites

Electrical Conductance (EC): Electrical conductivity of water is a measure of the water's capacity to carry electric current[8], in the present investigation the EC values varied between 300 µS/cm&1300 µS/cm with an average value of 533.3 µS/cm as shown in table-1.



.Graph -2: showing the EC values of different study sites

Total Dissolved Solids (TDS): The TDS value in this investigation is high as 858 ppm and a minimum value of 394ppm with an average TDS value of 504.833ppm as showed in table-1.



.Graph -3: showing the pH values of different study sites

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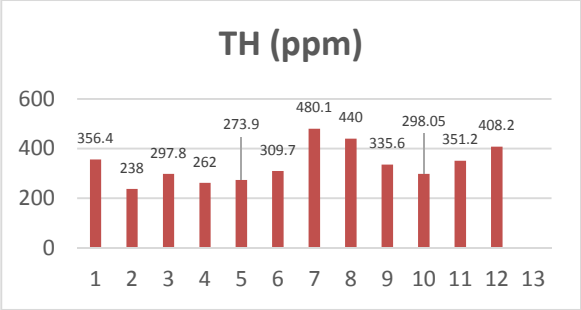
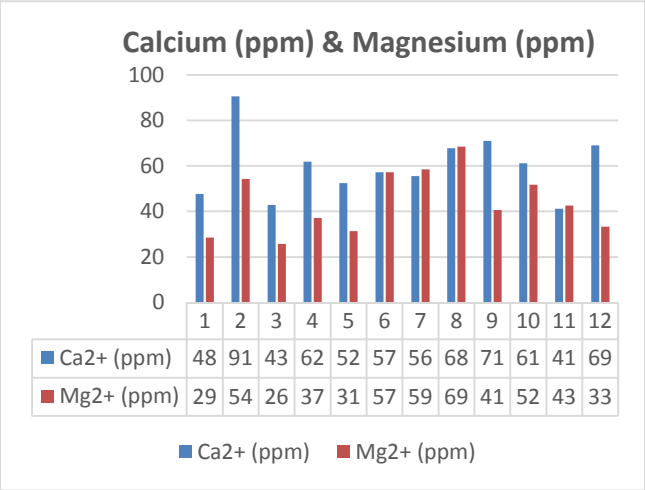
Total Hardness: Total Hardness is caused by the divalent metal ions and mainly due to the presence of Ca^{++} and Mg^{++} ions in the groundwater. The Hardness of water ranged from 238ppm to 480.1ppm with an average value of 289.63ppm as depicted in table-1.



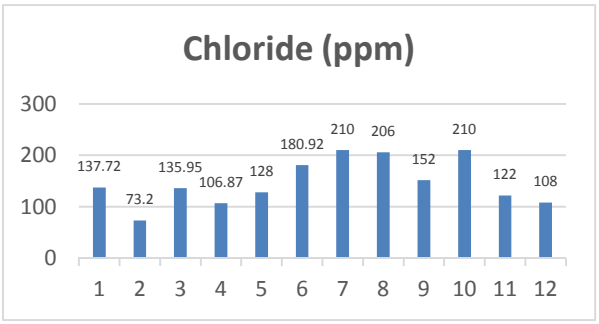
Graph -4: showing the TH values of different study sites

Calcium and Magnesium: Calcium is the major component of most of the Igneous, metamorphic and sedimentary rocks, whereas Magnesium is a major component of the Igneous rocks namely the Amphibolites, Dunites and Pyroxenites.[7]. The Calcium value in this investigation is high as 90.53ppm and a minimum value of 41.2 ppm with an average Calcium value of 58.76 ppm. Magnesium values ranged from a minimum of 25.72 ppm and a maximum of 68.5ppm with in average of 39.053ppm. The values are shown in the table-1.



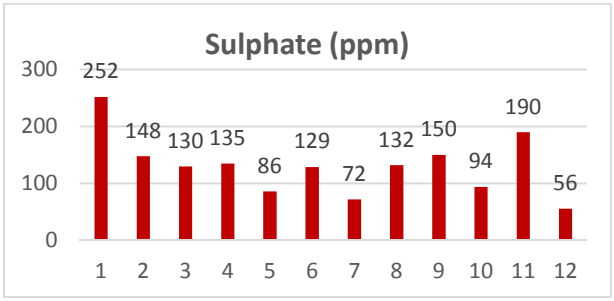
.***Graph -5: showing the pH values of different study sites***

Chloride: The presence of Chloride in groundwater is attributed to the contact with minerals like NaCl beneath the soil, in the current study. The presence of Chloride in water imparts a salty taste to water, people who are not prone to this are prone to laxative effects. [9]. Chloride values fluctuated from a minimum of 73.2 ppm to maximum of ppm and with an average of 127.11ppm, as shown in table-1.



Graph 6: showing the chloride values of different study sites

Sulphate: Sulphate gets into water when it passes through minerals such as Epsom salt, Gypsum and Glauber's salt underneath the soil [10]. In the current investigation, the sulphate values ranged from a minimum of 56ppm to a maximum of 252ppm with a mean value of 132.16ppm, as displayed in table-1.



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