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ANALYSIS OF GROUND WATER QUALITY OF IMPORTANT TOWN AREAS OF THRISSUR DISTRICT, KERALA

Ms Anju Therese Jose. C[1] &Dr. Tom Cherian[2*]

Water is the most fundamental, essential and abundantly available natural resource. The analysis of water quality of the aquifers of important town areas of Thrissur district was carried out during the pre-monsoon period of 2014. 42 samples are collected from 13 sites. The physico – chemical and biological parameters such as Temperature, Turbidity , EC, TDS, pH, Alkalinity, Chloride, Salinity, TH, Ca, Mg, Iron, Phosphate, Sulphate, DO, COD, Total coliform count and E.coli count were determined. All the physico-chemical parameters of the sample are above the desirable limit but below the permissible limit. In this study all the 42 samples shows, higher amount of Coliform count beyond the permissible limit and presence of E.coli.

Keywords: Coliform&E.coli bacteria, Ground water in Kerala, Physico-chemical characteristics, Water quality,Well water.

Ground Water is a renewable natural resource. Various physico-chemical parameters have a significant role in determining potability of water. As per World Health Organization (WHO), safe and wholesome drinking water is a basic need for human development, health and well being, and it is an internationally accepted human right. In most cases the degradation is irreversible. Dumping of wastes near road sides, flood due to heavy rains, improper waste management in hospitals, markets, flats etc increases the pollution of ground water. Remediation is very expensive and is often unsuccessful. The Hindu reportedthat many coastal areas of Thrissur district is reeling under a severe drought like situation[1].Times of India reported a study has found alarming presence of coliform bacteria in the water resources of Thrissur[2].

In this work an attempt has been done to analyze the physico-chemical and biological characteristics of the aquifers of important town areas of Thrissur district at the pre-monsoon period of 2014. All the physico-chemical parameters of the sample are above the desirable limit but below the permissible limit. In this study all the 42 samples shows, higher amount of Coliform count beyond the permissible limit and presence of E.coli.

Materials and Methods

The study area was the 13 important town areas of Thrissur district. Thrissur is situated in south western India 10.52°N 76.21°E and is in the central part of Kerala, India. The district has an area of 3032 sq.km. Geologically the area is composed mostly of Archaean gneisses and crystalline schists with a narrow coastal belt of recent sediment and laterite. 42 samples are collected from 13 sites. Wells were randomly selected and they are so close to the town areas. The water samples were collected in one litre rinsed plastic containers. Study locations are Thrissur town, Ollur, Wadakkanchery, Chelakkara, kunnamkulam, Guruvayoor, Manaloor, Nattika,

[1]*Department of Geology & Environmental Science, Christ College, Irinjalakuda, Thrissur, Kerala, India.*
Email id: anjutherese@gmail.com
[2] *Post Graduate & Research Department of Chemistry, Christ College, Irinjalakuda, Thrissur, Kerala, India.*
Email id: drtomcherian@gmail.com, Kerala, India.

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Kaipamagalam, Irinjalakuda, Kodugallur, Chalakudy, Puthukkad & Laloor

Samples were analyzed for physical parameters like temperature, turbidity, EC, TDS, chemical parameters like pH, alkalinity, chloride, salinity, total hardness, calcium, magnesium, carbonates and bicarbonates, iron, nitrate, phosphate, sulphate, DO, COD and biological parameters like MFT and MPN methods.

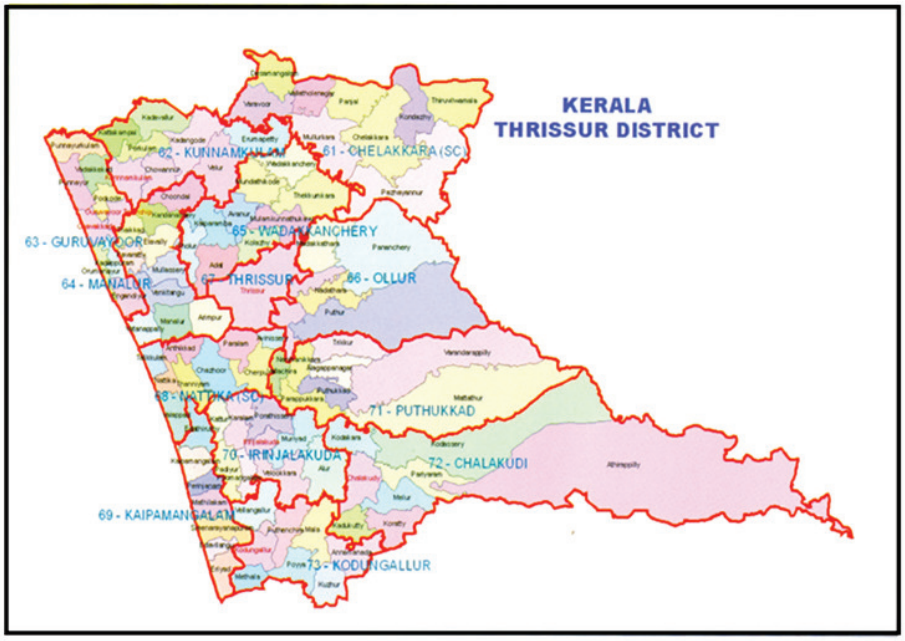

Figure 1: Map of the Study Area.

All the samples are analyzed by the standard methods of APHA and values are compared with the water quality standards of WHO. Temperature and pH measured at the spot and other water quality parameters were done in laboratory. Studies shows that seasonal variation in physico-chemical and microbiological quality of drinking water at Mannuthy in Thrissur

Methodologies Used for Analyzing Water Samples:

SL NO	PARAMETERS	UNITS	METHOD
1	Temperature	°C	Electrode Method
2	Turbidity	NTU	Turbidimetric method
3	Electrical Conductivity	µS	Electrode Method
4	Total Dissolved Solids	ppm	Electrode Method
5	pH	-	Electrode Method
6	Alkalinity	mg/L	HCl Titrimetric Method
7	Chlorides	mg/L	Argentometric Method
8	Salinity	mg/L	Argentometric Method
9	Total Hardness	mg/L	EDTA Titrimetric Method
10	Calcium Hardness	mg/L	EDTA Titrimetric Method
11	Magnesium	mg/L	EDTA Titrimetric Method
12	Carbonates and bicarbonates	mg/L	HCl Titrimetric Method
13	Iron	mg/L	Colourimetric Method
14	Nitrate	mg/L	Spectro - photometric method
15	Phosphate	mg/L	Stannous Chloride Method
16	Sulphate	mg/L	Gravimetric Method
17	Dissolved Oxygen	mg/L	Iodometric method
18	COD	mg/L	Titrimetric Method
19	Total coliform	-	MPN/100ml
20	E – coli	-	-

Table 1: A comparison of physico-chemical parameters of the study area with drinking water standards of WHO (1983,1984 and 1993)

Parameters	Most desirable limit	Maximum permissible limit	Undesirable effects	Minimum - maximum values of parameters in the study area
Temperature	-	-	-	28.5^{0}C - 31.7^{0}C
Turbidity	5 NTU	-	Disinfection	0 - 16 NTU
Conductivity	400	2000	-	128-830 micro mhos/cm.
TDS	500	1000	Gastrointestinal irritation	101-1055 mg/l.
pH	6.5 – 8.5	9.2	taste	5.38 – 7.46
Alkalinity	200	600	Taste	22-268 mg/l
Chloride	200	600	Salty taste	3.999 – 75.995 mg/l
salinity	200	600	Salty taste	7.338-139.45 mg/l
Total Hardness	100	500	Scale formation	8-165.7 mg/l
Calcium	75	200	-	2.4 – 47.4 mg/l
Magnesium	50	150	Scale formation	0.03 - 15.9 mg/l
Iron	-	0 .3	-	0 – 0.0972 mg/l
Nitrate	-	45	methaemoglobinaemia	.1-1.9 mg/l
Phosphate	-	5	-	0.1-1.02 mg/l
Sulphate	200	400	Laxative effect	0.1-0.7 Mg/l
DO	4	6	-	1-8 Mg/l
COD	-	240	-	50-200 Mg/l
Coliform	-	10	Intestinal diseases	1100 MPN/100 ml
E.Coli	Absent	Absent	Intestinal diseases	1100 MPN/100 ml

district(Divya Rani Thomas, B. Sunil and C. Latha (2011). The amount of E.Coli, Vibrio cholera&Salmonella typhi are present in well(AnjuGopinath, Pratap Chandran ,Vysakhi M.V and Anu A.S (2012)

Results and Discussion

Table 1: A comparison of physico-chemical parameters with drinking water standards of WHO (1983,1984 and 1993)

Temperature: The temperature was in the range of 28.50C - 31.70C.Thevariation in the water temperature may be dueto different timings of collection and influence of weather.

Turbidity:Turbidity ranges from 0-16 NTU. The permissible limit of turbidity is 5 NTU.Higher values may be due to humanactivities, decrease in the water level and presence ofsuspended particulate matter.

Electrical Conductivity: The conductivity measurement provides an indication of ionic concentrations. Electrical conductivity of groundwater ranges from 128-830 micro mhos/cm. According to the drinking water quality standards of WHO (1993), the desirable and permissible limits of EC is specified as 400 and 2000 micro mhos/cm at 250C respectively.

Total Dissolved Solids: Analysis for Total dissolved solids (TDS) value ranges from 101-1055 mg/l. According to WHO (1983), the desirable and permissible limits of TDS is specified as 500 mg/l to 1000 mg/l respectively.

pH: The pH value is an important index of acidity or alkalinity and the concentration of hydrogen ion in the ground waters. The standard range of pH is 6.5-8.5 (WHO, 1983). In this study the range is in between 5.38 – 7.46.

Alkalinity: According to WHO (1993), the desirable limit of alkalinity is 200 mg/l and the permissible limit in the absence of alternate source is 600 mg/l. It is observed from the results that the alkalinity ranges from 22-268 mg/l.

Chloride: According to WHO (1993), the desirable and permissible limits of chloride specified as 200 mg/l and 600 mg/l. in the samples the chloride concentrations varies from 3.999–75.995 mg/l.

Salinity: Salinity is the saltiness or dissolved salt content of a water body. According to WHO (1993), the desirable and permissible limits of chloride specified as 200 mg/l and 600 mg/l. In the samples the salinity concentrations varies from 7.338-139.45 mg/l.

Total Hardness: Total hardness is defined as the total of temporary and permanent hardness. The hardness found in water is mostly due to calcium and magnesium. According to WHO (1984), the permissible limit of total hardness is 500 mg/l. The minimum and maximum concentration of TH in this analysis is found to be 8-165.7 mg/l.

Calcium: Calcium found in the observed well samples varies from 2.4 – 47.4 mg/l. the desirable limit of calcium in potable water is 75 mg/l by WHO (1993).

Magnesium: In the sample analysis magnesium ranges from 0.03 - 15.9 mg/l. The desirable and permissible limit of magnesium is 30 mg/l and 150 mg/l by WHO (1993).

Iron: Iron ranges from 0 – 0.0972 mg/l. The maximum permissible limit of Iron for drinking water is 0.3 mg/l by WHO (1993).

Nitrate: Nitrate ranges from 0.1-1.9 mg/l. In the analysis all the sample values were found within the WHO (1983) limit. The maximum permissible limit of nitrate for drinking water is 45 mg/l by WHO (1983).

Phosphate: The result of analysis shows the minimum and maximum concentration of phosphate ranges from 0.1-1.02 mg/l. The maximum permissible limit of Phosphate for drinking water is 5 mg/l by WHO (1983).

Sulphate: According to the drinking water quality standards of WHO (1984), the desirable and permissible limits of Sulphate is specified as 200 mg/l and 400 mg/l respectively. It is observed from the result that all 42 samples were below detection limit.

Dissolved Oxygen:The value of DO fluctuates from 1- 6 mg/l. the permissible limit of DO is 5 mg/l.

Chemical Oxygen Demand: According to the drinking water quality standards of WHO, the permissible limit of COD in drinking water is 250 mg/l. The value of DO fluctuates from 48- 200 mg/l.

Total Coliform Count: According to the drinking water quality standards of WHO the permissible limit of coliform bacteria is 10 MPN /100 ml (MPN-Most Probable Number). All the samples are beyond the limits. All the samples show values greater than 1100 in 100 ml of water.

E.coli: According to the drinking water quality standards of WHO the water should be free of E.coli bacteria. In this analysis all the values shows the presence of E.coli bacteria.

The same was reported by Karthick B, Boominathan M, Sameer Ali and Ramachandra T V in 2010.

Conclusion

The groundwater quality of the study area shows that are not harmfully polluted. Coliform bacteria&E.coli count, turbidity,TDS, DO,COD are above the permissible limits ofdrinking water standards of World Health Organization (WHO). Conductivity, pH, alkalinity, total hardness are below but nearer to the maximum permissible limit & higher than the desirable limit. Chloride, Salinity, Mg, Iron, Nitrate, Phosphate, Sulphate are below the desirable limit. The presence of E.coli and Coliform count are beyond the limits. The wells near hospitals, markets, or near the waste dumping areas show higher turbidity and acidic nature. Salinity is little higher in coastal areas. In monsoon periods the problem will be higher due to the leaching of waste water in to the well. Better quality was found in premonsoon period in a study at Bhopal by AkhileshJinwal and Savita Dixit in 2008.in the case of race metals same results are found in a study conducted by Rejith PG, Jeeva SP, Vijith H, Sowmya M, Hatha AA (2009)

Dumping of wastes near road sides, flood due to heavy rains, improper waste management in hospitals, markets, flats etc increases the pollution of ground water.In most cases the degradation is irreversible. Remediation is very expensive and is often unsuccessful. Demineralization using RO system can remove all forms of impurities from drinking water and would be cost effective in many situations.Keeping adequate distance from polluting sources, cleaning of wells at regular intervals, use of nets over the wells etc should also be adopted.

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