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Studies on Iron Contamination of Well Water in Karikkakom Locality- Case studies

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ABSTRACT

The pH, conductivity and iron content present in the drinking water samples collected from the Karikkakom locality in Thiruvananthapuram district to find out the quality of drinking water. The pH and conductivity of the water samples lies with in the permissible limit but the iron content of all the samples were on higher side. The aeration, addition of lime and alum is the suitable and economical method to remove the iron content in these areas.

Keywords: Iron contamination, Conductivity, pH, Water Quality

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INTRODUCTION

Surface water contains different kind of suspended and dissolved materials which cause turbidity, acidity/ alkalinity, variation of pH, conductance, metallic and non metallic elements, odour, taste and colour [1 -3]. The usual source of these contaminants is from clay / sand particles resulting from the erosion of soil in the catchment area [1]. The size of the colloidal particles in water may range from 0.001 microns to 10 microns. The time to settle down these particles in surface waters range from half an hour to to 63 years [4, 5]. The contaminants in open water may causes by growth of phytoplankton. Human activities like civil constructions and land altering can lead to high sediment levels in water. Natural calamities like storm rain etc will also create variation in water quality. Urbanized areas contribute large amounts of problem to nearby waters, through storm water pollution from paved surfaces bridges and parking lots. Certain industries such as quarrying, mining and coal recovery can generate very high level of impurities in water. These impurities in drinking water cause gastrointestinal diseases. This is especially problematic for immune- compromised people, because contaminants like bacteria can become attached to the suspended solids. The parameters and Indian standards of drinking water sample is given in Table1.

Table 1: The parameters and Indian standards

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sl.no	Parameters	Units	Drinking water 1s:10500-1991	
			Desirable	Maximum
1	Colour	Hazen units	5	25
2	Odour		Unobjectionable	
3	Taste		Agreeable	
4	Turbidity	NTU	5	10
5	pH value		6.5 to 8.5	No relaxation
6	Total hardness	Mg/l	300	600
7	iron	Mg/l	0.3	1.0
8	Chlorides	Mg/l	250	1000
9	Residual , free Cl_2	Mg/l	0.2	
10	Dissolved solids	Mg/l	500	2000
11	Calcium	Mg/l	75	200
12	Copper	Mg/l	0.05	1.5
13	Manganeese	Mg/l	0.1	0.3
14	Sulphate	Mg/l	200	400
15	Nitrate	Mg/l	50	No relaxation
16	Flouride	Mg/l	1.0	1.5
17	Phenolic compound	Mg/l	0.001	0.002
18	Mercury	Mg/l	0.001	No relaxation
19	Cadmium	Mg/l	0.01	No relaxation
20	Selenium	Mg/l	0.01	No relaxation
21	Arsenic	Mg/l	0.05	No relaxation
22	Cyanide	Mg/l	0.05	No relaxation
23	Lead	Mg/l	0.05	No relaxation
24	Zinc	Mg/l	5	15
25	Anionic detergents	Mg/l	0.2	1.0
26	Chromium	Mg/l	0.05	No relaxation
27	Mineral oil	Mg/l	0.01	0.03
28	Pesticides	Mg/l	Absent	0.001

MATERIALS AND METHODS

Procedure for collecting water sample

The samples are collected from 10 houses near Karikkakom area. Ground water samples can be collected using pumps or bailers. Pumps must be used to collect samples when testing for volatile organic compounds, and are highly recommended for monitoring other parameters as well. This is because there is less chance for sample contamination when using pumps than there is when using bailers. If pumps are not available, Teflon or stainless steel bailers may be used. The use of any other devices for sample collection must be approved by the MPCA Hydro geologist prior to sampling.

Monitoring of water quality parameters

The pH of water sample is measured using a pH meter (Elico). The conductance of water samples are measured using conductivity meter (Thoshniwall). The iron content in the water is analyzed by standard volumetric method.

RESULT AND DISCUSSION

Variation of pH

Table 2shows the pH values for different samples collected from Karikkakom locality . The pH of all the samples collected would lies between 6.5 to 8.5 indicating that there is not that much problem with related to pH.

Table 2: pH for different samples

Samples	1	2	3	4	5	6	7	8	9	10
pH	7.98	7.42	7.68	7.56	7.37	7.61	8.33	7.24	6.56	7.54

Variation of conductance

Table 3 shows the conductance values for different samples collected. All the samples collected shows values lies with in the standard limit.

Table 3: Conductance for different samples

Samples	1	2	3	4	5	6	7	8	9	10
Conductance (MS)	0.58	0.48	1.22	0.68	1.07	0.85	0.91	0.59	1.05	1.07

Concentration of iron

Although iron is an essential mineral helping in the transportation of oxygen in the blood, its presence in ground water above a certain level makes water unusable due to its metallic taste discoloration, odor, turbidity and staining of laundry. Iron “overload” in drinking water may cause vomiting, bleeding and circulatory disorders. When the iron combines with tea, coffee and other beverages, it produces an inky, black appearance and a harsh, unacceptable taste. Vegetables Iron is mainly present in cooked in water containing excessive iron turn dark and look unappealing. water in two forms either in soluble ferrous iron or insoluble ferric iron. Water containing ferrous iron is clear and colorless, because the iron is completely dissolved. When exposed to air, the water turns cloudy and a reddish brown substance begins to form. This sediment is the oxidized or ferric form of iron that will not dissolve in water. The rates of oxidation are not rapid and this reduced form can persist for sometime in aerated water. This happens when the pH is below 6. In addition, iron can form stable complexes with humic substances in water that can be even more resistant to oxidation than the inorganic species alone. Iron determination is very important in explorations of new water supplies, particularly from ground water sources. Supplies may be rejected on this basis alone. When supplies containing amounts in excess of 0.3 ppm (0.3 mg/l) iron are developed, the engineer must decide whether treatment is justified and if so, the best method of treatment. The efficiency of treatment units is determined by routine tests for iron. Table 4 shows the values of concentration of Iron in mg/l for different samples collected from the Karikkakom locality.

Table 4: Concentration of Iron for different samples

Samples	1	2	3	4	5	6	7	8	9	10
Concentration of iron (mg/l)	1.150	0.949	1.438	1.006	1.236	1.208	0.920	2.538	1.955	2.013

The concentration of iron in all the samples collected above was found to be above the desirable limit. Aeration and separation is the most common method for removal of iron from ground water in public water supply systems [6]. There are other methods like ion-exchange method oxidation with oxidizing agents such as chlorine and potassium permanganate [7], treatment with lime stone [8] magnetic separation [9] and use of activated carbon and other filtering materials.

CONCLUSION

Most of the sample we collected from Karikkakom area contains iron above the permissible limit of 0.3 ppm. This high iron content in the water may be due to geological formations inside the earth, excessive usage of pesticides /chemicals or industrialization. The aeration and addition of lime and alum is the suitable and economical method to remove the iron content in these areas.

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