ASSESSMENTOFWATER QUALITY AND ITS SUITABILITY FOR PORTABLE WATER SUPPLY SYSTEM

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Abstract— *Water is a major resource for human survival. In the present study, the physico-chemical characteristics of public water distribution system of Paravur town in Kollam district, Kerala were assessed for its suitability for drinking purposes .Samples were collected from two bore well stations and their corresponding consumers. In order to assess quality of public water distribution system the samples were analyzed for different physico–chemical properties eg pH, electrical conductivity, calcium, magnesium, total hardness, total alkalinity, chloride, residual chlorine concentrations, dissolved oxygen ,biological oxygen demand. The results were compared with the standards prescribed by world health organization and bureau of Indian standards. Most of results are within permissible limits hence the water can be used directly for portable purposes.*

Index Terms— physicochemical parameters, public water distribution system, water quality,

1. INTRODUCTION

Water covers 78% of the earth's surface, yet water available for human use is limited Groundwater pollution unlike others is very critical, as once an aquifer becomes polluted, it is very difficult, expensive and time consuming affair to clean it up and may remain unusable for decades[2]. Understanding the potential influences of human activity on ground water quality is important for protection and sustainable use of ground water resources [3]. Natural bodies of water are not absolutely pure as various organic compounds and inorganic elements remain in dissolved form. Many kinds of macroscopic flora and fauna grow in different types of aquatic habitats. The physical and chemical quality of water vary according to the basin shape and size, depth, light penetration, precipitation, location, temperature, chemical nature of surrounding soil and dissolved minerals, pH, etc, and the biological components of the habitats depend upon them If all the physical, chemical and biological parameters are in optimum condition the balance between these is maintained[14].

The present work was carried out in Paravur City in Kollam district in order to study the water quality of public water distribution system. Paravur is a narrow land stretching in between the backwaters and the sea in Kollam District. Paravur is located at 8.78N76 E.

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The town occupies an area of 19.19km^2 and has a population of 43,739. Almost 75%of population directly or indirectly depending the public distribution system.

2. MATERIALS AND METHODS

Four Water samples were collected from two bore well stations and their corresponding consumer points. Atmost care was taken during the collection of samples to avoid any kind of contamination. Prior to sampling all the sampling containers were washed and rinsed thoroughly with ground water. The main aim of the study was to investigate the Physicochemical characteristics of water samples collected. Also given importance to understand the residual Chlorine level of public water distribution. Physico-chemical parameters were analysed as given in standard manual of water and wastewater analysis in Environmental Engineering Laboratory. All these samples were analyzed for pH, Chloride, Residual Chlorine, Total Hardness, Calcium Hardness, Magnesium, Calcium, Turbidity, Electrical Conductivity, Total Alkalinity, DO, and BOD.

RESULT AND DISCUSSIONS

The classical use of water analyses in groundwater hydrology is to produce information concerning the water quality .This may yield information about the environments through which the water has circulated and give an understanding of the suitability of the ground water for domestic, agricultural and industrial purposes [1].The result of physicochemical analysis of groundwater collected from different points were analyzed.

3.1. pH

pH ,one of the important factor of groundwater it indicates hydrogen ion concentration in water [3]. pH of

present study reveals with the range of 4.92 to 7.13 during second and third week of sample analysis.. Permissible limits of pH ranges between 6.5to8.5 as per IS 10500-2012.The acidic pH will results in corrosion of water supply units. Low pH of water results in releasing of toxic metals such as zinc, lead and copper [13]. So low pH is adverse one for the metal supplies using for water distribution. Various studies inferred that somehow agricultural effluevents are also one source for decrease in pH and also the soil characteristics rock bed beneath ground water also one important reason. The two bore well points are located in agricultural area residences which may resulting the decrease in pH.

3.2. Electrical conductivity

Electrical Conductivity is a measure of waters capacity to conduct electric current [13]. If conductivity increases, it indicates the presence of dissolved ions. Conductivity can serve as an indicator of water quality problems [7]. Electrical conductivity is a decisive parameter in determining suitability of water for particular purpose and classified according to electrical conductivity as follows. [13]

EC in μmhos/cm at 25^{0}C	Classification
<250	Excellent
250-750	Good
750-2000	Permissible
2000-3000	Doubtful
<3000	Unsuitable

Electrical conductivity of samples studied varied from 43-111μs/cm .The groundwater of study area comes under excellent category.

3.3. Turbidity

Turbidity is an important parameter which indicates quality of water .Turbidity in water is caused by suspended matter such as clay, silt, finely divided organic and inorganic matter soluble coloured organic compounds, planktons and other microscopic constituents. Turbid water interferes in self purification of water by reducing photosynthesis activity of aquatic plants. Turbidity in desirable limit as per IS10500:2012 IS 1 NTU AND permissible limit5 NTU. From the present study it reveals that in the first week at station A1 a result obtained 68 NTU, in second week at station A 29 NTU and in third week 24ntu at station B which was very much above permissible limits.

3.4. Total hardness

The effect of hardness is scale in utensils and hot water system in boilers [4]. In groundwater hardness is mainly contributed by bicarbonates, carbonates, sulphates and chlorides of calcium and magnesium. From analyzed water sample the hardness of water samples were varied from 20 to 76 mg/L.As per IS10500-2012 desirable limit of hardness is 200mg/l and permissible limit 600mg/l. Hardness in the groundwater in present study where within permissible limits.

Calcium hardness values ranged from 10-40mg/l

3.5. Total alkalinity

Alkalinity is the sum total of components in the water that tend to elevate the pH value to the alkaline side of neutrality. Alkalinity is the buffering capacity of water and is an important parameter of water quality. In the present study the alkalinity values in samples collected ranged from 6 to 18 mg/l. As per IS10500-2012 acceptable limit of water is 200mg/l and permissible limit 600 mg/l. The results from the present study found within acceptable limits.

3.6. Chlorides

Chlorides naturally occupies in all water [13]. In present study chloride content in water samples ranged from 19.85-61.56 mg/l. Acceptable limits of chloride as per IS10500-2012 is 250mg/l. The level chloride also fluctuated in all samples in three week in which the study conducted within acceptable limits.

3.7. Calcium

Calcium is naturally present in water. Calcium is a determinant of water hardness .Acceptable limit of calcium is 75mg/l as per IS10500-2012.values of calcium ranged from 4.008-16.032 mg/l

3.8. Magnesium

A large number of minerals contain magnesium is washed from rocks and subsequently end up in water. Magnesium has many different purposes and consequently may end up in water in many different ways. Chemical industries add magnesium to plastics and other materials as a fire protection measure or as filler. Magnesium desirable value is 30mg/l as per IS10500-2012. The magnesium values ranged from.0.972 - 14.09mg/l in the present study.

3.9. Dissolved Oxygen

Dissolved oxygen refers to the level of free, non-compound oxygen present in water or other liquids. It is an important parameter in assessing water quality because of its influence on the organisms living within a body of water. A dissolved oxygen level that is too high or too low can harm aquatic life and affect water quality. DO values varied from 4.81 - 8.91 mg/l values in the present study.

3.10. BOD

BOD also called biological oxygen demand is the amount of dissolved oxygen needed by aerobic biological organisms to break down organic material present in a given water sample at certain temperature over a specific time period. BOD values varied in the present study from 1.58-3.67mg/l.

3.11. Residual Chlorine

Chlorine residual is a low level of chlorine remaining in water after its initial application. It constitutes an important safeguard against the risk of subsequent microbial contamination after treatment a unique and significant benefit public health. Desirable limits of chlorine as per is10500-2012 0.2mg/l and permissible limit 1mg/l. Out of 12 samples 4 samples showed residual chlorine presence. The values obtained were above permissible level. It varied from 3.54-10.635mg/l. Water samples collected from consumer points showed high dosage of residual chlorine in some samples which is not favourable for human health. And in some samples absence of residual chlorine noticed which helps for the survival of pathogens is. Like its effect on pathogens and parasites, chlorine attacks delicate body tissues when tap water is consumed. Chlorine residual in tap water causes a mildly pungent odour and taste [10].

Chlorine in treated water can also cause allergic symptoms ranging from skin rash. Long term risks of consuming chlorinated water include aging, cancer development, hinders cholesterol metabolism, and promotes hardening of arteries. Chlorine reacts with organic impurities in the water to make trihalomethanes (THMS),or chloramines.

The THMs produced have been associated through epidemiological studies with some adverse health effects [8].

CONCLUSION

The main aim of study was to determine water quality of public water distribution system. The results reveals that the ground water quality is almost agreeable with IS standards recommended for during purposes. Slight variation obtained with the ph values and turbidity. The presence of residual chlorine in drinking water is above permissible limit in some samples and some samples showed absence of residual chlorine which want to be controlled by the concerned authority by conducting deep study on this problem. Till then authority shall introduce substitute methods to consumers for controlling excess amount of chlorine from drinking water.

	FIRST WEEK				SECOND WEEK				THIRD WEEK			
PARAMETER	A	A1	B	B1	A	A1	B	B1	A	A1	B	B1
pH	5.52	6.03	5.04	6.2	4.92	5.19	5.23	5.72	6.57	6.37	6.61	7.13
Turbidity(NTU)	2	68	3	4	29	Nil	2	4	5	4	24	4
E C(µs/cm)	43.5	71	82.9	95	91	98	43	56	111	100	100	100
T H (mg/l)	76	48	26	22	20	30	26	34	38	42	38	48
Ca Hardness (mg/l)	18	10	11	16	14	26	16	30	36	30	24	40
Ca (mg/l)	7.21	4.008	4.4	6.41	5.61	10.42	6.41	12.024	14.42	12.02	9.61	16.032
Mg(mg/l)	14.09	9.234	6.075	1.458	1.458	0.972	2.43	0.972	0.972	2.91	4.37	1.944
Chloride(mg/l)	19.85	15.88	42.69	40.78	41.77	46.66	28.79	20.85	57.58	61.56	28.79	22.83
Residual Chlorine(mg/l)	Nil	Nil	10.635	Nil	7.09	7.09	Nil	Nil	7.09	3.54	Nil	Nil
Alkalinity(mg/l)	6	10	6	6	6	10	6	6	10	10	16	18
DO(mg/l)	8.1	8.1	4.05	7.29	8.1	8.56	8.91	4.86	8.1	7.29	7.29	7.29
BOD(mg/l)	1.58	1.62	2.39	1.61	3.67	1.61	3.27	1.59	1.62	2.4	1.61	1.61

Table 1. Physico-chemical parameters of bore well and tap water of public water supply of Paravur town in kollam District, Kerala.

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