

Comparison of Open Well Water Quality Parameter in Industrial Zone, Ariyalur District, Tamil Nadu, India

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Abstract: To assess the quality parameter of ground water in the Industrial area, Ariyalur district Tamil Nadu, water samples from 4 different locations were collected spreading over a period of three months in the year (2012-2013) namely December, January and February. The index of water quality was assessed by measuring various physico-chemical parameters such as pH, Total Dissolved Solid (TDS), Total Hardness (TH), Total Alkalinity (TA), Calcium, Magnesium, Sodium, Potassium, Nitrate and Chloride content. After analysis of water quality, all the samples indicate that water of allocation is acceptable for consumption and is within the permissible limit. The Pump house water may be used for direct consumption which is nearly equal to the permissible limit. Other some samples were also used for drinking purpose after treatment.

Keywords: Water quality, Physico-chemical parameter, Ariyalur district, CHEEPO, Contamination, Open well, Ground water.

1. Introduction

Water is one of the most abundant commodities in nature but is also the most misused one. Although earth is a blue planet and four fifth of its surface is covered by water, the hard fact of life is that, about 97% of it is locked in the oceans which is too saline and not fit for drinking, agricultural. Laboratory and industrial purposes [1]. About 80% is trapped in polar ice caps and giant glaciers from which icebergs break off and slowly melt at sea [2]. Another 10% of it is locked in rock crevices and minerals lying as deep as 800m below the earth's crust which is very expensive to pump out. This leaves only about 0.3% of the world's water resource that man can tap for domestic, agricultural and industrial use. Indeed, more than two thirds of the earth's surface is covered by water, the total volume representing almost 1,500 million cubic kilometers.

The use of water by man, plant and animal is universal. Without water there can be no life. Man can go nearly two months without food, but can live only 3 and 4 days without water. Water is the most priceless human commodity. It can be both priceless and worthless a blessing or curse depending on circumstances. Nothing can take place without water. Water serves more in fulfilling the human needs than does any other natural source [3]. In our homes whether in urban or in rural areas water is essential for cleanliness and health [4]. When humanity runs out of clean water everything stops. Though there are many liquids like alcohol, vegetable oil, mineral oil etc., they do not have the uniqueness of water, because they are composed of chemically different substances.

Water can be considered as the principal raw material from which most of our farm products are made. It is essential for the growth of crops and animals [5]. If there is a shortage of water there will be a decline in farm production. Water is only essential for the lives of animals and plants, but also

occupies a unique position in industry [6]. Probably, its most important use as engineering material is in the 'steam generation'. Moreover, ground water and soil moisture constituting 22% of the global fresh water resource cannot be exploited at present as it lies at a depth of more than 800m. The atmosphere and steam contain only 0.4% of fresh water of the earth [6]. Long and sustained industrial activity in any given area can often lead to soil and ground water contamination. Improper waste disposal practices might contaminate the soils and gradually the ground water in the area, impairing ground water quality for many applications including drinking. The study of underground contamination will be of immense help to researchers and environmental regulators working in the area to understand and evolve by initiating remedial measures. The determination alteration of the naturally occurring physical, thermal, chemical, or biological quality of groundwater is called ground water contamination.

2. Aim and Scope of the Present Work

The objective of the present work is to assess

- The quality of ground water in open wells.
- To study the Physico chemical properties of ground water in open wells.
- To know whether the open well water is suitable for drinking purposes.
- To compare the physico chemical properties of the four water samples.

3. Material and Methodology

Detailed survey was conducted to identify the four number of existing bore wells. The survey was conducted by each industrial plot and identifying the existence of bore wells.

3.1 Sample Areas

The area wise bore well locations are indicated in distribution of Bore well in study areas.

Sample No	Sample Station
SAMPLE A	Asthinapuram
SAMPLE B	Kyralabath
SAMPLE C	Keelapaluvur, Annamalai Nagar
SAMPLE D	Chettinadu, Vetri Nagar

3.2 Sample Collection

Samples of ground water from sample stations were collected in glass containers and were labeled at the time of sampling to avoid misidentification. The information included while labeling the samples were the sample number, name of the person who collected the sample, date of collection and the place of collection. The samples were then refrigerated in the laboratory at 4°C and then taken for analysis.

3.3 Experimental Methodology

The examination made on the sample and the methods adopted are

3.4 Physical Examination

Table 1:

S. No.	Property Measured	Method Of Examination Of The Sample
1.	Colour	-
2.	Odour	-
3.	Electrical Conductivity	Conductivity Meter

3.5 Chemical Examination

Table 2

S. No.	Property Measured	Method of Examination of the Sample
4.	pH	pH Meter
5.	Total Alkalinity mg/L	Titration Method
6.	Total Hardness mg/L	Titration Method
7.	Calcium mg/L	Titration Method
8.	Magnesium mg/L	Titration Method
9.	Sodium mg/L	Flame Photometer
10.	Potassium mg/L	Flame Photometer
11.	Iron mg/L	Colorimetric Method
12.	Manganese mg/L	Colorimetric Method
13.	Free Ammonia mg/L	Colourimetric Method
14.	Nitrate mg/L	Colourimetric Method
15.	Chloride mg/L	Colourimetric Method
16.	Fluoride mg/L	Titration Method
17.	Sulphate mg/L	Colour Comparison
18.	Phosphate mg/L	Colourimetric Method
19.	Tidy's Test 4 Hrs. mg/L	Titration Method
20.	Total dissolved solids mg/L	Gravimetric Methods

4. Result and Discussion

In the present investigation the following parameters were analyzed for using a standard method. The parameters such as water appearance odour, total dissolved solids, electrical conductivity, pH, alkalinity, ammonia, nitrate, chloride, fluoride, Sulphate, phosphate, tidy's test, calcium. Magnesium, sodium and potassium were analyzed in four areas open well water and results are described below:

Open well ground water samples were collected from four places in Ariyalur District. The Physico – Chemical parameters were measured to assess the ground – water quality. The results were compared with the specification given by the Central Public Health Environmental Engineering Organization (EPHEEO).

5. Physical Examination of Open Well Water Samples

Table 3

Place of Collection	Asthinapuram	Kyralabath	KeelapaluvurAnnamalai Nagar	Chettinadu Vetri Nagar	CPHEEO VALUE	
Sample No.	Sample A	Sample B	Sample C	Sample D	Minimum Limit	Permissible Limit
Appearance	Clear	Clear	Very slightly yellowish colour	Clear	Colourless	
Odour	None	None	None	None	Unobjectionable	
Turbidity NTU	1	1	2	2	1	5
Electrical Conductivity mho/cm	1050	900	1180	1220	800	1800

Table 4: Chemical Examination of Open Well Water Samples

Place of Collection	Asthinapuram	Kyralabath	Keelapaluvur Annamalai Nagar	Chettinadu Vetri Nagar	CPHEEO VALUE	
Sample No.	Sample A	Sample B	Sample C	Sample D	Minimum	Permissible
Ammonia mg/L	0.01	0.20	0.01	0.04	0.5	0.5
Nitrite mg/L	0.7	1.2	2	2.4	20	45
BOD	13	15	11	18	10	30
COD	112	142	128	115	100	250
Fluoride mg/L	0.4	0.3	0.1	0.3	1.0	1.5
Sulphate mg/L	60	18	18	37	200	400
Phosphate mg/L	0.2	0.9	0.06	0.07	2	50
DO	6.2	5.4	6.8	5.9	6	10

Chloride mg/L	112	102	144	92	36	900
pH	7.38	7.20	8.2	8.3	6.5 – 8.5	6.5 – 8.5
Alkalinity mg/L	300	272	380	260	200	600
Total Hardness mg/L	216	280	420	260	200	600
Calcium mg/L	64	65	68	67	75	200
Magnesium mg/L	16	22	22	22	30	100
Sodium mg/L	90	110	112	85	20	200
Potassium mg/L	0.9	1.8	0.6	1.4	3	12
Total dissolved solids	438	488	730	630	500	2000

Sample A :Asthinapuram,, Sample B :KyralabathSample , Sample C :KeelapaluvurAnnamalai, NagarSample, SampleD :ChettinaduVetrinagar.

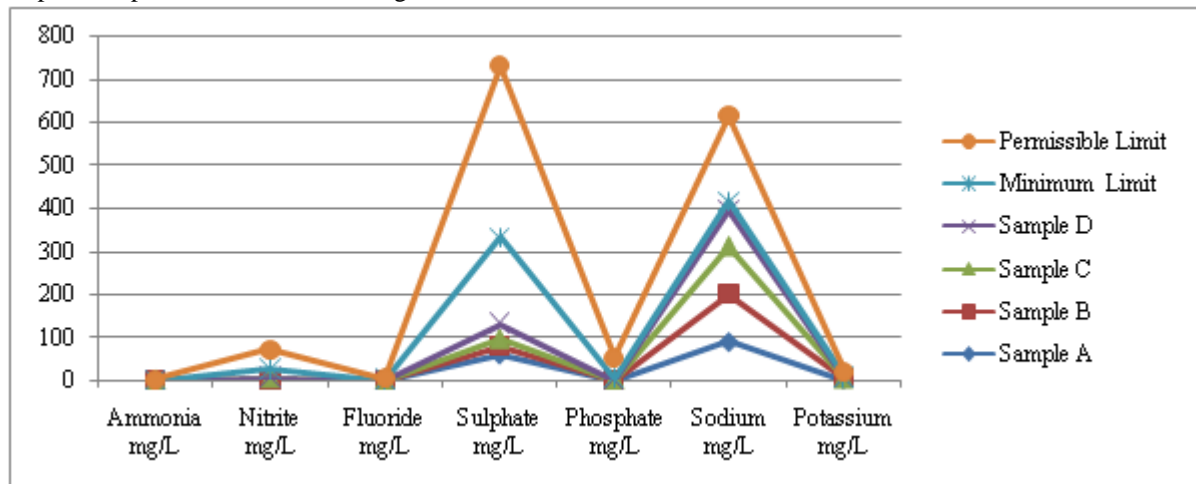


Figure 2: Comparison of water quality parameter with respect to CPHEEO values

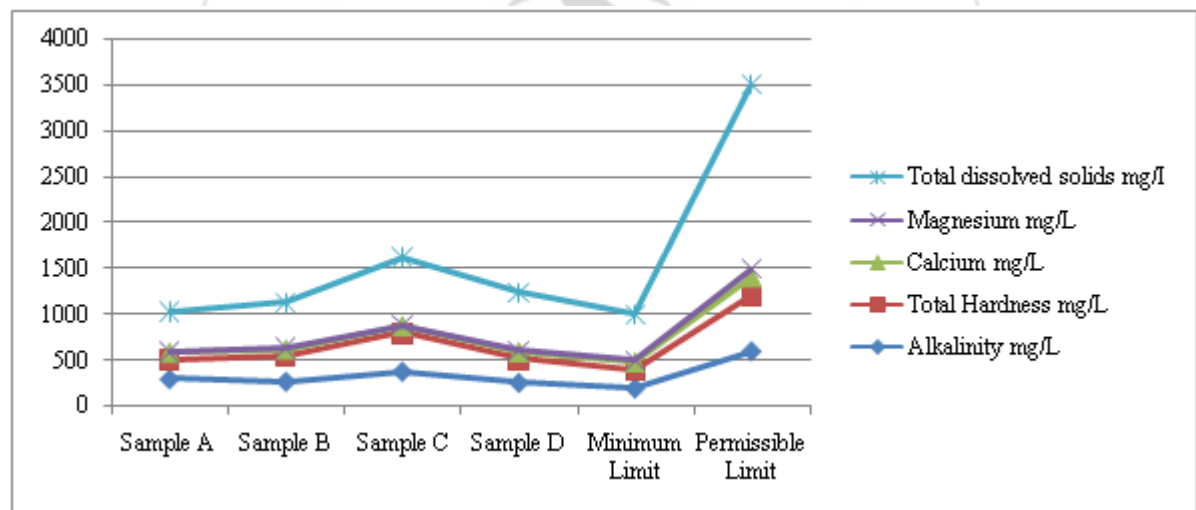


Figure 2: Comparison of water quality parameter with respect to CPHEEO values

Total Dissolved Salt

On the basis of sample analysis from four open wells less than 100 feet deep, two ground water samples (Sample A and Sample D) in the uppermost zone of the aquifer did not exceed drinking water standards for the analyzed constituents but have higher than desirable dissolved solid concentration in water samples from two wells (Table- 4).

Colour

Out of the four samples analyzed three samples are colourless and clear. One sample is very slightly yellowish Sample:C.

Fluoride

Fluoride concentration of 1ppm in drinking water is suitable for dental health. Fluoride is found in 4 bore wells ranging from 0.1 mg/L to 1.5 mg/L. None of the samples indicated fluoride concentration exceeding the permissible limit of 1.5 mg/L (Table -4).

Alkalinity, Hardness and Chloride

The alkalinity and total hardness detections show the vulnerability of shallow ground water to contamination in four samples. The values are higher than the desirable limit specified (Table 4). These waters if used for drinking may cause gastrointestinal discomforts [8]. Higher concentration of calcium magnesium, bicarbonate and Carbonate in these samples indicates the reason for the elevated total hardness of the samples.

Nitrate

Nitrate in potable water is one the important environmental problems, as intake of excessive nitrate presents a potential risk to public health [9]. All the samples are found to have nitrate concentration much less than the desirable limit.

Chloride

Range between 36 mg/L and 900 mg/L. All the samples are well within the permissible limit of 900 mg/L (Table 4).

Electrical Conductivity

The samples collected from Keelapaluvur Annamalai Nagar and Chettinadu Vetri Nagar is having higher concentration of total dissolved solids (Table 4). This is indicated also by the higher electrical conductance values for the samples.

Micro Nutrients

Sodium, Potassium, Calcium, Magnesium and Fluoride contents are secondary nutrients which are essential for plants and used for crops yield development and also essential for animals and human. There are comparatively low micro nutrients in the samples collected from Keelapaluvur Annamalai Nagar (Table- 4).

Sulphate and Phosphate

The assessment was reported that the concentration of Sulphates and Phosphate also not exceeded the permissible limits range from (Table-1). High level of Sulphates in water can cause dehydration and diarrhea and may also cause corrosion effect on plumbing. So in the present study area there is no problems due to Sulphate content present the water (Table 4).

pH

The observed pH value ranging from 7.2 to 8.3 shows that quality of water samples were slightly alkaline (Table-4) which may be used for domestic purposes directly. These values are maximum permissible limit prescribes CPHEEO standards. If pH increases the permissible level it may promote corrosion of plumbing systems and fixtures. If pH decrease the permissible level it may cause for health issues which is not fit for domestic purposes.

BOD and COD

As per the study report it was observed that BOD and COD not exceeded the limit which is very much essential for aquatic species (Table-1).

A correlation analysis has been carried out among the various parameters. There is a wide variation in the quality of water, from place to place which is reflected by the related parameters. All these four open well water samples found that may suitable for drinking purpose after condoning (such as boiling, Chlorination etc.) . The parameters measured are within the desirable limit of drinking water standards.

The sample have permissible limit of hydrological parameters from the results. As urbanization increase around the world, many of these open wells are being created to assist in controlling runoff. There is considerable need for additional quantitative data and a better understanding of these small impoundments so they may be managed more effectively.

Four water samples were collected from different locations in Ariyalur District and the Physico Chemical parameters were measured. The experimental results were compared with the Central Public Health Environmental Engineering Organization (CPHEEO) specification.

The ground water which was taken from the various places in Ariyalur district (Keelapaluvur Annamalai Nagar, Chettinadu Vetri Naga, Asthinapuram, and Kyrilabath) was analyzed for the various water quality parameters like pH, EC, Potassium, Calcium, Magnesium, Chloride, Alkalinity, Hardness, Nitrate, Phosphate, Nitrate, Ammonia, Total dissolved salt and physical parameters. The content of the substance lies above the maximum permissible limit prescribed by Central Public Health Environmental Engineering Organization (CPHEEO). Especially the analysis report shows that the contamination slightly takes place in Keelapaluvur Annamalai Nagar. The reason for this slight variation of Physico-chemical parameters at certain sampling location may be due to unscientific disposal of wastes, industrial effluents may affect the quality water. So from this research study, it can be concluded that there are no major impacts due to water pollution in the study areas.

6. Conclusion

In the present study the following significant findings were made. After the analyses of water quality parameters it is clearly found that, the value of two sampling station of the study areas are permissible rating of pollution and other two of the sampling station of the water rating is very slightly polluted and slightly permissible rating of pollution. So, proper treatment is essential before using it for various purposes mainly drinking and domestic purposes. Some techniques that can be used to raise the quality of the water that are Activated Carbon Filtration, Distillation, Ion Exchange, Reverse Osmosis, Ultraviolet Radiation, Fish bone Charcoal etc.

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