www.jmscr.igmpublication.org
Impact Factor (SJIF): 6.379
Index Copernicus Value: 71.58
ISSN (e)-2347-176x ISSN (p) 2455-0450
crossrefDOI: https://dx.doi.org/10.18535/jmscr/v6i7.105

IGM Publication
Journal Of Medical Science And Clinical Research
An Official Publication Of IGM Publication

Assessment of Drinking Water Quality in Some Schools in Palayamkottai Taluk

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Abstract
Drinking water samples were collected from sixteen schools in and around Palayamkottai, Tirunelveli District, TN during Jan – Feb 2017 to analyse various physical and chemical characteristics. The following physico-chemical parameters such as appearance, colour, odour, turbidity, total dissolved solids, electrical conductivity, pH, total alkalinity, total hardness, calcium, magnesium, sodium, potassium, iron, manganese, free ammonia, nitrite, nitrate, chloride, fluoride, sulphate, phosphate and oxygen were analysed. The obtained results were compared with the BIS (BIS 10500:2012) standard values.
Keywords: *Palayamkottai Taluk, physical and chemical parameters.*

Introduction

Water is one of the most important and abundant compounds of the ecosystem. All living organisms on the earth need water for their survival and growth. Water plays a significant role in maintaining the human health and welfare. Clean drinking water is now recognised as a fundamental right of human beings. In India, ponds, rivers and groundwater are used for the domestic and agriculture purposes (Pramod *et al.*, 2011). Water quality and suitability for use are determined by its taste, odour, colour, concentration of organic and inorganic matters (Dissemeyer, 2000). Due to increased human population, industrialization, use of fertilizers in the agriculture and man- made activity water is highly polluted with different harmful contaminants. Most of the rivers in the urban areas of the developing countries are the ends of effluents discharged from the industries (Agarwal Animesh, 2011). In many parts of the country available water is rendered non-potable because of the presence of heavy metal in excess. The situation gets worsened during the summer season due to water scarcity and rainwater discharge. Around 780 million people do not have access to clean and safe water and around 2.5 billion people do not have proper sanitation. People on globe are under tremendous thread due to undesired changes in the physical, chemical and biological characteristics of air, water and soil (Misra and Dinesh, 1991). As a result, around 6-8 million people die each year due to water related diseases and disasters (UNESCO, 2013). Contamination of water resources available for household and drinking purposes with heavy elements, metal ions

and harmful microorganisms is one of the serious major health problems (Gupta, 2009). It is necessary that the quality of drinking water should be checked at regular time interval, because due to the use of contaminated drinking water, human population suffers from various water borne diseases (Basavaraja Simpi *et al.*, 2011). Hence, an attempt has been made to investigate the physical and chemical quality of drinking water in selected schools, Palayamkottai, Tirunelveli District, TN.

Materials and Methods

The drinking water samples were collected in a clean white 2 liters polythene container without air bubble from the following schools such us during early morning in the month of Jan – Feb 2017. Bharathiyar Govt. School (S_1), Shanthinagar Primary School (S2), R.C Primary School, Nochikulam (S3), Panchyatu union Middle School (S4),R.C Middle School, Pottalnagar (S5), Govt. H.S.S. School, Seevalaperi (S6), Govt. HS. School, Burkitmanagar (S7),TDTA Primary, School.Burkitmanagar (S8), St.Johns Hrs School, Samathana Puram(S9), Cathitral Hs. School, Palayamkottai (s10),christhu Raja HS.School, Palayamkottai. (S11), Gandhimathi Girls HS.School, High Ground (s12), St.Xavier's HS. School, Palayamkottai (S13), Blind School in St.Thomas Road, Palayamkottai, (S14), Got. HS.School, Samathanapuram (S15), and Sarah Tucker Girls H.S.S, in Palayamkottai (S_{16}) The water samples were collected early morning during the month of Jan.-Feb'.2017. The collected samples were analysed for various physical and chemical parameters viz., such as appearance, colour, odour, turbidity, total dissolved solids, electrical conductivity, pH, Ph. alkalinity, total alkalinity, total hardness, calcium, magnesium, sodium, potassium, iron, manganese, free ammonia, nitrite, nitrate, chloride, fluoride, sulphate, phosphate and oxygen by following the standard method (APHA 2009).

Results and Discussion

The obtained data revealed that there were considerable variations in the samples with respect to their physical and chemical characteristics and They were compared with the drinking water standards of BIS (Tables 1,2 and 3). value of TDS as suggested by BIS ie., s1 TDS=1123mg/l and s3 TDS=1074mg/l.

Physical Parameters

In all stations, the colour of the water samples are clear and colourless. As per BIS and WHO drinking water must be colourless and clear. Odour of the samples in the collected sites is agreeable limits of BIS. Turbidity is an expression of the optimal property that causes light to be scattered and absorbed rather than transmitted in straight lines through the sample. Turbidity in water is caused by suspended matter such as clay, silt and finely divided organic compounds (Saxena, and Kaur, 2003). The recorded turbidity value of all the samples is found to be within the range of permission limit. The electrical conductivity values varied from 106 – 1651 micro mho/cm and the values were found to be within the permissible limit. All the sites showed to have normal range of total dissolved solids compared to the standard values. Water with high dissolved solids has inferior palatability and may reduce the unfavourable physiological reaction in the transient consumer (Chaudhary et al., 2005). Depending upon the concentration of TDS, drinking water has been ranged as excellent (<300 mg/liter); good (300-600 mg/liter) ; fair (600-900 mg/liter) ; poor (900-1200 mg/liter) and unacceptable (>1200 mg/liter). From this findings, it is observed that sites s1 and s3 samples are belongs to poor and unacceptable

The pH of the water samples collected at all the sixteen sites revealed only a marginal variation over the neutral value and the pH of the samples were observed to be mild alkaline range of 7.13 to 7.82 and it indicates the presence of weak basic salts. The constituents of alkalinity in natural system mainly include carbonate, bicarbonate and

hydroxide. These constituents result from dissolution of mineral substances in the soil and atmosphere (Mittal and Verma, 1997). The BIS and WHO acceptable limit for total alkalinity is 200-600 mg/L whereas in the present investigation total alkalinity varied from 40-380 mg/L showing that two sites (S_1 and S_3) were well within the prescribed drinking water standard and some sites (S_2, S_{4-16}) were showed the values below the standard values.

Hardness of water is important in determining the suitability of a water for domestic and industrial uses. The values of total hardness for sixteen water sample fall within permissible limit. Hardness in water is caused by metallic ions dissolved in water. In freshwater, these include calcium and magnesium ions, although iron and manganese contribute to hardness (Shivashankaran, 1997). The contents of total hardness, calcium and magnesium in potable water according to BIS and WHO should range from 200-600 mg/L ; 75-200 mg/L and 30-100 mg/L respectively. In this study calcium and magnesium contents of all the sixteen water samples were well within the desirable limit and the values ranged in the Table-3 between 10-200 mg/L and 4-72 mg/L respectively. Hard-water might promote growth in children due to the presence of calcium. Magnesium hardness, particularly associated with sulphate ions has laxative effects on persons unaccustomed to it. It also precipitates the protein of meat and makes tasteless (Khadsan, R.E. and V.K. Mangesh, 2003). Calcium not only contribute hardness to the water it also imparts unpleasant odour, when present in high levels (Balakrishnan, V and S. Karuppusamy, 2005). The sodium and potassium contents were also found to be agreeable for drinking.

The values of iron and manganese contents were observed as 0 mg/L. Ammonia, Nitrite and Nitrate contents were between 0.0-0.80mg/L; 0.0-0.24 mg/L and 1-4 mg/L respectively. In surface water, nitrate occurs in trace quantities but may attain high levels in some ground waters. In excessive amounts, it contributes to the illness of infant methemoglobinemia. To prevent this a limit of 45 mg/L of nitrate nitrogen is imposed on drinking water (Saxena, N. and H. Kaur, 2003). But the level of nitrate in the ground water of the city is below the WHO prescribed limits.

Chloride content in all the sixteen sites were well within the permissible limit as prescribed by BIS that ranged between 250-1000 mg/L and the values ranged between 2-365 mg/L. The fluoride contents were observed as 0.0 mg/L in all the sixteen samples. The sulphate and phosphate content of samples were ranged between 2-106 mg/L and 0-0.48 mg/L respectively and the values were well within the permissible limit. phosphates are not toxic and do not represent a direct health threat to human health or other organism. Small quantity of phosphorous in surface waters is necessary for biological life, but excess amount promotes the abundant growth of the nuisance algae.

Table-1 Drinking water standards of BIS (BIS 10500 : 2012)

BIS 10500 : 2012	Acceptable limit	Permissible limit in the absence of alternate source
Appearance	-	-
Color	5	15
Odor	Agreeable	agreeable
Turbidity	1	5
TDS	500	2000
EC	-	-
pH	6.5-8.5	6.5-8.5
Ph.A	-	-
TA	200	600
TH	200	600
Ca	75	200
Mg	30	100
Na	-	-
K	-	-
Fe	0.3	0.3
Manganese	0.1	0.1
NH_3	0.5	0.5
NO_2	-	-
NO_3	45	45
Cl	250	1000
F	1.0	1.5
SO_4	200	400
PO_4	-	-
O_2	-	-

Table -2. Physico-chemical parameters of sites 1-8

parameters	Sites							
	S_1	S_2	S_3	S_4	S_5	S_6	S_7	S_8
Appearance	clear	clear	clear	clear	clear	clear	clear	clear
Colour	Colour-less	Colour-less	Colour-less	Colour-less	Colour-less	Colour-less	Colour-less	Colour-less
Odour	none	none	none	none	none	none	none	none
Turbidity	0	0	2	0	2	3	2	3
TDS	1123	231	1074	404	151	199	163	155
EC	1651	340	1580	594	222	293	240	228
pH	7.28	7.70	7.14	7.82	7.77	7.39	7.66	7.67
Ph.A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TA	380	60	250	180	80	120	88	88
TH	750	140	700	280	90	120	96	90
Ca	200	32	160	72	24	32	24	24
Mg	60	14	72	24	7	10	9	7
Na	35	10	25	10	10	10	10	10
K	18	3	10	3	3	4	4	3
Fe	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Manganese	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NH_3	0.00	0.00	0.64	0.00	0.64	0.64	0.64	0.80
NO_2	0.24	0.02	0.02	0.06	0.01	0.02	0.01	0.00
NO_3	4	1	4	3	1	1	1	1
Cl	280	2	365	80	20	18	22	20
F	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SO_4	59	106	59	9	2	6	4	4
PO_4	0.32	0.1	0.48	0.32	0.19	0.06	0.19	0.19
O_2	0.16	0.2	0.16	0.16	0.24	0.24	0.24	0.24

All values are expressed in mg/l except pH and EC (Micro mhos/cm)

Table-3 Physico-chemical parameters of sites 9-16

parameters	Sites							
	S_9	S_{10}	S_{11}	S_{12}	S_{13}	S_{14}	S_{15}	S_{16}
Appearance	clear	clear	clear	clear	clear	clear	clear	Clear
Colour	Colour-less	Colour-less	Colour-less	Colour-less	Colour-less	Colour-less	Colour-less	Colour-Less
Odour	none	none	none	none	none	none	none	None
Turbidity	0	0	2	3	0	0	1	1
TDS	135	76	72	112	161	100	76	161
EC	198	111	106	161	237	143	111	237
pH	7.68	7.68	7.46	7.33	7.55	7.62	7.32	7.13
Ph.A	0	0	0	0	0	0	0	0
TA	72	40	40	50	88	50	40	88
TH	90	42	40	70	96	60	42	100
Ca	24	10	10	16	24	16	10	24
Mg	7	4	4	7	9	5	4	10
Na	5	5	5	5	10	5	5	10
K	3	3	3	3	3	3	3	3
Fe	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Manganese	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NH_3	0.00	0.00	0.64	0.64	0.00	0.00	0.64	0.00
NO_2	0.06	0.05	0.05	0.05	0.01	0.06	0.05	0.01
NO_3	1	1	1	1	1	1	1	1
Cl	20	10	9	20	22	15	10	23
F	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SO_4	4	2	2	4	4	2	2	4
PO_4	0.10	0.13	0.13	0.26	0.19	0.00	0.13	0.19
O_2	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24

All values are expressed in mg/l except pH and EC (Micro mhos/cm)

Conclusion

The values of different physico-chemical parameters of samples collected from sixteen schools in Palayamkottai Taluk were found to be within the recommended limits of BIS and WHO. Therefore, the present investigation can conclude that the quality of drinking water is good and potable in all the selected sites. However, it is also important to investigate other potential water contaminations such as chemicals, microbial and radiological materials for a longer period of time, including human body fluids, in order to assess the overall water quality.

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