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Study of Physico-chemical and Biological properties of different Water Sample of the Mehsana district, Gujarat, India

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ABSTRACT: Most of the earth's water sources get their water supplies through precipitation. During precipitation water passes over (runoff) and through the ground (infiltration), acquiring a wide variety of dissolved or suspended impurities that intensely alters its usefulness. Physical, Chemical and Bacteriological parameters of Well water quality of selected region of Mehsana District was examine that included quality parameters such as pH, temperature, total hardness, calcium, magnesium, chloride, sulphate, isolation of bacteria and biochemical tests. The well water sample collected from 50 different sampling sites using a composites sampling method and the important physico chemical and bacteriological parameters were determined and compared with the standard values provided by the World Health Organization to evaluate the quality of water. The present research work contribute the different water samples testing and determine their different physical and chemical properties for the benefit of human society.

Keywords: Water samples, Physical, Chemical and Bacteriological parameters.

INTRODUCTION

Water is a liquid at the temperatures and pressures that are most adequate for life (Kumar and Pareek 2022). Specifically, at a standards pressure of 1 ATM, water is a liquid between 0 and 100 °C (32 and 212°F) increasing the pressure slightly lowers the melting point, which is about -5°C (23°F) at 600 atm and -22 °C (-8°F) at 2100 atm. It takes several exotic forms that do not exists at lower pressures (Nagamani, 2015). Pure water is usually described as tasteless and odourless, although humans have specific sensors that can feel the presence of water in their mouths (Ahamed *et al*., 2004) and frogs are known to be able to smell it (Sitaram, 2022).

The apparent colour of natural bodies of water (and swimming polls) is often determined more by dissolved and suspended solids, or by reflection of the sky, than by water itself. Light in the visible electromagnetic spectrum can traverse a couple meters of pure water without significant absorption, so that it looks transparent and colourless (Sharma *et al*., 2017). Thus, aquatic plants, algae, and other photosynthetic organism can live in water up to hundreds of meters deep, because sunlight can reach them. Water vapor is essentially invisible as a gas (Patil and Patil 2010).

There are many ways to divide water wells based on well drop, method of building, type of water level, entry of water in to well, and type of emergence Open wells may be either ring-shaped or elliptical shape (Rahman *et al*., 2021). An open well is large with a diameter usually ranging from 2 to 5 m. Tube wells are consisting of pipes ranging in size from 6 to 45 cm in diameter and sunk into an aquifer. Tube wells are constructed by installing a pipe below the ground surface passing through different geological formations compromising water-bearing and nonwatery discharge in the water-bearing layers.

Wells are extremely important to all societies. In many places, wells provide a reliable and ample supply of water for home uses, irrigation, and industries. Where surface water is scarce, such as in deserts, people couldn't survive and thrive without groundwater and people use wells to get at underground water. Well water is a great way to lose weight, aids in maintaining a healthy heart it can reduce the risk of having a heart attack by drinking well water. it also helps enhances brain function, promotes healthy-looking skin, and reduces muscle and joint inflammation. Well water mainly uses for domestic purposes in rural areas (Olubunmi *et al*., 2017). The pathogenic, organic, and indicator organisms present in water samples need to study, as well as their physicochemical implications, render them unfit for human consumption, though they can be used for other purposes (Sunday *et al*., 2014).

The study was carried out for six months (December-May 2020) of which sampling done in December month, for sampling, the selected area was Mehsana district village. The water sample was collected in a distance around 20 to 25 Km fifty different well water sample were collected from fifty different location in Mehsana district and analysis of physical, chemical and bacteriological parameters. These samples were collected and transported aseptically condition to the laboratory for analysis. At the time collections, some parameters such as temperature and pH were recorded

on the site to avoid any fluctuation. Each sample bottle was marked with collection details such as sample code and numbers, temperature, and pH as well as name of the locality from where the sample was collected.

MATERIAL AND METHODS

Essential aspects to use all the pH meters is calibrate it with suitable buffer than after calibrate a meter put the electrode in water sample and record the result of Ph. Temperature test by directly Celsius thermometer. EC was determined using conductivity meter, Model: EQ-661 (EQUIPTRONICS). The unit of electrical conductivity ds/m. Colour was determined using the digital colorimeter. Model: EQ-650-A (EQUIPTRONICS). The antibiotics susceptibility of the bacterial species isolated was performed on Muller Hinton agar plate.

RESULTS AND DISCUSSION

The physico-chemical and biological properties of the water sample collected from the different fifty well water sample of the Mehsana district. All fifty-sample collected and transferred in to laboratory in aseptically condition. All sample analyses and are being presented below under the following heads. Bacterial species and some bacterial pathogens were isolated from well water sample collected from five different locations within selected region of Mehsana District and were subjected to microscopical, macroscopically, physiological and bacteriological tests. They were identified with the help of Rakesh Patel Experimental microbiology and Microorganism identifier software and may be *E. coli*, Bacillus cereus, Enterobacter aerogenes, Proteus vulgaris (Yadav *et al.*, 2012).

Proteus vulgaris is a Facultatively anaerobic commonly found in the manure, sewage, soil and on vegetation. It is considered now pathogen for humans. Most infections are associated with the experience of Urinary tract infection, as well as infections of wound and burns. Bacillus cereus is an Endospore forming gram positive bacteria commonly found in soil, water, air, milk, vegetation. It is a non-pathogenic and they are used for the fermentative production of amylase (Parihar *et al.*, 2012).

The water temperature is very important physical characteristics of aquatic ecosystem, as it affects the aquatic organism. The water temperature affects number of other water quality parameters of environmental, domestic and agriculture application. In present study, the temperature of the water varied from 24.2 to 24.3.

Table 1: Physical parameters of well water.

Sample	TEM	Sample	TEM	Sample	TEM	Sample	TEM	Sample	TEM
1.	24.2	11.	24.2	21.	24.2	31.	24.2	41.	24.2
2.	24.2	12.	24.3	22.	24.2	32.	24.2	42.	24.2
3.	24.2	13.	24.2	23.	24.2	33.	24.2	43.	24.2
4.	24.3	14.	24.2	24.	24.2	34.	24.2	44.	24.2
5.	24.2	15.	24.2	25.	24.2	35.	24.2	45.	24.2
6.	24.3	15.	24.2	26.	24.2	36.	24.2	46.	24.2
7.	24.2	16.	24.2	27.	24.2	37.	24.2	47.	24.2
8.	24.3	18.	24.2	28.	24.2	38.	24.2	48.	24.2
9.	24.2	19.	24.3	29.	24.2	39.	24.2	49.	24.2
10.	24.3	20.	24.2	30.	24.2	40.	24.2	50.	24.2

Table 2: Statistical analyses of Temperature value.

Sr. No.	Statistical parameters	TEM value
1.	Maximum	24.3
2.	Minimum	24.2
3.	Average	24.212

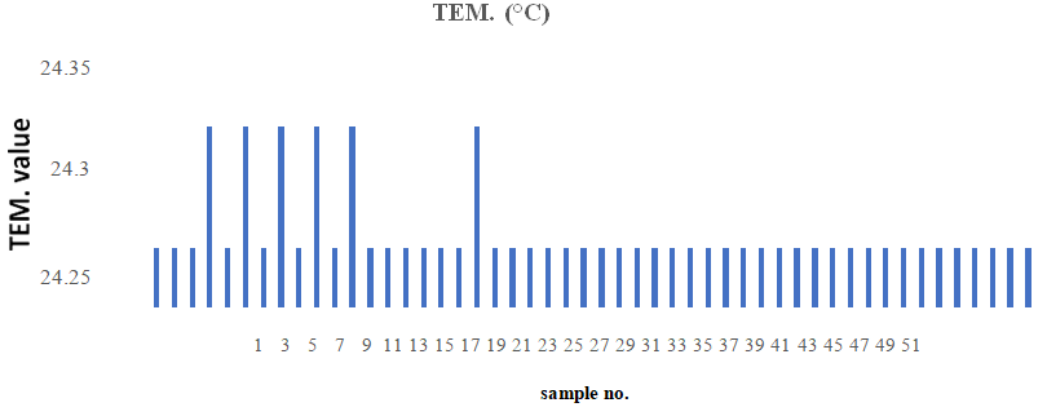

Fig. 1. Statistical graph of TEM value.

Table 3: The determining value of pH.

Sample	pH	Sample	pH	Sample	pH	Sample	pH	Sample	Ph
1.	6.72	11.	7.6	21.	7.4	31.	6.8	41.	7.6
2.	7.65	12.	7.5	22.	7.5	32.	7	42.	7.5
3.	6.71	13.	7	23.	7.2	33.	6.9	43.	6.8
4.	7.37	14.	6.3	24.	7.2	34.	6.8	44.	7.1
5.	6.9	15.	6.4	25.	7.4	35.	7.1	45.	7.5
6.	6.5	15.	6.5	26.	7	36.	7.7	46.	7.5
7.	6.8	16.	6.9	27.	6.9	37.	7.6	47.	7.8
8.	7.2	18.	7.7	28.	6.3	38.	6.7	48.	6.8
9.	7.3	19.	7.4	29.	6.6	39.	6	49.	7
10.	7.5	20.	7.3	30.	7.3	40.	7.7	50.	6.2

Table 4: Statistical analyses of pH value.

Sr. No.	Statistical parameters	pH value
1.	Maximum	7.8
2.	Minimum	6
3.	Average	7.083

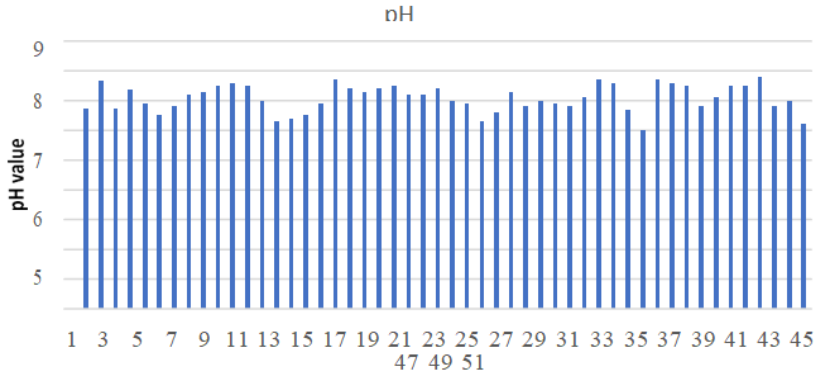

Fig. 2. Statistical graph of pH value.

Table 5: Total dissolved solid (mg/L) of well water sample.

Sample	TDS (mg/L)	Sample	TDS (mg/L)	Sample	TDS (mg/L)	Sample	TDS (mg/L)	Sample	TDS (mg/L)
1.	600	11.	1500	21.	400	31.	1600	41.	800
2.	1800	12.	1200	22.	800	32.	2000	42.	3000
3.	6800	13.	400	23.	800	33.	800	43.	1000
4.	800	14.	8100	24.	3900	34.	600	44.	400
5.	3300	15.	9700	25.	3000	35.	200	45.	2500
6.	600	15.	4200	26.	3000	36.	1200	46.	2700
7.	400	16.	6700	27.	2800	37.	9900	47.	400
8.	4700	18.	4300	28.	400	38.	2500	48.	900
9.	800	19.	300	29.	600	39.	2000	49.	1040
10.	600	20.	2800	30.	2000	40.	2200	50.	700

Table 6: Statistical analyses TDS of value.

Sr. No.	Statistical parameters	TDS value mg/L
1.	Maximum	9900
2.	Minimum	200
3.	Average	2274.8

pH is the indicator of acidic and alkalinity condition of water status. WHO suggested 6.5 to 8.5 range of pH is permissible to use water for any purpose. In present study, all sample pH is significantly difference and all are within the range of permissible values. The maximum pH value observed the sample number 47 (7.8) and the minimum pH value observed the sample 39 (6).

The value of TDS is significantly different among all the fifty well water sample. The fifty- sample varying from 200 to 9900 mg/L and also found the maximum and minimum value observed at sample 37 (9900 mg/L) and sample 35 (200 mg/L). almost sample TDS values within the range of permissible value given by WHO. TDS consists of oxygen demanding wastes and disease-causing agents which can cause immense harm to public health the presence of synthetic organic chemical like fuse detergents paints solvents etc.

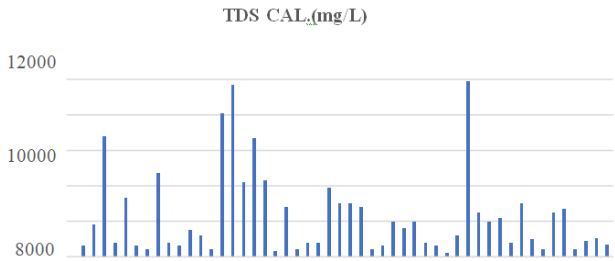

Fig. 3. Statistical graph of TDS value.

Table 7: Chemical parameters of well water result.

Sample	chloride (mg/L)	Sample	chloride (mg/L)	Sample	Chloride (mg/L)	Sample	Chloride (mg/L)	Sample	Chloride (mg/L)
1.	111.1712	11.	109.186	21.	174.6976	31.	161.7938	41.	141.9418
2.	108.1934	12.	84.371	22.	152.8604	32.	158.816	42.	129.038
3.	119.112	13.	97.2748	23.	136.9788	33.	145.9122	43.	112.1638
4.	134.9936	14.	121.0972	24.	178.668	34.	129.038	44.	143.927
5.	124.075	15.	117.1268	25.	109.186	35.	119.112	45.	99.26
6.	192.5644	15.	181.6458	26.	109.186	36.	170.7272	46.	128.0454
7.	190.5792	16.	158.816	27.	125.0676	37.	141.9418	47.	185.6162
8.	174.6976	18.	67.4968	28.	142.9344	38.	163.779	48.	129.038
9.	173.705	19.	94.297	29.	81.3932	39.	140.9492	49.	171.7198
10.	148.89	20.	181.6458	30.	119.112	40.	148.89	50.	138.964

Table 8: Statistical analyses Chloride of value.

Sr. No.	Statistical parameters	Chloride value mg/L
1.	Maximum	192.5624
2.	Minimum	67.4968
3.	Average	137.633

Chloride concentration of fifty well water sample show a significant difference among different sample studied. The result also shows that the chloride contents in water sample are within prescribing limit given by WHO. All sample chloride content under 200 mg/L.

Bacteriological Analysis. Bacterial pathogen and bacterial species were isolated from well water samples collected from different location within Mehsana district and were subjected to microscopical, physiological and biochemical tests.

Total bacterial count by SPC method. The isolated bacteria are qualified by calculating colony forming unit CFU. The obtain CFU values are represented in the following table.

Physiological characteristics Result. In this study use the different pH and different temperature, and salt concentration. Take the two different salt concentration (1%, 3%, 5% and 7%) so isolated bacteria grow in different salt concentration, it may be staphylococcus, *E. coli*, bacillus species present in water sample. And take pH 7 and 8, isolated bacteria grow in this pH so it is alkaline pH and grow Neutrophils and Alkalophilic bacteria may be present in water sample.

Table 9: Bacterial Count by SPC method.

Sample	Dilution	No. of colony	Dilution factor	CFU
1	**10-3**	**16**	**10-3**	**16×103**
3	10-3	11	10-3	11×103
4	10-3	12	10-3	12×103
26	10-3	14	10-3	14×103
27	10-3	22	10-3	22×103

Table 10: Antibiotic susceptibility result (zone size cm).

SAMPLE	GEN	AK	OF	GAT	CFS	PIT	COT	DO
Sample 1	2.3	2.6	2.5	1.6	2	2	2.2	2.6
Sample 3	2.6	2.5	2.3	1.9	2.2	2	1.8	2.4
Sample 4	2.2	2.1	2.6	2.7	2.8	2.8	1.8	2.6
Sample 26	2.2	2.3	2.5	1.3	2	2	1.5	2.1
Sample 27	No zone observation							

CONCLUSIONS

The study reveals that many water quality parameters were found to be beyond the permissible limit of the WHO. The results executing results below permissible limit could help state the water quality to be accurate for drinking and household purpose. The result shows average concentration of the corresponding ions and mostly below the permissible values.

Amount of minerals such as a Ca, Mg, chloride, sulphate, total hardness was present within the range of standard permissible value given by WHO. But well water from some rural region of some Mehsana district more amount of sulphate and total hardness of these minerals than other rural region. It was found that most of the water sample had higher values of TDS than the permissible values, which indicate water pollution via solid disposable waste around the well region.

The presence of *E. coli* in very few samples also draw attention of cause of diarrhoea to the people directly drinking well water, (sample no. 3 and 26).

FUTURE SCOPE

Overall, the water samples collected and analyzed could help us conclude that water can be used for potable purpose after proper filtering and boiling to avoid health issues. Almost all rural region well water can be used for domestic and drinking purpose. This study gave us an insight that rural water is less hard and containing more dissolved ions. The specific objectives of the study were however to assess physical and chemical properties of groundwater in the study area. Groundwater in Mehsana region requires precautionary measures before drinking so as to prevent adverse health effects on human beings.

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Conflict of interest. None.

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