

ASSESSMENT OF QUALITY OF OPEN WELL WATER AND ITS SUITABILITY FOR HUMAN USE IN POLLACHI, COIMBATORE DISTRICT, TAMILNADU, INDIA

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ABSTRACT

Ground water (Open well water) samples collected from various sites of thickly populated residential area of Pollachi in Coimbatore district, Tamilnadu, India were analysed to assess the quality of water determining its suitability for drinking purpose. The physico chemical properties of pH, electrical conductivity (EC), calcium, magnesium, sulphate, chloride, nitrate, total dissolved solids (TDS) and alkalinity of open well water surveyed between the period of May 2014 and April 2015. The results revealed that the pH, EC, calcium, magnesium, sulphate, chloride, nitrate, total dissolved solids and alkalinity ranged from 7.1 to 7.5, 1020 to 1080 (mMhos/cm), 49 to 60 (mg/l), 20 to 24

mg/l), 22 to 29 (mg/l), 79 to 85 (mg/l), 56 to 66 (mg/l), 601 to 615 (mg/l) and 319 to 343 (mg/l), respectively. The results of well water survey indicated that the pH, calcium, magnesium, sulphate and chloride content were within the limits of drinking water standards laid by WHO and ICMR. The concentration of nitrate, total dissolved salts and alkalinity were exceeded the water standards.

KEY WORDS: Physico chemical properties, Total Alkalinity, Total dissolved solids, Well water.

INTRODUCTION

About one third of the drinking water requirement of the world is acquired from rivers, dams, lakes and canals (Jonnalagada and Mhere, 2001). These sources have served as best sinks for the discharge of domestic as well as industrial wastes (Das and Achary, 2003; Tukura *et. al.*, 2009). Rapid growth of urbanization and industrialization especially in developing countries

generating huge quantity of waste, waste water and contaminate the aquatic ecosystem. The quality of ground water may depend upon geology of a particular area, seasonal changes, composition of dissolved salts depending on the source and from soil surface interaction (Amaliya and Sugirtha, 2013). The use of chemical substances in agriculture (fertilizers, herbicides and pesticides) are the primary causes of groundwater contamination (Ullah *et. al.*, 2009). Pollachi is situated to the south of Coimbatore (10.662° N 77.0065° E) in the state of Tamilnadu, India. It is an important commercial are in this district and has big agricultural market. Open well water is chiefly used for drinking, agricultural and industrial needs. A study was conducted to assess the drinking quality of open well water in the highly populated residential area of Venkatesa colony, Mahalingapuram, Sudharsan Nagar, Kandasamy Chettiar Park and Jothi Nagar in this town during the period of May 2014 to April 2015.

MATERIAL AND METHODS

Sample collection

The open well water samples for the present study were collected from Venkatesa colony, Mahalingapuram, Sudharsan Nagar, Kandasamy Chettiar Park and Jothi Nagar. The water samples were collected at monthly interval from May 2014 to April 2015. Water sample were taken in closed sterilized glass containers (500 ml capacity) and stored at 4⁰C on ice and transport aseptically for analysis within 24 hrs.

Chemical analysis of water

Various physico-chemical parameters as Electrical Conductivity (EC), pH, Calcium (Ca), Magnesium (Mg), Sulfate (SO₄), Chloride (Cl), Nitrate (NO₃), Total dissolved solids (TDS) and Total Alkalinity (CaCO₃) were analysed in the laboratory as per APHA (1985).

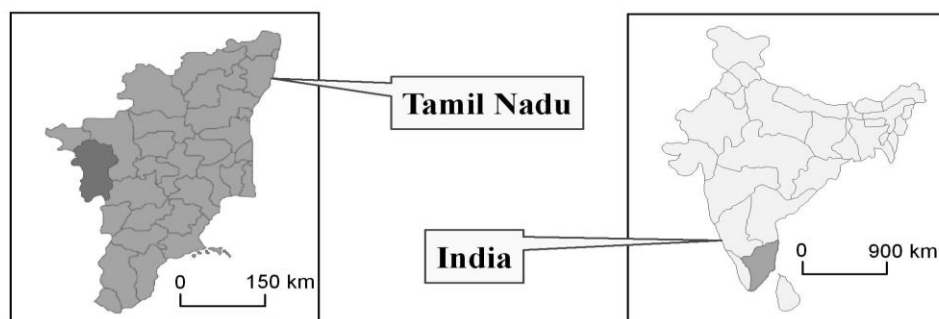


Figure - 1 Study Area

Map Showing Coimbatore District Pollachi With Study Area**Electrical Conductivity (EC)**

Conductivity meter 304 was used to estimate the electrical conductivity.

pH

Systronics digital pH meter No.335 was implemented for pH determination.

Calcium and Magnesium

Calcium and magnesium in the water samples were estimated by EDTA titration method as recommended by Jhingran *et. al.*, (1969).

Sulphate

The sulphate in the water samples were evaluated by the method given by Michael (1984).

Chlorides

Chloride estimation was done by titration method given by Jackson (1973).

Nitrate

The Nitrate in the water samples were estimated by the method of Strickland and Parson (1965) [Colorimetric method (650 nm), Brucine sulphate acid method (530nm)].

Total Dissolved Solids (TDS)

The filtrate obtained from the above process was evaporated, dried, weighed and recorded as the quantity of dissolved solids in the water samples.

Total Alkalinity

Total alkalinity was estimated as per the method given by Piper (1950).

RESULTS AND DISCUSSION

The physico chemical parameters of open well water samples of Pollachi were furnished in the Table - 2. Electrical conductivity (EC) is a measure of water capacity to convey electric current. It signifies the presence of total dissolved salts. EC is found to be good indicators of the overall water quality (Abbasi *et. al.*, 1999). In the present study, the EC values were in the range of 1020 to 1080 micromhos/cm which is higher than the standards laid down by ICMR. This is in accordance with earlier reports of Dhanalakshmi *et. al.*, (2013). They reported that the EC value of KAK pond water in Pollachi varied from 1620 to 1730, 1800 to 1950, 1560 to 1660 and 1430 to 1570 mMhos/cm during premonsoon, monsoon, postmonsoon and summer period. Jothivenkatachalam *et. al.*, (2010) also reported that the EC value of drinking water samples of Perur block in Coimbatore, ranged from 1020 to 2910 (μ mho/cm). The average EC value of drinking water samples of Coimbatore was 2633.06 (μ mho/cm) with range of 670 to 9820 (μ mho/cm) (Ibrahim and Saseetharan, 2006).

pH is an important parameter in water body since most of the organisms are adapted to an average pH and do not withstand abrupt changes. The pH value of drinking water is an important parameter of acidity or alkalinity. Minerals and organic matter interact within them to give the resultant pH value to the water. The average pH value of well water was 7.3 and ranged from 7.1 to 7.5. The pH was within the permissible range 6 to 8 by WHO. Kalaivani and Ramesh (2014) recorded the mean pH value of drinking water was 7.47 and 7.26 during pre and post monsoon period in Coimbatore. Generally pH of water is influenced by geology of catchments area and buffering capacity of water (Shyamala *et. al.*, 2008).

In the study, calcium and magnesium concentration was ranged from 49 to 60 mg/l and 20 to 24 mg/l. Calcium and magnesium are common constituents of water. In Coimbatore, high calcium and magnesium content in portable water ranged from 413 to 1048 mg/l and 325 to 1385 mg/l (Jothivenkatachalam *et. al.*, 2010). Rajiv *et. al.*, (2012) also found the presence of high level of calcium and magnesium in the ground water samples of Coimbatore. Higher concentration of magnesium in human body results nausea, muscular weakness and paralysis (Adak and Purohit, 2001).

The sulphate and chloride content of analysed open well water samples varied from 22 to 29 mg/l and 79 to 85 mg/l, respectively. The concentration of sulphate and chloride lies within the limits of quality standards. The sulphide concentration of water samples in Coimbatore ranges from 25 to 35 mg/l (Manivannan *et. al.*, 2013). The amount of sulphate ion is estimated in portable water vary from 39-169 mg/l (Jothivenkatachalam *et. al.*, 2010). Sulphate produces an objectionable taste at 300-400 mg/l and bitter taste at 500 mg/l (Gethanjali and Kumaresan, 2006). The chloride content of drinking water samples of Coimbatore ranged from 5.67 to 255.24 mg/l (Shanmugasundaram *et. al.*, 2012). Kalaivani and Ramesh (2015) observed mean chloride content of ground water in Coimbatore was 218.63 and 200.3 during premonsoon and post monsoon period.

The average of nitrate concentration of open well water sample was 61mg/l with a range of 56 to 66 mg/l. Dhanalakshmi *et. al.*, (2015) observed 1 mg/l of nitrate concentration in bore well water samples of Pollachi. The major source of nitrate contamination of ground water is from catchments area by rainfall, sewage effluent, agro inputs and wastes of farming area and suspended organic matter. Shanthi and Soumya (2013) reported that the nitrogen of more than 75 percentage of sampling sites in Coimbatore were within permissible limit.

In the present study total dissolved salts (TDS) ranged from 601 to 615 mg/l. TDS ranged from 968-010mg/l (Jothivenkatachalam *et. al.*, 2010). According to WHO, total dissolved solid values for drinking water less than 500 mg/l minimum is the desirable limit and 1500 mg/l is the maximum permissible limit (ICMR). High solids in water cause inferior potable quality of water. Water with high residue is normally less palatable and may induce an unfavourable physiological reaction in the transient consumer and even may cause gastrointestinal irritation (Adak and Purohit, 2001). Water containing high solid concentration may cause constipation effects (Kumarasamy, 1991). High level of TDS may aesthetically be unsatisfactory for bathing and washing (Abdul and Sirajudeen, 2006). Water body exhibited high values of TDS which is caused by the addition of huge quantities of sewage. High solids in water cause inferior potable quality of water. Similar observations were recorded by Pinaki *et. al.*, (2007).

Alkalinity is a measure of buffering capacity of the water. It is generally important by the salts of carbonates, bicarbonates, phosphates, nitrates, borates etc. together with the hydroxyl ions in free state. The alkalinity of water samples of present study was ranged from 319 to 343 mg/l. Dhanalakshmi *et. al.*, 2015 recorded minimum alkalinity of 510 mg/l and

maximum of 542 mg/l in bore well water samples. Dhanalakshmi *et al.*, (2013) also observed maximum total alkalinity as 192 and 198 mg/l during summer month and minimum value of 120 mg/l and 140 mg/l in monsoon month in pond water during (2006-07 and 2007-08 respectively). The alkalinity ranged between 62 mg/l and 481 mg/l in the year 2009, and 68 mg/l and 481.9 mg/l in the year 2010 in subsurface water of Coimbatore (Hagnesh *et al.*, 2012). Water having 40 mg/l or more levels of total alkalinity is considered to be more productive than that of lower alkalinity level (Saluja and Jain, 1998). The total alkalinity was more than 50 mg/l in Vembakottai reservoir, Virudhunagar district thereby indicating that the reservoir water is highly productive (Ponmanickam, 2007). Water with higher alkalinity, hardness and chlorides are found to be more productive and support rich flora and fauna in summer. The higher alkalinity values may be due to the discharge of municipal sewage, domestic sewage and urban wash off into the fresh water bodies. An increase in the free CO₂ may result in increase in alkalinity (Singhal *et al.*, 1986).

Table - 1 Standard values of drinking water.

Particular	Drinking water standard		
	Highest desirable	Maximum permissible	ICMR 1975
Electrical Conductivity (d ³ /m ²)			40
pH	7.50-8.5	6.5-9.2	7.6-8.5
Calcium (mg/l)	75	200	75
Magnesium (mg/l)	30	45	30
Sulphate	200	400	-
Chloride	200	600	250
Nitrate	45	45	20
Total Solids	500	1500	-
Total Hardness as CaCO ₃	-	-	300
Total Alkalinity as CaCO ₃	-	-	120

Table - 2 Physico chemical properties of well water.

Month	E.C (mMhos/cm)	pH	Calcium (mg/l)	Magnesium (mg/l)	Sulphate (mg/l)	Chloride (mg/l)	Nitrate (mg/l)	Total Dissolved Solids (mg/l)	Alkalinity (mg/l)
May -14	1080	7.4	58	23	28	85	66	612	340
Jun -14	1020	7.3	50	21	22	79	59	608	325
Jul -14	1076	7.4	54	20	26	82	60	610	330
Aug-14	1030	7.4	52	22	24	80	65	610	343
Sept -14	1040	7.2	56	21	29	79	64	606	330
Oct-14	1075	7.3	58	24	27	81	60	608	320
Nov-14	1060	7.4	49	22	24	83	58	613	335
Dec-14	1058	7.5	50	20	25	85	56	610	326
Jan-15	1030	7.4	56	23	26	82	62	615	319
Feb-15	1078	7.3	58	24	23	79	60	606	324
Mar-15	1050	7.2	60	20	22	81	63	603	320
Apr-15	1056	7.1	59	23	24	80	64	601	335

CONCLUSION

The pH value of open well water samples were within the limit when were analysed during the period of May 2014 to April 2015 at monthly interval. The calcium, magnesium, sulphate and chloride concentration of water samples were with in the drinking water standards. Higher level of total dissolved solids and alkalinity recorded throughout the year. The exceeded level of total dissolved solids and alkalinity of open well water in this region may be due to over exploitation of ground water and poor waste disposal practices.

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